Appendix D7

Air Quality Technical Report

NYS Route 33, Kensington Expressway Project

PIN 5512.52

Air Quality Technical Report

Contents

1 Introduction

This document describes the air quality analyses that were conducted for the NYS Route 33, Kensington Expressway Project (hereafter, "the Project") for purposes of the National Environmental Policy Act (NEPA), State Environmental Quality Review Act (SEQRA) and transportation conformity regulations under the Clean Air Act.

The air quality analyses for the Project were performed based on U.S. Environmental Protection Agency (USEPA) and Federal Highway Administration (FHWA) guidance, using required USEPA models (which incorporate the best available science), and were developed in consultation with the Project's interagency air quality group (consisting of FHWA, New York State Department of Transportation (NYSDOT), USEPA, and New York State Department of Environmental Conservation (NYSDEC)). Key guidance documents used in the development of the air quality analysis methodologies included:

- NYSDOT's *Transportation Environmental Manual (TEM) Air Quality Section*.[1]
- USEPA's *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas*[2]
- USEPA's *Using MOVES3 in Project-Level Carbon Monoxide Analyses*.[3]
- FHWA's *Updated Interim Guidance on Mobile Source Air Toxic (MSAT) Analysis in NEPA Documents* [4]
- USEPA's *Transportation Conformity Guidance for the South Coast II Decision*[5]

This report is focused on the long-term/operational air quality effects of the Project. Information related to energy consumption and greenhouse gas emissions is provided in Section 4.10 of the DDR/EA. Construction air quality effects and mitigation measures are discussed in Section 4.20 of the DDR/EA.

Air quality modeling files associated with this report are available on request. Contact Kensingtonexpressway@dot.ny.gov

1.1 Project Overview

The Project is located in the City of Buffalo, Erie County, New York. The term "transportation corridor" is used to describe the section of NYS Route 33 and Humboldt Parkway being studied for improvements under this Project. The transportation corridor is defined as NYS Route 33 (Kensington Expressway) and

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[1] https://www.dot.ny.gov/divisions/engineering/environmental-analysis/manuals-and-guidance/epm/repository/epmair01.pdf

[2] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013C6A.pdf

[3] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013NP8.pdf

[4] https://www.fhwa.dot.gov/environMent/air_quality/air_toxics/policy_and_guidance/msat//fhwa_nepa_msat_memorandum_2023.pdf

[5] https://nepis.epa.gov/Exe/ZyPDF.cgi/P100VQME.PDF?Dockey=P100VQME.PDF

Humboldt Parkway between Best Street and Sidney Street. The Kensington Expressway provides three travel lanes in each direction through the transportation corridor.

The purpose of the Project is to reconnect the community surrounding the defined transportation corridor and improve the compatibility of the corridor with the adjacent land uses, while addressing the geometric, infrastructure, and multi-modal needs within the corridor in its current location.

The following objectives have been established to further refine the Project purpose:

- Reconnect the surrounding community by creating continuous greenspace to enhance the visual and aesthetic environment of the transportation corridor;
- Maintain the vehicular capacity of the existing transportation corridor;
- Improve vehicular, pedestrian, and bicycle mobility and access in the surrounding community by implementing Complete Street roadway design features; and
- Address identified geometric and infrastructure deficiencies within the transportation corridor.

As documented in Chapter 3 of the DDR/EA, the Build Alternative would cover the depressed section of NYS Route 33 (Kensington Expressway), creating a 4,150-foot-long tunnel between Sidney Street and Dodge Street. NYS Route 33 would be regraded north of Sidney Street and south of Dodge Street to bring the expressway back to existing grade. Each direction of traffic in the tunnel would be ventilated by the piston effect of moving traffic under normal operating conditions, with jet fans provided for ventilation in the case of a breakdown in traffic flow or an emergency event (refer to Chapter 3 of the DDR/EA for more detail regarding the ventilation system design). No exhaust stacks are proposed as part of the Project.

The Build Alternative does not involve changes in the capacity of NYS Route 33 through the transportation corridor and therefore is not expected to substantially alter regional traffic patterns. The Build Alternative does include the elimination of a partial interchange between NYS Route 33 and East Utica Street, which may shift some local traffic within the transportation corridor to use the nearby Best Street interchange instead. Existing local street connections across NYS Route 33 would be maintained under the Build Alternative and new east-west street connections would be created on top of the tunnel. A preliminary traffic study was completed as part of the Project Scoping Report and additional traffic analyses have been performed subsequently as documented in Chapter 3 and Appendix B of the DDR/EA.

1.2 Transportation Conformity

Transportation conformity is a Clean Air Act requirement that ensures highway and transit projects which are Federally funded or approved in nonattainment and maintenance areas are consistent with the air quality goals established by a state air quality implementation plan (SIP). Transportation conformity does not apply in attainment areas.

Erie County is currently in attainment with all current NAAQS.[6]

Erie County was part of a nonattainment area for the 1997 8-hour ozone NAAQS. The 1997 NAAQS were subsequently replaced by the 2008 and 2015 NAAQS, and Erie County was designated attainment for both standards. The USEPA revoked the 1997 ozone NAAQS in 2015. A 2018 court decision required transportation conformity determinations in areas designated nonattainment or maintenance for the 1997 NAAQS but attainment for the 2008 and 2015 NAAQS (referred to as orphan areas), such as Erie County. USEPA issued guidance entitled *Transportation Conformity Guidance for the South Coast II Court Decision* to clarify the transportation conformity requirements for these orphan areas.[7] No regional emissions analysis is required for the revoked 1997 NAAQS and hot-spot analysis requirements are not applicable to ozone. Based on the USEPA South Coast II guidance, the following project-level conformity requirements are applicable:

- Consultation requirements (40 CFR 93.112);
- There is a currently conforming transportation plan and Transportation Improvement Program (TIP) in place (40 CFR 93.114); and
- The project is from that transportation plan and TIP (40 CFR 93.115).

The Greater Buffalo Niagara Regional Transportation Council (GBNRTC) has prepared a transportation conformity determination for the GBNRTC 2023-2027 TIP and 2050 Long-Range Transportation Plan (LRTP).[8] The NYS Route 33 Kensington Expressway Project is included in the conforming 2023-2027 TIP and LRTP, which was adopted by the GBNRTC on September 7, 2022. Final FHWA/FTA approval of the GBNRTC transportation conformity determination occurred on October 4, 2022. The requirement for interagency and public consultation has been met through the GBNTRC TIP and Plan conformity process, this includes an in place TIP which this project is part of. Therefore, all transportation conformity requirements for the Project are met.

2 Pollutants for Analysis

Table 1 summarizes the pollutants for analysis for the Project. The air quality analyses include “microscale” (localized concentrations) analysis, as well as “mesoscale” (regional) emissions analysis of total quantity of emissions generated by the roadways affected by the Project. The pollutants for analysis include:

- Carbon monoxide (CO)
- Nitrogen oxides (NOx)
- Volatile organic compounds (VOCs)
- Particulate matter less than or equal 2.5 micrometers in diameter (PM2.5)
- Particulate matter less than or equal 10 micrometers in diameter (PM10)

Mobile source air toxics (MSATs) are discussed in Section 7.

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[6] https://www3.epa.gov/airquality/greenbook/anayo_ny.html
[7] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100VQME.pdf
[8] https://www.gbnrtc.org/tip-2023-2027-air-quality-conformity

Ozone is not analyzed at the project level and is formed through chemical reactions in the atmosphere. However, emissions of ozone precursor pollutants VOC and NOx are considered in the mesoscale analysis.

Vehicular sources of sulfur dioxide are not substantial; therefore, analysis of this pollutant from mobile sources or construction equipment is not warranted. Lead would not be emitted by any source associated with this Project; therefore, analysis of lead as part of the air quality analysis is not warranted.

There are no appropriate procedures or tools available for microscale analysis of 1-hour nitrogen dioxide (NO2) concentrations from mobile sources; therefore, NO2 (one component of NOx) was not analyzed. For CO, PM2.5 and PM10, USEPA has developed a transportation conformity regulatory framework and detailed technical guidance for microscale analysis of CO and PM2.5/PM10.[9] Even for projects not subject to transportation conformity requirements, the USEPA guidance provides a clear and consistent analysis framework that can be used for an air quality analysis of CO and/or PM2.5/PM10 that is being conducted for other purposes (e.g., NEPA compliance). In contrast to CO and PM2.5/PM10, the transportation conformity regulations do not require 1-hr NO2 hot-spot analysis and there is no available guidance specific to 1-hr NO2 analysis for mobile sources with AERMOD (the available technical guidance pertains to stationary source permitting).[10] Guidance is particularly important regarding the 1-hr NO2 standard in a near-road context given the complex chemical reactions involved, which make such an analysis far more complex than a CO or PM2.5/PM10 analysis. For example, a 1-hr NO2 analysis would need to address the conversion of NO emissions to NO2, the effects of background ozone concentrations, the effects of the background NO2/NOx ratio and other factors such as the mixing of roadway emissions with background air.[11]

In addition to a lack of appropriate methods and guidance for 1-hr NO2 analysis, it is unlikely that attempting such an analysis would identify air quality effects not already identified by analyzing CO, PM2.5 and PM10. When the NAAQS review for NO_2 was completed in 2010, it established requirements for states to locate monitors near heavily trafficked roadways in large urban areas in locations where maximum NO_2 concentrations can occur.[12] The subsequent NO_2 NAAQS review completed in 2018 utilized the data collected by these near-road monitors and stated that "recent NO_2 concentrations in all U.S. locations meet the existing primary NO2 NAAQS."[13] The comprehensive network of near-road NO_2 monitors throughout the country did not identify any exceedances of the NO_2 NAAQS. These near-road monitors were placed near highways with substantially larger volumes than the Kensington Expressway. Thus, it can be concluded that, based on the volumes expected for this Project, it is not likely that any violation of the NO_2 NAAQS would occur as a result of the Project.

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[9] See the transportation conformity regulations at 40 CFR 93 Subpart A, and the PM and CO hotspot analysis guidance resources available from USEPA: https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses

[10] https://www.epa.gov/sites/default/files/2015-07/documents/appwno2_2.pdf
https://www.epa.gov/sites/default/files/2015-07/documents/appwno2.pdf

[11] https://www.sciencedirect.com/science/article/abs/pii/S1352231017304089

[12] USEPA, Primary National Ambient Air Quality Standards for Nitrogen Dioxide, 75 FR 4674 pages: 6473-6537, February 9th, 2010, https://www.govinfo.gov/content/pkg/FR-2010-02-09/pdf/2010-1990.pdf

[13] USEPA, Review of the Primary National Ambient Air Quality Standards for Oxides of Nitrogen, 83 FR 17226 pages: 34792-34834, April 18th, 2018., https://www.govinfo.gov/content/pkg/FR-2018-04-18/pdf/2018-07741.pdf

Table 1.: Pollutants for Analysis

	Microscale (Localized Concentrations) Analysis	**Mesoscale Emissions Analysis**
CO*	☑	☑
NOx**		☑
VOC**		☑
PM10*	☑	☑
PM2.5*	☑	☑

*Clean Air Act Criteria Pollutant

**Criteria Pollutant and Ozone Precursor

3 Analysis Years and Scenarios

Table 2 summarizes the air quality analysis years. Existing conditions air quality is described based on 2020-2022 ambient air quality monitoring data.

The Project is anticipated to be completed and opened to traffic by 2027 (the estimated time of completion [ETC]). The mesoscale analysis for the Project (described in subsequent sections) was conducted for years 2027 (ETC), 2037 (ETC+10), and 2047 (ETC+20).

It is likely that year 2027 would be the year with the highest emissions because mobile source emissions are decreasing due to fleet turnover and more efficient vehicles being introduced at a faster rate than regional traffic growth. Therefore, it is expected that emissions would be lower in years 2037 and 2047. As described in NYSDOT procedures, a microscale analysis should be conducted for the critical analysis year (the modeled year with the highest emissions). However, both years 2027 and 2047 were analyzed for the microscale analysis for this Project (described in subsequent sections) to illustrate the expected air quality trends over time and to inform the assessment of other topics, such as environmental justice, for the Project.

Table 2. Air Quality Modeling Analysis Years and Scenarios

	2027 (ETC)		**2037 (ETC+10)**		**2047 (ETC+20)**	
	No Build	**Build**	**No Build**	**Build**	**No Build**	**Build**
Microscale (Localized Concentrations) Analysis*	☑	☑			☑	☑
Mesoscale Emissions Analysis**	☑	☑	☑	☑	☑	☑

*CO, PM2.5 and PM10 concentrations

** Quantity of emissions of CO, PM2.5, PM10, ozone precursors (VOC and NOx)

4 CO Screening

NYSDOT procedures provide Level of Service (LOS) and volume screening methodologies addressing emissions from intersections and roadway segments. However, there are no screening procedures available to address the potential CO emissions impact from emissions related to the tunnel portals. Therefore, CO was addressed as part of the microscale analysis using AERMOD (see Section 5). The microscale analysis is a cumulative analysis taking into account traffic volumes and speeds for all roadways in the Study Area, including the major intersections along Best Street, East Utica Street and East Ferry Street. Therefore, a separate CO LOS and volume screening of intersections outside the Study Area is not necessary. If the microscale analysis of CO shows no exceedance of the NAAQS taking into account the increased density of emissions at the tunnel portals combined with roadway emissions outside the tunnel, no exceedance would occur from the Project at other intersections outside the Study Area.

5 PM2.5/PM10 Microscale (Localized Concentrations) Analysis

As noted in Section 1.2, the Project is located in an attainment area for CO, PM2.5 and PM10 and not subject to transportation conformity hot-spot analysis requirements. To address public concerns regarding air quality in the project area and inform the decision-making process, a PM2.5/PM10 microscale analysis was conducted consistent with the procedures outlined in USEPA's *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas*.[14] A CO microscale analysis was also conducted using an approach consistent with the PM2.5/PM10 analysis and taking into consideration USEPA's *Using MOVES3 in Project-Level Carbon Monoxide Analyses*.[15]

5.1 Methodology

5.1.1 Background Concentrations

Representative background concentrations are important to the PM hot-spot analysis to account for emissions and sources not included in the dispersion modeling. The approach used to select background concentrations was consistent with Section 3.7 of the EPA PM hotspot guidance. Table 3 summarizes the characteristics of the available PM2.5 and PM10 NYSDEC regional air quality monitoring sites, including the USEPA-calculated design values based on 2019-2021 data. Figure 1 shows the general location of the three Buffalo area monitoring sites in relation to the Project.

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[14] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013C6A.pdf

[15] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013NP8.pdf

The Buffalo monitor at the NYS Thruway Authority Bridge Maintenance Facility was selected as the basis for background concentrations because it is the closest monitor to the Project (approximately three miles away). This monitor has a greater concentration of manufacturing, warehousing and logistics land uses nearby when compared to the Project area land use, which is primarily residential in character. Thus, it provides a conservative (overestimating rather than underestimating) basis for establishing background concentrations. Another advantage of the Buffalo monitor is that it provides data for both PM2.5 and PM10 (other locations provide PM2.5 only).

The Amherst monitor is located farther from the Project compared to the Buffalo monitor and would be less affected by emissions from Buffalo's commercial/industrial core. Therefore, the Amherst monitor was not selected.

The Buffalo Near-Road monitoring site is not appropriate for background concentrations for this Project because of its geographic scale and purpose being oriented towards monitoring localized concentrations along I-90. This site is also located farther from the Project and downtown than the Buffalo monitor.

The predominate wind directions at the Buffalo International Airport are from the west/southwest (Figure 2). The only upwind monitor is located 37 miles away in Dunkirk and would not be representative of the larger urbanized area emissions sources in Buffalo.

The interagency air quality group concurred with the use of the Buffalo monitor at the NYS Thruway Authority Bridge Maintenance Facility as the basis for background concentrations for this Project.

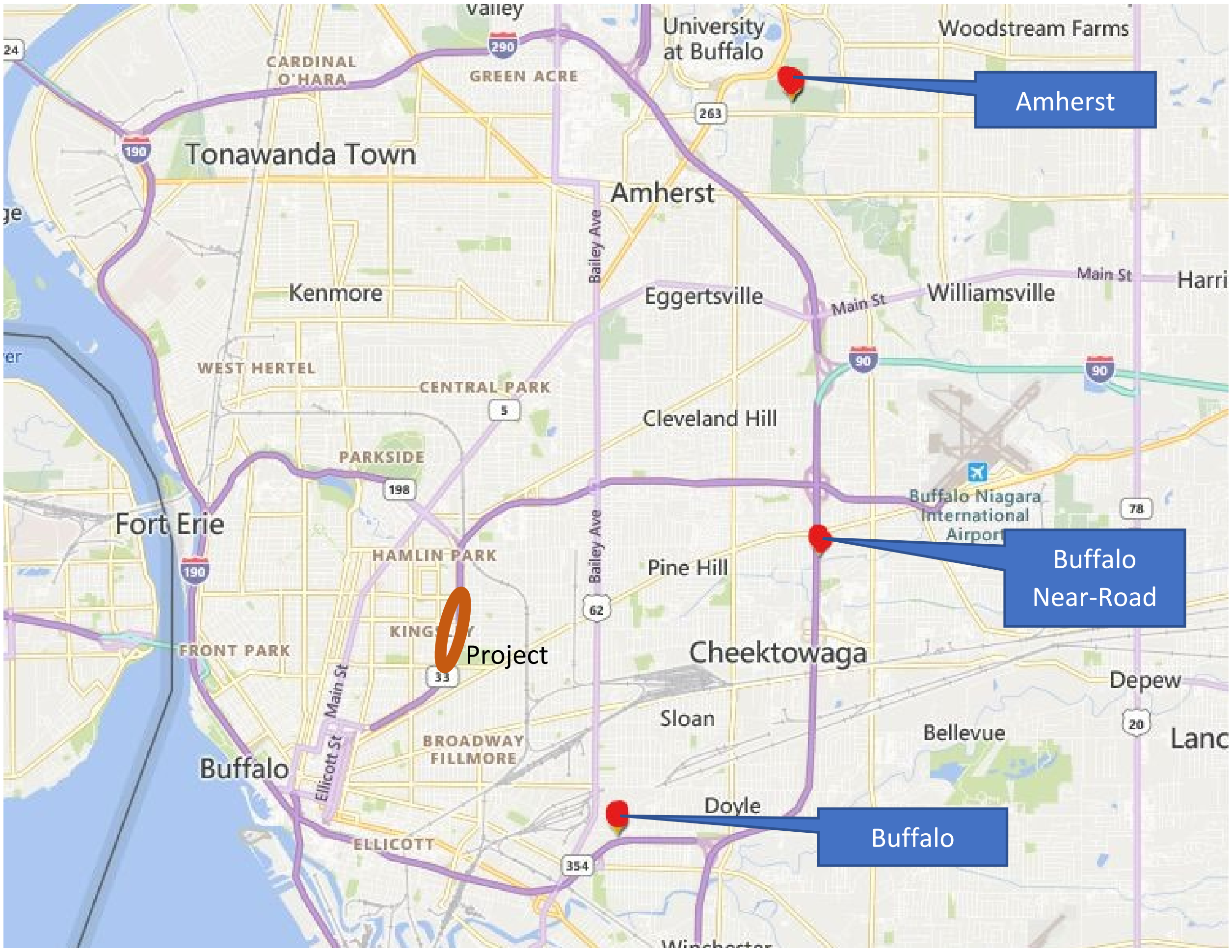

Figure 1: Buffalo Area Air Quality Monitoring Sites

Table 3. Buffalo Region NYSDEC Ambient PM Monitoring Sites

AQS ID	Monitor Name	Distance from Project *	Monitor Geographic Scale	Land Use Considerations	Annual Ave. PM2.5 Design Value – 2021 (µg/m3)	24-hr Ave. PM PM2.5 Design Value- 2021 (µg/m3)	PM10 Max 24-hr Ave.- 2021 µg/m3)
36-029-0005	**Buffalo** (NYS Thruway Authority Bridge Maintenance Facility Access Road (Near Weiss St.)	2.9 miles southeast	Neighborhood (500 M to 4 KM)	Located on north side of I-190 (300 ft from road) Surrounded by and downwind of commercial, manufacturing and warehousing.	7.0	18	29 (2019 and 2020) 37 (2021)
36-029-0023	**Buffalo Near-Road** (I90 Mile Post 424.6 East Bound Side, Cheektowaga)	4.0 miles east	Microscale (0 M to 100 M)	Located 50 feet from I-90 (east of highway). Adjacent land uses are residential.	7.2	16	Not available
36-029-0002	**Amherst** (Audubon Golf Course, 450 Maple Road)	6.8 miles northeast	Neighborhood (500 M to 4 KM)	Golf course, residential and University at Buffalo North Campus	6.4	15	Not available
36-013-0006	**Dunkirk** (Wright Park Drive)	37 miles southwest	Urban (4 KM to 50 KM)	Wastewater treatment plant, parks, and residential	6.0	14	Not available

*Measured from East Utica Street crossing of NYS Route 33

Sources: monitor details – EPA AirData https://www.epa.gov/outdoor-air-quality-data/interactive-map-air-quality-monitors

Design Values: EPA 2021 Design Value Reports. https://www.epa.gov/air-trends/air-quality-design-values

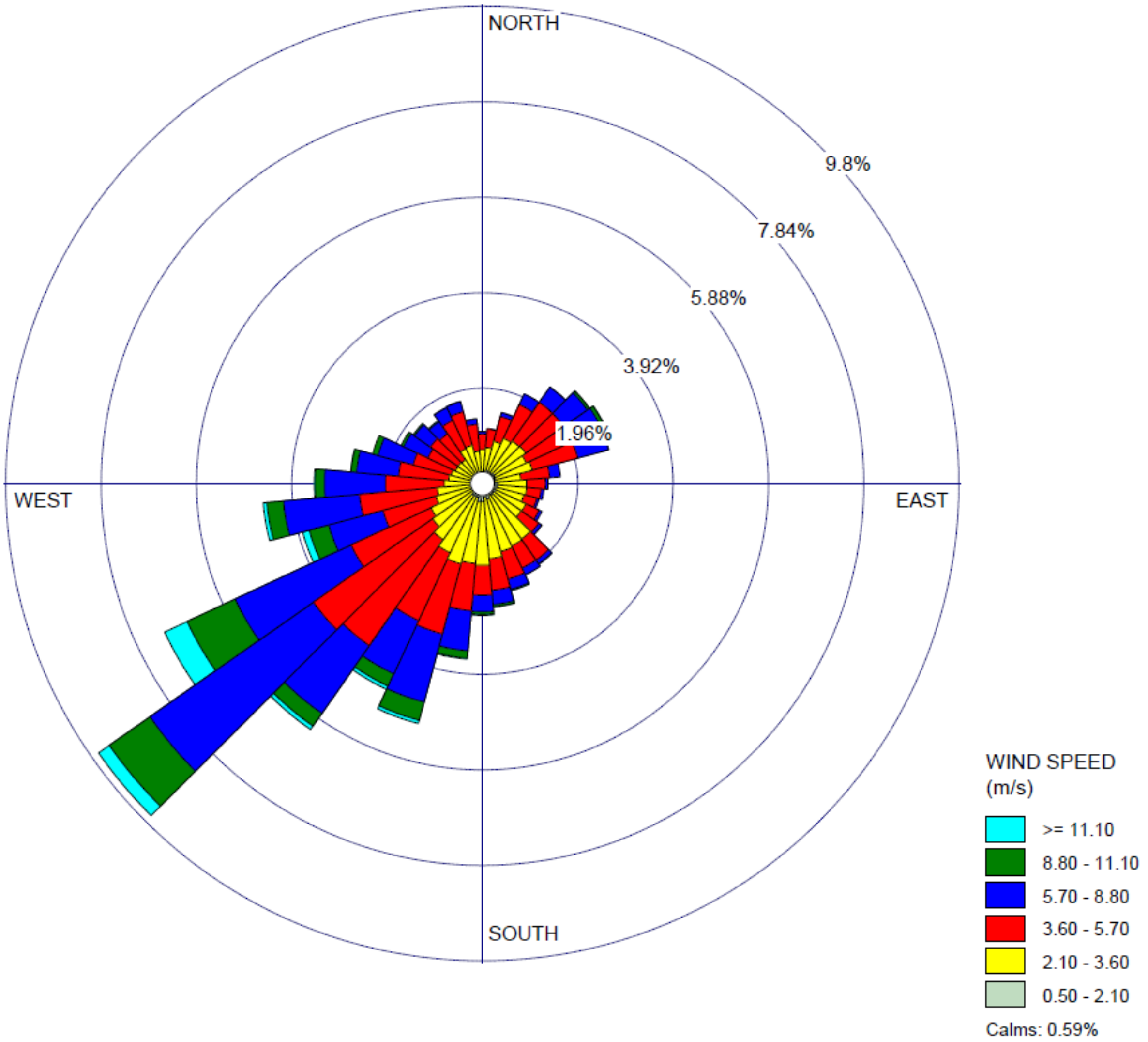

Figure 2: Wind Rose for Buffalo International Airport (2018-2022)

The latest three complete years of data for the Buffalo monitor (2020-2022) were used to establish the background concentrations used in the microscale analyses as summarized in Table 4 below.

Table 4. Buffalo Monitor 2020-2022 data Used to Establish PM2.5/PM10 Background Concentrations

	24-hr PM2.5 (98th percentile)	**Annual Average PM2.5**	**24-hr PM10 (highest)**
2020	18.7	6.5	29
2021	17.2	7.4	39
2022	15.8	6.5	67
2020-2022 average	**17.2**	**6.8**	**45**

5.1.1.1 Other Nearby Sources

Based on Section 8.2 of the USEPA PM hotspot guidance, nearby sources need to be included in air quality modeling when these sources are not appropriately reflected in background data or would be affected by the project. Stakeholder coordination identified other emission sources of concern to the community that included the following:

- A CSX freight rail line on the northeast edge of the Study Area, crossing the intersection of Fillmore Avenue and Northland Avenue and curving northward to cross NYS Route 33 just north of the interchange between NYS Route 33 and NYS Route 198. This is a minor rail line branch from the main CSX Chicago Line which is located over one mile to the southeast.[16] Based on the expected frequency of freight rail activity on the CSX freight line branch, it would not substantially affect PM concentrations in a manner not accounted for by the monitor used for background concentrations (which also has numerous freight rail lines in the vicinity).
- Auto repair shops- the relatively small size of these type of sources would limit their ability to substantially affect PM concentrations.
- Buffalo General Medical Center- this source operates three 75 MMBTU/hr boilers under a NYSDEC air facility permit.[17] The stack heights are 152 and 55 feet and the source is approximately 5,000 feet southwest of the Best Street bridge of NYS Route 33. Based on the height of the stacks and the distance from the Study Area, this source would not substantially affect PM concentrations in a manner not accounted for by the monitor used for background concentrations. There are numerous permitted sources west and southwest of the Buffalo monitor location, including Engineered Composites Inc. (Title V permit DEC ID 9-1402-00773), and Habasit Belting Inc (State Air Facility permit DEC ID 9-1-1402-00269), among others.

In conclusion, there are no “nearby sources” of PM emissions that need to be modeled for this Project. The background concentration data appropriately reflects the combined effects of the other sources located in the Study Area.

5.1.2 Study Area

For the microscale analysis, the Study Area includes an area within 1,000 feet of the Kensington Expressway corridor from High Street to Northland Avenue.

5.1.3 Traffic Data

5.1.3.1 Analysis Time Periods

The selection of traffic data and analysis time periods was consistent with Section 3.3.7 of the EPA PM hotspot guidance.

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[16] See Figure 3- 17: Rail Line Densities in the Buffalo-Niagara Region in the 2010 Niagara Frontier Urban Area Freight Transportation Study. https://static1.squarespace.com/static/56ccbbfd3c44d8670dbd1d84/t/56df3aace321408636996204/1457470267534/Final_Report.pdf

[17] https://www.dec.ny.gov/dardata/boss/afs/permits/914020008900014_r1.pdf?req=78870

The traffic study provides AM and PM peak period traffic volumes for existing conditions (year 2021), year 2027, and year 2047. The PM10/PM2.5 analysis requires traffic data for a minimum of four time periods to cover a 24-hour day (AM Peak, Midday, PM Peak and Overnight). The specific hours to be represented by each of these time periods were determined based on analysis of the available 24-hour traffic count data for NYS Route 33 at the automated traffic recorder (ATR) count station located near Sidney Street (#28) as shown in Figure 3.

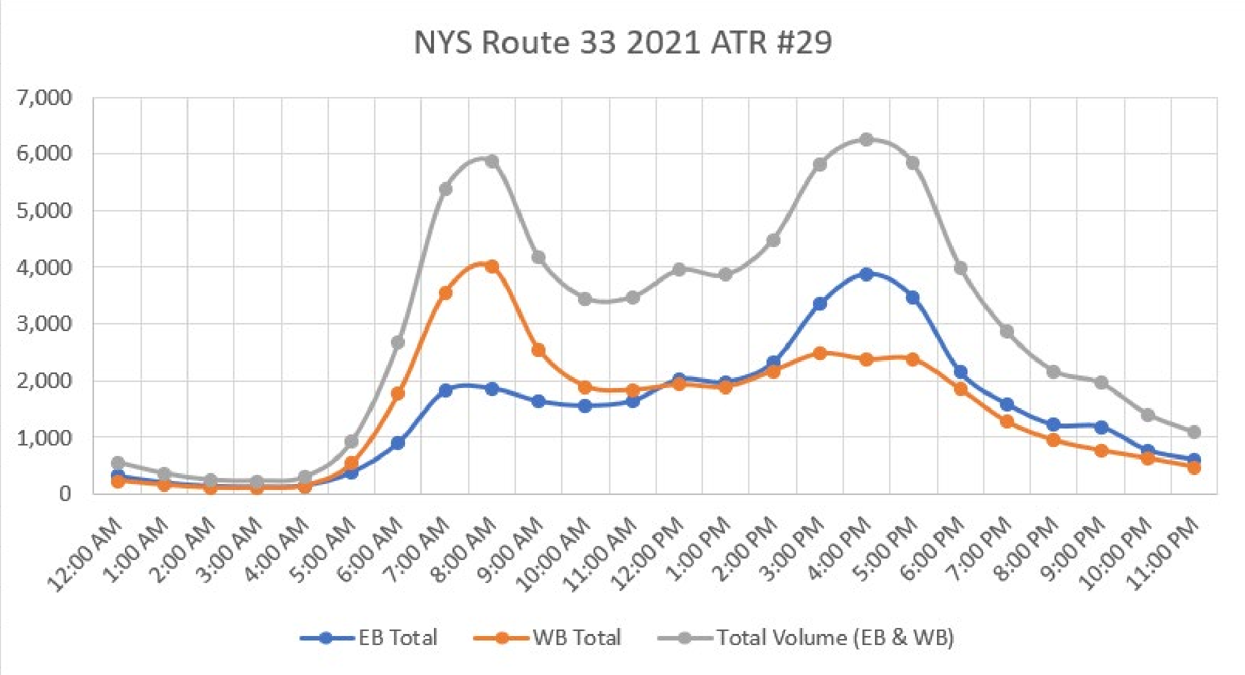


Figure 3: NYS Route 33 Existing 24-hr Traffic Counts

Table 5 summarizes the selected representative time periods and hours. The year 2021 24-hour counts for NYS Route 33 were used to determine the percentage of daily traffic occurring during each modeled time period and how the off-peak time period volumes relate to the peak periods.

Table 5. Representative Time Periods for Traffic Volume and Classification Development

Time Period	Hours Covered	Data used
AM peak period	6:00 AM to 10:00 AM	Traffic study AM peak traffic (8-9 AM)
Midday	10:00 AM to 2:00 PM	Average of 10AM-2PM
PM peak period	2:00 PM to 7:00 PM	Traffic study PM peak traffic (4-5 PM)
Overnight	7:00 PM to 6:00 AM	Average of 7 PM-6 AM

The off-peak (midday and overnight) period volumes for the No Build and Build Alternatives were determined based on the relationship between off-peak and peak volumes as shown in Table 6.

Table 6. Off-Peak Volume Relationship to Peak Volume by Direction

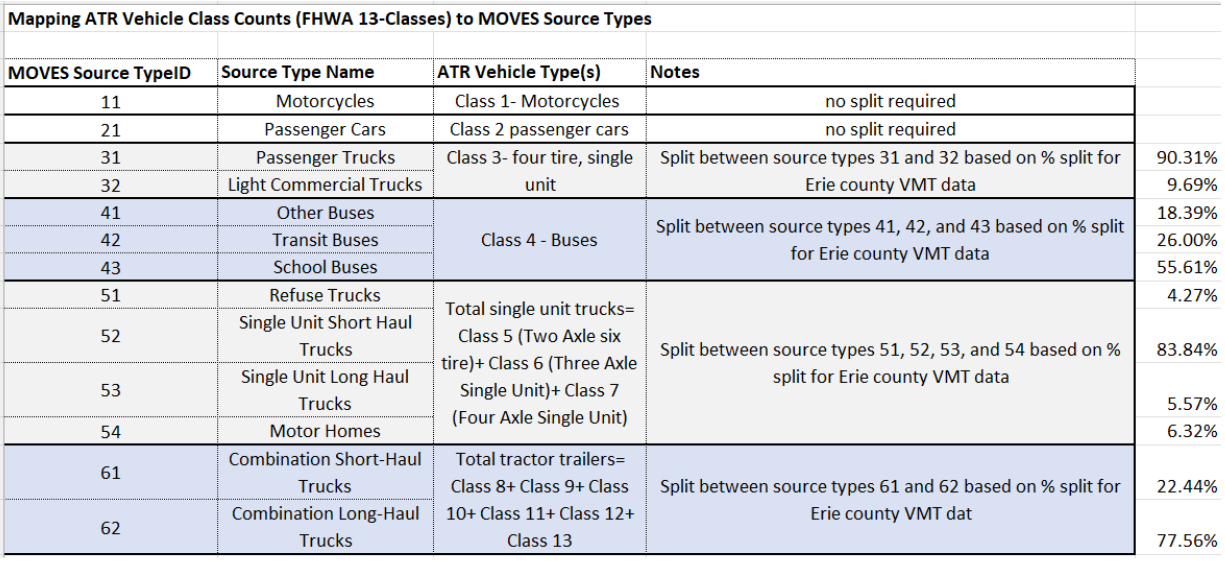
Time Period	NYS Route 33 Eastbound (percent of PM Peak eastbound)	NYS Route 33 Westbound (percent of AM peak westbound)
Midday (average hourly volume)	46.4%	47.1%
Overnight (average hourly volume)	15.7%	12.2%

Similar to the NYS Route 33 methodology described above, AM and PM peak volumes for other roadways in the Study Area were obtained from the traffic study. The detailed 24-hour counts available for NYS Route 33 are not available for all local roadways in the Study Area. However, 24-hour counts are available from the NYSDOT Traffic Data Viewer database (e.g., East Ferry Street, East Utica Street, Best Street, among others). Off-peak volumes for local roadways were volumes based on proportion of midday and overnight traffic to AM peak hour traffic on Best Street, Humboldt Parkway northbound and southbound, Northampton Street, East Utica Street and East Ferry Street. Any data gaps where 24-hour volume distributions were not available for a particular roadway were addressed by applying a representative 24-hour distribution from another roadway in the Study Area with the same functional classification and/or similar peak volume characteristics.

5.1.3.2 Vehicle Classification

Vehicle classification counts were included in the NYS Route 33 Automatic Traffic Recorder (ATR) data collection and the existing fleet mix by vehicle type is assumed to remain constant in future analysis years. The ATR count program counted the 13 FHWA vehicle class types. The Erie County VMT from the NYSDEC MOVES input databases was used to further subdivide the vehicle classification as appropriate. Table 7 summarizes the approach used to convert the vehicle class types included in the detailed ATR counts with the MOVES Source Types.

Table 7. Mapping NYS Route 33 ATR Classes to MOVES Source Types

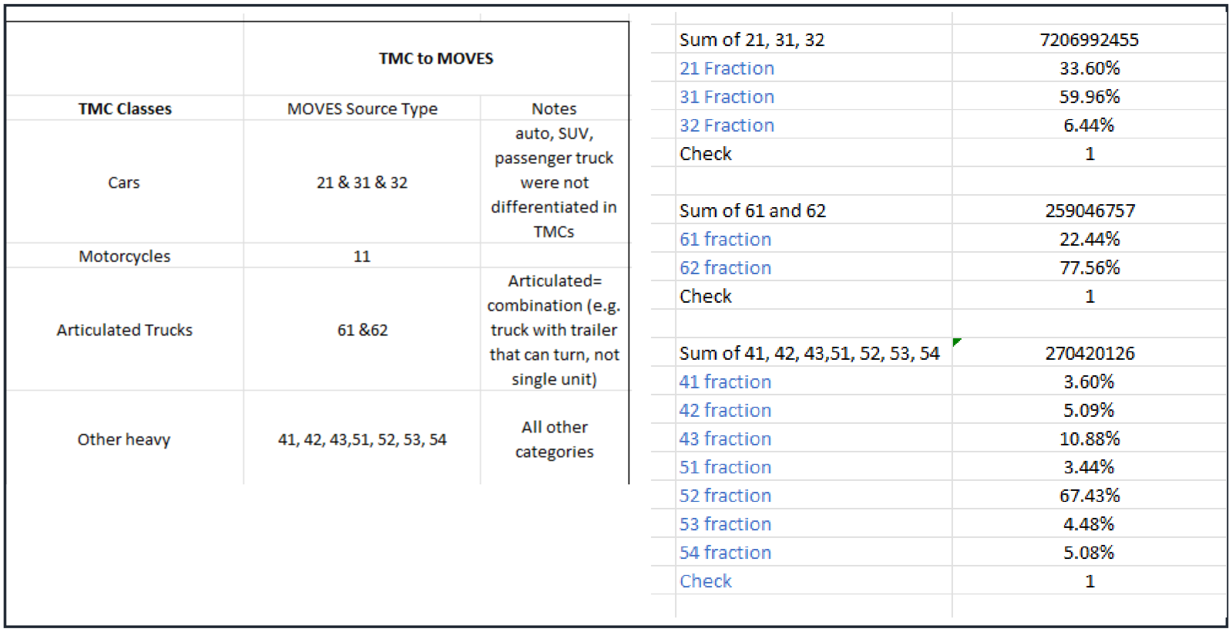


Mapping ATR Vehicle Class Counts (FHWA 13-Classes) to MOVES Source Types

MOVES Source TypeID	Source Type Name	ATR Vehicle Type(s)	Notes	
11	Motorcycles	Class 1- Motorcycles	no split required	
21	Passenger Cars	Class 2 passenger cars	no split required	
31	Passenger Trucks	Class 3- four tire, single unit	Split between source types 31 and 32 based on % split for Erie county VMT data	90.31%
32	Light Commercial Trucks			9.69%
41	Other Buses	Class 4 - Buses	Split between source types 41, 42, and 43 based on % split for Erie county VMT data	18.39%
42	Transit Buses			26.00%
43	School Buses			55.61%
51	Refuse Trucks	Total single unit trucks= Class 5 (Two Axle six tire)+ Class 6 (Three Axle Single Unit)+ Class 7 (Four Axle Single Unit)	Split between source types 51, 52, 53, and 54 based on % split for Erie county VMT data	4.27%
52	Single Unit Short Haul Trucks			83.84%
53	Single Unit Long Haul Trucks			5.57%
54	Motor Homes			6.32%
61	Combination Short-Haul Trucks	Total tractor trailers= Class 8+ Class 9+ Class 10+ Class 11+ Class 12+ Class 13	Split between source types 61 and 62 based on % split for Erie county VMT dat	22.44%
62	Combination Long-Haul Trucks			77.56%

For local roadways, the vehicle classification counts were less detailed and were supplemented with the regional NYSDEC MOVES input for the appropriate roadway type. Table 8 shows the categories used in the turning movement counts and the Erie County-VMT based fractions used to further subdivide the data into the 13 MOVES source use types.

Table 8. Mapping Local Street TMC Vehicle Classification to MOVES Source Types



	TMC to MOVES	
TMC Classes	MOVES Source Type	Notes
Cars	21 & 31 & 32	auto, SUV, passenger truck were not differentiated in TMCs
Motorcycles	11	
Articulated Trucks	61 &62	Articulated= combination (e.g. truck with trailer that can turn, not single unit)
Other heavy	41, 42, 43,51, 52, 53, 54	All other categories

Sum of 21, 31, 32	7206992455
21 Fraction	33.60%
31 Fraction	59.96%
32 Fraction	6.44%
Check	1
Sum of 61 and 62	259046757
61 fraction	22.44%
62 fraction	77.56%
Check	1
Sum of 41, 42, 43,51, 52, 53, 54	270420126
41 fraction	3.60%
42 fraction	5.09%
43 fraction	10.88%
51 fraction	3.44%
52 fraction	67.43%
53 fraction	4.48%
54 fraction	5.08%
Check	1

5.1.4 MOVES Emissions Modeling

Project scale emissions modeling was performed for No Build and Build conditions (years 2027 and 2047) using the latest version of MOVES—MOVES3. The emissions modeling approach was consistent with Section 4 of the EPA PM hotspot guidance.

The emissions rates option was used. Rather than typical modeling of project specific links, the modeling focused on development of an emission factors database from which appropriate emission rates can be extracted for a given vehicle type, speed, grade, etc. This allows for more efficient adjustments to emission rates without running MOVES if project conditions or traffic inputs change in the future.

Table 9 summarizes the range of parameters modeled in MOVES for the PM2.5/PM10 analysis. As discussed further under fuel inputs below, a single Month/Hour with the fuel formulation resulting in the highest emissions was used (PM running emissions do not vary based on temperature in MOVES3).

Table 9. Range of Conditions Used in Emissions Modeling for PM2.5/PM10 Microscale Analysis

Parameter	Range of conditions modeled
Analysis Month/ Hour	July, 8:00 AM
Analysis Years	2027, 2047
Road type	4- Urban Restricted Access 5- Urban Unrestricted Access
Average Speed	1 to 55 mph (Unrestricted access) 1 to 65 mph (Restricted Access) In 1 mph increments
Average Grade	-8 to 8% in 1 degree increments
Source use type	All available

5.1.4.1 Links

As noted above, specific links were not explicitly modeled. A detailed link network was developed and emission rates for those links obtained from the MOVES output databases. Links were defined taking into consideration areas where traffic volumes and speeds change, and to account for roadway grade changes (which would differ between the No Build and Build conditions because of roadway vertical profile changes to construct a tunnel). Links included cruise, queue, and acceleration links per USEPA guidance. **Attachment 1** shows the link network and link volumes for the 2027 AM Peak (No Build and Build) as an example.

5.1.4.1.1 Queue Links

Queue links at intersection approaches were defined based on the SYNCHRO 95th percentile queue length in 2047 (using the longest of AM or PM). The SYNCHRO queue lengths were adjusted based on intersection geometry and physical limits on a given approach. The AM and PM peak hour average speed for queue links was calculated based on link length, SYNCHRO approach delay per vehicle and assumed free flow speed travel time. During off-peak time periods, queue links were assumed to operate with an average speed of 10 mph.

5.1.4.1.2 Acceleration links

Acceleration link length was calculated based on the initial and final speed for the link. For local streets the final speed was 30 mph. For ramps the final speed used was the VISSIM ramp analysis speed (VISSIM is a traffic simulation model). The auto acceleration rate used for defining acceleration rate length was 10 ft/sec2.[18]

5.1.4.1.3 Free Flow Links

The traffic simulation model VISSIM provides link-specific average speed for the AM and PM peak periods. Off-peak travel periods assumed an average speed of the posted speed (55 mph on NYS Route 33, 30 mph on local streets).

5.1.4.2 Vehicle Age Distribution

Age distributions for each vehicle source type were developed based on calendar year 2019 New York Department of Motor Vehicles registration data for NYSDOT Region 5 processed by NYSDEC. MOVES uses 31 vehicle age classes to characterize the fleet age in relation to the analysis year. The vehicle age distribution (e.g., percentage of vehicles in each age class) was kept constant for the future analysis years 2027, 2037 and 2047. As an example, the percentage of vehicles that are five years old was kept constant. This still accounts for the effects of fleet turnover and newer model year vehicles coming into the fleet because a vehicle that is five years old in 2019 is model year 2014, while in 2047, a five-year-old vehicle implies a model year of 2042.

5.1.4.3 Meteorology

The meteorological data (zonemonthhour) is from the National Oceanic and Atmospheric Administration (NOAA) weather station WBAN:14733 at the Buffalo Niagara Airport. The data are from calendar year 2019.

5.1.4.4 Fuel Inputs

Default fuel supply and fuel usage fraction files were used, as provided by NYSDEC in December 2022.

A fuel formulation unique to the Upstate New York area was used. Data from local gasoline sampling performed by the NYS Department of Agriculture and Markets between May and September 2019 were used by the NYSDEC to modify Reid Vapor Pressure (RVP) values using the MOVES3 Fuels Wizard for Fuel Formulation ID 8105. The Fuels Wizard updates the T50 T90 e200 and e300 values based on formulas described in *Fuel Supply Defaults: Regional Fuels and the Fuel Wizard in MOVES3 (*EPA-420-R-21-006 March 2021). Table 10 provides information on the modified local Fuel Formulation 8105 (used for May, June, July, August, and September), as well as the default values for Fuel Formulation ID 8106 (used for January, February, March, November, and December) and Fuel Formulation ID 8107 (April and October).

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[18] https://ops.fhwa.dot.gov/trafficanalysistools/tat_vol3/Vol3_Guidelines.pdf

Table 10. Default and Local Fuel Formulation Details

Source	Fuel Formulation ID	Fuel Sub Type ID	RVP*	e200**	e300**	T50#	T90#
Defaults (Used for Jan, Feb, March, Nov., and Dec)	8106	12 (E10)	12.5	42.3813	83.9552	215.365	325.067
Local (Used for May, June, July, Aug., and Sept).	8105	12 (E10)	8.59	52.8727	85.6809	182.111	318.384
Defaults (Used for April and Oct.)	8107	12 (E10)	10.5	52.0168	85.6846	187.018	318.369

*RVP = Reid vapor pressure, a measure of gasoline volatility

**refers to distillation values (percent evaporated at 200 degrees C for example)

distillation temperature at which 50% or 90% is evaporated

For the MOVES emissions modeling for the PM microscale analysis, a seasonal fuels test was conducted to confirm the fuel formulation with the highest emissions (and thus avoid the need to model separate fuel seasons). The test run was performed for gasoline passenger cars in a 2027 project-scale analysis. As shown in Table 11 below, the summer (May-Sept.) fuel formulation (#8105) has the highest PM2.5 running exhaust emission rate (the summer fuel formulation emissions are approximately 7% higher than the winter fuel formulation). Based on this information, the PM2.5/PM10 microscale analysis was performed using an analysis month where fuel formulation 8105 would be used (July).

Table 11. Seasonal Fuel Test Results for Gasoline Passenger Autos (2027)

Fuel Formulation ID	Used for Months	PM2.5 Running Exhaust Rate for gasoline passenger Autos (grams/VMT)	Percent difference from winter emission rate
8106	Jan, Feb, March, Nov., and Dec	0.001310	na
8105	May, June, July, Aug., and Sept	0.001405	7.24%
8107	April and Oct.	0.001352	3.20%

Additional information on the seasonal fuel runspec is provided below.

Scale: Project Level, Inventory

Year: 2027

Months: February, July, October (three runs)

Hour: 8-8:59

Vehicles: Passenger cars only

Road Type: Urban restricted access

Pollutants: PM2.5 Primary Exhaust Total (and prerequisites), no start or idle, no tire/brake wear

Links: 1 generic one mile link – 55 mph speed, 100% passenger cars, 0% grade

Output differentiated by fuel type (to enable extraction of gasoline passenger car emissions rate)

Age, fuels, meteorology – inputs specific to Eric County

LEV input database was used

5.1.4.5 Alternative Vehicle Fuels and Technology (AVFT)

The Alternative Vehicle Fuels and Technology (AVFT) file is based on engine fuel type data in the Erie County portion of the New York State Department of Motor Vehicles (NYSDMV) vehicle registration database for vehicle model years 1960 to 2019. For model years 2020 to 2060, the model year 2019 data were used for MOVES Source Types 11, 21, 31, 32, 41, 43, 51, 52, 53, 54, 61 and 62. One minor data gap in the availability of fuel and engine type data for transit buses was filled using data from an adjacent model year. Specifically, model year 2018 fuel engine fractions were used for Source Type 42 (Transit Buses) because no model year 2019 Transit Buses were registered in Erie County.

Using the 2019 vehicle registration data to define fuel/engine types for the future analysis years (2027 and 2047) is conservative because of the substantial increase in electric vehicles anticipated over the next several decades. Accounting for increased electric vehicle sales would result in lower estimates of pollutant concentrations than shown in this report. However, it should also be noted that in terms of particulate matter, the brake wear and tire wear components are still generated by electric vehicles.

5.1.4.6 I/M (Inspection and Maintenance) Coverage

The IM Coverage files are based on calendar year 2019 program compliance data from NYSDEC and NYSDMV. Files for each of the Project analysis years are included in this set. A description of the IM program in New York State follows below (the IM program does not change the PM emissions).

The New York Vehicle Inspection Program (NYVIP) emissions test procedure examines the Malfunction Indicator Lamp (MIL), also known as the "check engine" light, for operation/illumination and verifies the test results of the vehicle's exhaust system on-board emissions diagnostic system. Vehicles that weigh 18,000 pounds or less are subject to inspection. Vehicles that are two years old or newer and vehicles that are 25 years and older are exempt. For subject vehicles, the registration can’t be renewed in New York State unless the NYSDMV has a computer record or a copy of the vehicle inspection report showing that the vehicle passed the required emissions inspection within the last 12 months.

The New York State regulation for Motor Vehicle Inspection and Maintenance (6 NYCRR Part 217) is depicted as MOVES IM test standards 51 and 45 in the IM Coverage files. Table 12 summarizes the model year (MY) ranges for which vehicles are subject to inspections.

Table 12. Model Years Subject to Inspection/Maintenance Program

Year ID	Beginning MY	Ending MY
2027	2003	2025
2037	2013	2035
2047	2023	2045

The compliance factor for gasoline and E-85 capable passenger cars, passenger trucks and light commercial vehicles is 97.97. The compliance factor for gasoline and E-85 capable single unit trucks is 88.96. The compliance factor for gasoline and E-85 capable motor homes is 61.15. The MOVES model only calculates I/M program benefits for gasoline vehicles.

The Compliance Rate (CR) is 98% statewide. The Waiver Rate(s) were 0.50% in the New York City Metropolitan Area and 0.54% in the remainder of the State. The Failure Rate(s) were 5.35% in the New York City Metropolitan Area and 4.91% in the remainder of the State. The Compliance Factor (CF) equation is *CF = Compliance Rate × (1 – waiver rate × failure rate) × regulatory class coverage]*. While the waiver and failure rates differ slightly around the State, the resulting CF in the IM files is the same up to five decimal places. (i.e., NYMA CF = .98*.9997325*regulatory class coverage and
Upstate CF = .98*.9997349*regulatory class coverage). Thus, the IM coverage files are identical Statewide. The regulatory class coverage data are summarized in Table 13.

Table 13. Regulatory Class Coverage

Regulatory Class Coverage	Source Type Description	Source Type ID	MOVES regulatory Class description	MOVES Reg Class ID
1	Passenger Car	21	Light Duty Vehicles	20
0.9612	Passenger Truck	31	Light Duty Trucks	30
0.0388	Passenger Truck	31	Class 2b and 3 Trucks (8,500 lbs < GVWR <= 14,000 lbs)	41
0.7526	Light Commercial Truck	32	Light Duty Trucks	30
0.2474	Light Commercial Truck	32	Class 2b and 3 Trucks (8,500 lbs < GVWR <= 14,000 lbs)	41
0.5676	Single Unit Short-haul Truck	52	Class 2b and 3 Trucks (8,500 lbs < GVWR <= 14,000 lbs)	41
0.3404	Single Unit Short-haul Truck	52	Class 4 and 5 Trucks (14,000 Lbs < GVWR <= 19,500 Lbs)	42
0.6241	Motor Home	54	Class 4 and 5 Trucks (14,000 Lbs < GVWR <= 19,500 Lbs)	42

5.1.4.7 Low Emission Vehicle (LEV) File

The 2020 New York State Low Emission Vehicle (LEV) input database was used with all MOVES runs. The purpose of this file is to adjust the default MOVES emissions rates based on New York's adoption of California emissions standards stricter than federal standards for certain model years.

5.1.5 Road Dust

Road dust emissions were included in the PM10 analysis based on USEPA's AP-42.[19]

Road dust is not a substantial contributor to ambient PM2.5 concentrations in New York State and therefore were not included in the PM2.5 analysis consistent with Section 6 of the EPA PM hotspot guidance.

The silt loading factor for the road dust analysis was based on the AP-42 defaults for various ADT categories as follows:

- Limited access highways with over 10,000 ADT (includes NYS Route 33)- 0.015 grams/m2
- Other roads with over 10,000 ADT- 0.03 grams/m2
- Roads with 5,000-10,000 ADT- 0.06 grams/m2
- Roads with 500-5,000 ADT- 0.2 grams/m2

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[19] https://www.epa.gov/sites/default/files/2020-10/documents/13.2.1_paved_roads.pdf

- Roads with less than 500 ADT- 0.6 grams/m2

The traffic weighted average vehicle weight for each link was determined based on the MOVES average vehicle weights, consistent with the approach to vehicle weights used by the 2017 National Emissions Inventory.[20] Table 14 summarizes the MOVES average vehicle weights. The 24-hour traffic data by vehicle type were used to determine the average vehicle weight for each link for purposes of road dust emissions

Table 14. MOVES Average Vehicle Weights for Road Dust Emission Calculation

MOVES Vehicle Type	Source Mass (tons)
Motorcycle	0.285
Passenger Car	1.479
Passenger Truck	1.867
Light Commercial Truck	2.0598
Intercity Bus	19.594
Transit Bus	16.556
School Bus	9.070
Refuse Truck	23.114
Single Unit Short-haul Truck	8.539
Single Unit Long-haul Truck	6.984
Motor Home	7.526
Combination Short-haul Truck	22.975
Combination Long-haul Truck	24.601

5.2 Dispersion Modeling

USEPA's AERMOD dispersion model (Version 22112) was used for the air quality analysis. AERMOD is a state-of-the-art dispersion model, applicable to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including point, area, and volume sources). AERMOD is a steady-state plume model that incorporates current concepts about flow and dispersion in complex terrain and includes updated treatments of the boundary layer theory, understanding of turbulence and dispersion, and handling of terrain interactions.

The Lakes Environmental AERMOD View interface software was used for this Project. The Lakes AERMOD MPI executable file was used (this allowed for more efficient processing time using multiple processors). Lakes Environmental has produced a MPI validation report documenting that the MPI version of AERMOD executable produces identical results to the USEPA released version of AERMOD 22112.[21] Despite using multiple processors, the MPI produces a single AERMOD output file with formatting identical to AERMOD

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[20] https://www.epa.gov/sites/default/files/2021-02/documents/nei2017_tsd_full_jan2021.pdf

[21] Lakes Environmental Software AERMOD MPI Validation (Version 22112)

22112. During the interagency consultation process, EPA and NYSDEC concurred with the use of the Lakes AERMOD MPI for this Project.

It is important to note that air quality effects of tree plantings included in the Project were not included in the air quality modeling analysis.

5.2.1 Source Characterization

Roadways

Adjacent volume sources were used to represent open roadways in AERMOD (e.g., all roadways in the No Build condition and portions of NYS Route 33 outside the tunnel limits under the Build Alternative, as well as Humboldt Parkway and cross streets). The AERMOD View interface software includes the ability to generate a series of adjacent volume sources along a line. The volume source receptor exclusion zone was considered in determining the appropriate width of volume sources and whether multiple lanes of traffic could be combined. For the NYS Route 33 mainline it was possible to model each direction of traffic (three lanes in each direction) as volume sources, rather than modeling each individual lane as a separate volume source. This approach is consistent with the EPA PM hotspot guidance given that there were no publicly accessible receptor areas excluded as a result of the volume source width.

Based on Section J.3.3 of the EPA PM hotspot guidance, plume height was calculated on a link level for PM2.5 based on 1.7 times the emissions-weighted average of light-duty (average height of 1.53 meters) and heavy-duty vehicles (average height of 4 meters). Plume width was defined based on the width of the travel lane. The initial vertical dispersion coefficient was defined as the plume height divided by 2.15, and the lateral dispersion coefficient was defined as the plume width divided by 2.15. Release height was defined based on 0.5 times the emissions-weighted initial vertical dimension for light-duty and heavy-duty vehicles on each link (in other words, 3.4 meters average release height for heavy duty vehicles and 1.3 meters average release height for light-duty vehicles).

The source characterization based on PM2.5 emissions was performed separately for the No Build and Build, and for 2027 and 2047. The same source characterization inputs were used for the corresponding PM10 and CO microscale analyses. For example, the 2027 No Build plume height for each link for PM10 used the same plume heights calculated from the PM2.5 emissions data for the 2027 No Build case.

Tunnel Portals

The Project's ventilation design is based on the movement of vehicles pushing the air out of the tunnel under normal operating conditions (jet fans are provided to address a breakdown of traffic flow or fire event). The tunnel exit portal emissions plume was represented in AERMOD as a volume source using a methodology based on the H. Ginzburg and G. Schattanek paper "Analytical Approach to Estimate Pollutant Concentrations from a Tunnel Portal Exit Plume." This research was based on a wind tunnel study conducted for Boston's Central Artery/Tunnel Project and was determined to be an appropriate methodology for this Project through the interagency consultation process. The research identified the following factors as important to plume length:

- Portal exit area geometry (walls, depressed or at-grade)
- Traffic flow characteristics (higher speed- longer plume length)

- Meteorology /crosswinds

The research included information on estimated portal jet lengths for vehicle speeds from 5 to 30 mph, wind speeds from 1 to 6 meters/second and portal configurations with and without dividing walls. Based on this information, dispersion modeling of the Build Alternative assumed a 300-meter-long portal jet based on the following considerations:

- Vehicle speed: 55 mph speed is higher than conditions assessed in the research study, which supports selection of a longer plume length (300 meters at the high end of estimated plume lengths presented in the research study).
- Dividing wall: The exit and entry portals would be separated by a dividing wall extending past the tunnel portal, which also supports a slightly longer plume length.
- Retaining walls/ depressed section at the tunnel exits support plume integrity.
- Average wind speed 4.7 m/s. Low wind speeds are uncommon but are important to pollutant concentrations.

The 300 meter portal jet was divided into three equal sections, with 57% of the emissions in the applicable side of the tunnel occurring in the first section, 31% in the second section and 12% in the third section. Figures 4 and 5 show the portal jet configuration for the Dodge Street and Sidney Street portals, respectively. All the emissions occurring in the tunnel were assumed to be pushed out into the portal jet and the emissions divided into the three segments based on the percentages above.

The portal jet volume sources overlap with the exiting roadway volume sources. The width of the source is equal to the width of the exiting roadway and vertical dimension and release height are calculated with the USEPA emissions weighted method.

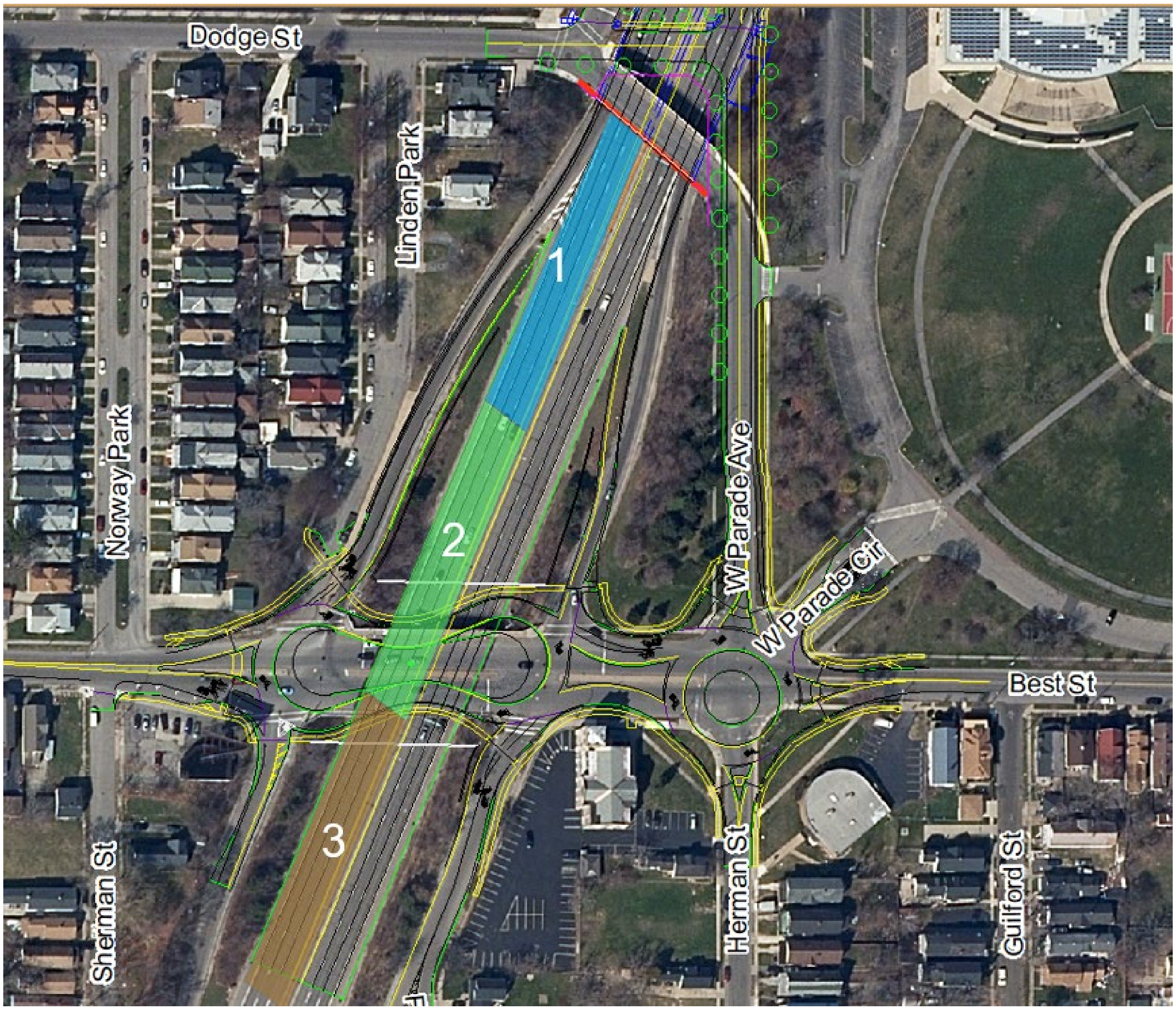

Figure 4: Dodge Street Portal Jet

Figure 5: Sidney Street Portal Jet

5.2.2 Meteorological Data

Five years of preprocessed surface and upper air meteorological data (2018-2022) for the Buffalo Airport were obtained from Lakes Environmental. The airport meteorological station is the closest source of this data to the Project. The meteorological data was discussed with the interagency air quality group and concurred on for use.

5.2.3 Terrain Options

Consistent with USEPA's PM hot-spot guidance, the AERMOD option for flat terrain was used. This is a conservative approach because terrain height differences could result in lower concentrations in some conditions where the expressway roadway is depressed relative to receptors.

5.2.4 Receptor Placement

Two categories of receptors were developed: 1) No Build/Build conditions receptors (representing human use areas that currently exist and would continue to be present in future No Build and Build conditions), and 2) Build condition-only receptors (representing new human use areas created by the Project—such as the greenspaces on the tunnel deck). No Build/Build conditions receptors were used for making No Build to Build concentration comparisons, as well as comparison to the NAAQS. Build condition-only receptors were compared to the NAAQS (a No Build comparison is not possible for these locations because the greenspaces they represent only exist in the Build condition). Figure 6 provides an overview of the receptor network. Further details of the methodology used to develop the receptor network are provided below. Detailed mapping of the receptor network is provided in **Attachment 2**.

As recommended by the USEPA PM and CO hotspot guidance, a default receptor height of 1.8 meters was used given that the highest concentrations from roadway and tunnel-related sources would be expected near ground level.

No Build/Build Conditions Receptor Network

The overall basis for No Build/Build conditions receptor placement was to orient receptors towards NYS Route 33/Humboldt Parkway (the largest traffic-related emissions source in the study area). In general, receptor density was highest closest to NYS Route 33/Humboldt Parkway transportation corridor and decreased with increasing distance from the transportation corridor. Near-road air quality literature and modeling show that annual and 24-hour average PM2.5 concentrations near limited access highways drop off rapidly within the first 100 meters from the roadway, and then decrease more gradually at distances beyond 100 meters from the roadway.[22] Therefore, receptor density is most important within the first 100 meters and at 100-300 meters fewer receptors are needed.

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[22] Caltrans. 2017. Quantitative Particulate Matter Hot-Spot Analysis Best Practices Guidebook (see Figure 14)

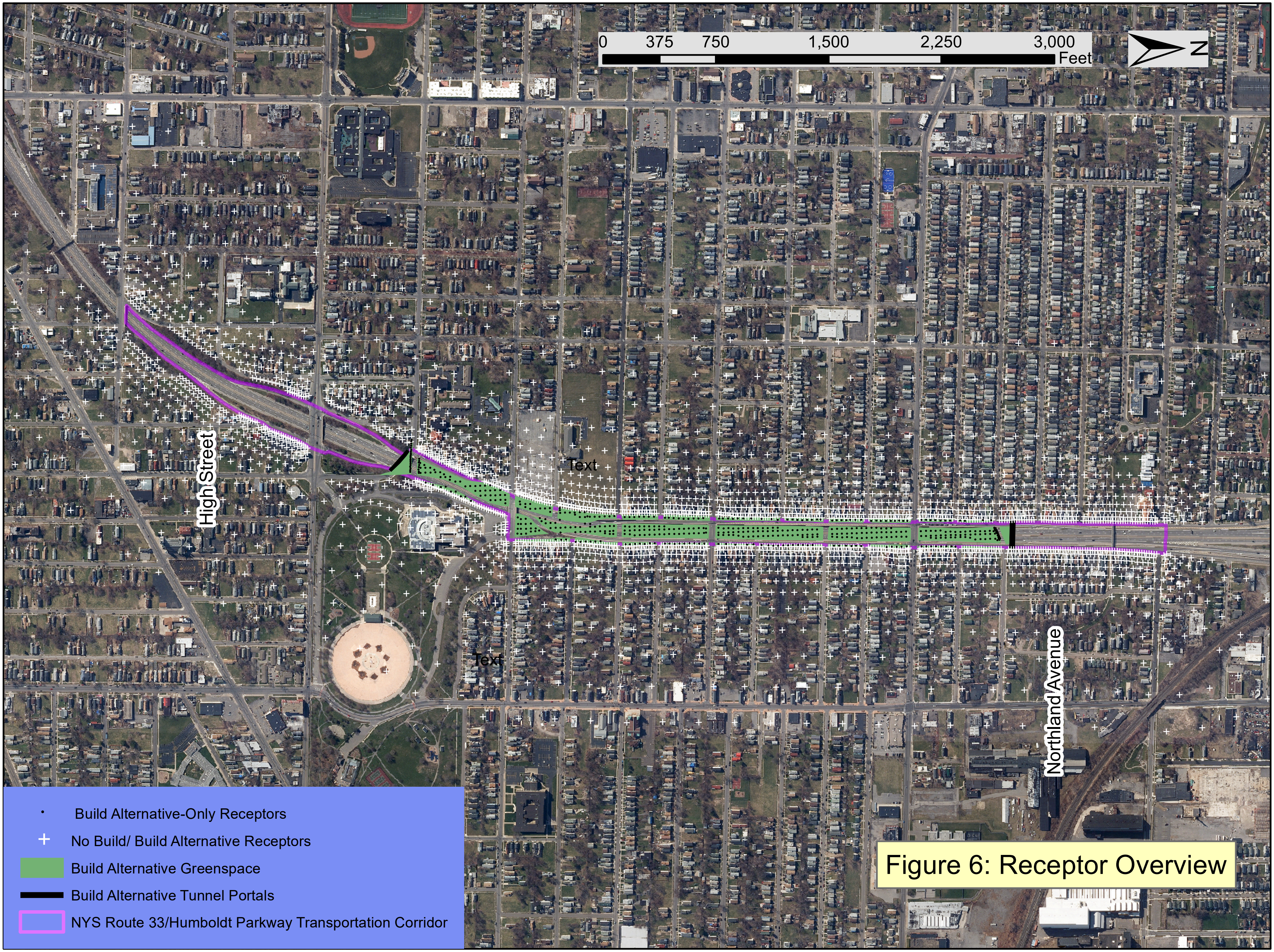

Figure 6: Receptor Overview

Detailed receptor network development steps:

1. <u>Define transportation corridor</u>. NYS Route 33/ Humboldt Parkway transportation corridor north /south limits were defined based on Northland Avenue and High Street (corresponding to limits of work). The east-west extent of the corridor was based on the outermost edge of travel lanes. See Figure 6.

2. <u>Generate receptor row lines.</u> A "row" refers to receptors along lines parallel to the transportation corridor.

    a. A total of 12 receptor row lines were established around the transportation corridor out to a distance of 363 meters from the transportation corridor. The distance of each row from the transportation corridor is shown in the "Row Line Distance from edge of transportation corridor" column in Table 15. A multiple ring buffer GIS tool was used as illustrated in Figure 7.

    b. The first receptors row line was placed at a distance of 5 meters from the edge of the transportation corridor, which is consistent with USEPA guidance that receptors should generally not be located closer than 5 meters from an emissions source in a hot-spot analysis. Sidewalks at least 5 meters from the nearest travel lane were included as appropriate receptor locations.

    c. The distance between receptor rows was increased gradually by adding the value shown in the "Row Line and Receptor Point Spacing" column of Table 15. For example, the first receptor row is 5 meters from the transportation corridor. The spacing value for second row is 8 meters. Therefore, the second receptor row is located 13 meters from the edge of the transportation corridor (5+8). The spacing value for the third row is 11 meters and the third row is located 24 meters from the edge of the transportation corridor (13+11).

3. <u>Generate receptor points along receptor row lines.</u> The receptor row lines were converted to points representing discrete receptors for import into AERMOD. The spacing between receptor points along a row line is shown in the "Row Line and Receptor Point Spacing" column of Table 15 and increases gradually with increasing distance from the transportation corridor. Figure 8 illustrates the concept of spacing along the line increasing.

    a. The first row of receptor points was placed with 5-meter spacing along the line (e.g., each point is 5 meters from the previous point).

    b. For the first 100 meters from the transportation corridor, receptor spacing along the receptor row line was increased by 3 meters per row. The spacing along the row line for the second row is 8 meters, for the third row it is 11 meters, and for the fourth row it is 14 meters (See Table 15).

   c. For distances of greater than approximately 100 meters from the transportation corridor, receptor spacing along the row line increases by 10 meters per row. The twelfth row is 363 meters from the edge of the transportation corridor.

4. Remove inappropriate receptors. Receptors were removed from within NYS Route 33 highway boundary (based on survey data) and local streets (inappropriate receptor locations because streets would not be a location of prolonged public exposure).

The total number of No Build/Build conditions receptors is 2,833.

Build Condition-Only Receptor Network

A receptor grid with 10-meter spacing was placed over the tunnel deck greenspaces created under the Build Alternative. Receptors within 5 meters of the travel lane area of Humboldt Parkway and cross streets or overlapping with areas covered by the No Build/Build conditions receptor network were removed. Receptors were also relocated from the fenced off areas near the tunnel portals that would not be publicly accessible. In total, the Build condition-only receptor network consists of 492 receptors.

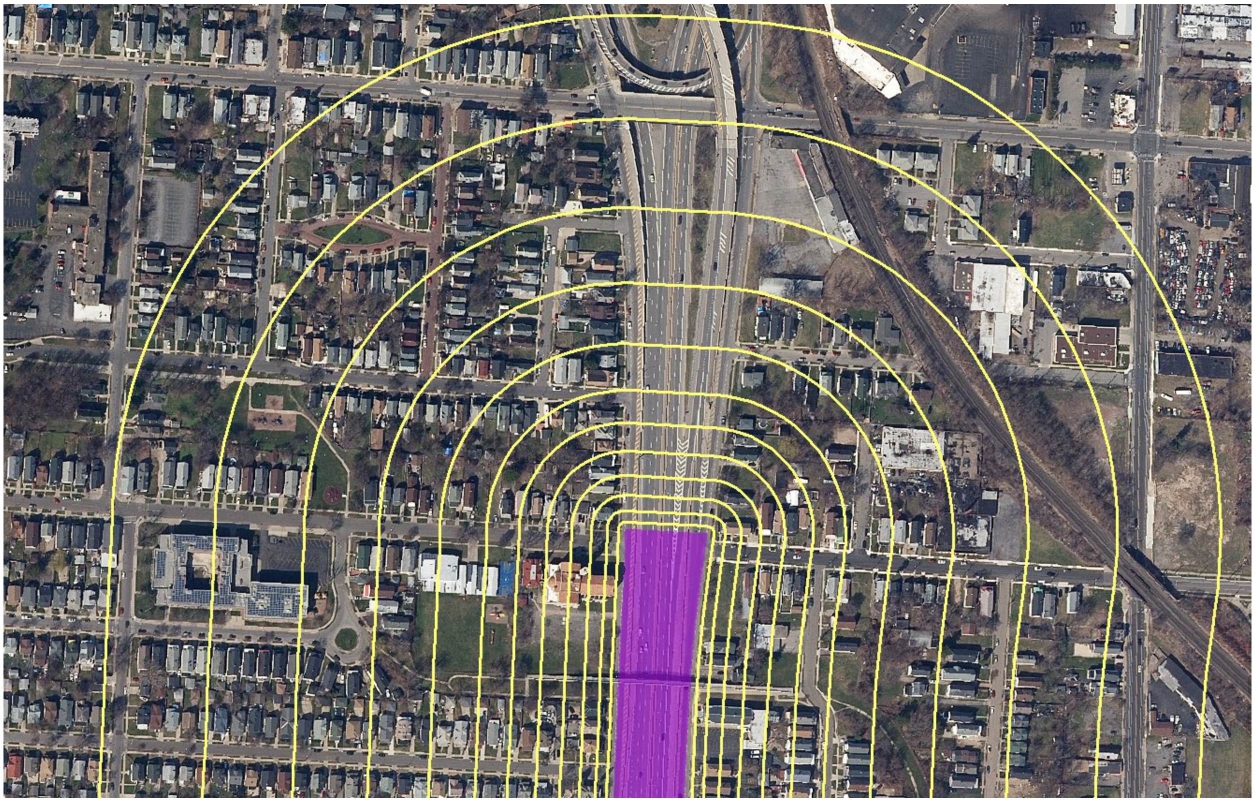

Figure 7: Multiple Ring Buffer Example

Table 15. No Build/Build Conditions Receptor Placement

Receptor Row Number	Row Line and Receptor Point Spacing (meters)	Row Line Distance from edge of transportation corridor (meters)*
1	5	5
2	8	13
3	11	24
4	14	38
5	17	55
6	20	75
7	23	98
8	33	131
9	43	174
10	53	227
11	63	290
12	73	363

*Specifically, the nearest travel lane of NYS Route 33 or Humboldt Parkway (not including on-street parking)

Figure 8: Example of converting lines to points with equidistant spacing along the line

5.3 Results – PM2.5

Tables 16 and 17 provide the years 2027 and 2047 No Build PM2.5 concentration results, respectively. The results represent the receptor with the highest modeled concentration consistent with the statistical form of the standards. The predicted concentrations remain well below the NAAQS. The 2047 highest concentration decreases slightly compared to the 2027 highest concentration as a result of fleet turnover and emission standards regulations. Figures 9 and 10 compare the No Build and Build 24-hour average PM2.5 modeled concentrations for 2027 and 2047, respectively. Figures 11 and 12 compare the No Build and Build annual average PM2.5 modeled concentrations for 2027 and 2047, respectively. The contours show a drop off in concentrations with increasing distance from the transportation corridor as well as the contribution of cross streets to the total concentrations. In the No Build Alternative, the highest annual average PM2.5 concentration occurs at a receptor near the East Ferry Street intersection with Humboldt Parkway northbound.

Table 16. Year 2027 No Build Alternative PM2.5 Results (µg/m3)

	Modeled Concentration	Background	Total*	NAAQS
Annual Average PM2.5	0.5	6.8	7.3	12
24-hr Average PM2.5	1.2	17.2	18.5	35

*Total calculated from unrounded values

Table 17. Year 2047 No Build Alternative PM2.5 Results (µg/m3)

	Modeled Concentration	Background	Total*	NAAQS
Annual Average PM2.5	0.4	6.8	7.2	12
24-hr Average PM2.5	0.9	17.2	18.2	35

*Total calculated from unrounded values

Tables 18 and 19 provide the years 2027 and 2047 Build Alternative PM2.5 concentration results, respectively. The predicted concentrations remain well below the NAAQS. As shown in the concentration plot figures, concentrations are lower along the proposed tunnel cap where receptor exposure would be reduced by the Build Alternative, and higher just north and south of the proposed tunnel portals where the density of emissions would slightly increase.

Table 18. Year 2027 Build Alternative PM2.5 Results (µg/m3)

	Modeled Concentration	Background	Total*	National Ambient Air Quality Standards
Annual Average PM2.5	0.7	6.8	7.5	12
24-hr Average PM2.5	1.4	17.2	18.7	35

*Total calculated from unrounded values

Table 19. Year 2047 Build Alternative PM2.5 Results (µg/m3)

	Modeled Concentration	Background	Total*	National Ambient Air Quality Standards
Annual Average PM2.5	0.5	6.8	7.3	12
24-hr Average PM2.5	1.0	17.2	18.2	35

*Total calculated from unrounded values

The difference between the No Build Alternative concentration and the Build Alternative concentration was calculated for each individual receptor location and the results are summarized in Tables 20 (highest increases) and 21 (highest decreases). The highest increase at a receptor is 0.4 µg/m3 for the annual average PM2.5 standard, and 0.8 µg/m3 for the 24-hour average standard in 2027. The receptor with the highest No Build to Build increase for both the annual average and 24-hour average standards is located along Humboldt Parkway northbound, north of Sidney Street. The total concentration at this location would be less than 63% of the annual average NAAQS and less than 54% of the 24-hour average NAAQS in 2027. Concentrations would be slightly lower in year 2047 compared to year 2027. The specific receptor with the highest increase is located on the sidewalk. Concentrations at homes where people would be exposed for longer periods of time would be lower. Measures to minimize air quality effects in the tunnel portal area are discussed in Section 9.

Table 20. Receptor Level No Build to Build PM2.5 Highest Increase, years 2027 and 2047

	2027-Highest No Build to Build Increase (µg/m3)	**2047-Highest No Build to Build Increase (µg/m3)**	**2027 Total Build (w/background)***		**2047 Total Build (w/background)***		**NAAQS (µg/m3)**
			Concentration (µg/m3)	**Percent of NAAQS**	**Concentration (µg/m3)**	**Percent of NAAQS**	
Annual Ave. PM2.5	+0.4	+0.3	7.5	62.5%	7.3	60.8%	12 (100%)
24-hr PM2.5	+0.8	+0.5	18.7	53.4%	18.2	52.0%	35 (100%)

*Total calculated from unrounded values

Table 21. Receptor Level No Build to Build PM2.5 Highest Decrease, years 2027 and 2047

	2027-Highest No Build to Build Decrease (µg/m3)	2047-Highest No Build to Build Decrease (µg/m3)	2027 Total Build (w/background)*		2047 Total Build (w/background)*		NAAQS (µg/m3)
			Concentration (µg/m3)	Percent of NAAQS	Concentration (µg/m3)	Percent of NAAQS	
Annual Ave. PM2.5	-0.2	-0.2	6.9	57.5%	6.9	57.5%	12 (100%)
24-hr PM2.5	-0.4	-0.3	17.6	50.3%	17.5	50.0%	35 (100%)

*Total calculated from unrounded values

The largest No Build to Build Alternative decrease at a receptor is -0.2 µg/m3 for the annual average PM2.5 standard, and -0.4 µg/m3 for the 24-hour average standard in 2027. For 2027, the receptor with the largest No Build to Build decrease for the annual average PM2.5 standard is located along Humboldt Parkway northbound, south of East Ferry Street. The receptor with the largest No Build to Build decrease for the 24-hour average PM2.5 standard is located along Humboldt Parkway southbound at the intersection with East Utica Street. The area of the largest decreases is near the center of the tunnel cap. The total concentration at these locations would be less than 58% of the annual average NAAQS and equal to approximately 50% of the 24-hour average NAAQS in 2027. Concentrations would be slightly lower in year 2047 compared to year 2027.

For the receptor network as a whole, the average No Build to Build change in annual average PM2.5 concentrations is a decrease of 0.02 µg/m3 in year 2027 and a decrease of 0.01 µg/m3 in year 2047. The average No Build to Build change for 24-hour average PM2.5 concentrations is a decrease of 0.03 µg/m3 and 0.02 µg/m3 in years 2027 and 2047, respectively.

For the Build Alternative only receptors on the tunnel cap/ new greenspace, the highest modeled annual average PM2.5 concentration is 0.4 µg/m3 in years 2027 and 2047. The average annual modeled concentration for all the Build condition only receptors is 0.17 µg/m3 and 0.12 µg/m3 in years 2027 and 2047, respectively. For 24-hour average PM2.5, the 8th highest modeled concentration is 1.0 µg/m3 and 0.8 µg/m3 in 2027 and 2047, respectively. The average of the 8th highest concentrations of all the Build Alternative only receptors is 0.42 µg/m3 and 0.31 µg/m3 in 2027 and 2047, respectively. When combined with background concentrations, these concentrations would be well below the NAAQS and less than the highest concentrations shown in Tables 18 and 19.

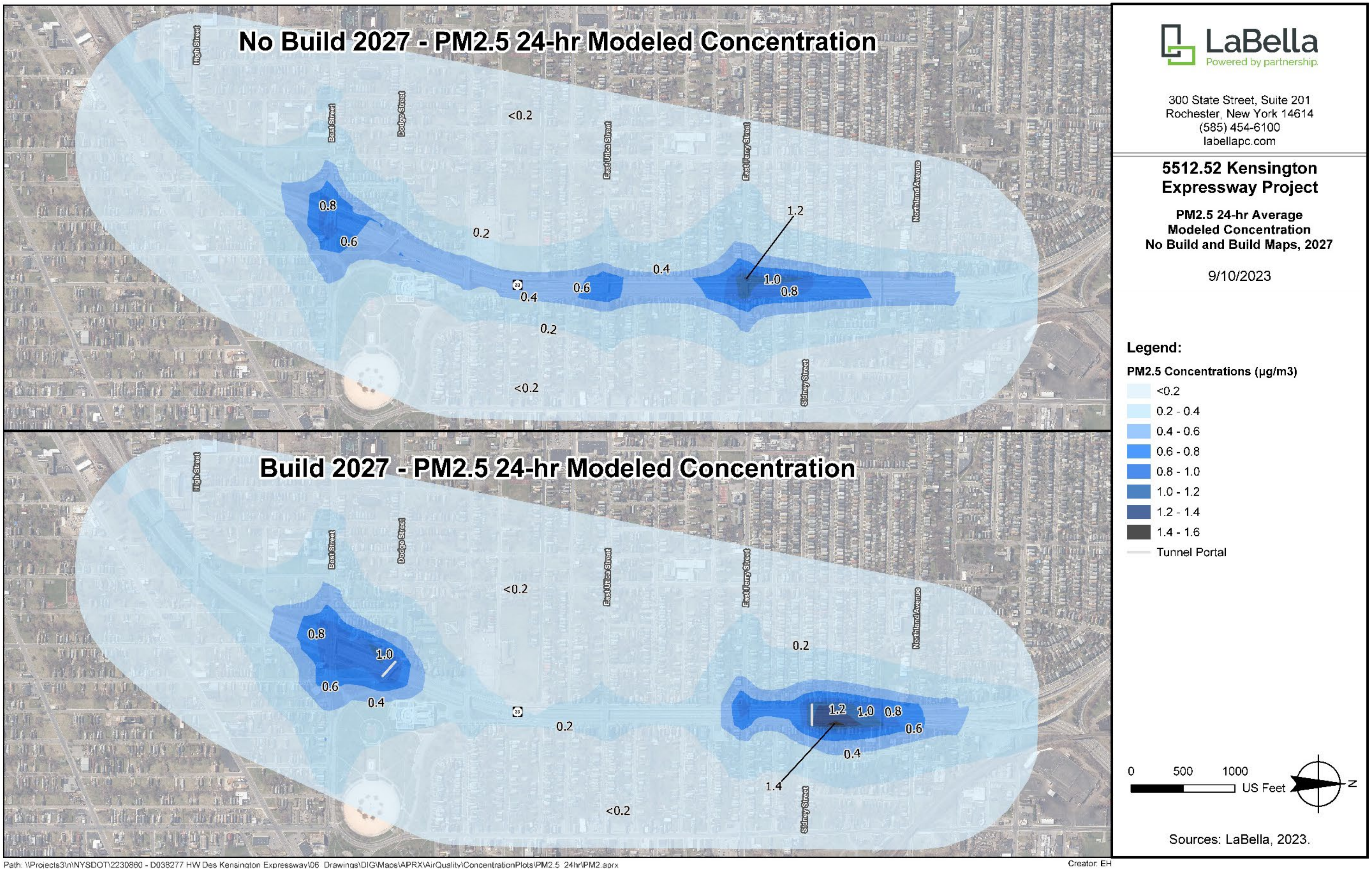

Figure 9: Modeled Year 2027 24-hour Average PM2.5 Concentrations

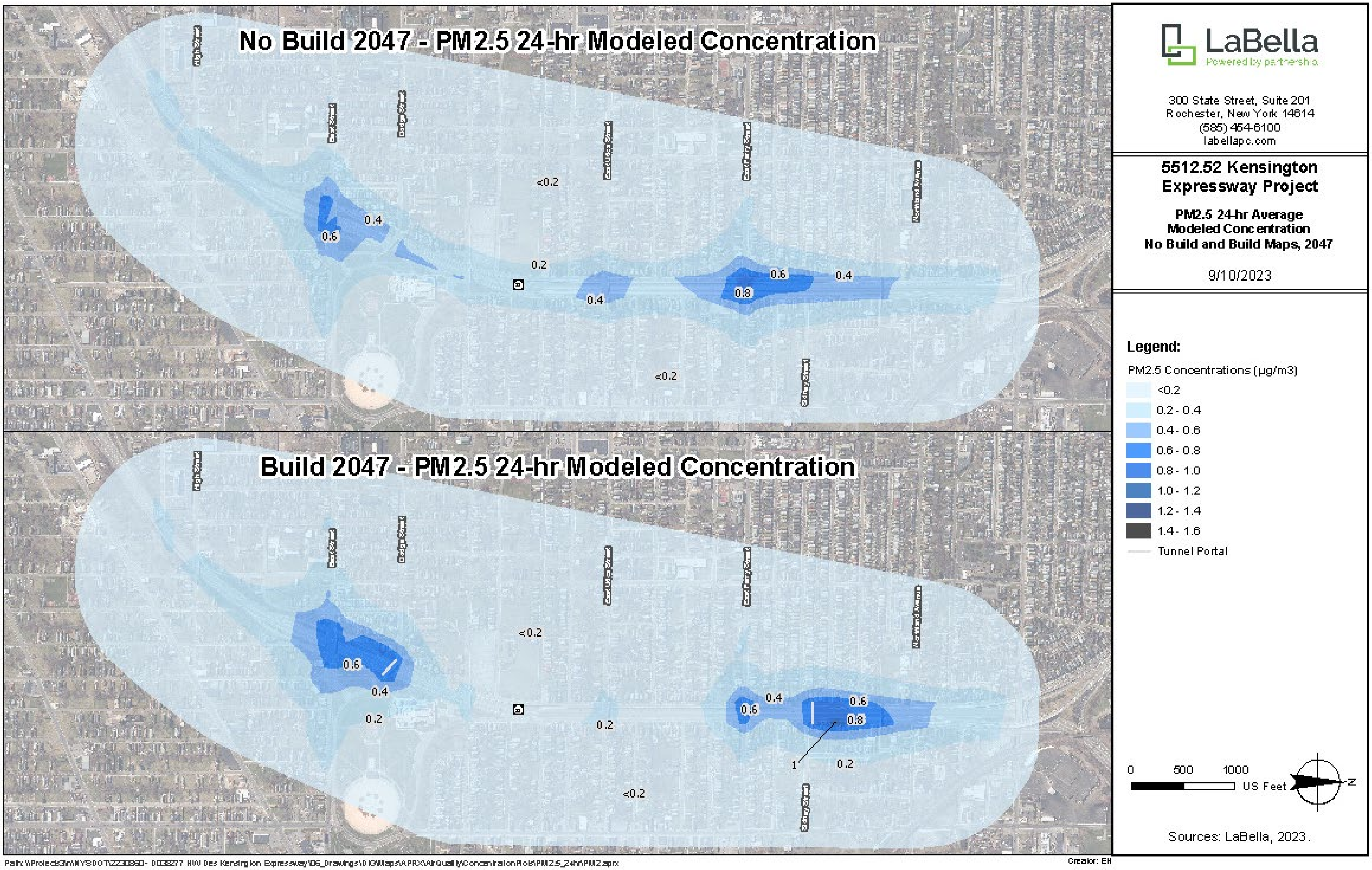

Figure 10 Modeled Year 2047 24-hour Average PM2.5 Concentrations

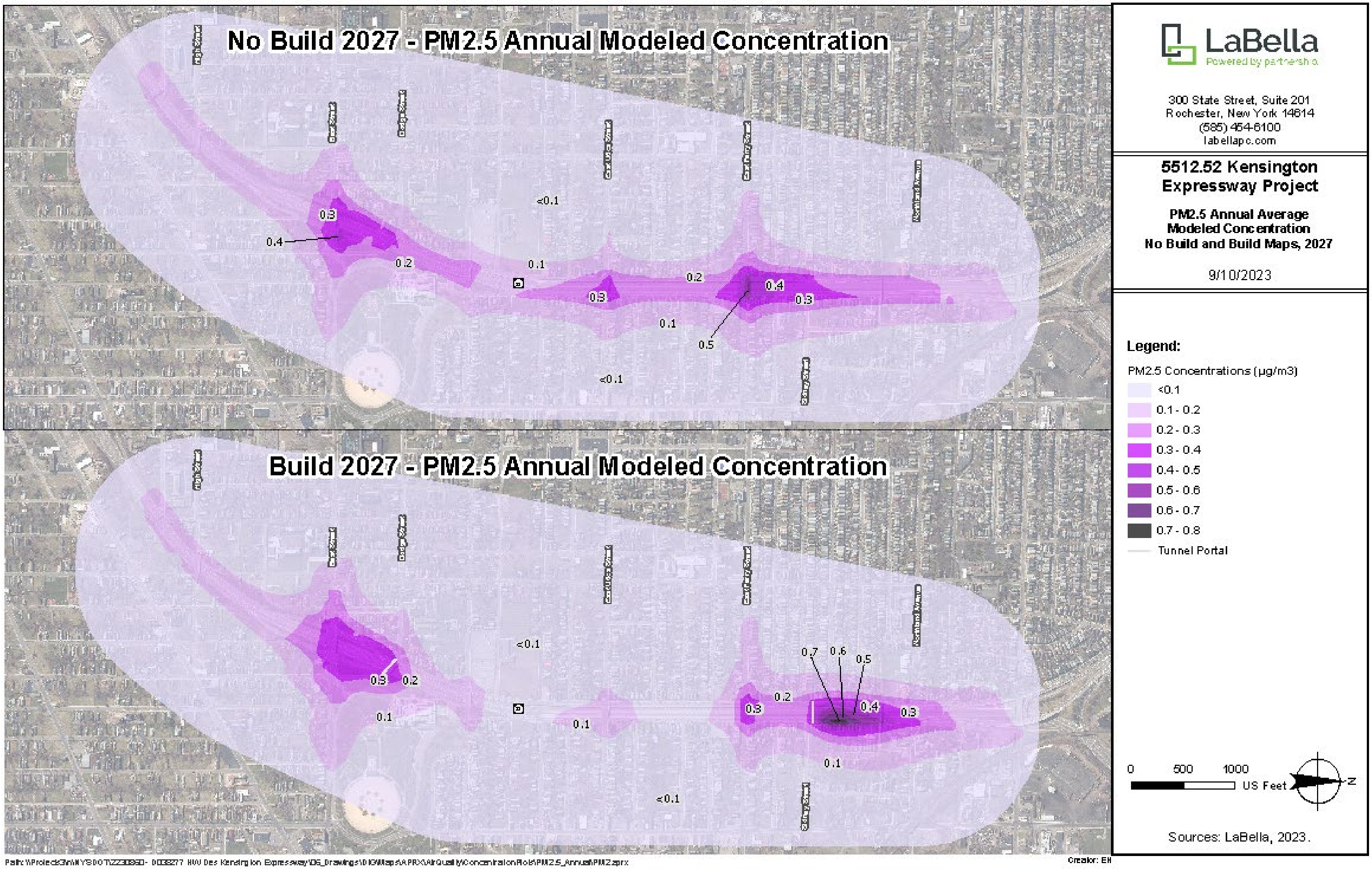

Figure 11 Modeled Year 2027 Annual Average PM2.5 Concentrations

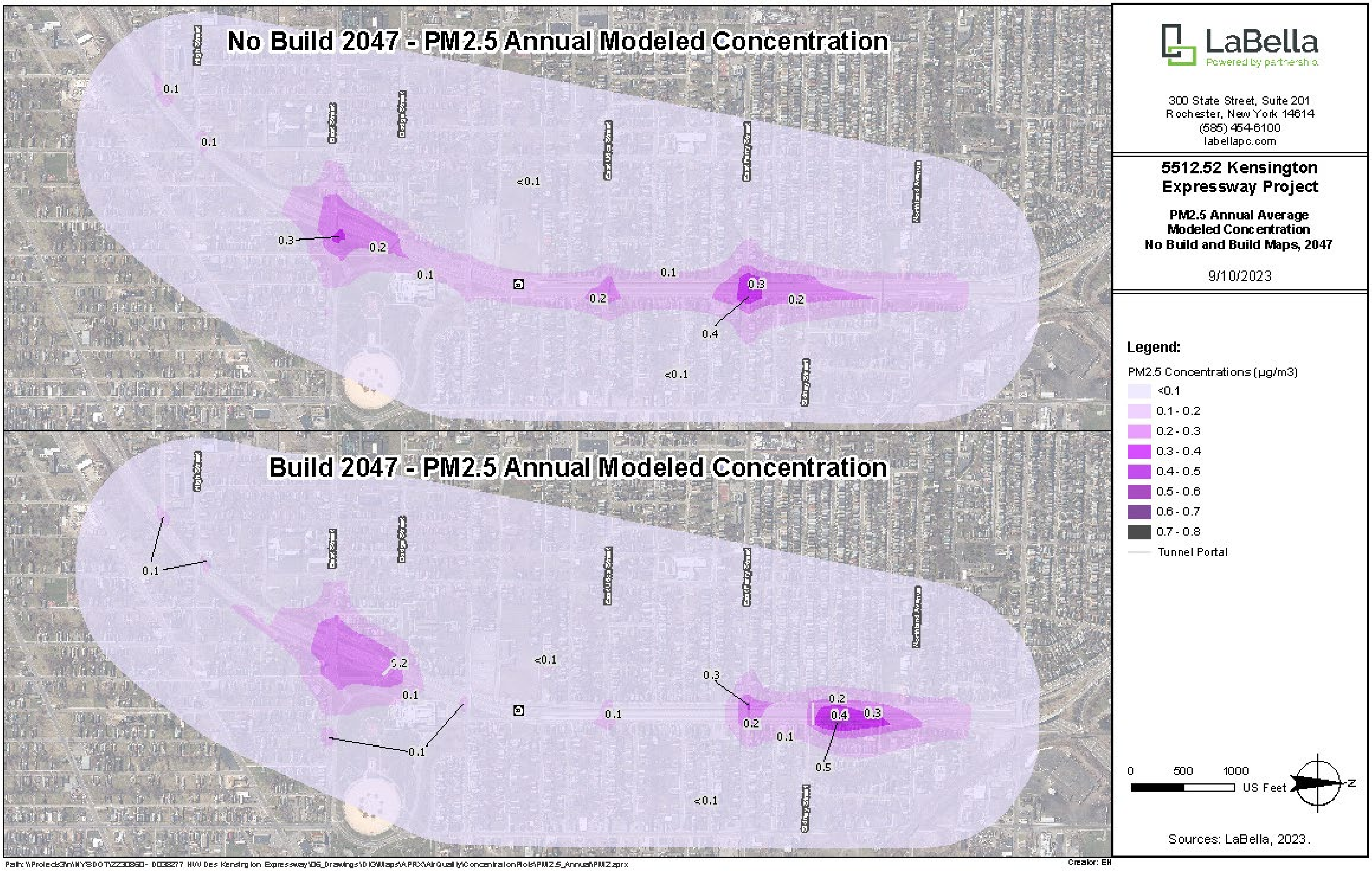

Figure 12 Modeled Year 2047 Annual Average PM2.5 Concentrations

5.4 Results – PM10

Tables 22 and 23 provide the PM10 concentration results for the No Build and Build Alternatives, respectively. The predicted concentrations remain well below the NAAQS in years 2027 and 2047. The pattern of concentrations is similar to the PM2.5 results discussed above. The highest concentration in the No Build condition is at the East Ferry Street intersection. The highest concentration in the Build condition is at a sidewalk receptor on Humboldt Parkway northbound, north of the Sidney Street exit portal.

The largest contributors to PM10 concentrations include road dust and particles released by vehicle brake wear and tire wear, which are not sensitive to cleaner emitting vehicles increasing in the fleet over time. As a result, the 2047 concentrations do not change substantially compared to 2027. The 2027 exhaust emission rates are lower than in 2047, but this can be offset by the higher traffic volumes in 2047 increasing the road dust component of the emissions.

Table 22. Year 2027 and 2047 No Build Alternative PM10 Results (µg/m3)

	Modeled Concentration	Background	Total*	NAAQS
2027 Highest 24-hour average	20	45	65	150
2047 Highest 24-hour Average	20	45	65	150

*Total calculated from unrounded values

Table 23. Year 2027 and 2047 Build Alternative PM10 Results (µg/m3)

	Modeled Concentration	Background	Total*	NAAQS
2027 Highest 24-hour average	27	45	72	150
2047 Highest 24-hour Average	29	45	74	150

*Total calculated from unrounded values

Table 24 shows the highest increase and highest decrease in 24-hour PM10 concentrations between the No Build and Build Alternatives for years 2027 and 2047. The highest predicted total concentration is 49% of the 24-hour PM10 NAAQS. The pattern of slight increases in concentrations occurring near the tunnel portals and slight decreases along the tunnel cap is similar to the PM2.5 results. The highest decrease occurs on Humboldt Parkway southbound at the intersection with Landon Street, which is within the tunnel cap area. The specific receptor with the highest increase is located on the sidewalk on Humboldt Parkway northbound, north of the Sidney Street exit portal. Concentrations at homes where people would be exposed for longer periods of time would be lower. Measures to minimize air quality effects in the tunnel portal area (including dust control/ tunnel washing, which is important to PM10) are discussed in Section 9.

Table 24. Receptor Level No Build to Build 24-hr Average PM10 Highest Increase/Decrease, years 2027 and 2047

Year	Highest No Build to Build Increase (µg/m3)	Highest No Build to Build Decrease (µg/m3)	Total Build Concentration at Receptor with Highest Increase (w/background)*		Total Build Concentration at Receptor with Highest Decrease (w/background)*		NAAQS (µg/m3)
			Concentration (µg/m3)	Percent of NAAQS	Concentration (µg/m3)	Percent of NAAQS	
2027	+14	-8	71	47%	52	35%	150(100%)
2047	+15	-9	74	49%	52	35%	150(100%)

*Total calculated from unrounded values

6 CO Microscale (Localized Concentrations) Analysis

A CO microscale analysis was conducted using an approach similar to the PM2.5/PM10 analysis and taking into consideration USEPA's *Using MOVES3 in Project-Level Carbon Monoxide Analyses.*[23] This section focuses on the elements of the CO microscale analysis that differ from the PM microscale analysis discussed in Section 5.

6.1 Methodology

CO emissions modeling with MOVES3 was performed for years 2027 and 2047 using the January 8:00 AM hour because CO emissions are higher under cold temperatures. The links definition, traffic volumes, vehicle classification, speeds, etc. were the same as the AM peak hour details developed for the PM microscale analysis.

The CO dispersion modeling with AERMOD was conducted with the same methodologies as the microscale PM analysis, except that it was performed for a 1-hour average concentration. The 8-hour modeled concentration was derived from the 1-hour average concentration using a 0.7 persistence factor.[24]

The Buffalo Monitor (AQS# 36-029-0005) selected for use with the PM2.5/PM10 background concentrations is also the most appropriate monitor available for CO background concentrations. USEPA-calculated CO design values for this monitor are as follows (based on 2020-2022 data):

- 1-hour standard design value= 1.2 ppm (NAAQS= 35 ppm)
- 8-hour standard design value= 0.9 ppm (NAAQS= 9 ppm)

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[23] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013NP8.pdf

[24] https://www.epa.gov/sites/default/files/2020-10/documents/coguide.pdf

The only other active CO monitor in the Buffalo area is the Buffalo Near-Road Monitor, which would not be appropriate because it already includes localized traffic related effects.

6.2 Results

Tables 25 and 26 provide the No Build Alternative CO concentration results for years 2027 and 2047, respectively. The highest 1-hour average concentration was modeled, and the highest 8-hour average concentration estimated based on a 0.7 persistence factor.[25]The highest total concentrations are well below the NAAQS in 2027 and 2047, and concentrations decrease between 2027 and 2047. The highest No Build Alternative CO concentration occurs at receptors in the parking lot of the Buffalo Museum of Science, south of Northampton Street and adjacent NYS Route 33 eastbound. This is the location in the Study Area where receptors are closest to the Kensington Expressway (in other locations, receptors are farther from the highway because of the buffer distance provided by Humboldt Parkway or by inaccessible areas around interchange ramps).

Table 25. Year 2027 No Build Alternative CO Results (ppm)

	Modeled Concentration	Background	Total	NAAQS
1-hr average	0.8	1.2	2.0	35
8-hr average	0.6	0.9	1.5	9

Table 26. Year 2047 No Build Alternative CO Results (ppm)

	Modeled Concentration	Background	Total	NAAQS
1-hr average	0.5	1.2	1.7	35
8-hr average	0.3	0.9	1.2	9

Tables 27 and 28 provide the years 2027 and 2047 Build Alternative CO concentration results, respectively. The predicted concentrations remain well below the NAAQS. The highest concentration under the Build Alternative occurs at a sidewalk receptor at the intersection of Dodge Street and West Parade Avenue (near the Dodge Street tunnel exit portal). The highest concentration likely occurs at this location because the CO screening analysis is based on the AM peak hour traffic analysis and AM traffic is heaviest in the westbound direction.

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[25] EPA. 1992. Guideline for Modeling Carbon Monoxide from Roadway Intersections.

Table 27. Year 2027 Build Alternative CO Results (ppm)

	Modeled Concentration	Background	Total	NAAQS
1-hr average	1.9	1.2	3.1	35
8-hr average	1.3	0.9	2.2	9

Table 28. Year 2047 Build Alternative CO Results (ppm)

	Modeled Concentration	Background	Total	NAAQS
1-hr average	1.1	1.2	2.3	35
8-hr average	0.8	0.9	1.7	9

Table 29 shows the highest increase and highest decrease in CO concentrations between the No Build and Build Alternatives for years 2027 and 2047. The highest predicted total concentration is 9% of the 1-hour average CO NAAQS. The pattern of slight increases in concentrations occurring near the tunnel portals and slight decreases along the cap is similar to the PM2.5 results. The highest decrease occurs on Humboldt Parkway northbound north of East Utica Street, which is within the tunnel cap area. As noted above, the specific receptor with the highest increase is located on the sidewalk in the vicinity of the Dodge Street portal. Concentrations at homes where people would be exposed for longer periods of time would be lower. Measures to minimize air quality effects in the tunnel portal area are discussed in Section 9.

Table 29. Receptor Level No Build to Build 1-hour Average CO Highest Increase/Decrease, years 2027 and 2047

Year	Highest No Build to Build Increase (ppm)	Highest No Build to Build Decrease (ppm)	Total Build Concentration at Receptor with Highest Increase (w/background)		Total Build Concentration at Receptor with Highest Decrease (w/background)		NAAQS (ppm)
			Concentration (ppm)	**Percent of NAAQS**	**Concentration (ppm)**	**Percent of NAAQS**	
2027	+1.4	-0.5	3.1	9%	1.5	4%	35
2047	+0.8	-0.3	2.3	7%	1.4	4%	35

7 Mesoscale (Regional) Emissions Analysis

According to NYSDOT procedures, mesoscale analysis is recommended when a project would substantially affect traffic over a large area, including new or substantial modifications to interchanges on access controlled facilities. The Project includes elimination of an existing partial interchange between NYS Route 33 and East Utica Street. In addition, public engagement efforts have indicated public interest and concern regarding air quality effects. Therefore, a mesoscale emissions analysis was performed for year 2027 (No Build and Build Alternatives), year 2037 (No Build and Build Alternatives) and year 2047 (No Build and Build Alternatives).

7.1 Study Area

For the mesoscale analysis of potential regional changes in emissions, the Study Area was the GBNRTC travel demand model area consisting of Erie and Niagara Counties.

Given that the Project would not change the capacity of NYS Route 33, substantial changes in traffic on other routes more distant from the Project are not anticipated. Emissions Modeling

The mesoscale analysis was conducted for years 2027 (ETC), 2037 (ETC+10 years), and 2047 (ETC+20 years). GBNRTC vehicle miles traveled (VMT) outputs were available for years 2019 and 2045 for both the No Build and Build Alternatives. The year 2045 VMT outputs were used to represent year 2047 and the years 2027 and 2037 region-wide VMT were interpolated from the two available years.

The mesoscale emissions analysis was performed using MOVES3 at the county-scale using Erie County specific vehicle, roadway and fuel characteristics. The VMT breakdown by vehicle type and breakdown by hour/ weekday or weekend/ month were consistent with the latest NYSDEC/ NYSDOT MOVES inputs for Erie County.

To process the daily GBNRTC VMT into the MOVES format, it had to be distributed by the 13 MOVES vehicle types and by weekend vs. weekday.

- Distribution of VMT to source types was based on the percent of VMT in each source type for 2019 conditions from NYSDEC Erie County input data.
- Distribution to weekday vs. weekend was also based on the NYSDEC input data weekday vs. weekend split for urban roadways.

The criteria pollutants analyzed in the mesoscale analysis included CO, PM10, PM2.5, VOC, and NOx. All months and hours of the day were modeled, but the output was aggregated on an annual basis.

The mesoscale analysis was focused on running emissions only as opposed to off-network activity, such as vehicle starts that would not be changed by the Project.

7.2 Results

Table 30 presents the regional emissions burdens of VOC, NO$_x$, CO, PM$_{10}$ and PM$_{2.5}$ under the No Build and Build Alternatives. VOC and NO$_X$ are quantified because they are precursor pollutants to the formation of O$_3$. As shown in Table 30, the Build Alternative would result in a negligible decrease in emissions in all three analysis years. For each analysis year, even though there is an increase in VMT from 2027 to 2047, there is an overall emissions reduction due to fleet turnover and emission standards regulations.

Table 30. Mesoscale Emissions Burden (tons/year)

	2027			2037			2047		
Pollutant	No Build	Build	% Difference	No Build	Build	% Difference	No Build	Build	% Difference
VOC	223.62	223.61	0.00%	163.95	163.92	-0.02%	154.87	154.81	-0.04%
NOx	1,091.83	1,091.78	0.00%	721.16	721.01	-0.02%	679.83	679.59	-0.04%
CO	9,576.90	9,576.50	0.00%	6,518.38	6,517.05	-0.02%	5,995.66	5,993.46	-0.04%
PM10	277.95	277.93	0.00%	268.05	268.00	-0.02%	267.31	267.21	-0.04%
PM2.5	53.66	53.65	0.00%	43.39	43.38	-0.02%	42.11	42.09	-0.04%

8 Mobile Source Air Toxics

Under the Clean Air Act, USEPA is required to regulate emissions of 188 air toxics that have the potential for serious health effects. USEPA has identified nine compounds with substantial contributions from mobile sources that are among the national and regional-scale health risk contributors and FHWA considers these pollutants the priority Mobile Source Air Toxics (MSATs): 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter.

Under FHWA's Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents, the Project falls under Category 2: "Projects with Low Potential MSAT Effects" because it does not add new highway capacity, does not create facilities that would increase MSAT emissions, and involves annual average daily traffic (AADT) volumes less than 140,000 to 150,000. AADT on the Kensington Expressway through the defined transportation corridor is approximately 75,000. The FHWA guidance recommends that Category 2 projects be addressed with a qualitative discussion considering factors such as the effect of the Project on VMT, effects of fleet turnover, MSAT control regulations, and changes in source-receptor distances.

Table 31. Regional VMT in the No Build and Build Alternatives

Analysis Year	Alternative	Annual VMT	% Difference
2027	No Build	24,212,178	0.00%
	Build	24,211,186	
2037	No Build	24,265,438	-0.02%
	Build	24,260,473	

2047	No Build	24,318,309	-0.04%
	Build	24,309,759	

Note: Based on 2019 and 2047 VMT provided by GBNRTC (interim years interpolated)

MSAT emissions would be proportional to the VMT of the No Build and Build Alternatives for a given year when variables such as fleet mix remain similar. Since the estimated VMT under the No Build and Build Alternatives varies by less than 1 percent for the 2027, 2037 and 2047 analysis years as shown in Table 31, there would be no appreciable difference in overall MSAT emissions between the alternatives in either analysis year. Similar to other pollutants such as PM2.5, there may be localized areas of increased ambient concentrations of MSATs near the tunnel portals. Under both the No Build and Build Alternatives, future MSAT emissions are expected to be substantially lower than under existing conditions due to implementation of USEPA's vehicle and fuel regulations and fleet turnover.

In general, data are not sufficient to predict the project-specific health impacts due to changes in MSAT emissions. To determine the potential for adverse health effects, multiple levels of modeling must be performed (emissions, dispersion, exposure, etc.) with each subsequent model building on the predictions and assumptions of the previous model. Furthermore, there are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population.[26] Due to the limitations in the methodologies for forecasting health impacts, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. FHWA's MSAT guidance Appendix C provides additional discussion of incomplete or unavailable information for project-specific MSAT health impacts analysis.[27]

Statement on incomplete or unavailable information for project-specific MSAT health impacts analysis:

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in mobile source air toxic (MSAT) emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The Environmental Protection Agency (EPA) is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA, https://www.epa.gov/iris/). Each report contains assessments of non-

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[26] Health Effects Institute. Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-reviewliterature-exposure-and-health-effects.

[27] FHWA. 2023. Updated Interim Guidance on Mobile Source Air Toxic (MSAT) Analysis in National Environmental Policy Act (NEPA) Documents Appendix C. https://www.fhwa.dot.gov/ENVIRonment/air_quality/air_toxics/policy_and_guidance/msat/fhwa_nepa_msat_appendix_c_2023.pdf

cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). A number of HEI studies are summarized in Appendix D of FHWA's Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are: cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-reviewliterature-exposure-and-health-effects) or in the future as vehicle emissions substantially decrease.

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxicscritical-review-literature-exposure-and-health-effects). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA states that with respect to diesel engine exhaust, "[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk." (EPA IRIS database, Diesel Engine Exhaust, Section II.C. https://iris.epa.gov/static/pdfs/0642_summary.pdf).

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable (https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD5985257800005 0C9DA/$file/07-1053-1120274.pdf).

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between the No Build and Build Alternative is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits.

9 Measures to Minimize Air Quality Effects

The Build Alternative would not have an adverse effect on air quality because total concentrations would be well below the NAAQS. However, the Build Alternative includes the measures listed below to minimize the air quality effects in the tunnel portal areas. Note that these measures have not been quantified or credited in the microscale air quality analysis.

- **Redistribute portal jet emissions with tunnel ceiling vents**
  - Adding openings in the tunnel ceiling area of the exit portal would divert a portion of the air coming out of the portal (e.g., 90% out of the tunnel and 10% out of the openings). This measure could reduce the concentration of pollutants in the portal jet, causing better distributed emissions.

- **Use longitudinal ventilation system to dilute and disperse pollutants**
  - Tunnel operating procedures would include the goal of reducing the potential for increased concentrations near the portal jet by drawing in additional fresh air and increasing dispersion when warranted by air quality monitoring data in the tunnel.

- **Portal area wall treatments to remove pollutants**
  - The contractor would be required to investigate wall treatments to remove pollutants in the final design of the portal area retaining walls and safety walls (outside the tunnel).
  - One example of a potential wall treatment product is the "SmogStop" Photocatalytic Treatment. SmogStop removes NOx, which is a precursor to ozone and secondary particulate matter formation in the atmosphere.[28] The design-build contractor would not be required to use any particular product, but would be requested to recommend a product or solution and document the air quality benefits, cost, and maintenance considerations associated with the recommended solution for NYSDOT review and approval.

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[28] https://www.smogstop.co.uk/wp-content/uploads/2022/03/Van-Heyst-Shaw.pdf

- **Controlling road dust**
  - A washing schedule for the tunnel would be implemented to remove dust, reducing dust resuspension by traffic. This would reduce particulate matter concentrations. Tunnel washing frequency would be two times per year at a minimum, and more often if warranted by visible dust build-up on the tunnel walls.

- **Greenspace and tree-planting related**
  - The Build Alternative would provide approximately 11 acres of new publicly accessible greenspace and 480 trees which would remove particulate matter and provide other health-related benefits. Specific planting related commitments relevant to the portal areas include the following:
    - Planting trees in front of the residential properties adjacent to the tunnel portals.
    - Realigning Humboldt Parkway north of Sidney Street to accommodate tree planting.
    - Planting low growing shrubs in the greenspace immediately adjacent to the portals, with fencing to restrict public access to this greenspace for safety reasons.
    - Planting low growing trees adjacent to the above-referenced fencing.
    - Incorporating plantings into the design of retaining walls near the tunnel portals.

  Trees have direct benefits on air quality in urban areas, including removal of particulate matter through uptake of particles into the leaf stomata or interception of particles onto the leaf surface.[29] Factors affecting pollutant removal rates include the size and type of tree (especially leaf surface characteristics), ambient pollutant concentrations, the length of the growing season, precipitation and other factors. Removal of particulate matter is only a portion of the many health-related benefits provided by trees and greenspace. Other important benefits include providing summer temperature reduction from shade (which directly benefits human health and can also affect building energy consumption), encouraging physical activity, and psychological benefits.[30]

10 Agency Consultation

An interagency group consisting of NYSDOT, FHWA, NYSDEC and USEPA was formed to focus on coordination of air quality related issues for the Project. The purpose of the meetings is to allow early and meaningful agency input into the Project's air quality analysis. Table 32 summarizes the interagency air quality group meetings held between July 2022 and December 2023.

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[29] Nowak, David J. 2020. *Urban trees, air quality and human health*. In: Gallis, Christos; Shin, Won Sop, eds. Forests for public health. Newcastle Upon Tyne: Cambridge Scholars Publishing: 31-55.

[30] Wolf et al. Urban Trees and Human Health: A Scoping Review. Int J Environ Res Public Health. 2020 Jun; 17(12): 4371

Table 32. Interagency Air Quality Group Meetings

Meeting #	Date	Discussion Topics
1	7/26/2022	Project concepts and ventilation systems, the air quality analyses proposed for the Project, and air quality permitting requirements
2	9/13/2022	Agency comments on draft air quality analysis methodologies
3	11/8/2022	Revisions to draft air quality analysis methodologies
4	1/10/2023	Draft receptor placement methodology, AERMOD MPI, 1-hr NO2, road dust methodologies
5	2/7/2023	Review updated receptor placement, receptor height, emissions modeling methodologies
6	3/14/2023	Air quality methodology revisions, traffic data processing, fuel season for PM microscale analysis, meteorological data for AERMOD
7	5/9/2023	Presentation and discussion of No Build PM2.5 microscale methodology details and results
8	7/18/2023	Presentation and discussion of Build PM2.5 microscale methodology details and results, No Build to Build comparison, measures to minimize air quality effects
9	10/17/2023	Present and discuss results for pollutants other than PM2.5, construction air quality mitigation measures
10	12/19/2023	Wall treatments, public comments on DDR/EA, roof slots, traffic analysis, public outreach, air toxics

Attachment 1

Link Volume Maps

2027 AM Peak

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Rochester, New York 14614
(585) 454-6100
labellapc.com

5512.52 Kensington Expressway Project

2027 No Build - AM Peak Link Volume

9/7/2023

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Legend

- — Accelerate
- — Queue
- — Freeflow

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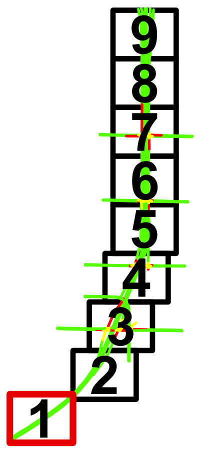
US Feet

N

Sources: Bing Maps, LaBella 2023, NYSDOT 2023, NYSGIS Clearinghouse 2022.



Path: \\Projects3\n\NYSDOT\2230860 - D038277 HW Des Kensington Expressway\06_Drawings\DIG\Maps\APRX\AirQuality\NoBuild2027_MapSeries\NoBuild2027_MapSeries.aprx

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2027 No Build - AM Peak Link Volume

9/7/2023

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Legend

- 🟨 Accelerate
- 🟥 Queue
- 🟩 Freeflow

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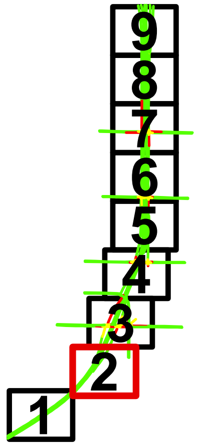
Sources: Bing Maps, LaBella 2023, NYSDOT 2023, NYSGIS Clearinghouse 2022.



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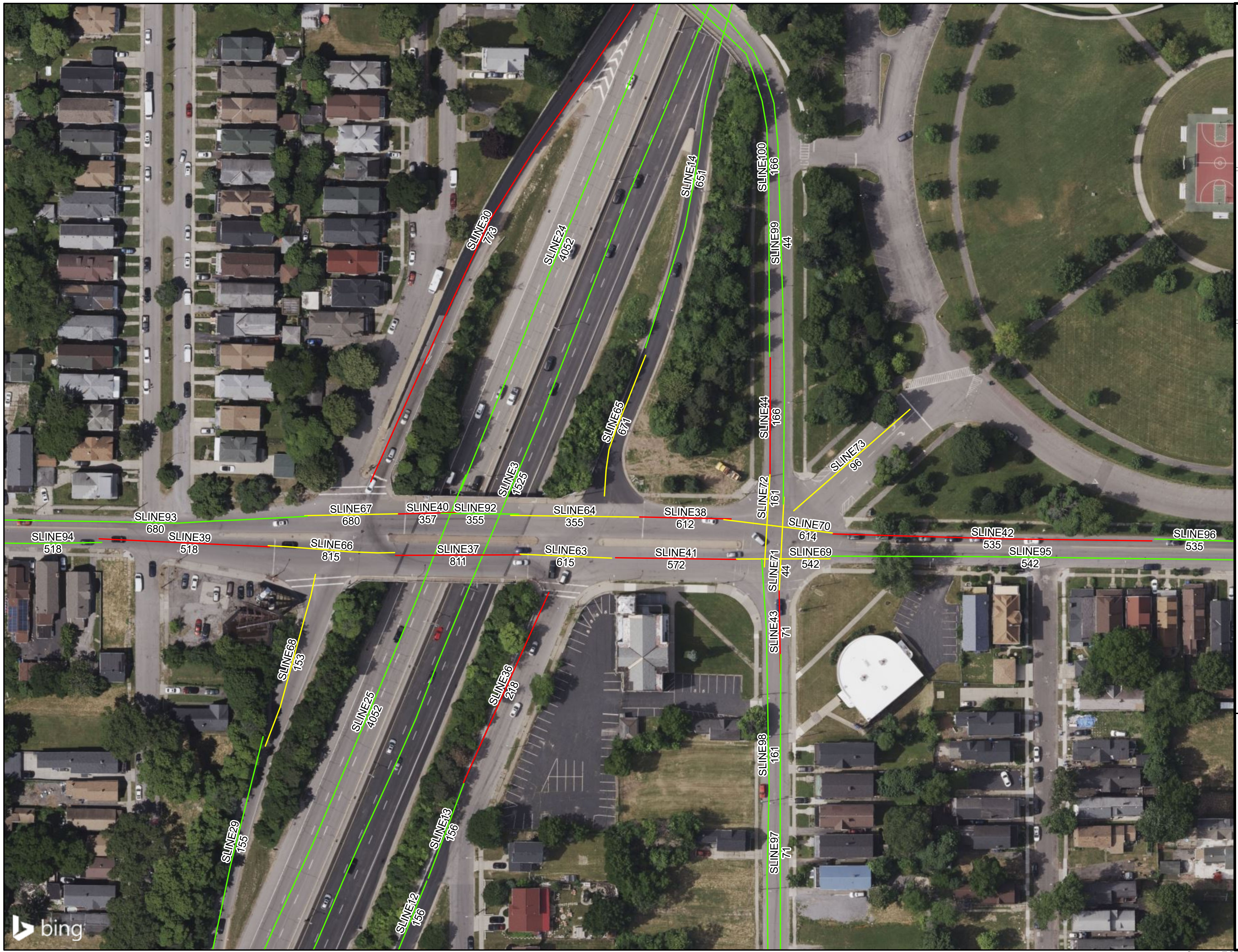

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2027 No Build - AM Peak Link Volume

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Legend

- Accelerate
- Queue
- Freeflow

0 50 100
US Feet

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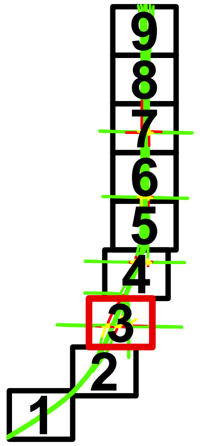
Sources: Bing Maps, LaBella 2023, NYSDOT 2023, NYSGIS Clearinghouse 2022.



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Legend

— Accelerate
— Queue
— Freeflow

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US Feet

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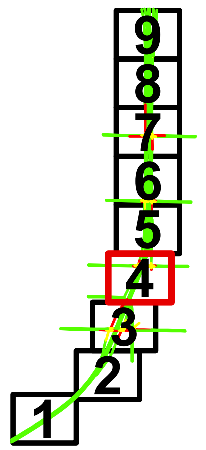

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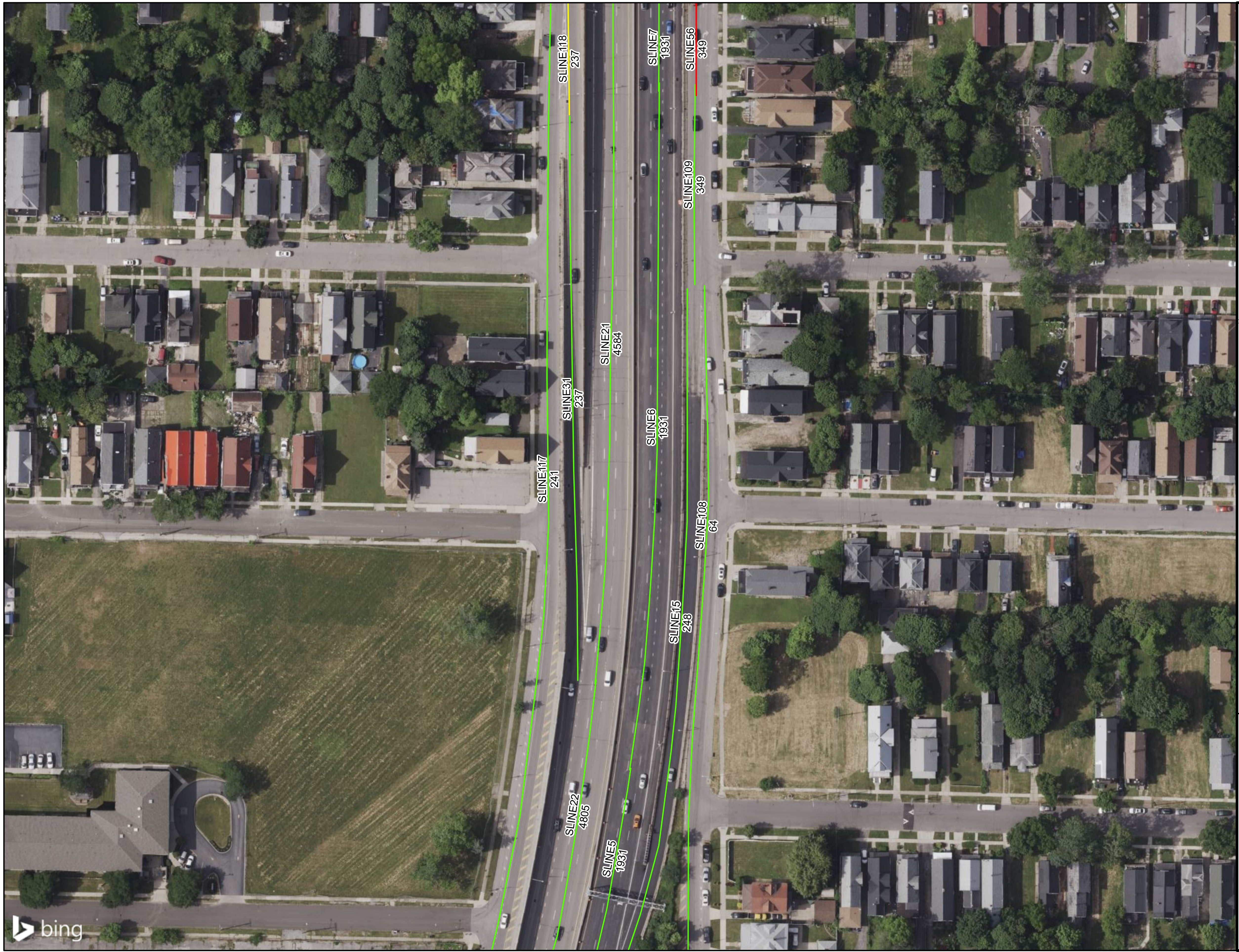

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Legend

- Accelerate
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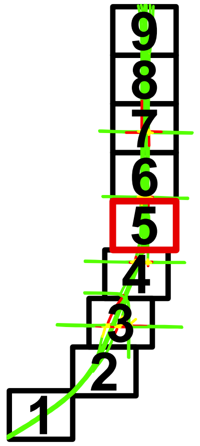

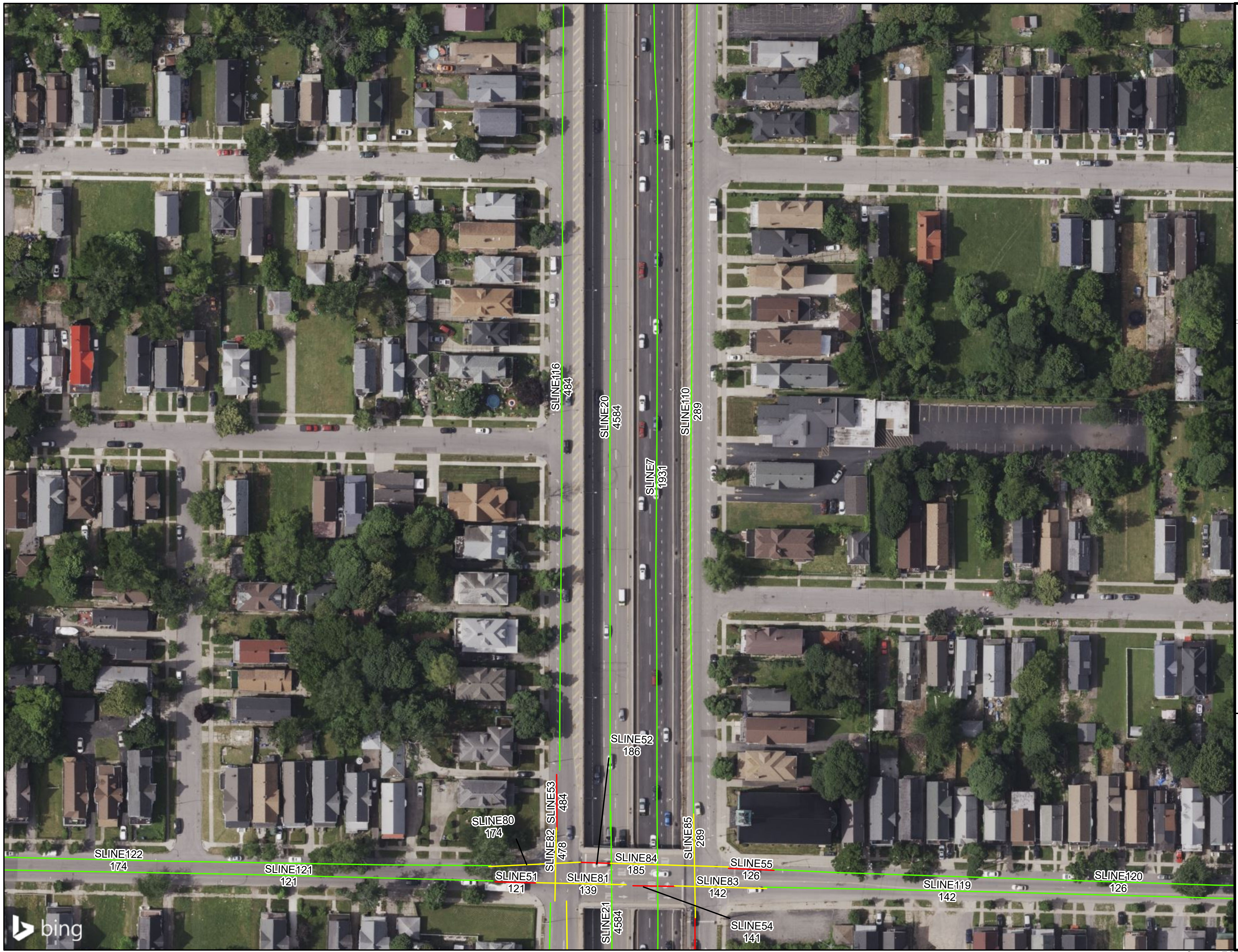

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Legend

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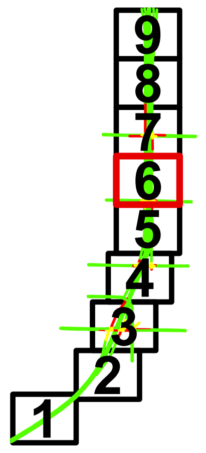

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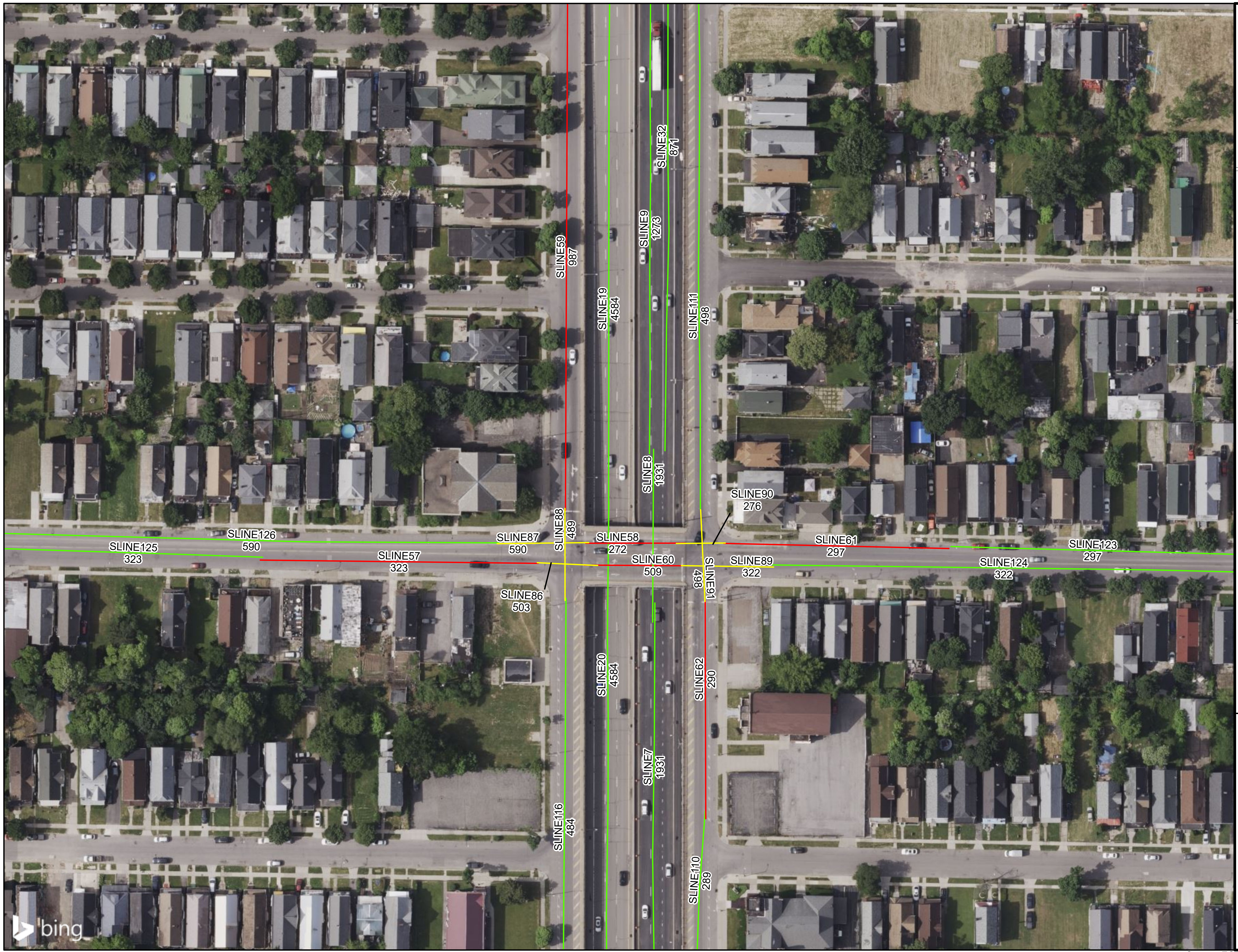

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Legend

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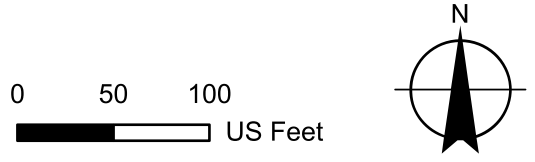

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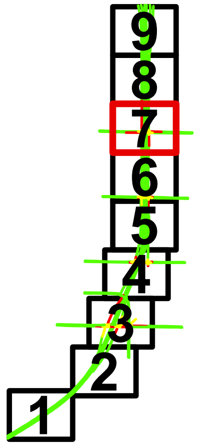

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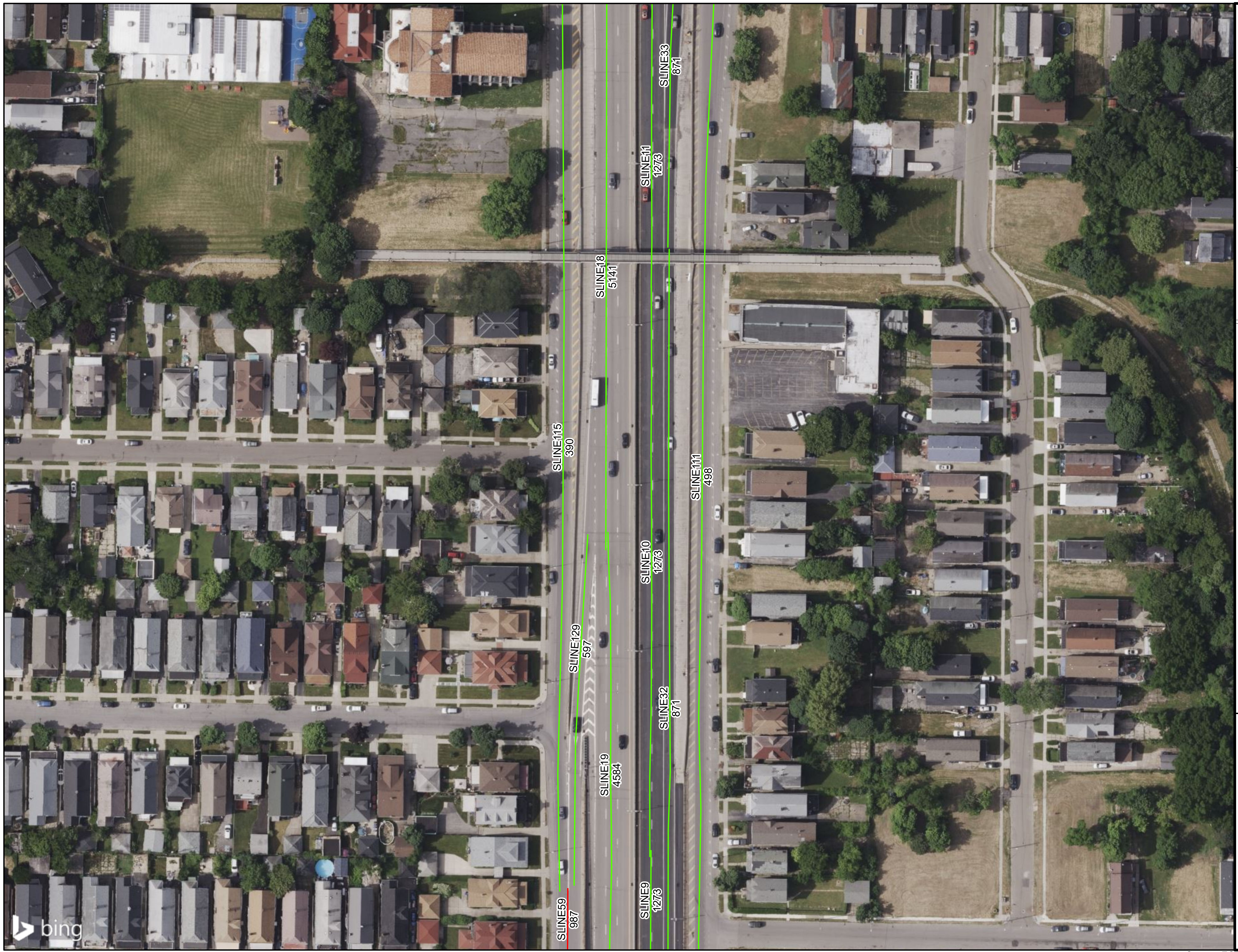

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Legend

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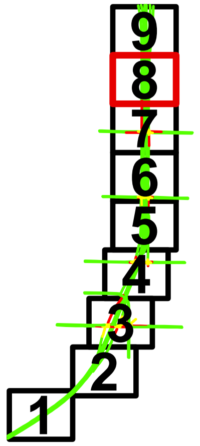

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Legend

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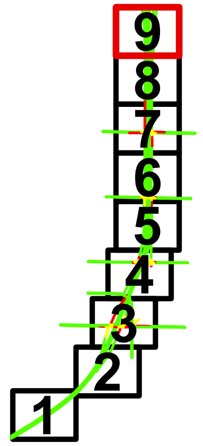

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Legend

- — Accelerate
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- — Freeflow
- — Tunnel Portal

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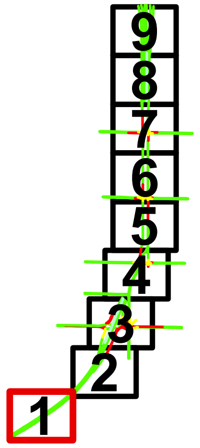

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Legend

🟨	Accelerate
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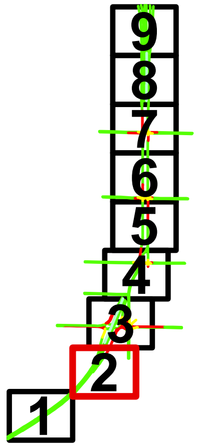

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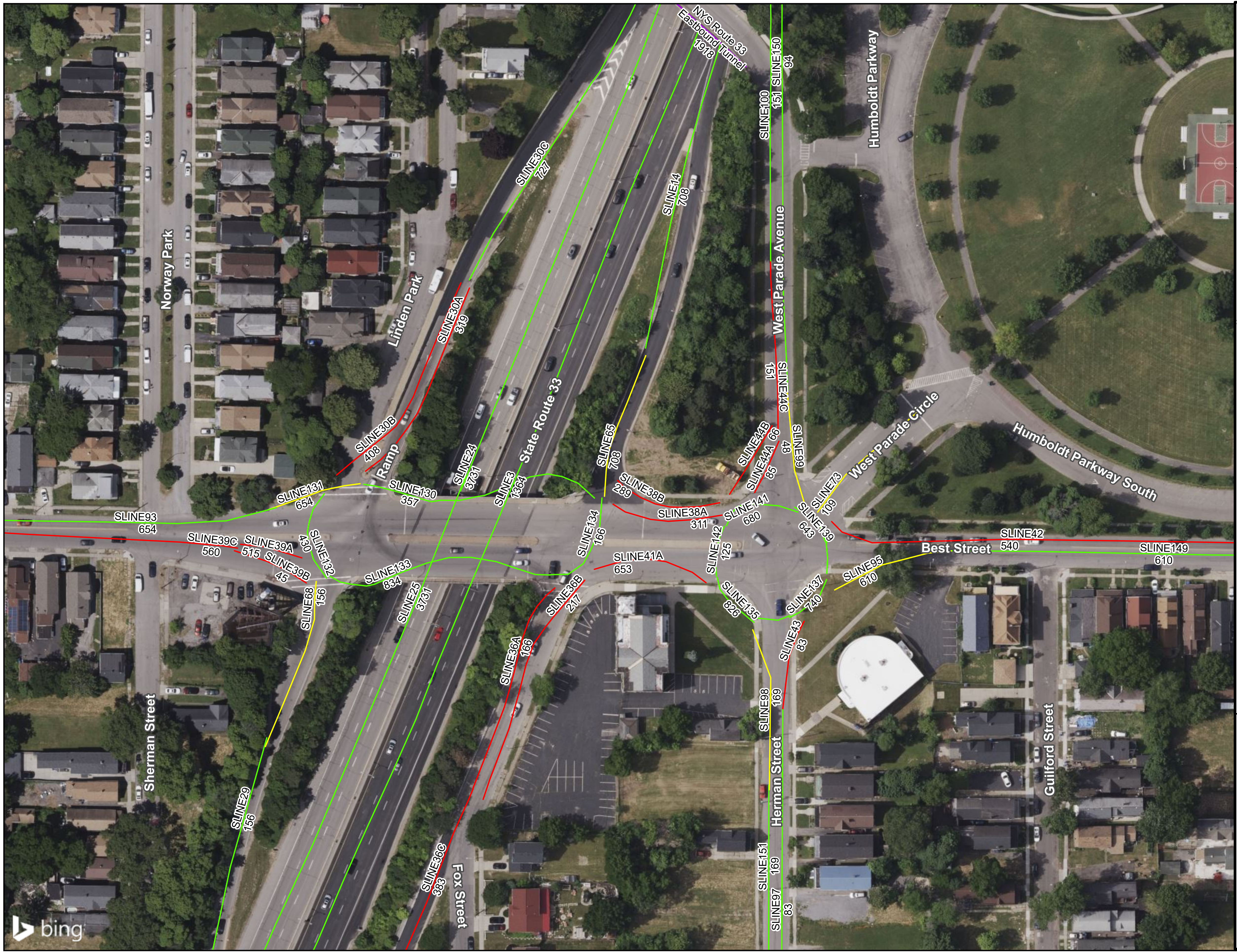

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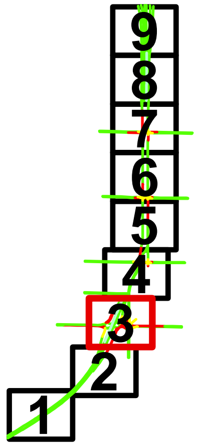

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9/7/2023

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- 🟨 Accelerate
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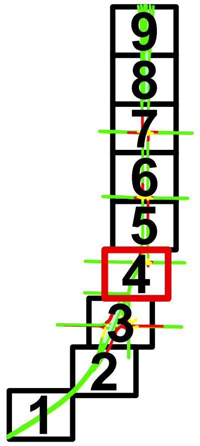

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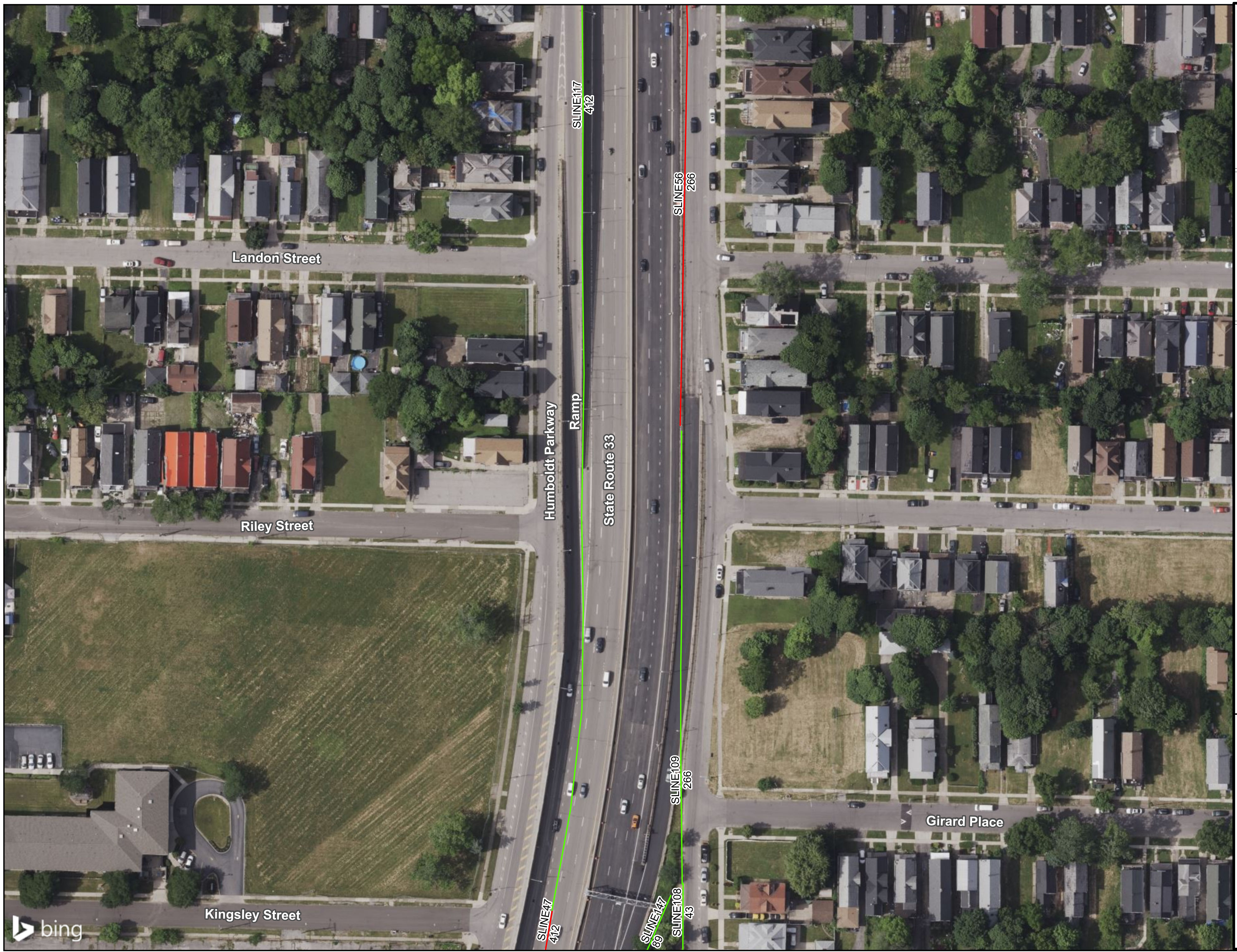

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9/7/2023

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Legend

- Accelerate
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- Tunnel Portal

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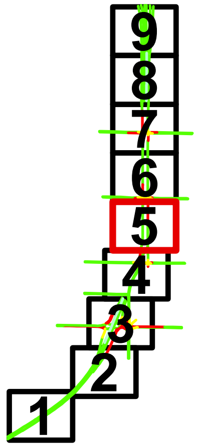

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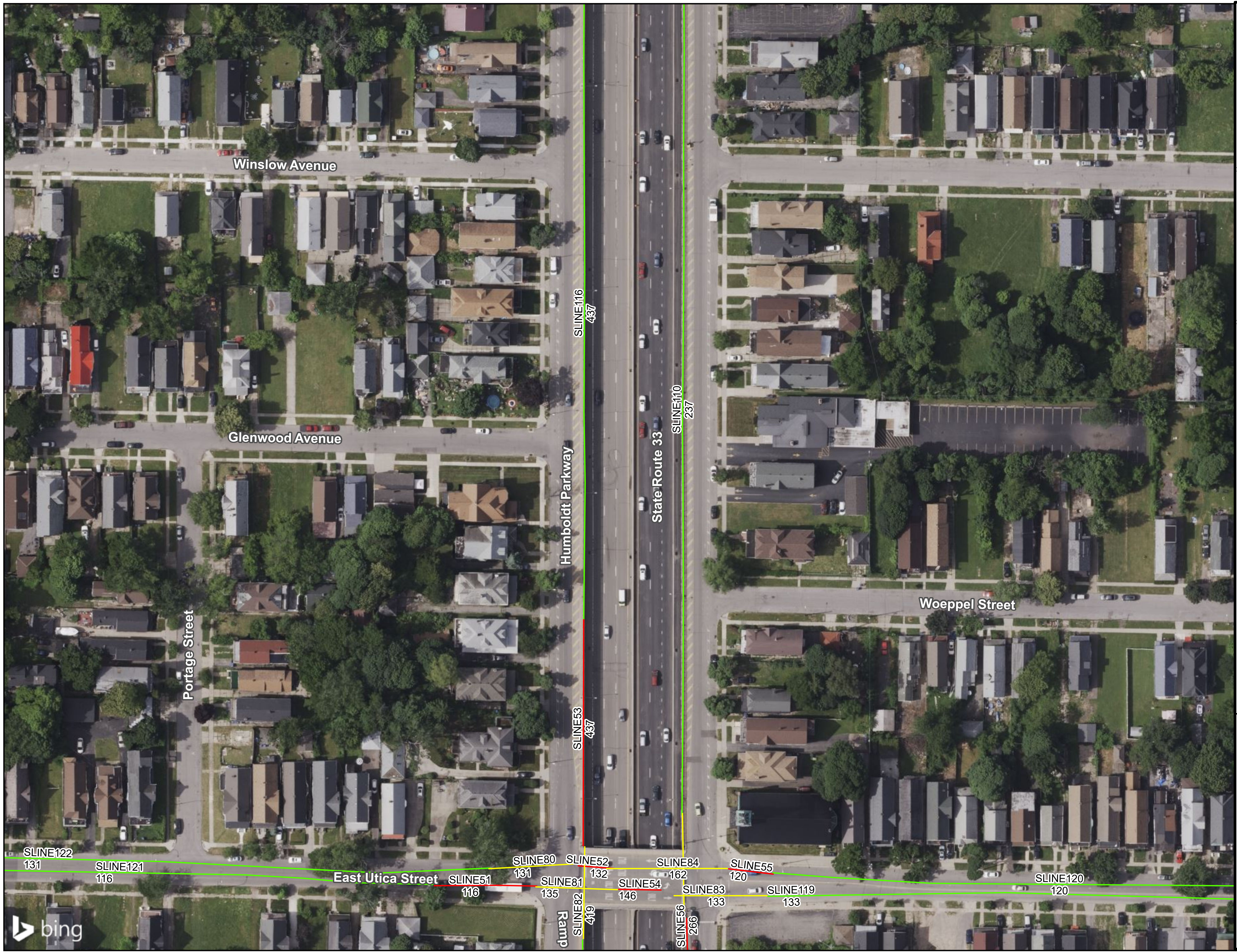

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Legend

- Accelerate
- Queue
- Freeflow
- Tunnel Portal

0 50 100 US Feet

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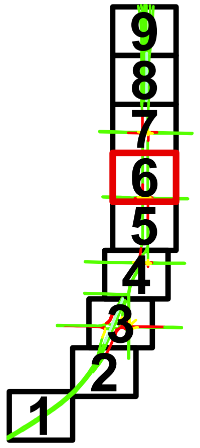

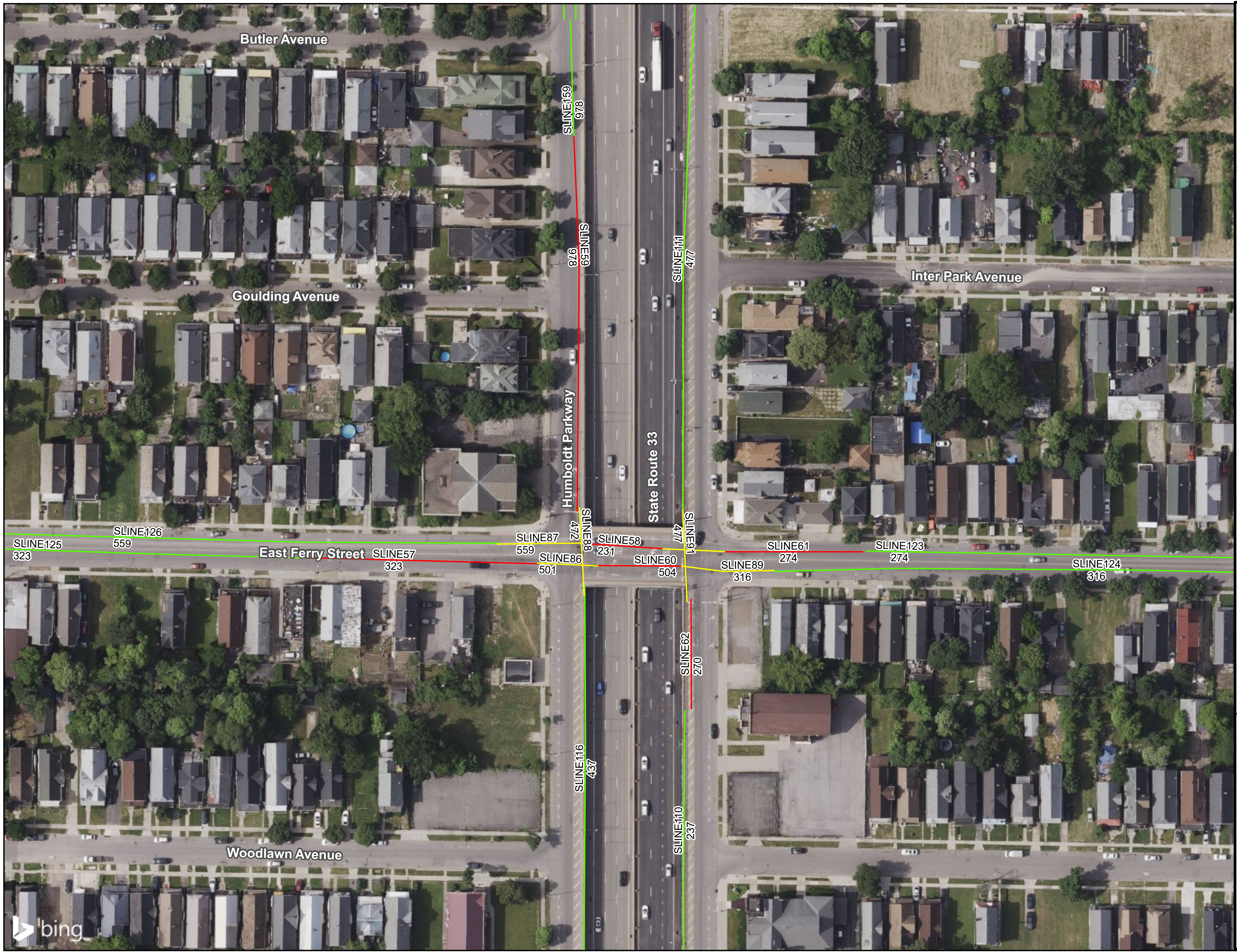

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Legend

- — Accelerate
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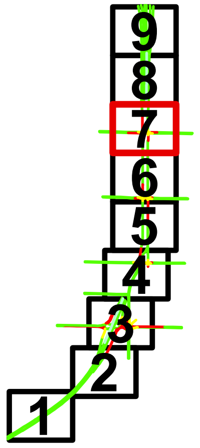

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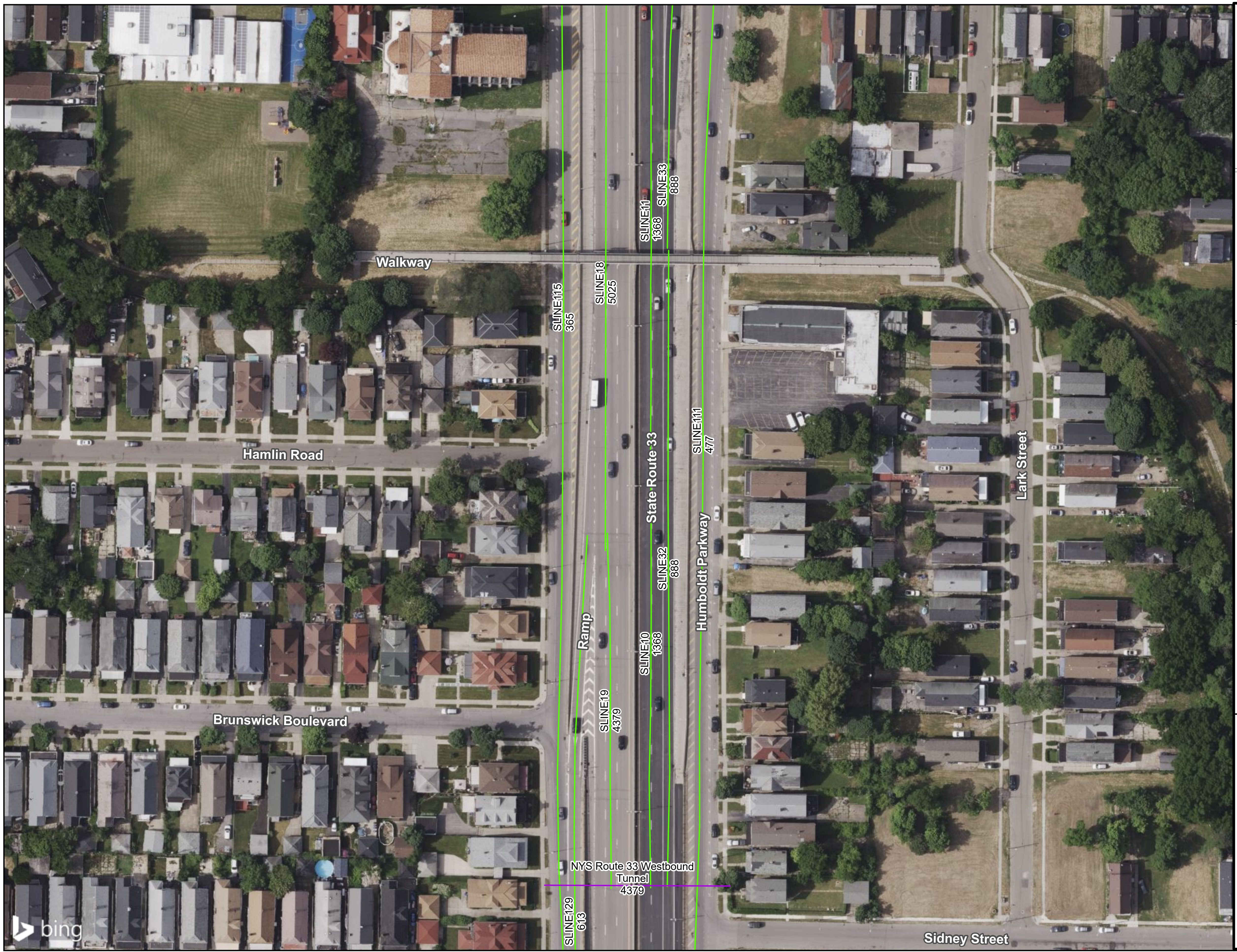

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Legend

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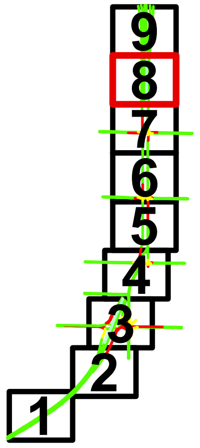

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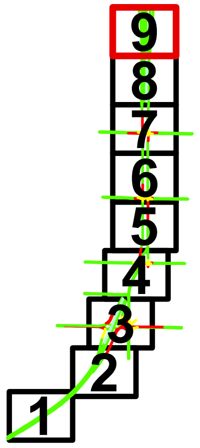

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Attachment 2

Detailed Receptor Maps

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Receptor Detail

8/31/2023

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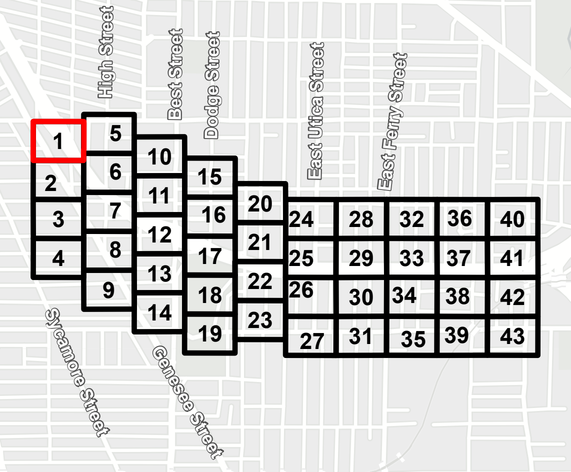
Legend

- × Build Only Receptors
- × No Build and Build Receptors

0 50 100
US Feet

N

Sources: Bing Maps, 2023; LaBella, 2023.



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Receptor Detail

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Legend

- × Build Only Receptors
- × No Build and Build Receptors

0 50 100
US Feet

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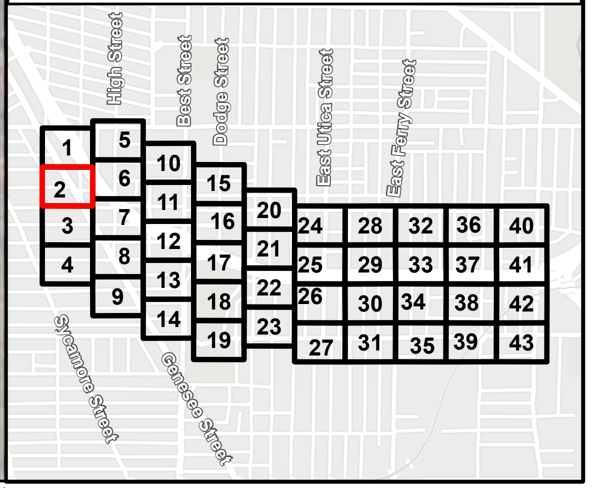

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Receptor Detail

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- × Build Only Receptors
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0 50 100
US Feet

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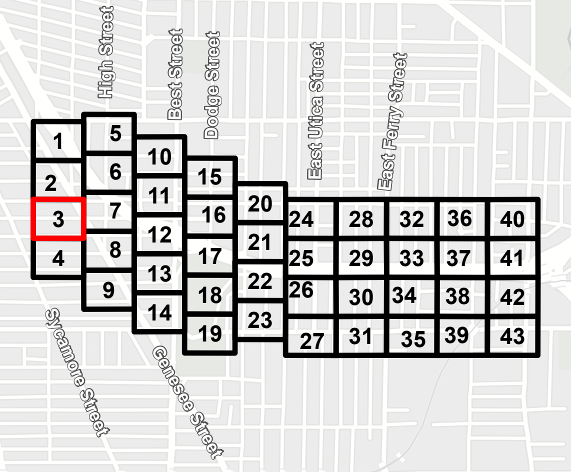

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US Feet

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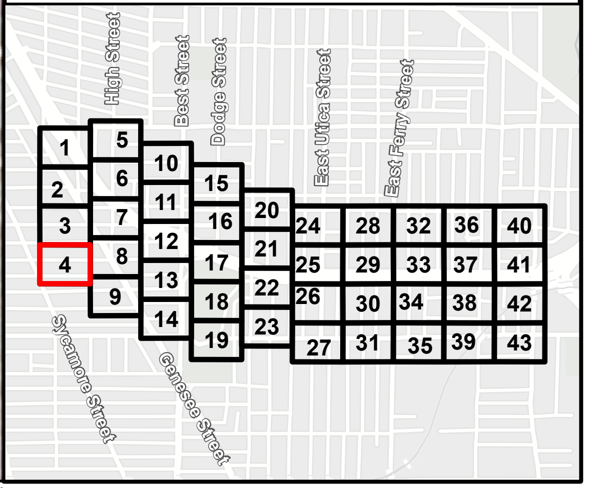

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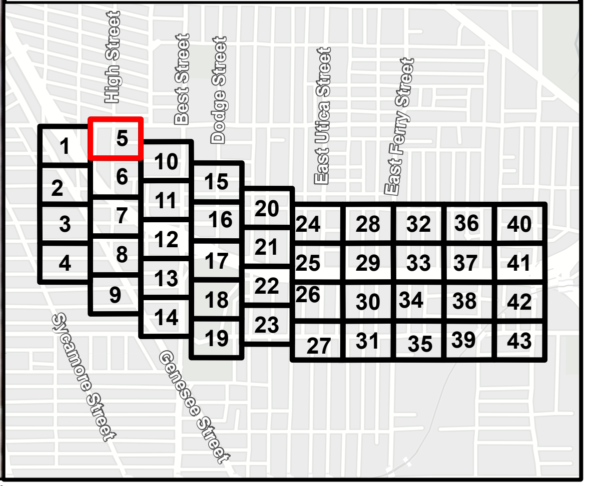

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×	No Build and Build Receptors

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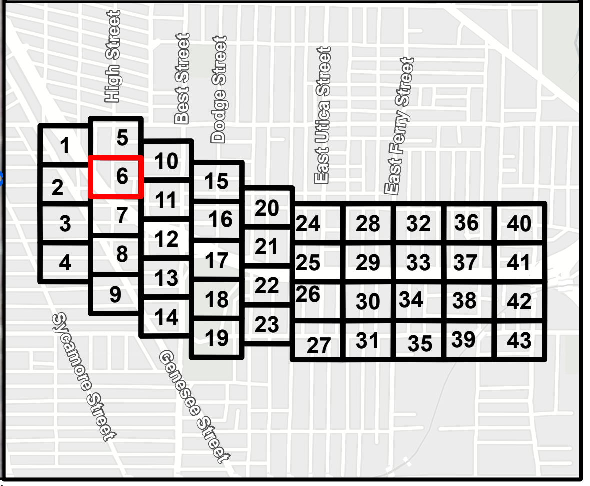

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Receptor Detail

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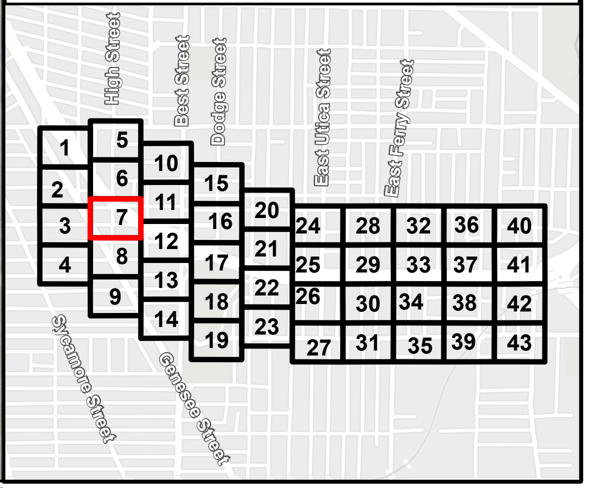
Legend

- × Build Only Receptors
- × No Build and Build Receptors

0 50 100
US Feet

N

Sources: Bing Maps, 2023; LaBella, 2023.



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Legend

- × Build Only Receptors
- × No Build and Build Receptors

0 50 100
US Feet

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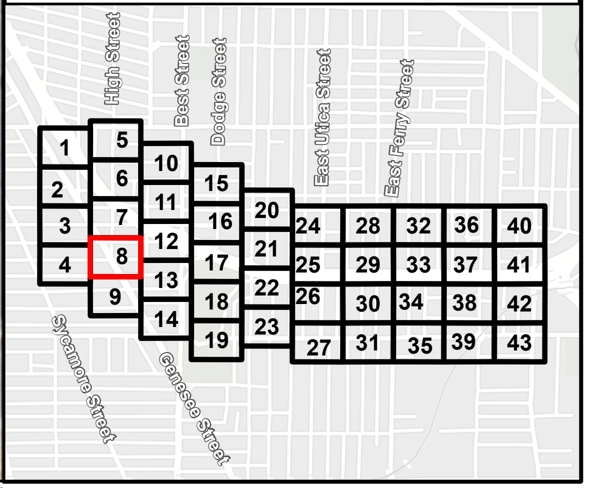
Sources: Bing Maps, 2023; LaBella, 2023.



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Legend

- × Build Only Receptors
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0 50 100
US Feet

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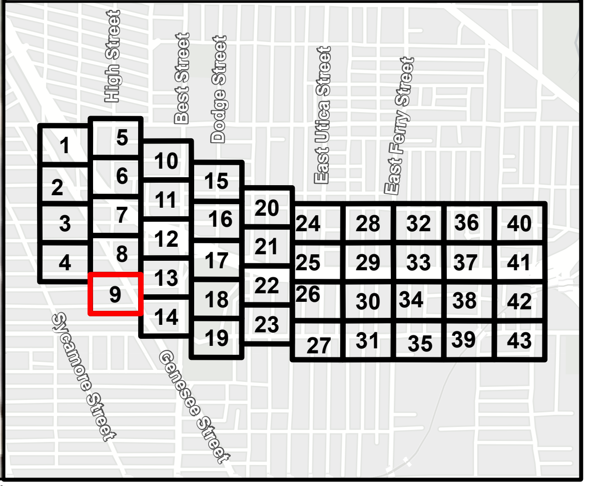

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Legend

- ✕ Build Only Receptors
- ✕ No Build and Build Receptors

0 50 100
US Feet

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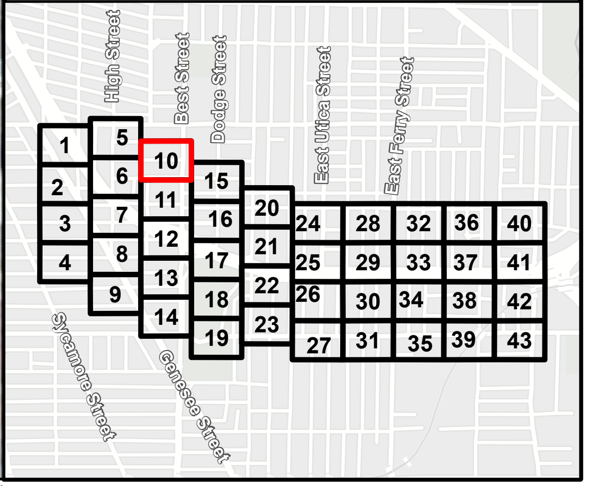

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Legend

- × Build Only Receptors
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0 50 100 US Feet

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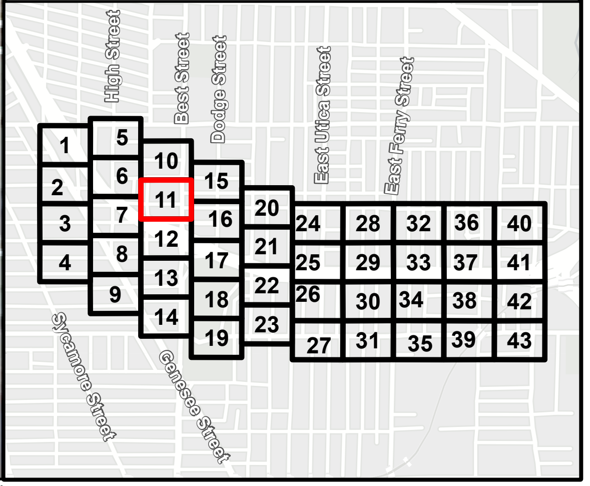

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Legend

- × Build Only Receptors
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0 50 100 US Feet

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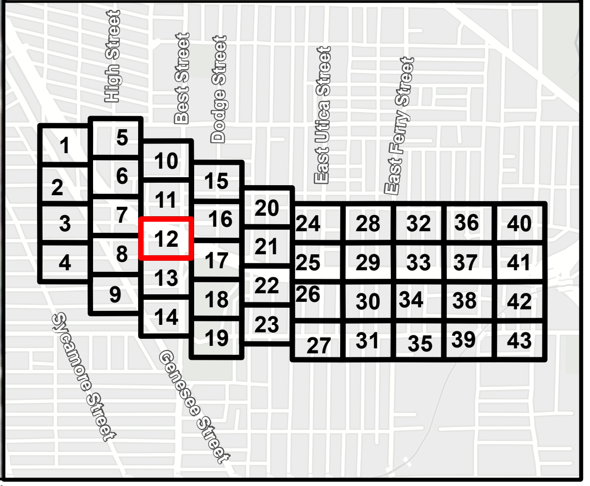

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Legend

× Build Only Receptors

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0 50 100
US Feet

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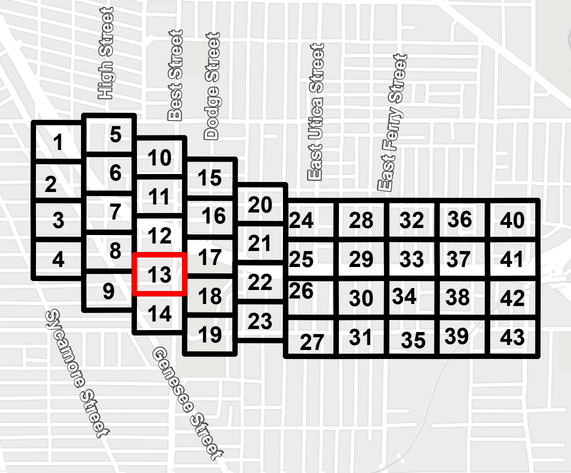

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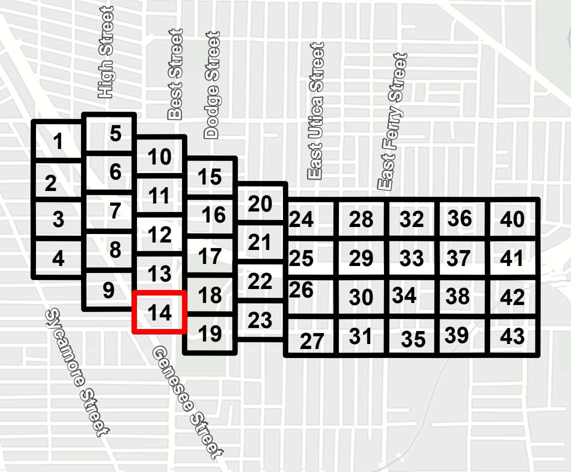

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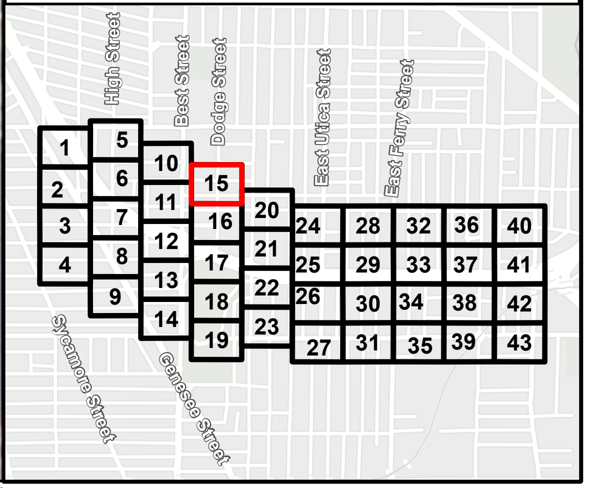

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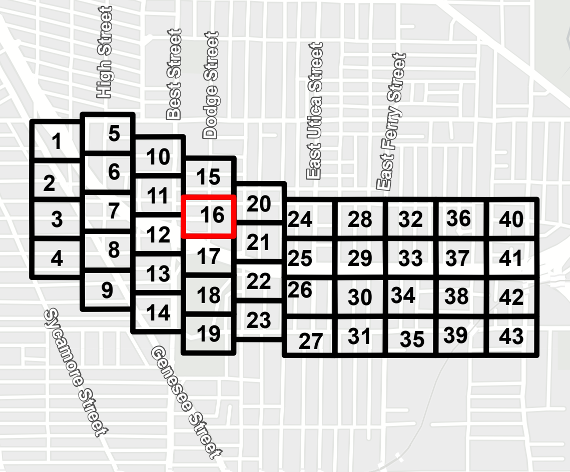

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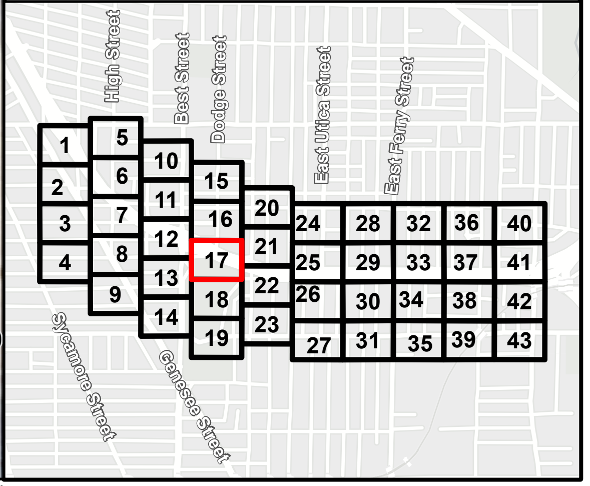

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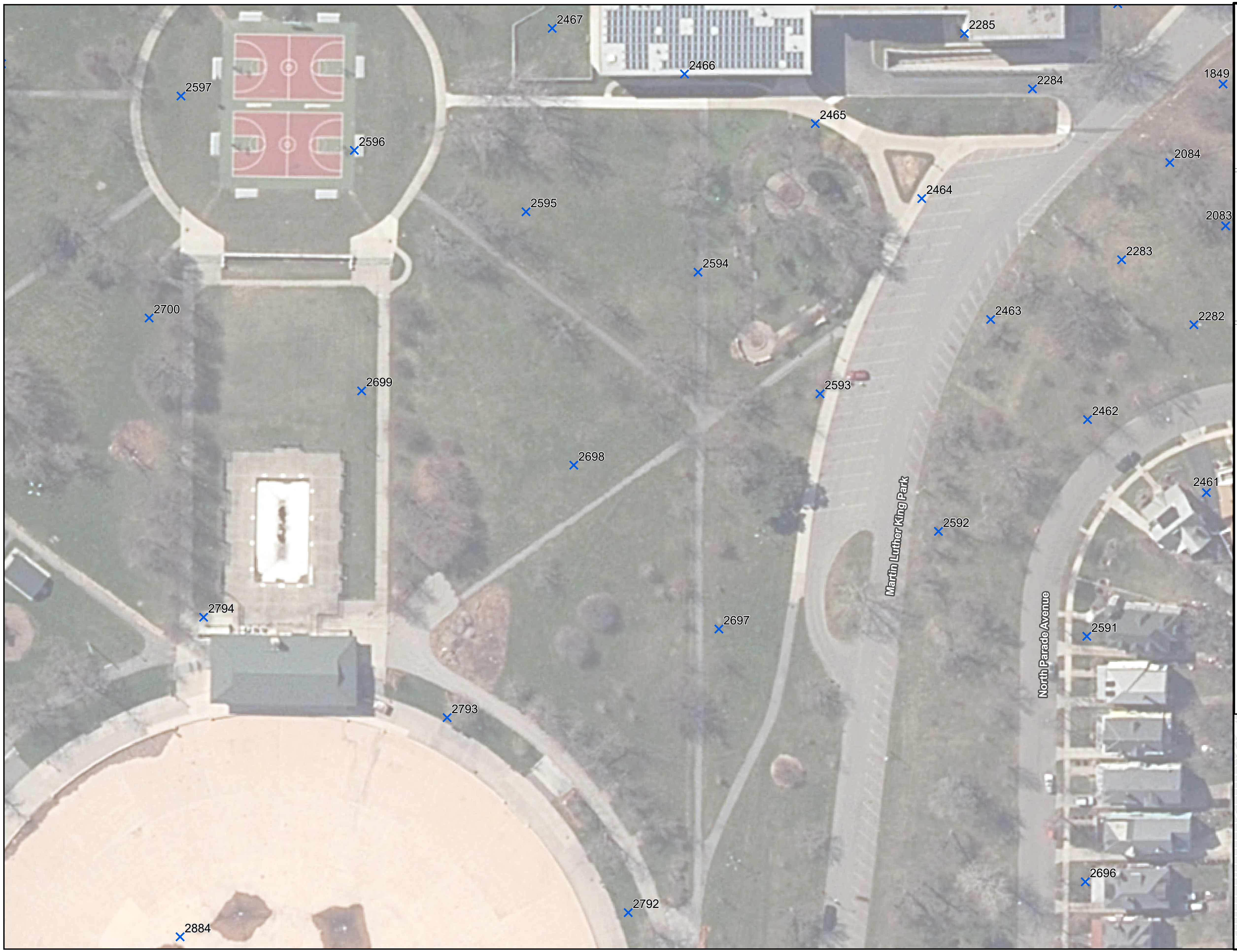

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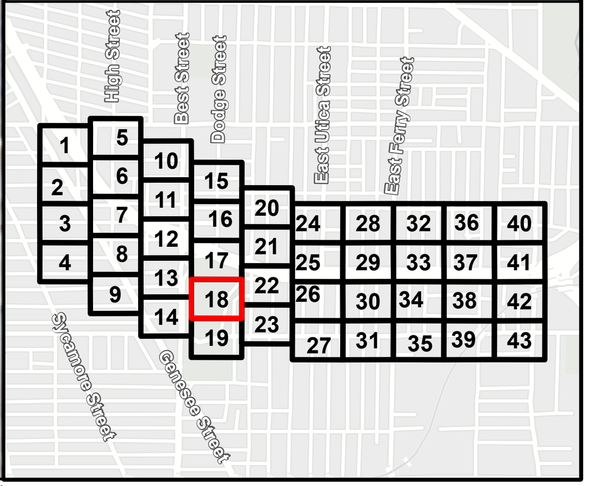

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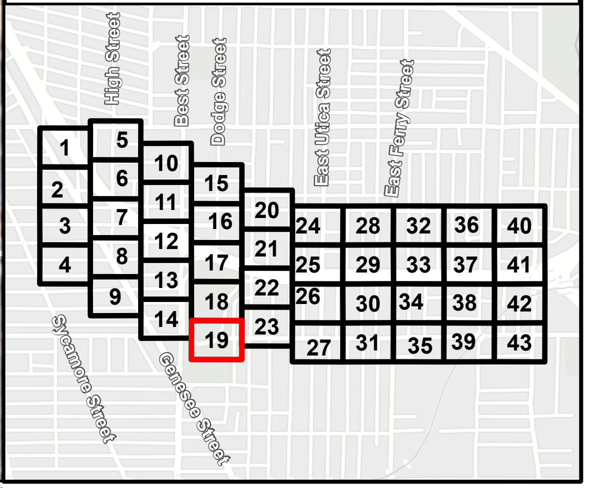

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Legend

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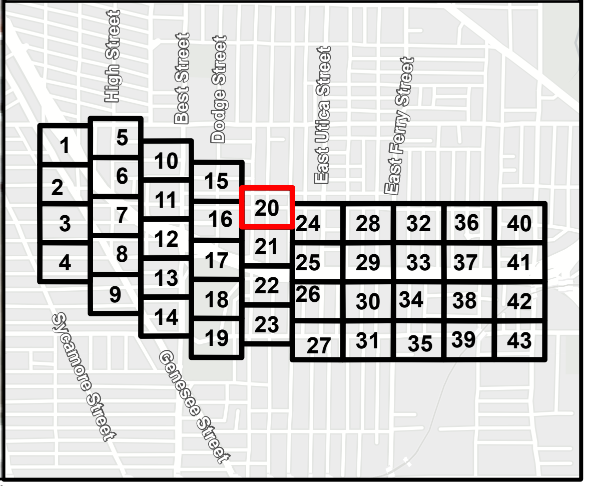

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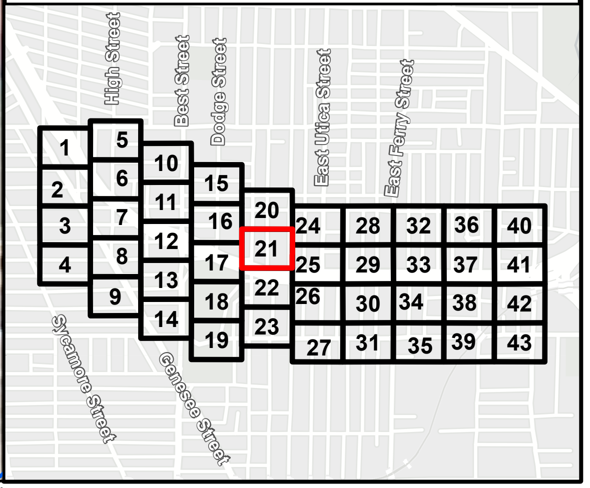

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Receptor Detail

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Legend

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0 50 100
US Feet

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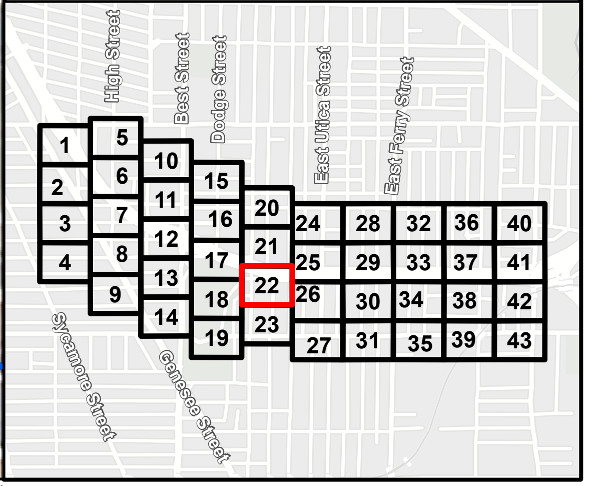

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Legend

- × Build Only Receptors
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0 50 100
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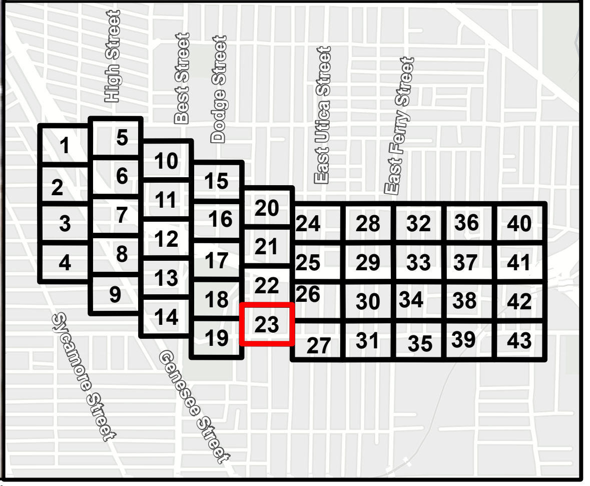

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Legend

× Build Only Receptors

× No Build and Build Receptors

0 50 100
US Feet

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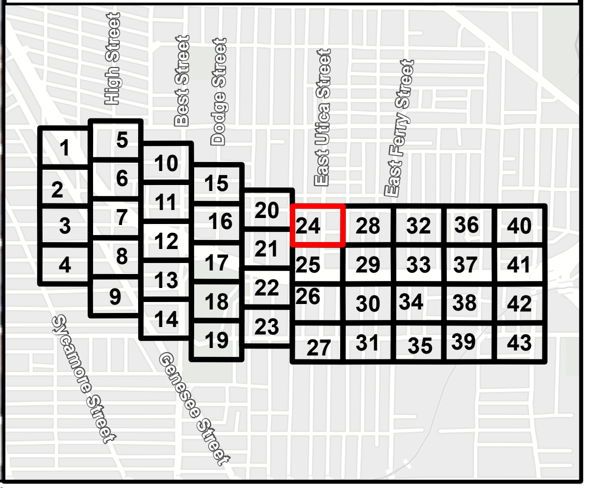

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Legend

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0 50 100
US Feet

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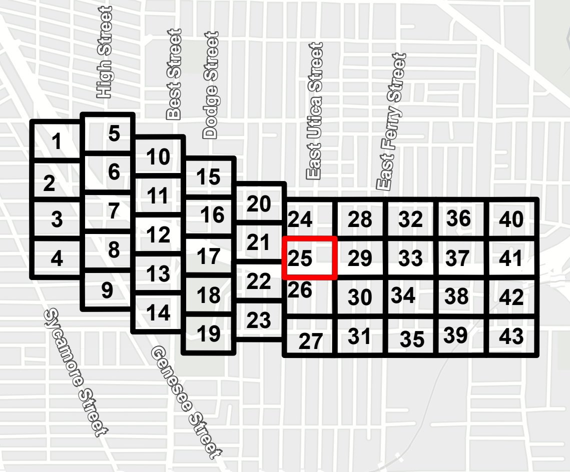

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Legend

✕ Build Only Receptors

✕ No Build and Build Receptors

0 50 100
US Feet

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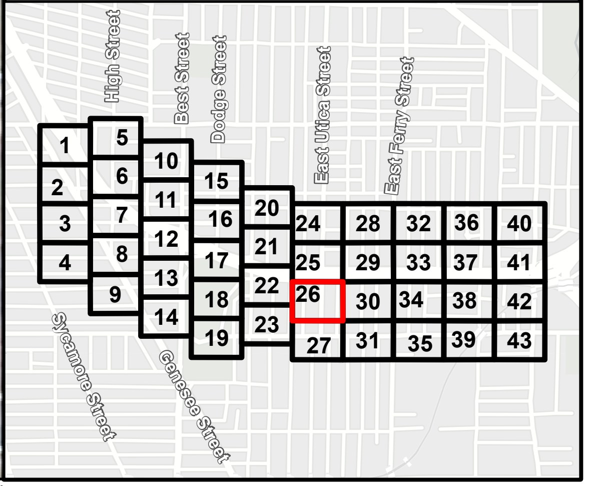

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Legend

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- ✕ No Build and Build Receptors

0 50 100
US Feet

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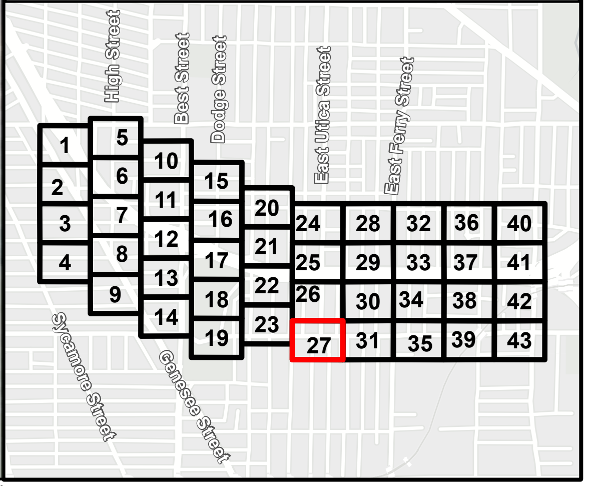

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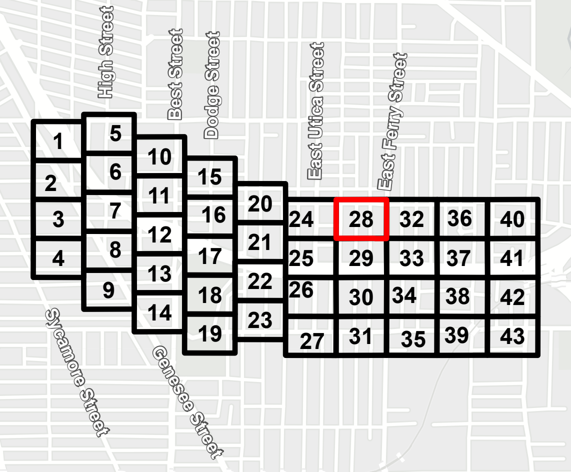

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Legend

✕ Build Only Receptors

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0 50 100 US Feet

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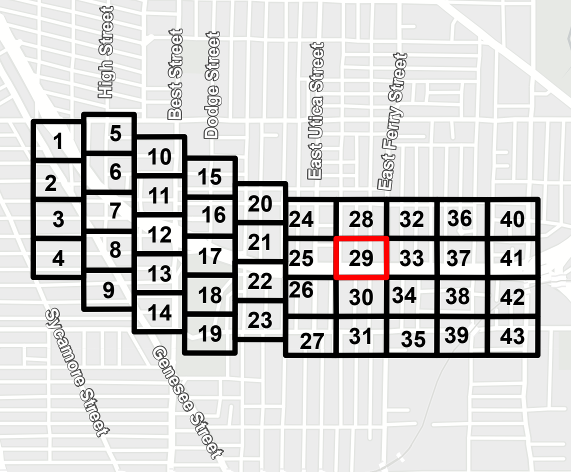

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- × Build Only Receptors
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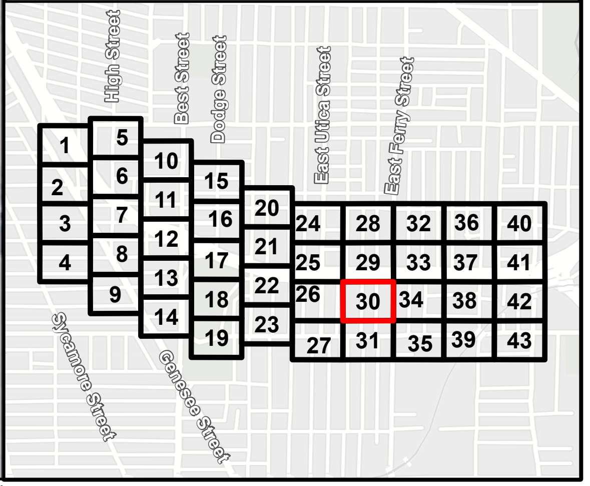

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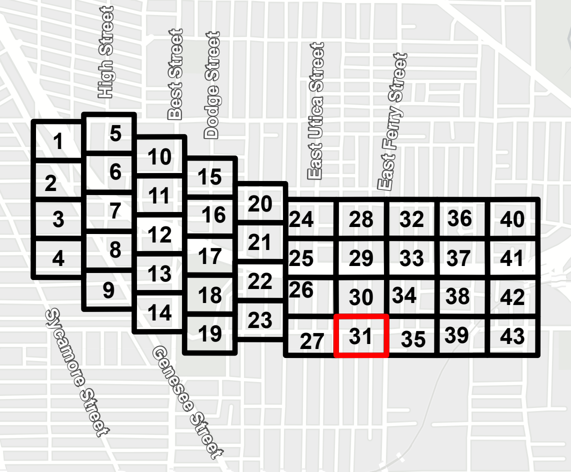

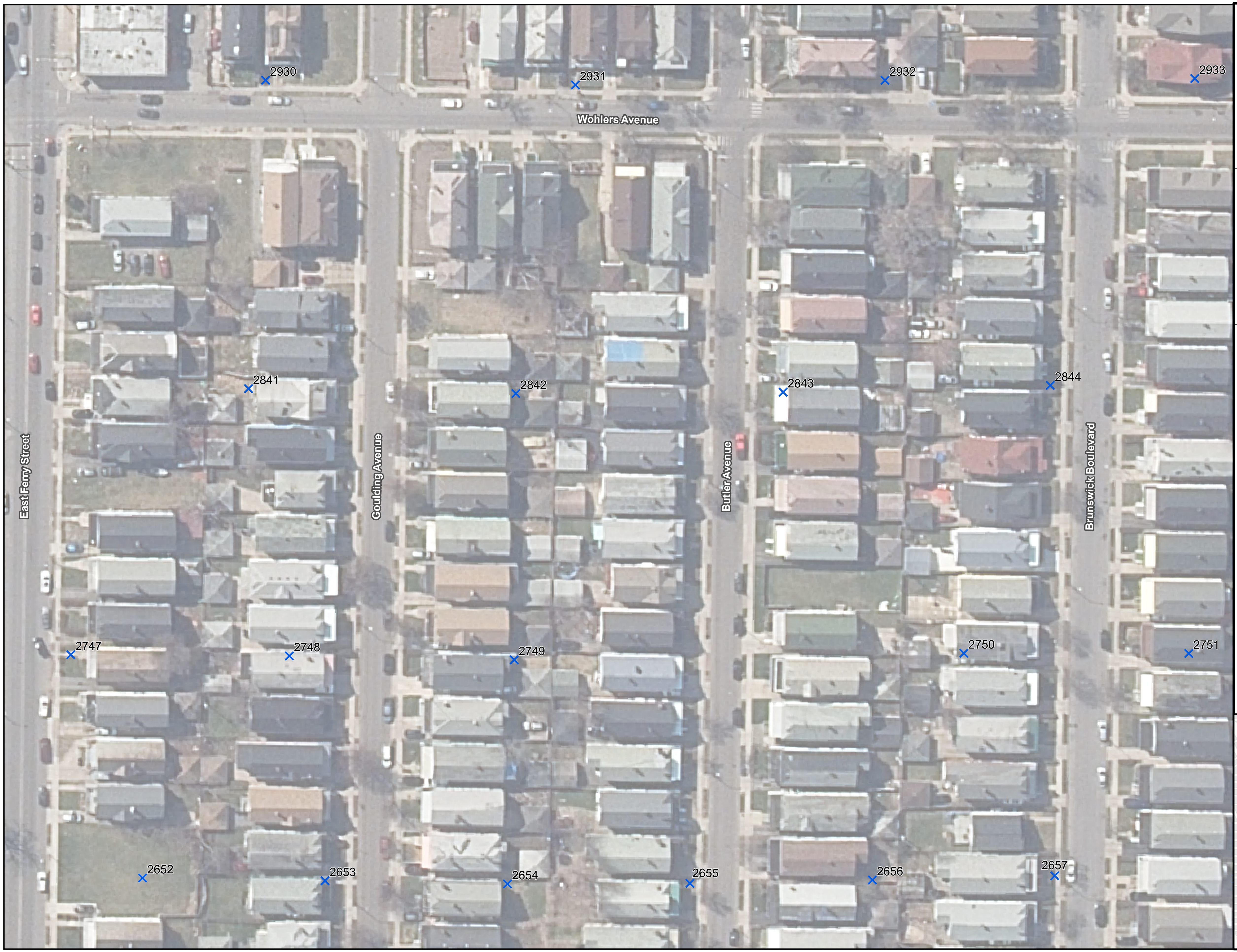

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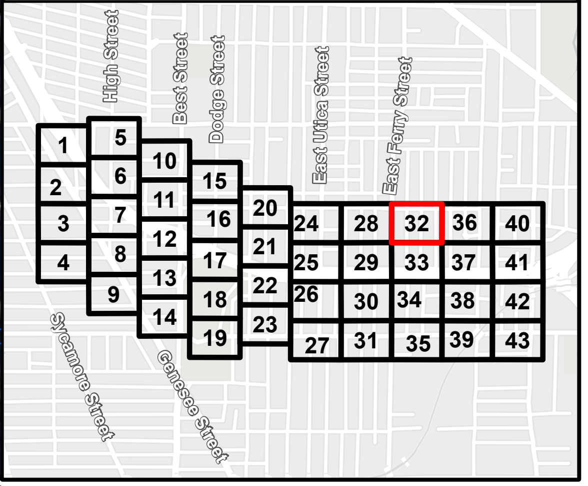

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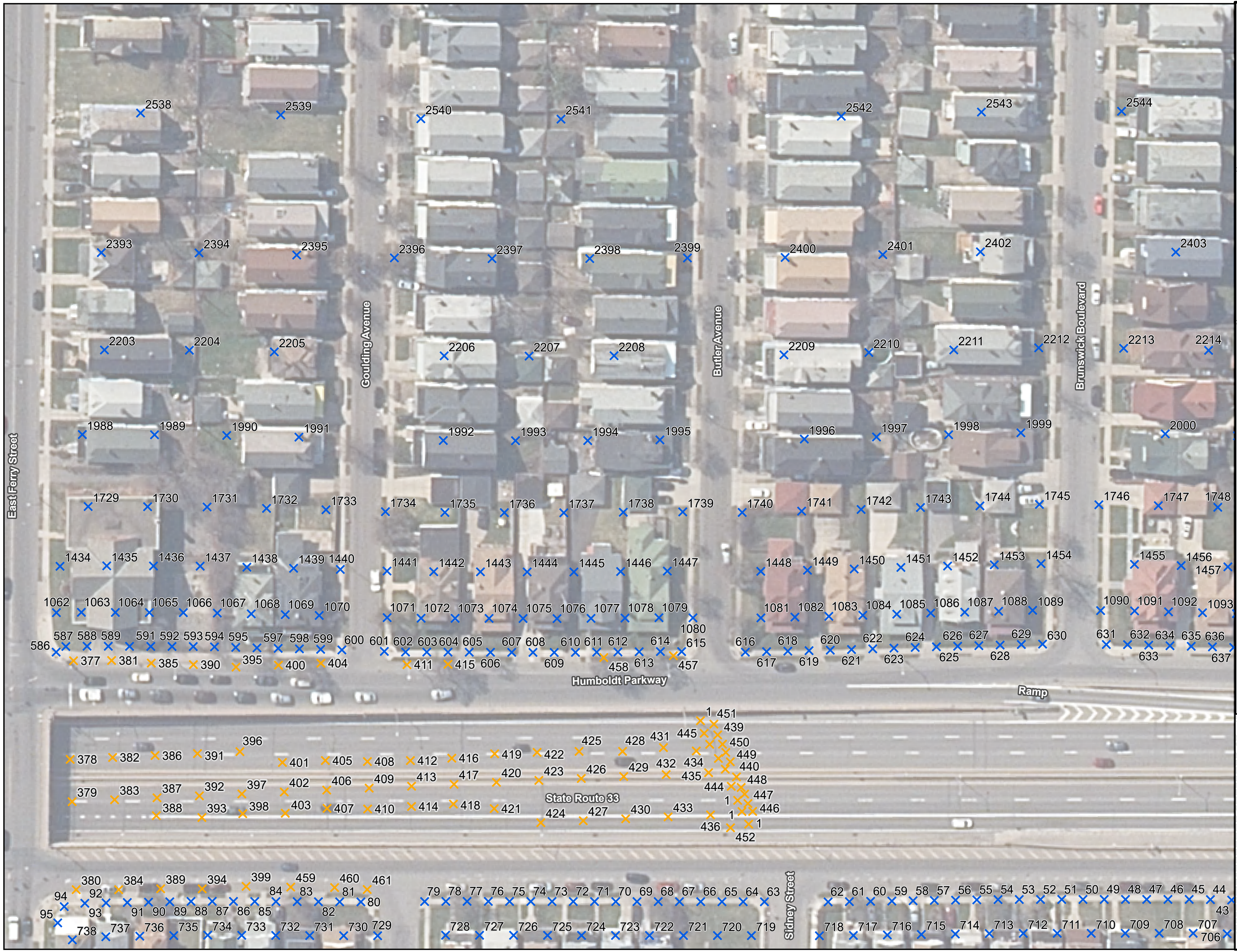

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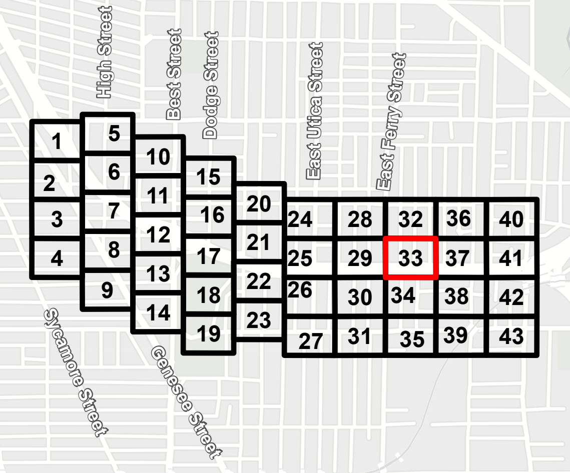

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Receptor Detail

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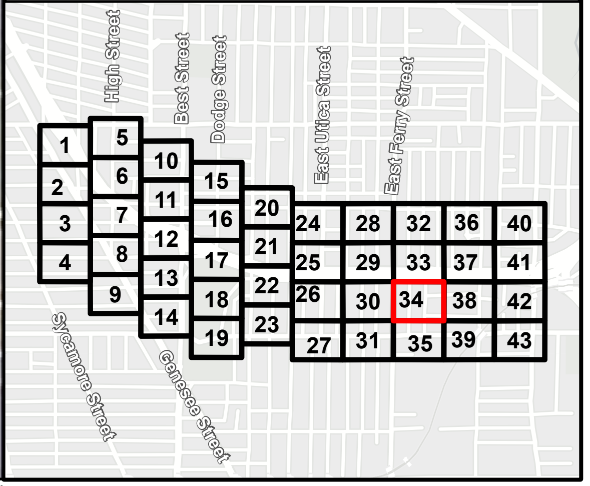
Legend

- × Build Only Receptors
- × No Build and Build Receptors

0 50 100
US Feet

N

Sources: Bing Maps, 2023; LaBella, 2023.



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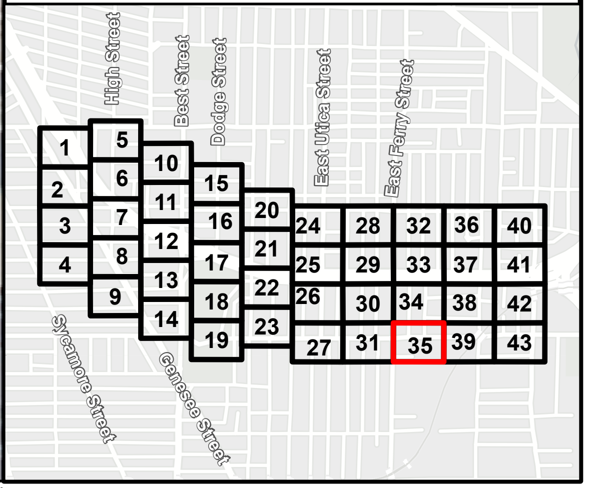

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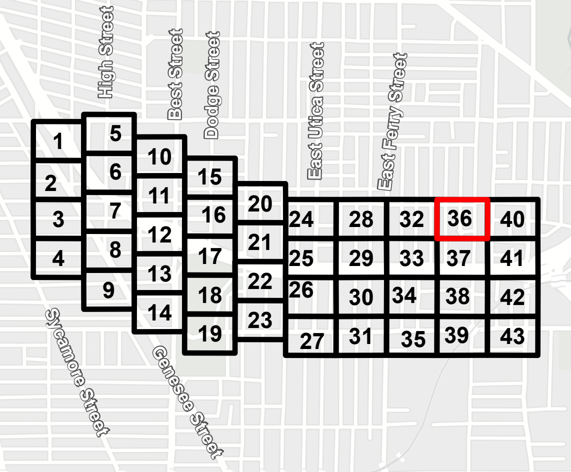

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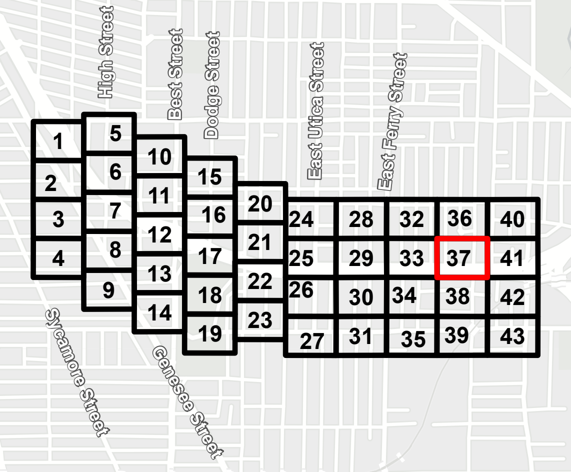

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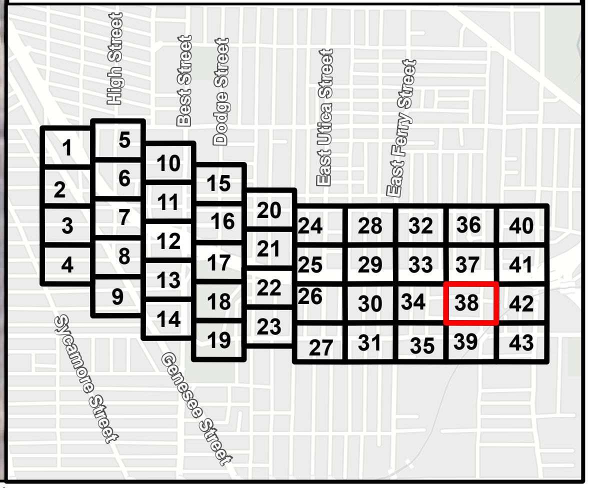

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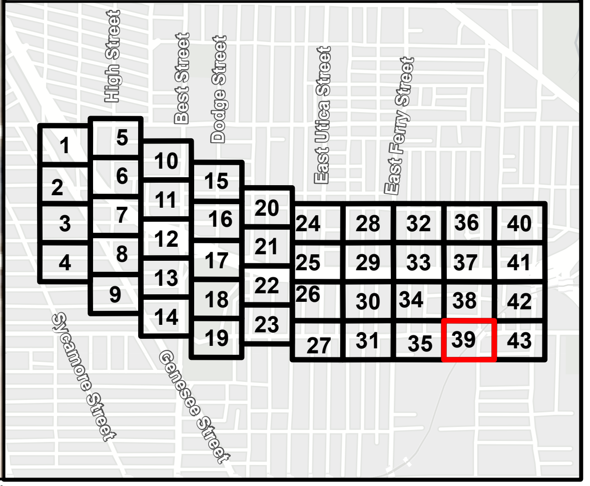

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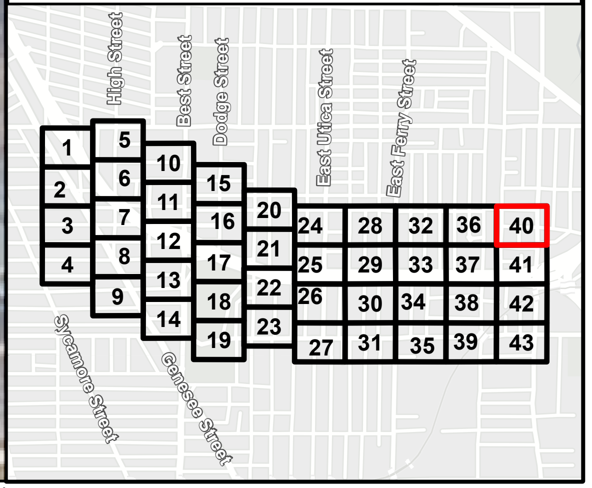

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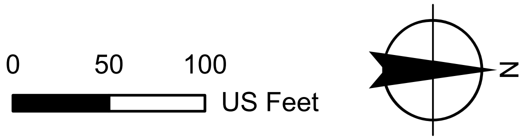

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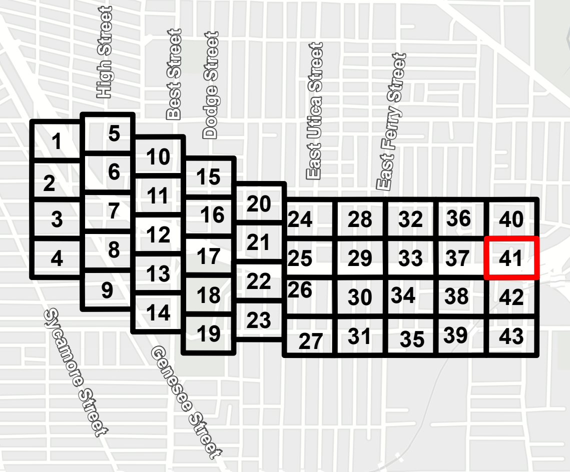

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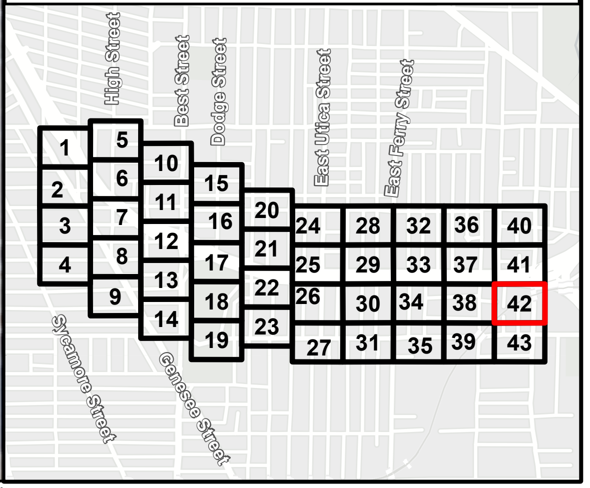

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