HGC ENGINEERING

Howe Gastmeier Chapnik Limited
2000 Argentia Road, Plaza One, Suite 203
Mississauga, Ontario, Canada L5N 1P7
t: 905.826.4044

Noise Feasibility Study
Proposed Residential Development
499 Mohawk Road East
Hamilton, Ontario

Prepared for:

499 Mohawk Inc.
3170 Harvester Road, #200
Burlington, ON
L7N 3W8

Prepared by:

Andrew Rogers, BASc

Reviewed by:

Mandy Chan, BASc, Peng

HGC Project No.: 02200125

September 13, 2022

VERSION CONTROL

Noise Feasibility Study,
499 Mohawk Road East,
Hamilton, Ontario.

Ver.	Date	Version Description / Changelog	Prepared By
0	September 13, 2022	Noise Feasibility Study in support of the approvals process.	A. Rogers/ M. Chan

Limitations

This document was prepared solely for the addressed party and titled project or named part thereof, and should not be relied upon or used for any other project without obtaining prior written authorization from HGC Engineering. HGC Engineering accepts no responsibility or liability for any consequence of this document being used for a purpose other than for which it was commissioned. Any person or party using or relying on the document for such other purpose agrees, and will by such use or reliance be taken to confirm their agreement to indemnify HGC Engineering for all loss or damage resulting therefrom. HGC Engineering accepts no responsibility or liability for this document to any person or party other than the party by whom it was commissioned.

Any conclusions and/or recommendations herein reflect the judgment of HGC Engineering based on information available at the time of preparation, and were developed in good faith on information provided by others, as noted in the report, which has been assumed to be factual and accurate. Changed conditions or information occurring or becoming known after the date of this report could affect the results and conclusions presented.

Table of Contents

1 Introduction and Summary

HGC Engineering was retained by 499 Mohawk Inc. to conduct a noise feasibility study for a proposed residential development located at 499 Mohawk Road East, in Hamilton, Ontario. This study has been prepared as part of the approvals process by the city. The study is conducted in accordance with the Ministry of Environment, Conservation, and Parks (MECP) guidelines.

The primary noise sources at the proposed development site were determined to be the road traffic on Upper Sherman Avenue and Mohawk Road East. The road traffic data used for this study was obtained from the City of Hamilton. The predicted sound levels were evaluated with respect to the guidelines of the Ministry of the Environment, Conservation and Parks (MECP).

The results of the study indicate that with suitable noise control measures integrated into the design of the buildings, it is feasible to achieve MECP guideline sound levels. Towers A and D require an alternative means of ventilation to open windows. Towers B and C require central air conditioning systems. When detailed floor plans and building elevations are available for Towers B and C, a review should be conducted to determine the required glazing and building façade constructions based on actual window to floor area ratios. Glazing constructions meeting the minimum requirements of the Ontario Building Code (OBC) will be adequate for all remaining buildings. Associated acoustical requirements are specified in this report. Noise warning clauses are also required to inform future occupants of the traffic noise impacts.

2 Site Description and Noise Sources

The key plan for the development is attached as Figure 1. The site is located on the northeast corner of Upper Sherman Avenue and Mohawk Road East in Hamilton. A site plan prepared by Graziani and Corazza Architects Inc. dated August 12, 2022, is provided as Figure 2. The proposed development included two 25-storey towers, one 20-storey tower, two 15-storey towers, one 13-storey tower, two 8-storey towers, and seven blocks of 3-storey townhouse units, with four levels of underground parking below the residential towers.

HGC Engineering personnel visited the site during the month of March 2022 to observe the acoustical environment and note the significant noise sources. The acoustical environment surrounding the site is urban in nature. It was observed that road traffic on Upper Sherman Avenue and Mohawk Road East was the dominant source of noise. The site is currently occupied by a closed Walmart and a Beer Store, with an associated parking lot. There are existing residences surrounding the site in all directions, including existing residential towers to the south across Mohawk Road East. There are gas stations on the southeast and southwest corners of Upper Sherman Avenue and Mohawk Road East. There are various retail and commercial low-rise buildings along Upper Sherman Avenue. Across Upper Sherman Avenue to the east is Baitun Nusrat Mosque. Macassa Park, which includes multiple soccer fields, is located 50 m northeast of the site. Further north along Upper Sherman Avenue is the Hamilton Fire Department – Station 4 and Franklin Road Elementary School. Sounds from these neighbouring uses were not audible at the subject site over the traffic noise. Nevertheless, a noise warning clause is recommended to inform future occupants of these nearby uses as indicated in Section 5.4.

3 Sound Level Criteria

3.1 Road Traffic Noise

Guidelines for acceptable levels of road traffic noise impacting residential developments are given in the MECP publication NPC-300, "Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning", release date October 21, 2013, and are listed in Table I below. The values in Table I are energy equivalent (average) sound levels [L_{EQ}] in units of A-weighted decibels [dBA].

Table I: MECP Road Traffic Noise Criteria (dBA)

Space	Daytime L_{EQ} (16 hour)	Nighttime L_{EQ} (8 hour)
Outdoor Living Areas	55 dBA	--
Inside Living/Dining Rooms	45 dBA	45 dBA
Inside Bedrooms	45 dBA	40 dBA

Daytime refers to the period between 07:00 and 23:00, while nighttime refers to the period between 23:00 and 07:00. The term "Outdoor Living Area" (OLA) is used in reference to an outdoor patio, a backyard, a terrace or other area where passive recreation is expected to occur. Balconies and terraces that are less than 4 m in depth are not considered to be outdoor living areas under MECP guidelines, and accordingly the noise criteria are not applicable there. Large private terraces require consideration only if they are the only OLA for the occupant. In general, common outdoor amenity terraces associated with high-rise buildings are the only OLA that require consideration.

The guidelines in the MECP publication allow the daytime sound levels in an Outdoor Living Area to be exceeded by up to 5 dBA, without mitigation, if warning clauses are placed in the purchase and rental agreements to the property. Where OLA sound levels exceed 60 dBA, physical mitigation is required to reduce the OLA sound level to below 60 dBA and as close to 55 dBA as technically, economically, and administratively practical.

A central air conditioning system as an alternative means of ventilation to open windows is required for dwellings where nighttime sound levels outside bedroom or living/dining room windows exceed 60 dBA or daytime sound levels outside bedroom or living/dining room windows exceed 65 dBA. Forced air ventilation with ducts sized to accommodate the future installation of air conditioning is

required when nighttime sound levels at bedroom or living/dining room windows are in the range of 51 to 60 dBA or when daytime sound levels at bedroom or living/dining room windows are in the range of 56 to 65 dBA.

Building components such as walls, windows and doors must be designed to achieve indoor sound level criteria when the plane of window nighttime sound level is greater than 60 dBA or the daytime sound level is greater than 65 dBA due to road traffic noise.

Warning clauses are required to notify future residents of possible excesses when nighttime sound levels exceed 50 dBA at the plane of the bedroom/living/dining room window and daytime sound levels exceed 55 dBA in the outdoor living area and at the plane of the bedroom/living/dining room window due to road traffic.

4 Traffic Noise Assessment

4.1 Road Traffic Data

Road traffic data for Upper Sherman Avenue and Mohawk Road East was obtained from the City of Hamilton (see Appendix A). These data were provided in the form of 24-hour intersection turning counts. In order to predict future sound levels during both the 16-hour daytime and 8-hour nighttime periods, the following assumptions were made:

- The prediction considered traffic that will exist in 10 years (2032), assuming annual traffic growth of 2.5% on all roadways, as required by the MECP,
- Daytime (7:00 – 23:00) vs. nighttime (23:00 – 7:00) traffic volumes were determined based on an assumed 90% day / 10% night split,
- Commercial vehicle percentages for both roadways were assumed to be 13%, split into 8% medium trucks and 5% heavy trucks, as per MECP standards.

A posted speed limit of 50 km/h was applied for both roadways in the analysis. Table II summarizes the road traffic volume data used in this study.

Table II: 2032 Projected Road Traffic Data

Street	Time	Cars	Medium Trucks	Heavy Trucks	Total
Upper Sherman Avenue	Daytime	20 761	278	174	**21 213**
	Nighttime	2 307	31	19	**2 357**
	Total	**23 068**	**309**	**193**	**23 570**
Mohawk Road East	Daytime	24 327	388	242	**24 957**
	Nighttime	2 703	43	27	**2 773**
	Total	**27 030**	**431**	**269**	**27 730**

4.2 Traffic Noise Predictions

To assess the levels of traffic noise that will impact the site, an acoustic model of the development was created, and predictions were made using a numerical computer modelling package (*CadnaA version 2022*). The model is based on the methods from ISO Standard 9613-2.2, "*Acoustics - Attenuation of Sound During Propagation Outdoors*", which accounts for reduction in sound level

with distance due to geometrical spreading, air absorption, ground attenuation and acoustical shielding by intervening structures.

The road noise sources were included in the model as line sources producing equivalent sound pressure levels at a reference distance to those predicted by STAMSON 5.04, a computer algorithm developed by the MECP, based on the daytime and nighttime traffic volumes presented in Section 4.1. Calibration outputs from STAMSON are included as Appendix B.

The model was used to predict traffic noise levels at each of the residential building facades and in the outdoor living areas. Predicted daytime and nighttime sound levels at the façades are shown in Appendix C. A summary of the maximum sound levels at each residential façade are shown in Table III below.

Table III: Traffic Sound Level Prediction at Building Façades [dBA]

Building, Description	Daytime – $L_{EQ\text{-}16\ hr}$	Nighttime – $L_{EQ\text{-}8\ hr}$
Towers B/C, South Façade	66	59
Tower A, South Façade	65	59
Towers B/C, East Façade	64	58
Tower C, West Façade; Tower D, East Facade	63	57
Tower A, East and West Façades; Tower B, West Façade	62	56
Tower D, North Façade	60	53
Tower D, South Façade	59	53
Tower C, North Façade	58	52
Towers A/B, North Façade; Tower D, West Façade; Towers E/F/G/H, All Façades	<55	<50
Southeast Townhouse Block, South and West Façades	55	<50
Southeast Townhouse Block, North and East Façades; All Other Townhouse Blocks, All Façades	<55	<50

A summary of the maximum daytime sound levels at the outdoor amenity areas are shown in Table IV below.

Table IV: Traffic Sound Level Prediction at Outdoor Living Areas [dBA]

Building	Location	Daytime – $L_{EQ-16\ hr}$
Building A	4th Floor	55
	5th Floor	<55
	7th Floor	<55
	9th Floor	<55
	16th Floor	<55
Building B	4th Floor	56
	9th Floor	<55
	26th Floor	<55
Building C	5th Floor	55
	7th Floor	<55
	9th Floor North	<55
	9th Floor South	<55
	26th Floor	<55
Building D	4th Floor	<55
	6th Floor	<55
	8th Floor	<55
	10th Floor	<55
	12th Floor	<55
	14th Floor	<55
Building E	At Grade	<55
	5th Floor	<55
	7th Floor	<55
	9th Floor East/West	<55
Building F	At Grade	<55
	5th Floor	<55
	7th Floor	<55
	9th Floor East/West	<55
Building G	At Grade	<55
	5th Floor	<55
	9th Floor West/South	<55
	16th Floor	<55
Building H	3rd Floor	<55
	5th Floor	<55
	9th Floor	<55
	21st Floor	<55
Townhomes	Northeast Unit Rear Yard	<55
	Southwest Unit Rear Yard	<55

Note: including a standard minimum 1.07 m high solid parapet for terraces

5 Discussion and Recommendations

The sound level predictions indicate that the future traffic sound levels will exceed MECP guidelines at some building façades of the proposed development. Recommendations are provided in the following sections.

5.1 Outdoor Living Areas

The dwelling units in the proposed development may have balconies that are less than 4 m in depth. These areas are not considered to be outdoor amenity areas under MECP guidelines, and therefore are exempt from traffic noise assessment.

The predicted daytime sound levels in the rear yards of the proposed townhouse units will be within the MECP limit of 55 dBA. No additional noise abatement is required for these spaces.

The predicted daytime sound level in the 5th Floor OLA of Building B will be 56 dBA, greater than the MECP limit of 55 dBA but less than 60 dBA (not exceeding the limit by more than 5 dBA) with the inclusion of a standard minimum 1.07 m high solid parapet around the area. According to MECP guidelines, this excess may be addressed by including a warning clause in sale and lease agreements for the development. No additional noise abatement is required for this space to comply with the MECP criteria outlined in Section 3. In order to further reduce the sound level in the area to 55 dBA, a 1.3 m high acoustic barrier would be required along the perimeter of the area.

As indicated in Table IV, the predicted daytime sound level in all other OLAs will be within the MECP limit of 55 dBA with the inclusion of a standard minimum 1.07 m high solid parapet around the terraces. For these areas, no additional noise mitigation is required.

The wall component of the barrier should be of a solid construction with a surface density of no less than 20 kg/m^2. The walls may be constructed from a variety of materials such as glass, wood, brick, pre-cast concrete or other concrete/wood composite systems provided that it is free of gaps or cracks. The heights and extents of the barriers should be chosen to reduce the sound levels in the OLA's to below 60 dBA and as close to 55 dBA as is technically, administratively and economically feasible, subject to the approval of the municipality respecting any applicable fence height by-laws.

5.2 Indoor Living Areas and Ventilation Requirements

As per the results summarized in Table III, the predicted future sound level at the proposed building façades of Towers B and C will be greater than 65 dBA during the daytime hours. To address these excesses, the MECP guidelines recommend that these buildings be equipped with central air conditioning systems, so that the windows can be closed. Associated warning clauses are also recommended.

The predicted sound levels at the proposed building façades of Towers A and D will be between 56 and 65 dBA during the daytime hours and/or between 51 and 60 dBA during the nighttime hours. To address these excesses, the MECP guidelines recommend that these buildings be equipped with an alternative means of ventilation to open windows. For multi-storey buildings, this requirement is typically satisfied through central air conditioning. Associated warning clauses are also recommended.

The predicted sound levels at the façades of Towers E, F, G, and H, and all townhouse units will be within 55 dBA during the day and 50 dBA during the night. There are no specific ventilation requirements for these buildings.

Window or through-the-wall air conditioning units are not recommended because of the noise they produce and because the units penetrate through the exterior wall which degrades the overall sound insulating properties of the envelope. Suitable units are those housed in their own closet with an access door for maintenance. The location, installation and sound ratings of the outdoor air conditioning devices should minimize noise impacts and comply with criteria of MECP publication NPC-300.

5.3 Building Façade Constructions

Predicted sound levels at the building facades were used to determine sound insulation requirements of the building envelope. The required acoustic insulation of the wall and window components was determined using methods developed by the National Research Council (NRC).

Detailed glazing requirements for different facades and spaces could be considered in value engineering, if required, when detailed floor plans and building elevations are available.

Exterior Wall Constructions

The exterior walls of the proposed buildings may include precast/masonry panel portions, as well as spandrel glass panels within an aluminum window system. In this analysis, it has been assumed that sound transmitted through elements other than the glazing elements is negligible in comparison. For this assumption to be true, spandrel or metal panel sections must have an insulated drywall partition on separate framing behind.

Exterior Doors

There may be swing doors and some glazed sliding patio doors for entry onto the balconies from living/dining/bedrooms. The glazing areas on the doors are to be counted as part of the total window glazing area. If exterior swing doors are to be used, they shall be insulated metal doors equipped with head, jamb and threshold weather seals.

Acoustical Requirements for Glazing

At the time of this report, detailed floor plans and elevations are under development. Assuming a typical window to floor area of 50% (30% fixed and 20% operable) for the living/dining rooms and 40% (30% fixed and 10% operable) for the bedrooms in the development, basic window glazing, including glass in fixed sections, swing or sliding doors, and operable windows meeting the minimum requirements of the Ontario Building Code (OBC) will provide adequate sound insulation for these buildings. In an urban area such as this, typically a minimum STC rating of 31 to 32 is recommended and is applicable to all buildings including the townhouses.

Further Review

When detailed floor plans and building elevations are available for Towers B and C, a review should be conducted to determine the required glazing and building façade constructions based on actual window to floor area ratios.

5.4 Warning Clauses

The MECP guidelines recommend that warning clauses be included in the property and tenancy agreements for all units with anticipated road traffic sound level. Examples are provided below.

Suggested wording for future dwellings with sound level excesses.

Type A:

> Purchasers/tenants are advised that sound levels due to increasing road traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment.

Suitable wording for future dwellings requiring forced air ventilation systems is given below.

Type B:

> This dwelling unit has been fitted with a forced air heating system and the ducting etc., was sized to accommodate central air conditioning. Installation of central air conditioning will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the noise criteria of the Municipality and the Ministry of the Environment. (Note: the location and installation of the outdoor air conditioning device should be done so as to minimize the noise impacts and comply with criteria of MECP publication NPC-300.)

Suitable wording for future dwellings requiring central air conditioning systems is given below.

Type C:

> This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment, Conservation and Parks. (Note: the location and installation of the outdoor air conditioning device should be done so as to minimize the noise impacts and comply with criteria of MECP publication NPC-300.)

Suitable wording to inform future residents of the adjacent retail, commercial, recreational, institutional, and/or religious facilities and that sounds from these facilities may at times be audible.

Type D:

> Purchasers/tenants are advised that due to the proximity of the adjacent retail, commercial, recreational, institutional, and/or religious facilities, noise from the facilities may at times be audible.

These sample clauses are provided by the MECP as examples and can be modified by the Municipality as required.

6 Impact of the Development on Itself

Section 5.8.1.1 of the Ontario Building Code (OBC), released on January 1, 2020, specifies the minimum required sound insulation characteristics for demising partitions, in terms of Sound Transmission Class (STC) or Apparent Sound Transmission Class (ASTC) values. In order to maintain adequate acoustical privacy between separate suites in a multi-tenant building, inter-suite walls must meet or exceed STC-50 or ASTC-47. Suite separation from a refuse chute or elevator shaft must meet or exceed STC-55. In addition, it is recommended that the floor/ceiling constructions separating suites from any amenity or commercial spaces also meet or exceed STC-55. Tables 1 and 2 in Section SB-3 of the Supplementary Guideline to the OBC provide a comprehensive list of constructions that will meet the above requirements.

Tarion's Builder Bulletin B19R requires the internal design of condominium projects to integrate suitable acoustic features to insulate the suites from noise from each other and amenities in accordance with the OBC, and limit the potential intrusions of mechanical and electrical services of the buildings on its residents. If B19R certification is needed, an acoustical consultant is required to review the mechanical and electrical drawings and details of demising construction and mechanical/electrical equipment, when available, to help ensure that the noise impact of the redevelopment on itself is maintained within acceptable levels.

7 Impact of the Development on the Environment

Sound levels from noise sources such as rooftop air-conditioners, cooling towers, exhaust fans, etc. should not exceed the minimum one-hour L_{EQ} ambient (background) sound level from road traffic, at any potentially impacted residential point of reception. Based on the levels observed during our site visit, the typical minimum ambient sound levels in the area are expected to be in the range of 55 dBA or more during the day and 50 dBA or more at night. Thus, any electro-mechanical equipment associated with this development (e.g., emergency generator testing, fresh-air handling equipment, etc.) should be designed such that they do not result in noise impact beyond these ranges. At the time of this study, the design of the proposed residential building was in its initial stages, and the mechanical systems had not yet been developed.

8 Summary of Recommendations

The following list and Table V summarize the recommendations made in this report. The reader is referred to the previous sections of the report where these recommendations are discussed in more detail.

1. Towers A and D should be equipped with an alternative means of ventilation to open windows. Central air conditioning will meet this requirement. The location, installation and sound ratings of the air conditioning devices should comply with NPC-300, as applicable.

2. Central air conditioning is required for Towers B and C. The location, installation and sound ratings of the air conditioning devices should comply with NPC-300, as applicable.

3. When detailed floor plans and building elevations are available for Towers B and C, a review should be conducted to determine the required glazing and building façade constructions based on actual window to floor area ratios. Any glazing and building facade constructions meeting the minimum requirements of the Ontario Building Code (OBC) will provide adequate sound insulation for the remaining buildings in the proposed development. However, in an urban area such as this, typically a minimum STC rating of 31 to 32 is recommended and is applicable to all buildings including the townhouses.

4. The use of warning clauses in the property and tenancy agreements is recommended to inform future residents of traffic noise issues.

5. Tarion Builders Bulletin B19R requires that the internal design of condominium projects integrates suitable acoustic features to insulate the suites from noise from each other and amenities in accordance with the OBC, and limit the potential intrusions of mechanical and electrical services of the building on its residents. If B19R certification is to be sought, an acoustical consultant is required to review the mechanical and electrical drawings and details of demising constructions and mechanical/electrical equipment, when available, to help ensure that the noise impact of the development on itself are maintained within acceptable levels.

The following table summarizes the noise control recommendations and noise warning clauses for the proposed building.

Table V: Summary of Noise Control Requirements and Noise Warning Clauses

Description	Acoustic Barrier	Ventilation Requirements*	Type of Warning Clause	Exterior Walls & Glazing Constructions
Towers B and C	--	Central A/C	A, C, D	OBC[2,3]
Towers A and D	--	Central A/C[1]	A, C, D	OBC[2,3]
Towers E, F, G, and H	--	--	D	OBC[2,3]
All Townhouse Units	--	--	D	OBC[2,3]
Townhouse Units, Rear Yard OLA	--	--	--	--
All OLAs	--	--	--	--

Notes:
-- no specific requirement
OBC – meeting the minimum requirements of the Ontario Building Code
* The location, installation and sound rating of the air conditioning condensers must be compliant with MECP Guideline NPC-300, as applicable.
1 The requirement is an alternative form of ventilation. For multi-storey buildings, this requirement is typically satisfied through central air conditioning.
2 When detailed floor plans and building elevations are available for, a review should be conducted to determine the required glazing and building façade constructions based on actual window to floor area ratios.
3 In an urban area such as this, typically a minimum STC rating of 31 to 32 is recommended.

8.1 Implementation

To ensure that the noise recommendations outlined above are fully implemented, it is recommended that:

1. When detailed floor plans and building elevations are available for Towers B and C, a review should be conducted to determine the required glazing and building façade constructions based on actual window to floor area ratios.

2. Prior to the issuance of occupancy permits for this development, the City's building inspector or a Professional Engineer qualified to perform acoustical engineer services in the province of Ontario should certify that the noise control measures have been properly incorporated, installed, and constructed, as required.

Figure 1: Key Plan

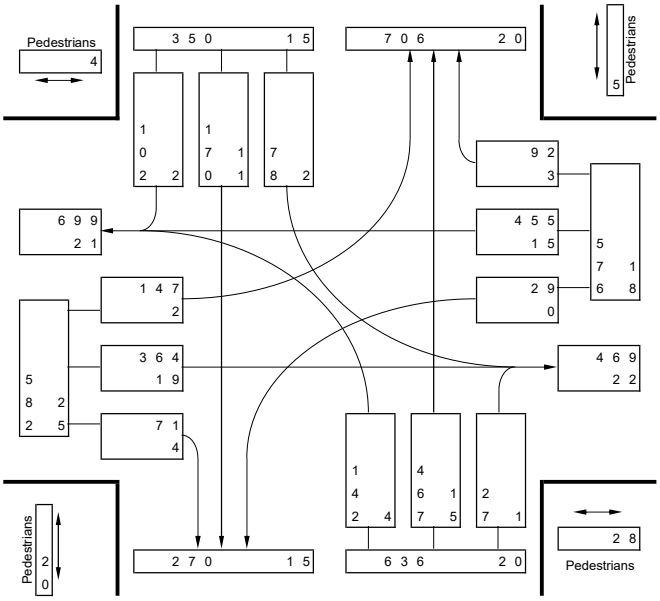
Figure 2 - Proposed Site Plan

Appendix A

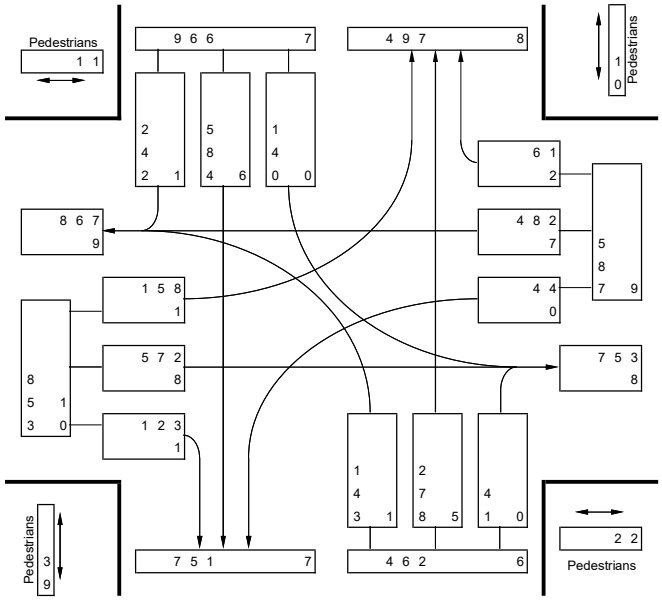
Road Traffic Data

City of Hamilton **TURNING MOVEMENT FLOW CHART** Loc. Code: 37

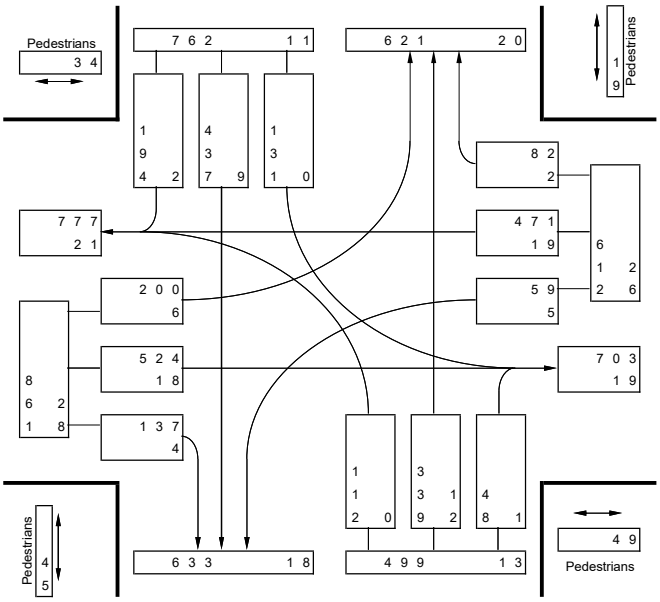
Intersection: **Upper Sherman Ave** **at** **Mohawk Rd** Total Vehicles: 16,005 Date: Tuesday
Direction: (North/South) (East/West) M.V.E./Year: 11.155 May 1, 2018
Road Condition: Dry Weather: Clear AWDT Factor: 2.05 Period: 7 hours
Comments:



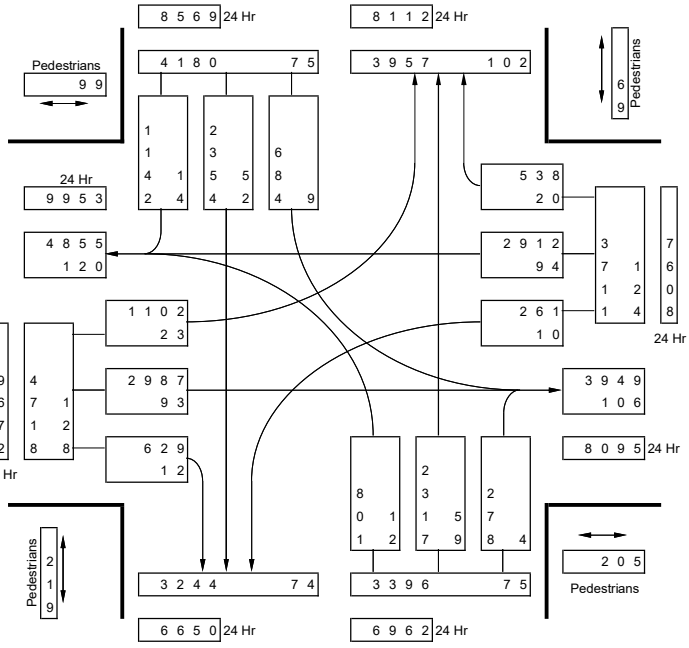
A.M. PEAK HOUR = 8:15 AM - 9:15 AM



P.M. PEAK HOUR = 4:45 PM - 5:45 PM



NORMAL HOUR = 2:30 PM - 3:30 PM



7 Hr & 24 Hr TOTAL VOLUMES

Appendix B

Calibration Stamson Output

```
STAMSON 5.0        NORMAL REPORT        Date: 18-08-2022 15:40:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: mohawk.te            Time Period: Day/Night 16/8 hours
Description: Mohawk calibration.


Road data, segment # 1:  (day/night)
-----------------------------------
Car traffic volume  : 24327/2703  veh/TimePeriod
Medium truck volume :   388/43    veh/TimePeriod
Heavy truck volume  :   242/27    veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1:  (day/night)
---------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1:  (day)
---------------------------

Source height = 0.99 m

ROAD (0.00 + 66.61 + 0.00) = 66.61 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  66.61   0.00   0.00   0.00   0.00   0.00   0.00  66.61
-------------------------------------------------------------------------------

Segment Leq : 66.61 dBA

Total Leq All Segments: 66.61 dBA

Results segment # 1:  (night)
-----------------------------

Source height = 0.99 m

ROAD (0.00 + 60.08 + 0.00) = 60.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  60.08   0.00   0.00   0.00   0.00   0.00   0.00  60.08
-------------------------------------------------------------------------------

Segment Leq : 60.08 dBA

Total Leq All Segments: 60.08 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 66.61
                           (NIGHT): 60.08
```

```
STAMSON 5.0        NORMAL REPORT        Date: 18-08-2022 15:41:16
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: sherman.te           Time Period: Day/Night 16/8 hours
Description: Sherman calibration.


Road data, segment # 1:  (day/night)
-----------------------------------
Car traffic volume  : 20761/2307  veh/TimePeriod
Medium truck volume :   278/31    veh/TimePeriod
Heavy truck volume  :   174/19    veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1:  (day/night)
---------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1:  (day)
---------------------------

Source height = 0.95 m

ROAD (0.00 + 65.59 + 0.00) = 65.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  65.59   0.00   0.00   0.00   0.00   0.00   0.00  65.59
-------------------------------------------------------------------------------

Segment Leq : 65.59 dBA

Total Leq All Segments: 65.59 dBA

Results segment # 1:  (night)
-----------------------------

Source height = 0.95 m

ROAD (0.00 + 59.04 + 0.00) = 59.04 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  59.04   0.00   0.00   0.00   0.00   0.00   0.00  59.04
-------------------------------------------------------------------------------

Segment Leq : 59.04 dBA

Total Leq All Segments: 59.04 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 65.59
                           (NIGHT): 59.04
```

Appendix C

Predicted Sound Levels at Residential Façades

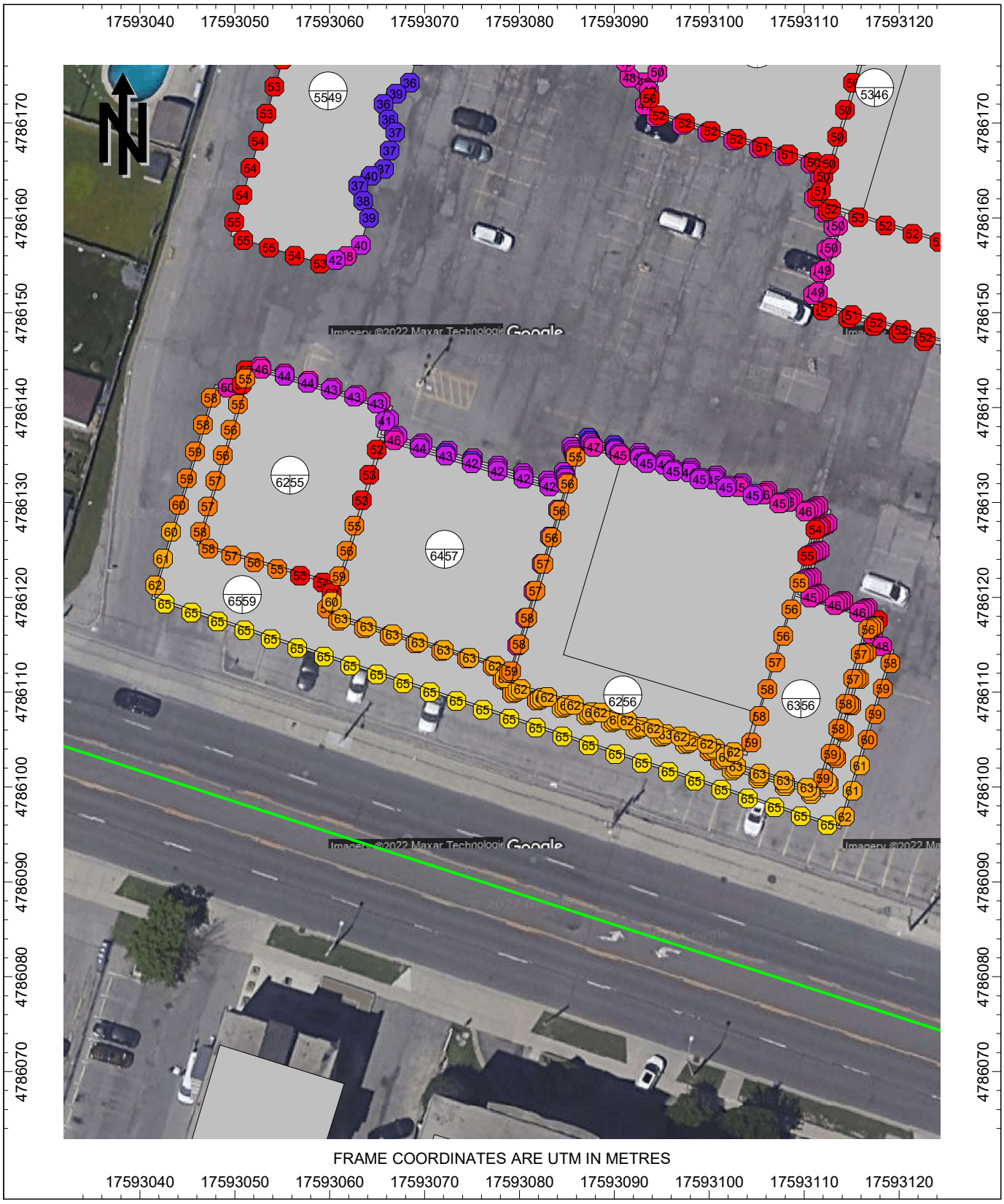


Figure C1: Building A Daytime Sound Level Predictions

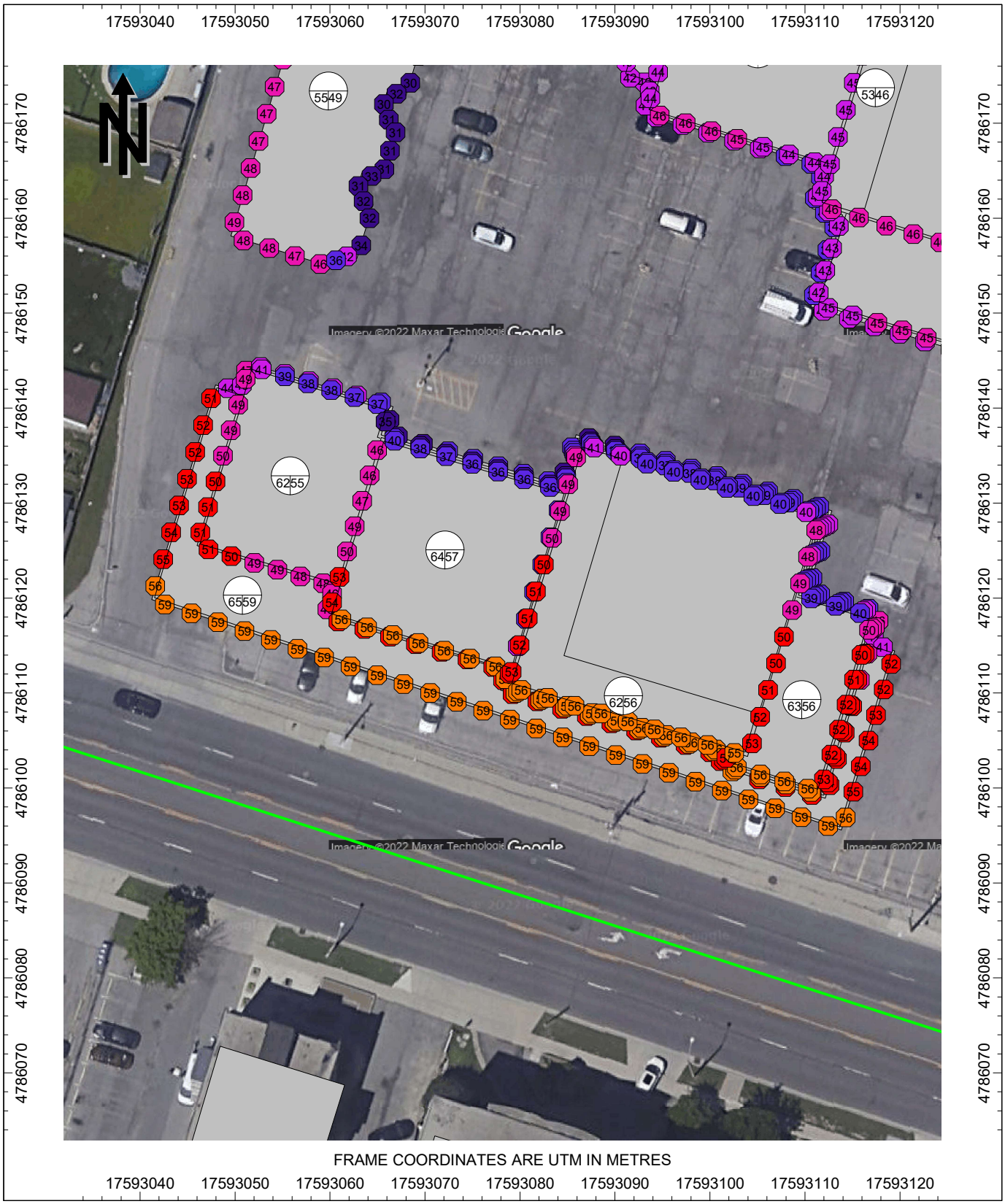


Figure C2: Building A Nighttime Sound Level Predictions

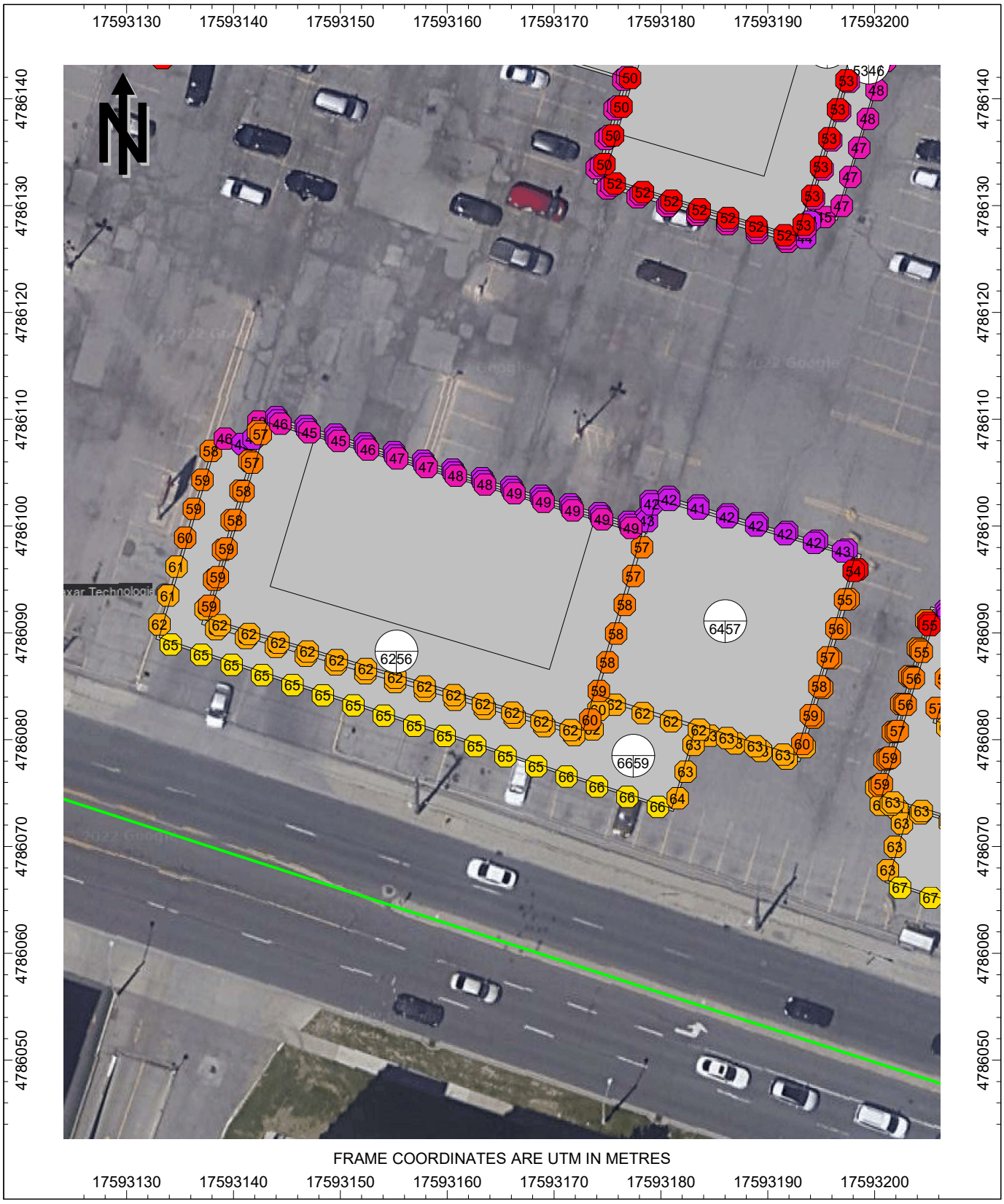


Figure C3: Building B Daytime Sound Level Predictions

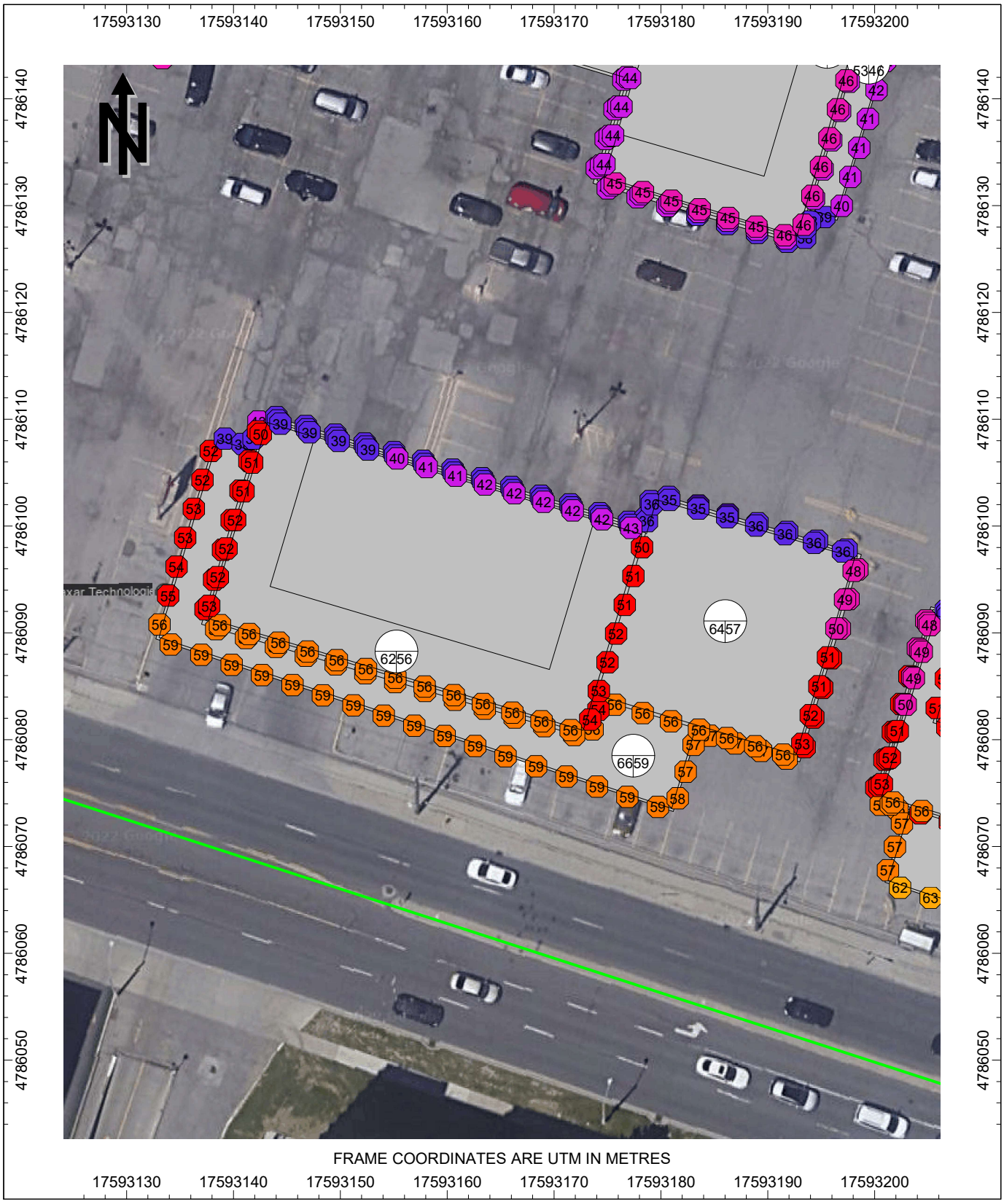


Figure C4: Building B Nighttime Sound Level Predictions

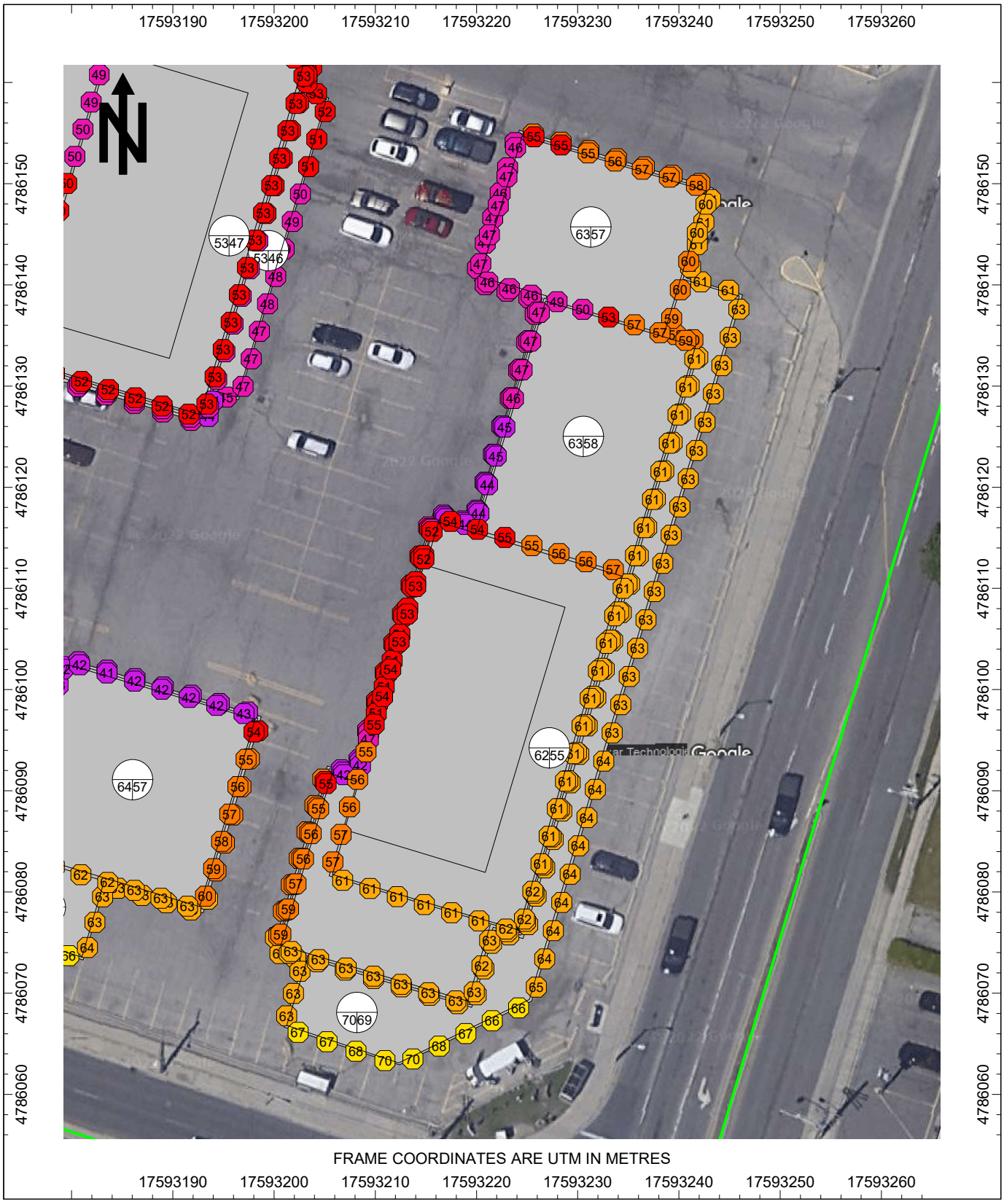


Figure C5: Building C Daytime Sound Level Predictions

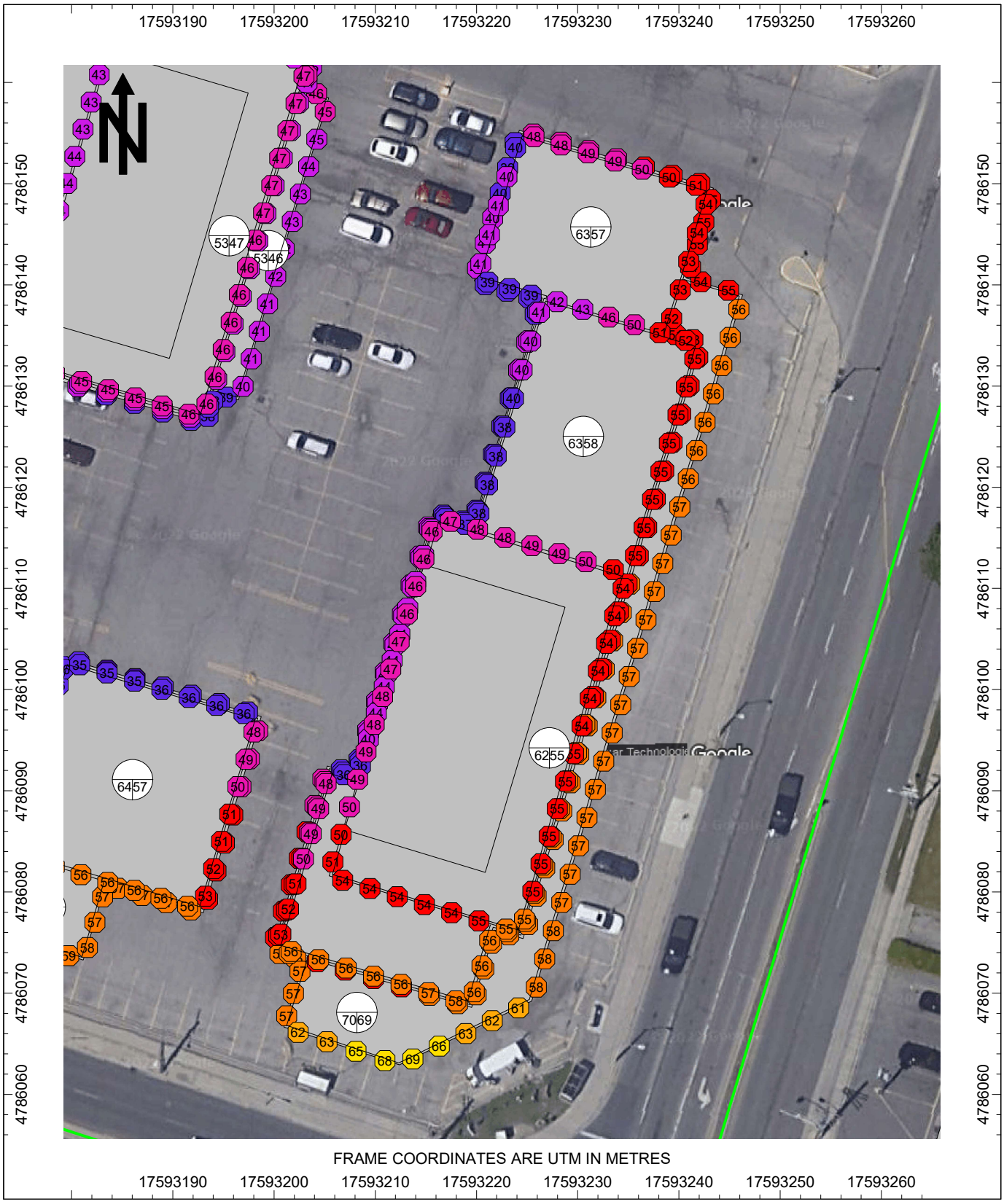


Figure C6: Building C Nighttime Sound Level Predictions

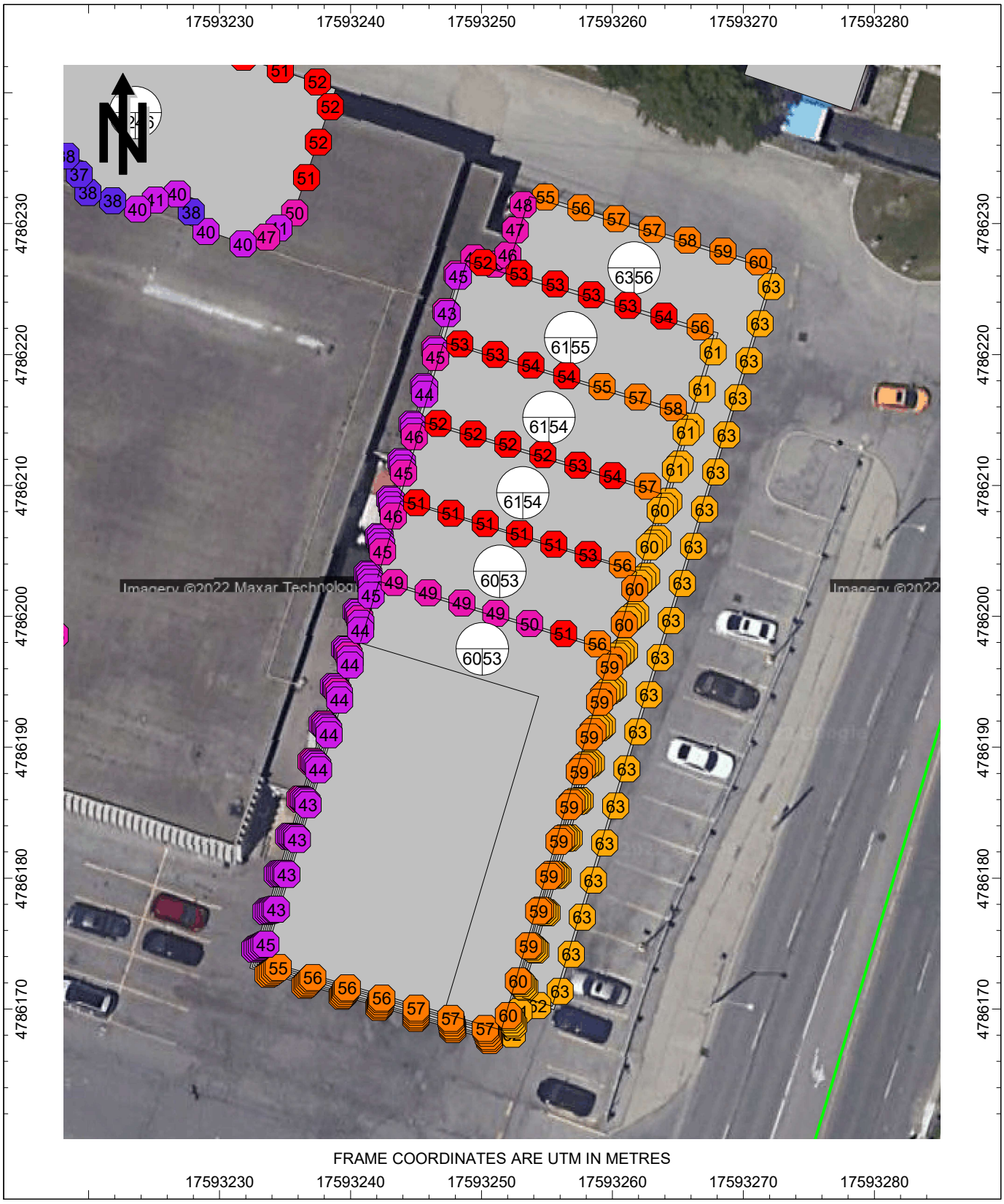


Figure C7: Building D Daytime Sound Level Predictions

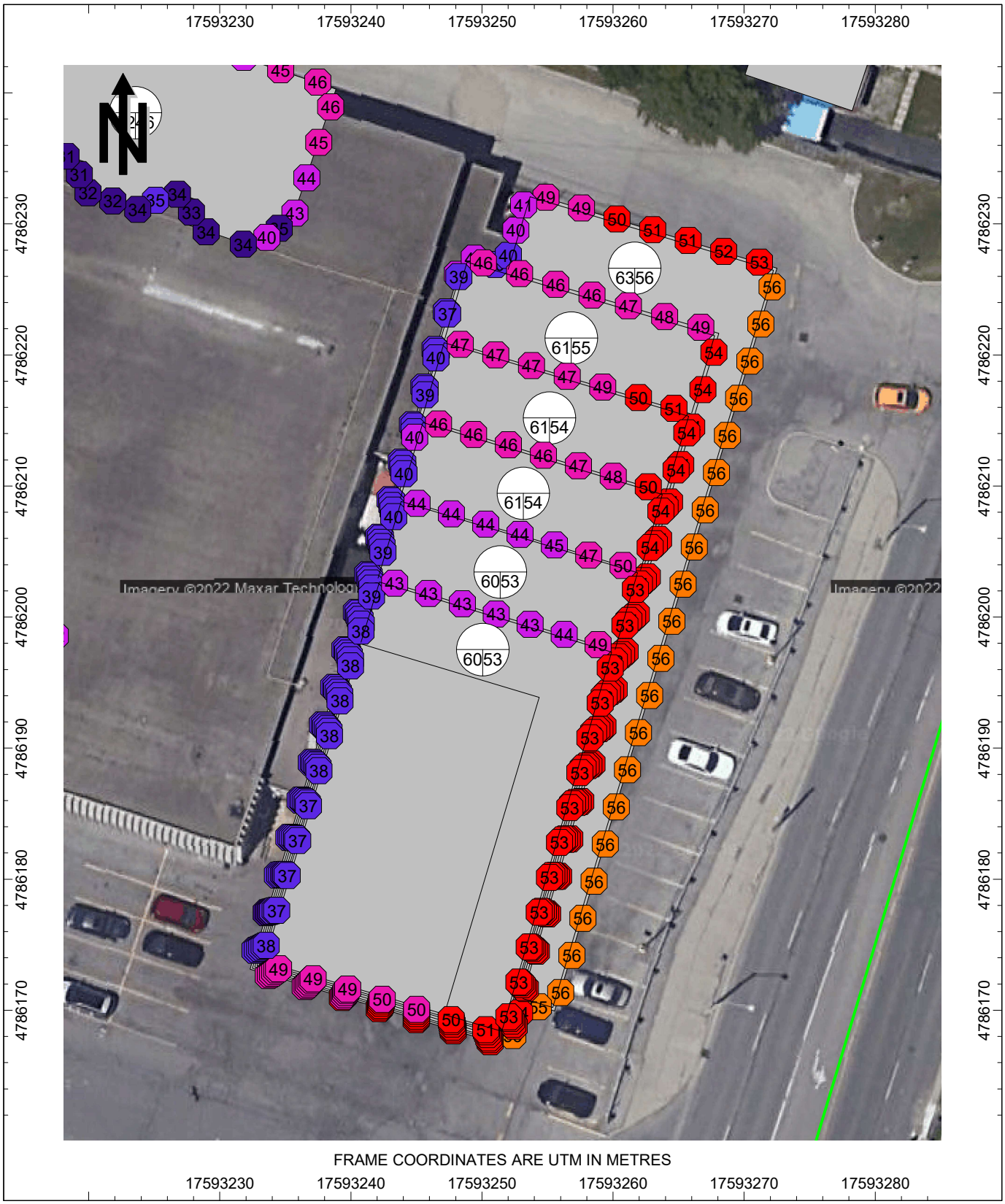


Figure C8: Building D Nighttime Sound Level Predictions

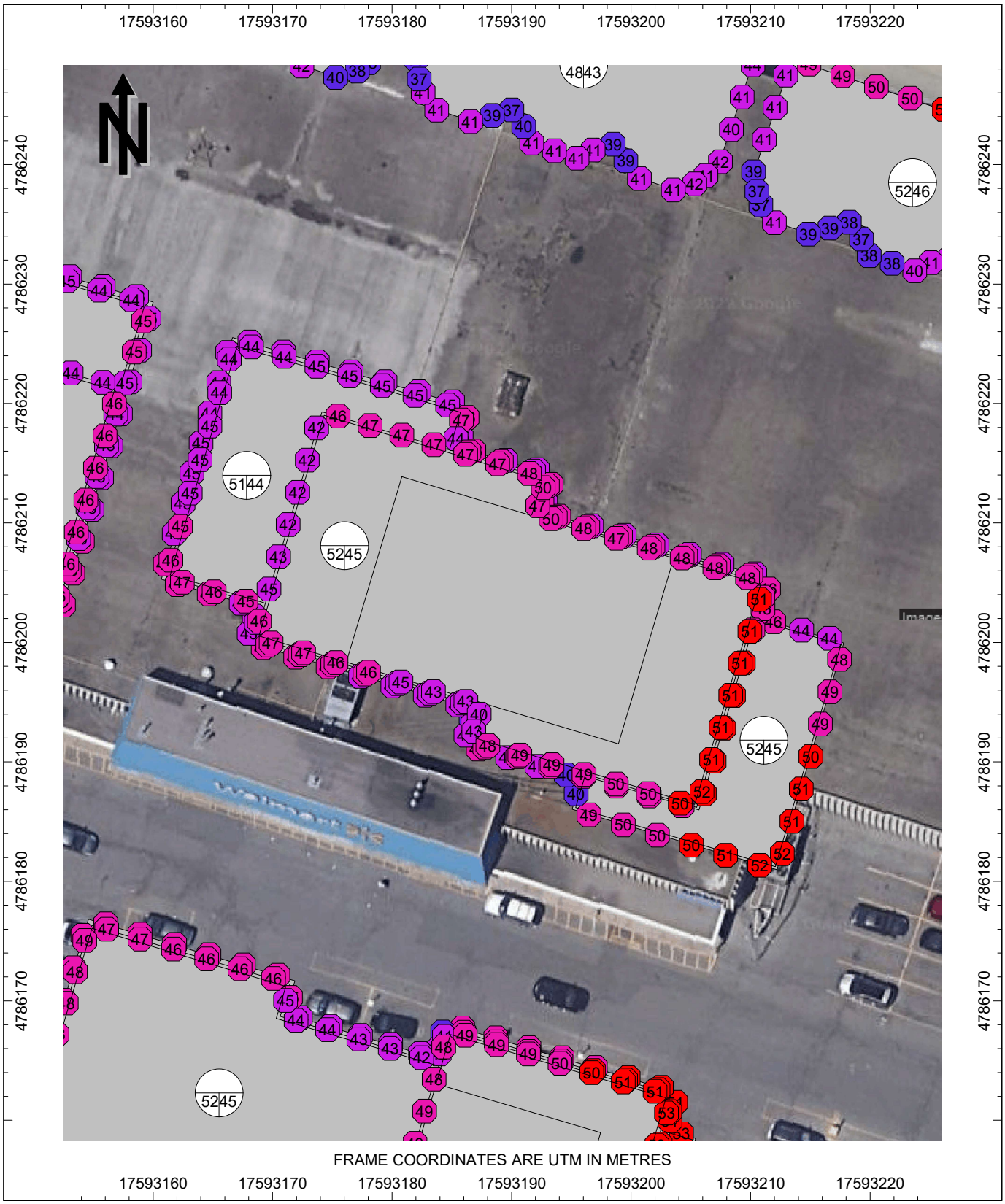


Figure C9: Building E Daytime Sound Level Predictions

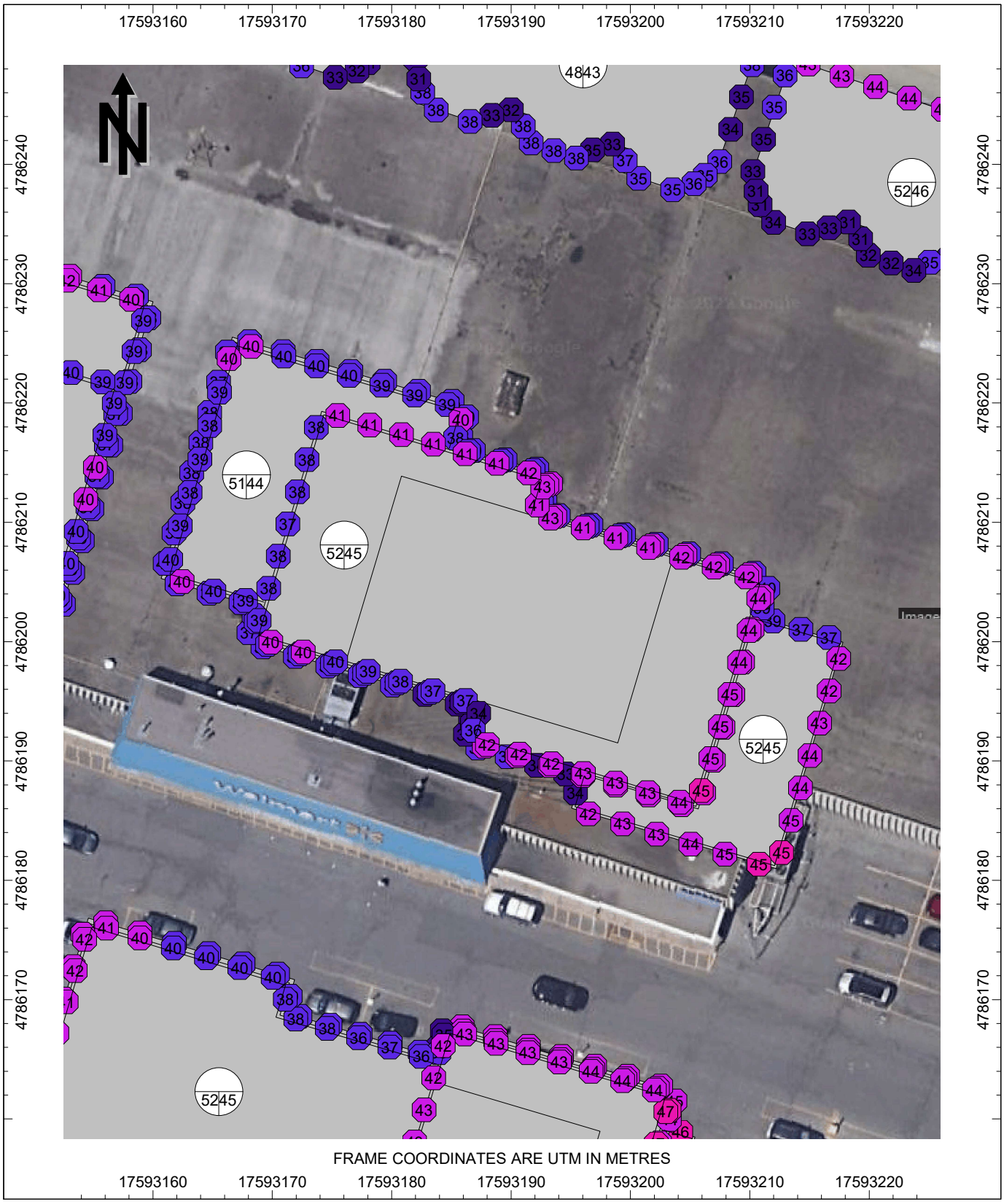


Figure C10: Building E Nighttime Sound Level Predictions

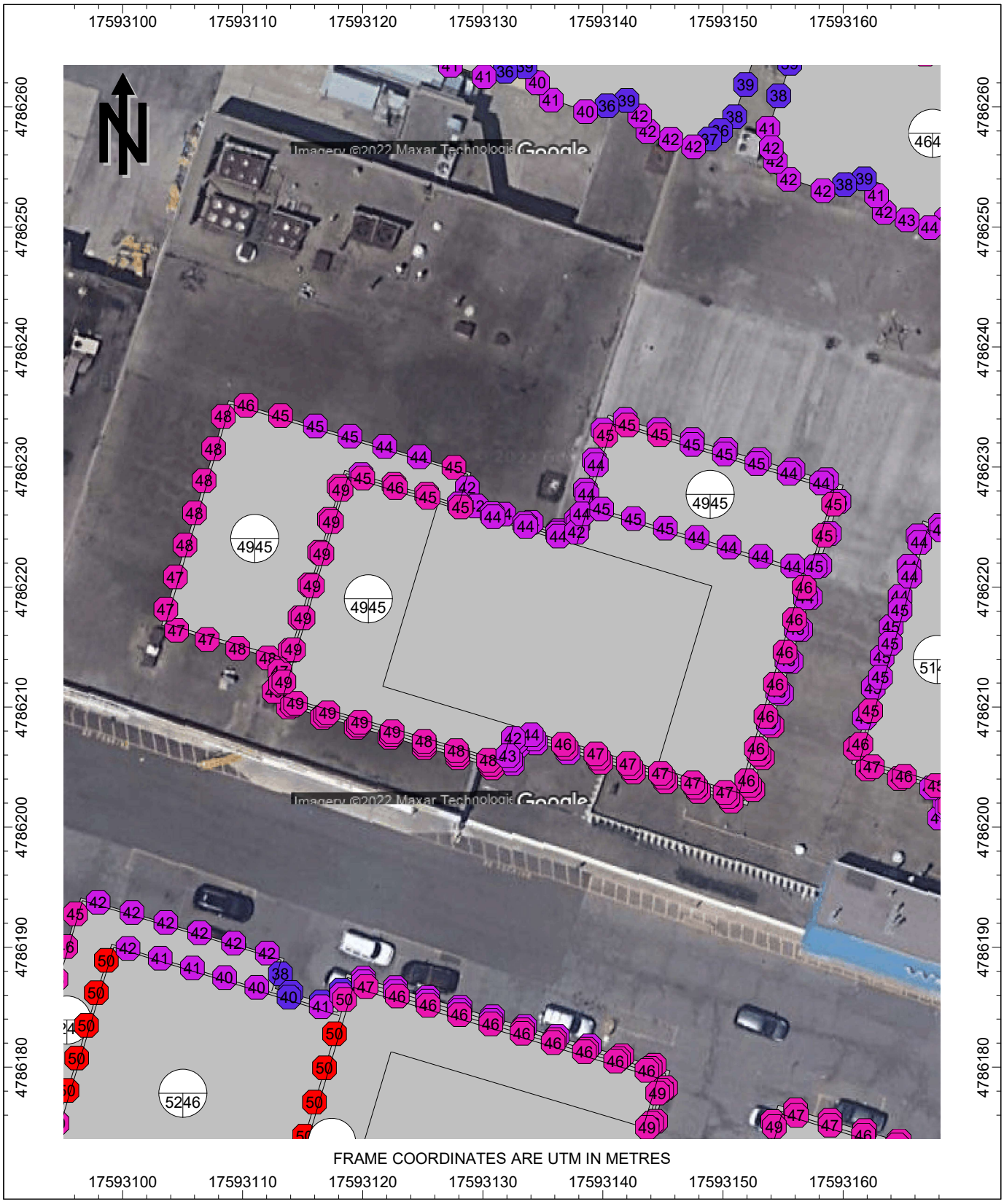


Figure C11: Building F Daytime Sound Level Predictions

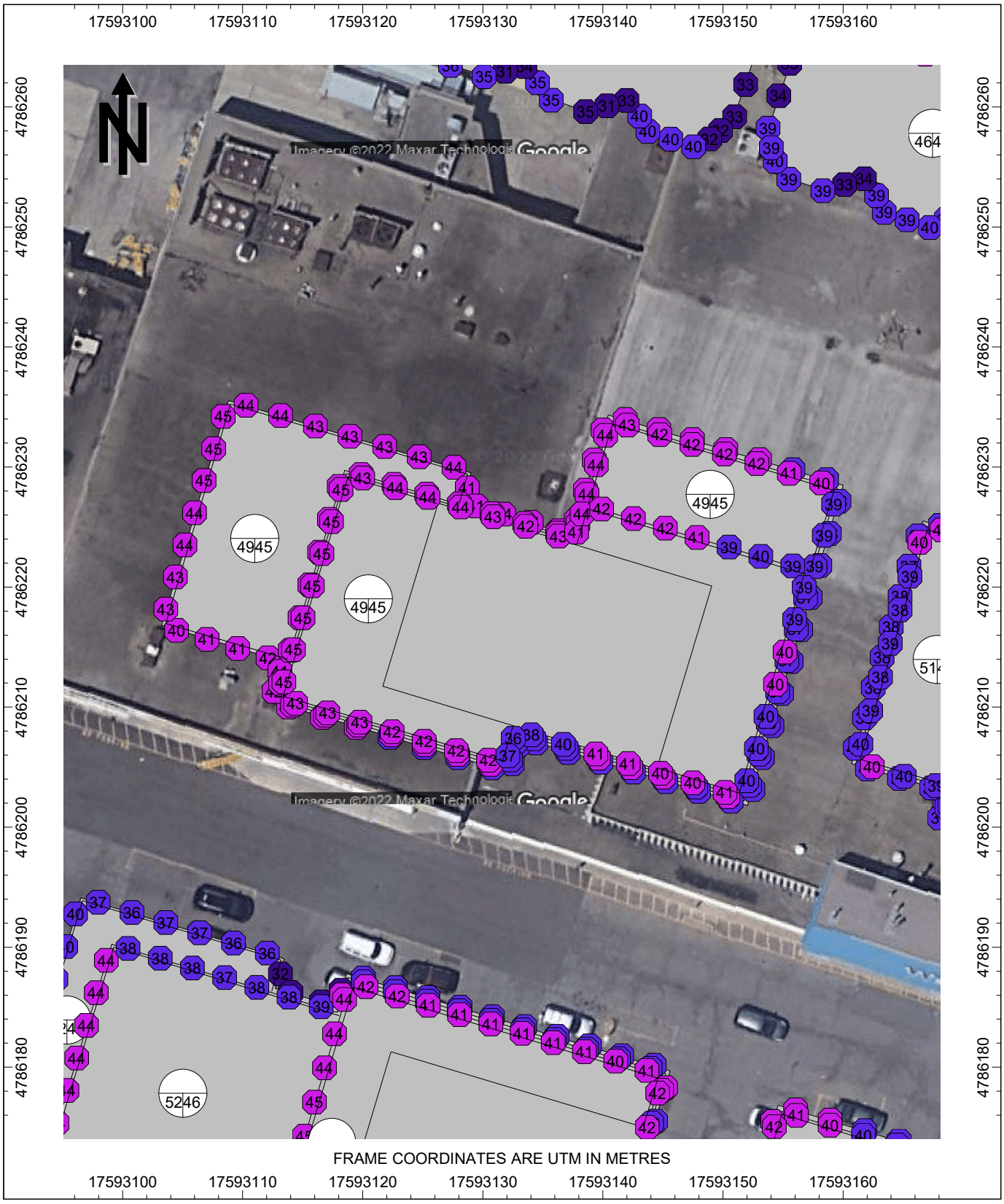


Figure C12: Building F Nighttime Sound Level Predictions

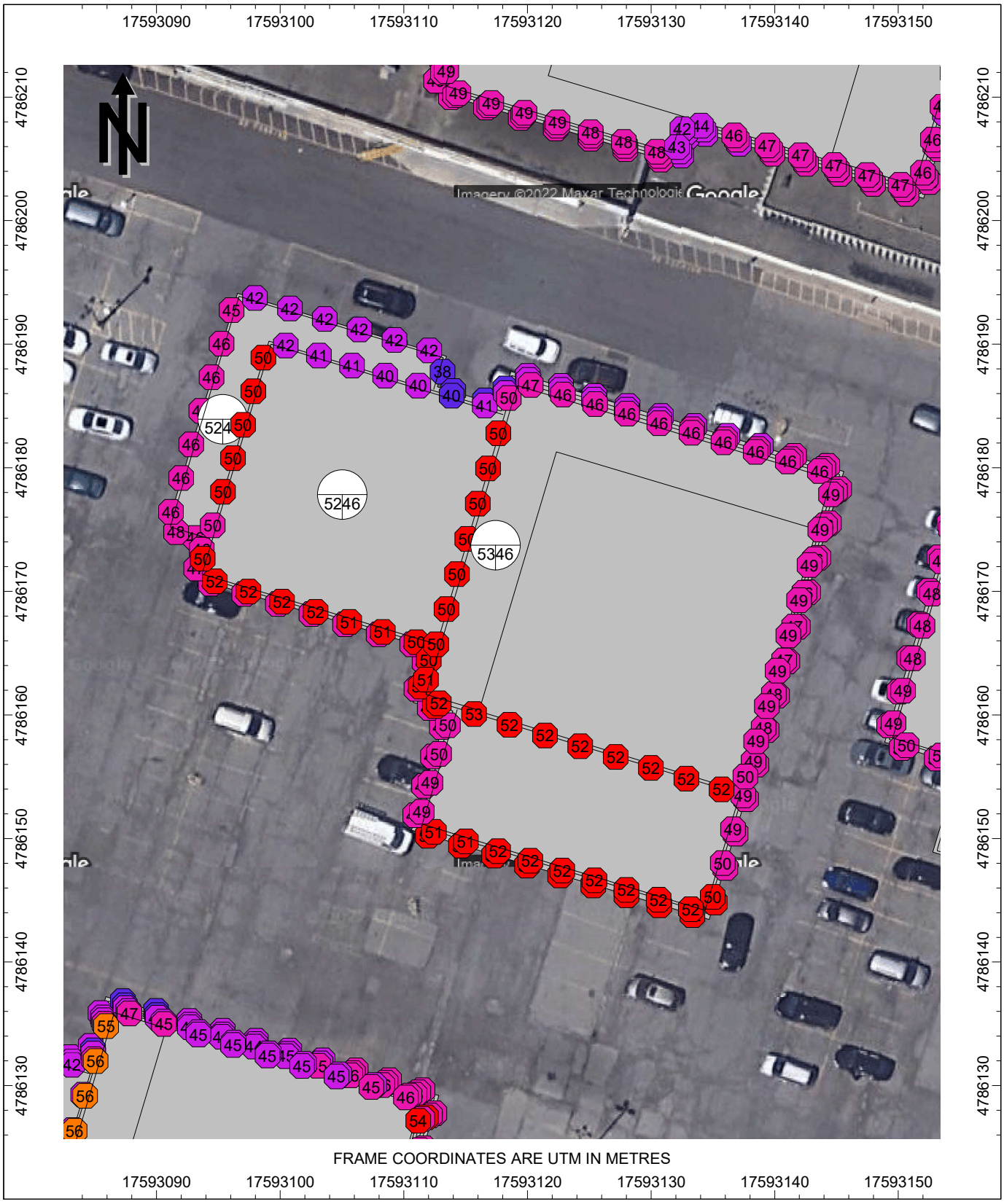


Figure C13: Building G Daytime Sound Level Predictions

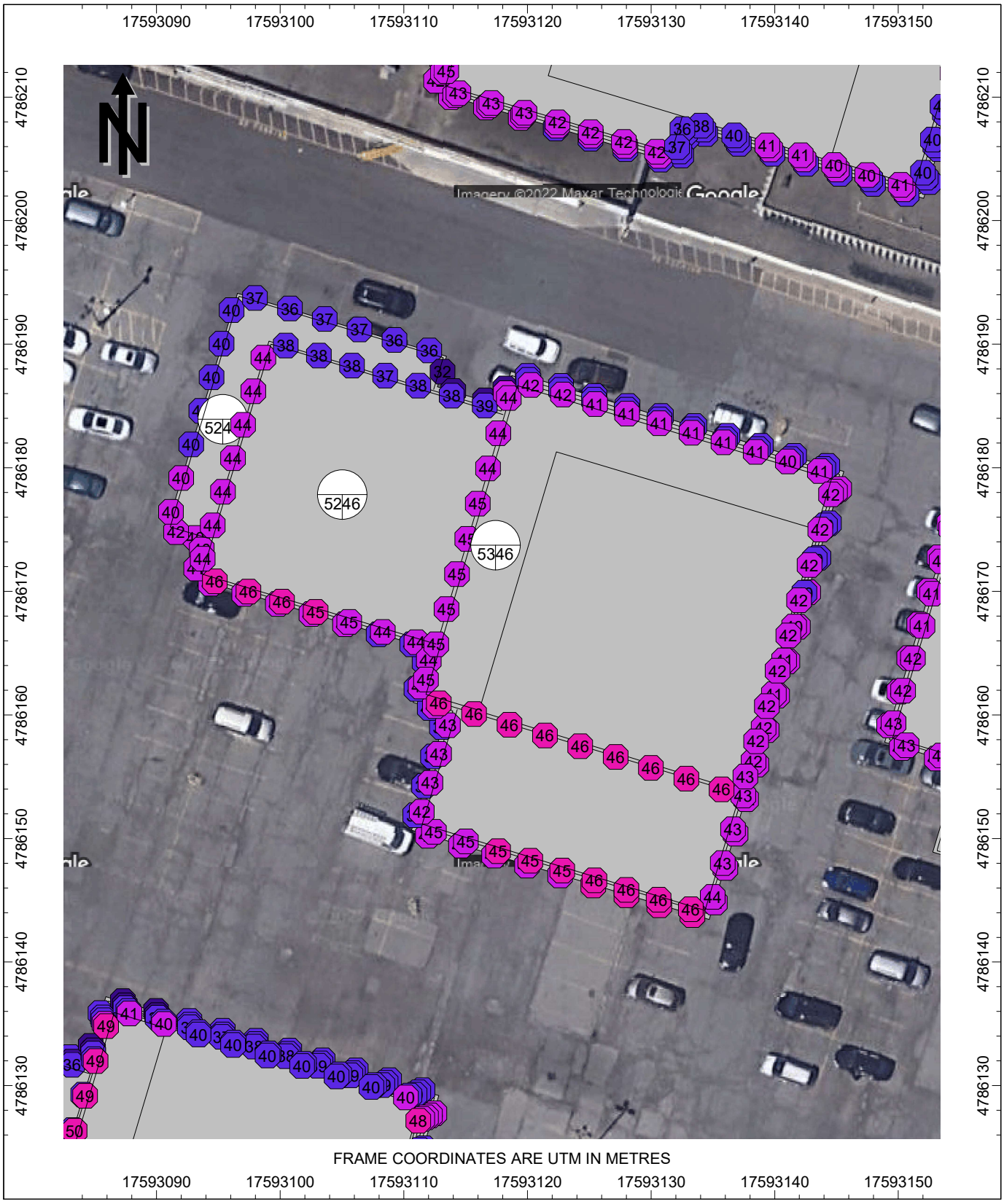


Figure C14: Building G Nighttime Sound Level Predictions

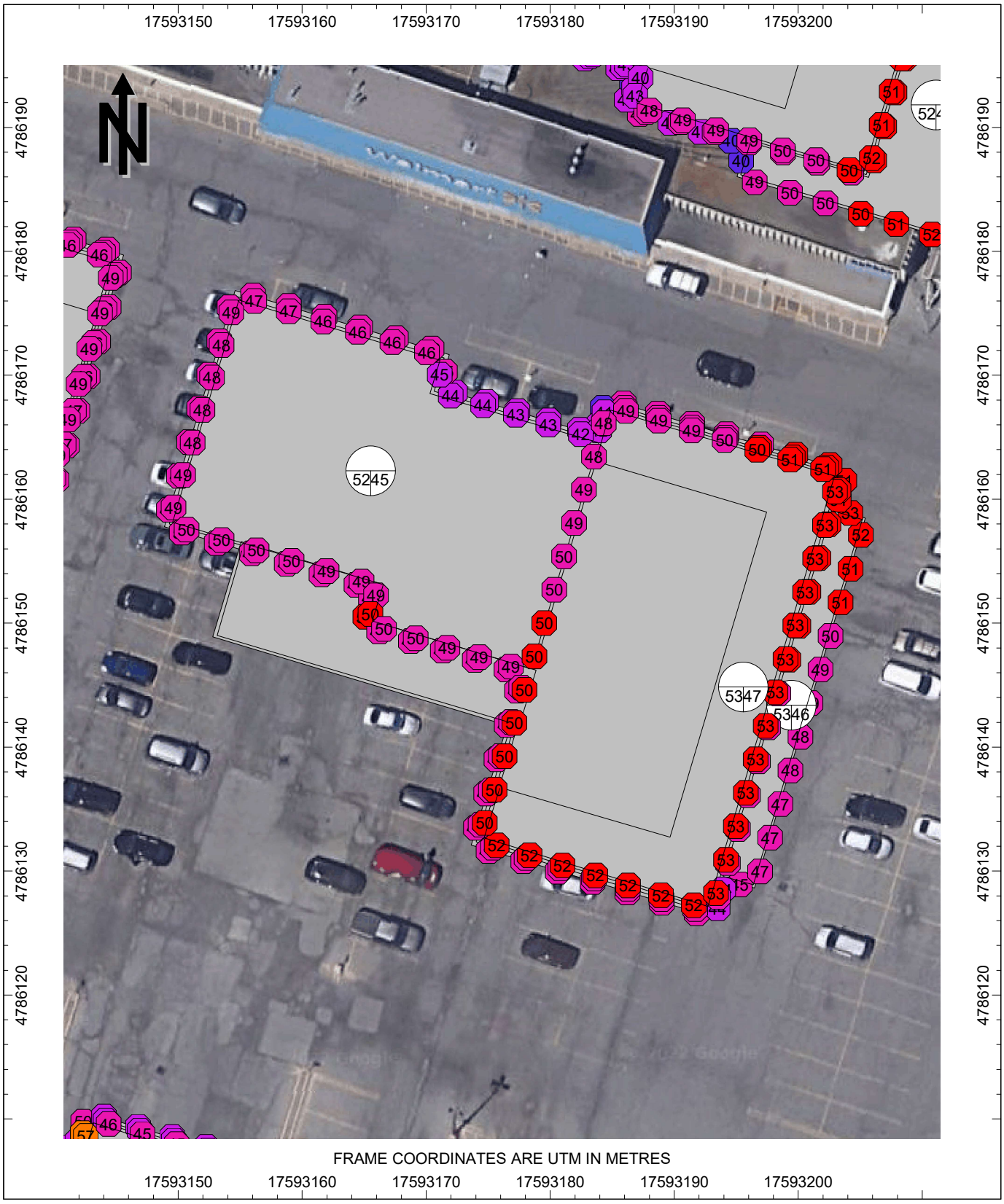


Figure C15: Building H Daytime Sound Level Predictions

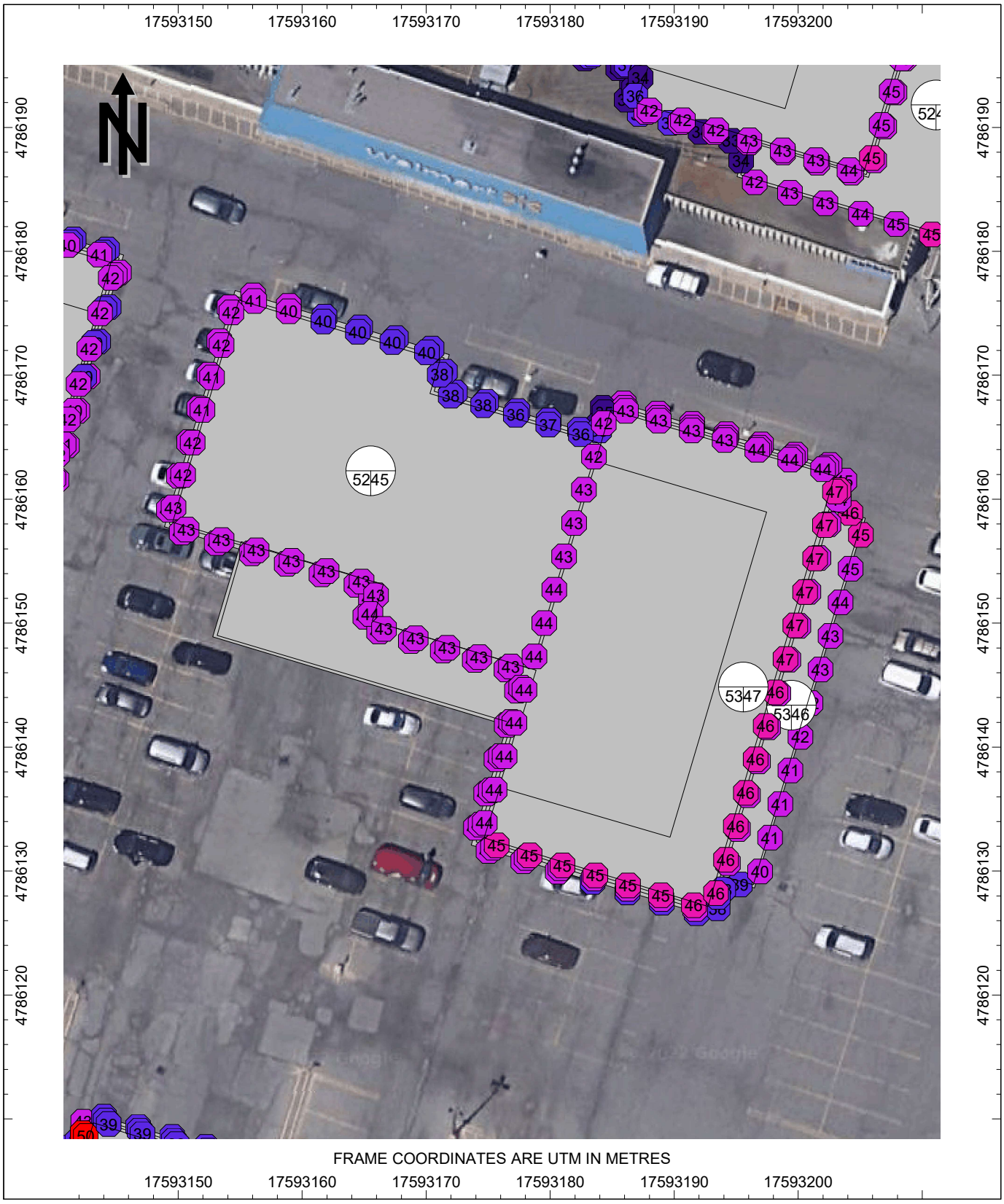


Figure C16: Building H Nighttime Sound Level Predictions

Figure C17: North Townhomes Daytime Sound Level Predictions

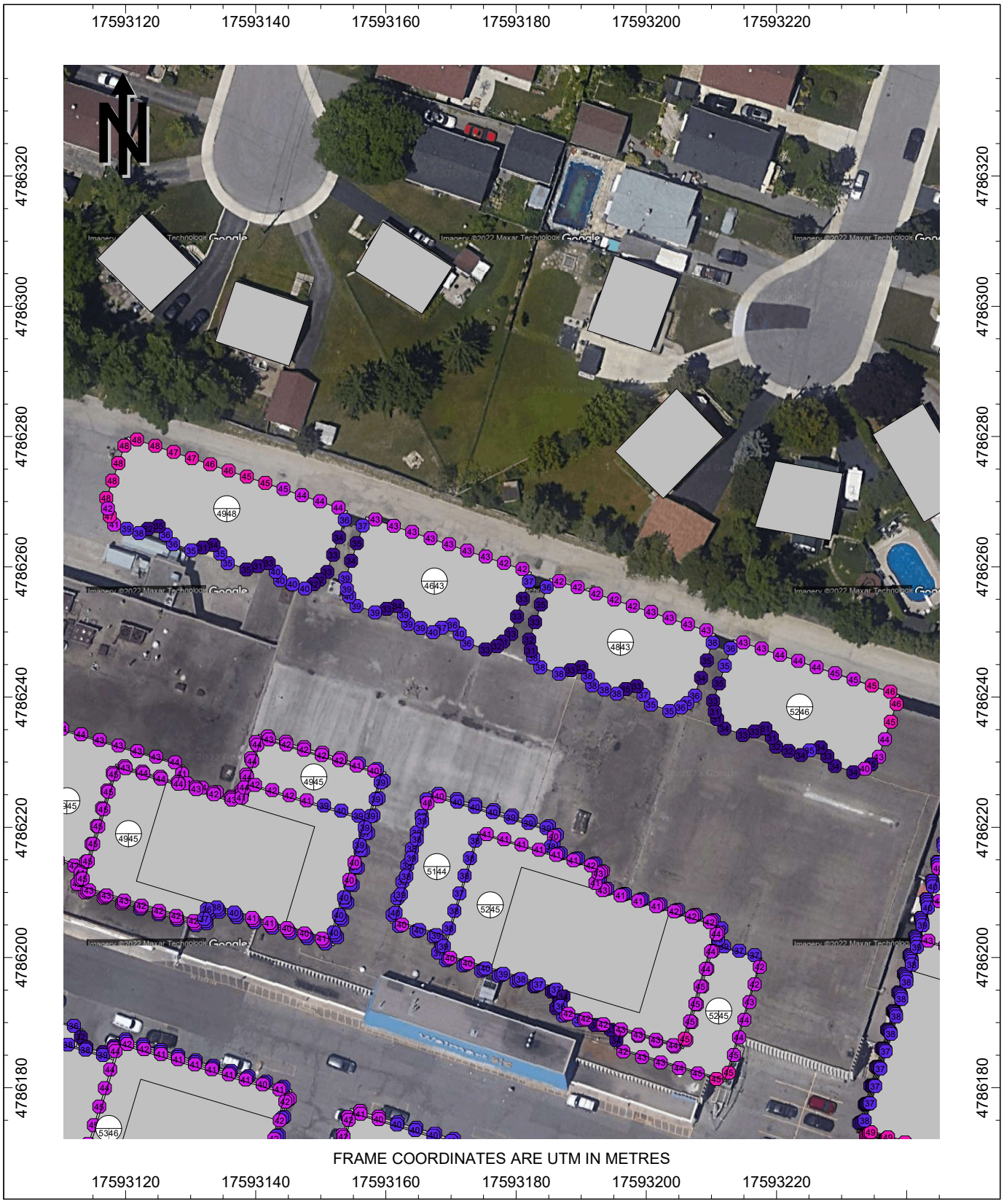


Figure C18: North Townhomes Nighttime Sound Level Predictions

Figure C19: West Townhomes Daytime Sound Level Predictions

Figure C20: West Townhomes Nighttime Sound Level Predictions

Figure C21: Outdoor Living Area Daytime Sound Level Predictions