Upper York Sewage Servicing
Detailed Design and Construction

York Durham Sewage System (YDSS) Modifications
Noise and Vibration Impact Assessment

Prepared for:
The Regional Municipality of York

Prepared by:

GHD

1195 Stellar Drive, Unit 1
Newmarket, Ontario L3Y 7B8

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Executive Summary

A noise and vibration review was completed for the amended York Durham Sewage System (YDSS) Modifications works as part of the Upper York Sewage Servicing (UYSS) project (Project) in York Region, Ontario.

Building on the outcome of the UYSS Environmental Assessment (EA), the Regional Municipality of York (York Region) engaged a GHD-led consortium to complete detailed design and construction of the YDSS Modifications. This expansion involves twinning a new sanitary forcemain to the existing forcemain that runs from the Newmarket Pump Station and connecting it into an existing gravity sewer that discharges to the Aurora Pump Station (**Figure 1**).

Construction of the YDSS Modifications would utilize microtunnelling methods for approximately 5,040 meters (m) of the alignment, requiring ten shafts spaced at an average of 504 m intervals. Open cut installation would be used in two additional areas for approximately 630 m.

The *Noise and Vibration Baseline Conditions Report* (CRA et al., 2013) confirmed that the majority of the EA-preferred YDSS Modifications alignment experienced road traffic background noise conditions between 50 decibels (dBA) and 55 dBA during the day and 45 dBA during the night and was therefore urban in acoustic character. These noise and vibration baseline conditions (**Section 3.0**) were used to establish criteria to evaluate the potential for adverse noise and vibration impacts associated with the operation and construction of the sending/receiving shafts and open cut areas (**Section 4.0**).

Analysis during the UYSS detailed design process identified 145 existing buildings immediately adjacent to the amended YDSS Modifications alignment and determined that the adoption of trenchless microtunnelling for the majority of the alignment - along with other impact management measures - is anticipated to result in a net reduction in adverse impacts for the majority of those adjacent properties (**Section 4.0**).

Proposed construction equipment and associated noise specifications were reviewed and their anticipated noise impacts were modelled using the Cadna A Acoustical Modelling Software (Cadna A).

Based on the expected noise impacts, preliminary noise abatement measures were recommended to reduce the impacts resulting from construction activities on neighbouring residences. Noise mitigation in the form of construction site hoarding was incorporated into the noise impact modelling. If warranted, hoarding placement was considerate of the site-specific layouts and optimized to provide maximum noise reduction.

Construction activities have the potential to affect surrounding sensitive receptors adversely at all times of the day. Truck traffic, bulldozer, excavator, and on-site generator noise are expected to be the most dominant noise sources at each of the construction sites. The above grade equipment supporting the MTBMs is expected to be the dominant sources of noise at each sending shaft.

Receiving Shaft 1 is ranked the lowest in terms of potential for noise impact exposure. Open Cut Area 2 is the highest potential for noise impact exposure and nuisance complaints but will be restricted to daytime operations to reduce the potential for complaints.

While there are no defined limits for vibration levels under Town of Newmarket By-law, construction vibration limits are defined by the City of Toronto, which may be considered appropriate, non-binding benchmarks for consideration during construction of the amended YDSS Modifications.

Based on the proposed scope of construction activities, ground-borne vibration intensities are not anticipated to exceed the outlined limits beyond the proposed 30 m zone of influence. However, as noted above, the perceived vibration levels in combination with noise and visual effects of heavy machinery working in close proximity to adjacent building and properties may result in complaints.

Of the 145 adjacent properties, 22 are within the 30 m vibration zone of influence with the potential to be adversely affected by vibration impacts from five of the 12 construction sites (**Figures 6A** to **6E**): Open Cut Area 2; Sending Shaft 3, and; Receiving Shafts 3, 4 and 5. Of these properties, 12 are built heritage resources, whilst an additional 10 cultural heritage landscapes were identified as falling within the zone of influence for vibration. 122 adjacent properties are within the 30 m vibration zone of influence of the amended YDSS Modifications alignment as the microtunnel boring machines (MTBMs) pass underground along tunnel drives between each shaft site (**Figures 6F** to **6J**). All 145 adjacent properties should have pre-construction surveys completed (UYSS EA commitment).

Outside of the pre-construction property surveys, GHD recommends a continuous noise and vibration-monitoring program during construction, in addition to specific corrective/contingency response actions (**Section 5.4**) and a complaint protocol.

The recommendations in this report have been generalized to provide a degree of flexibility for the contractors to specify exact mitigation measures.

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Section 1.0 Introduction

This document comprises the Noise and Vibration Impact Assessment for construction of the amended York Durham Sewage System (YDSS) Modifications as part of The Regional Municipality of York's *Upper York Sewage Servicing (UYSS)* project in York Region, Ontario.

An UYSS Environmental Assessment (EA) was undertaken for this project and submitted to the Ministry of Environment and Climate Change (MOECC) in July 2014. The UYSS EA included a number of reports (CRA et al. 2014 and CRA et al. 2013) providing a detailed description of the potential effects of the YDSS Modifications in terms of construction noise and vibration. The UYSS EA also provides a list of the reports reviewed or referenced herein.

York Region engaged a GHD-led consortium to complete detailed design and construction of the YDSS Modifications. This involves twinning a new sanitary forcemain to an existing forcemain running from Newmarket Pump Station, connecting to both the Bogart Creek Pump Station and to an existing gravity sewer that discharges to the Aurora Pump Station (**Figure 1**).

1.1 Project Description

The proposed YDSS Modifications include the following:

- A new 1,050 mm diameter forcemain from the existing Newmarket Pumping Station to the existing 1,050 mm diameter gravity sewer which discharges to the Aurora Pumping Station
- A new 450 mm diameter forcemain from the existing Bogart Creek Pumping Station to the new 1,050 mm diameter forcemain as noted above
- Modifications to the Newmarket and Bogart Creek Pumping Stations to accommodate for connection of the new forcemain(s)
- New meter chambers at the existing pumping stations and forcemain appurtenances to regulate and control flow

The new forcemain is to be constructed over a distance of approximately 5,040 metres (m) of microtunneling, with open-cut installation of an additional 630 m. Construction of the forcemain in all tunnelled sections will be undertaken as a double pass operation by microtunnel boring machines (MTBM), with the first pass for excavation and installation of reinforced concrete casing pipe and the second pass to ensure the concrete pressure carrier pipe is laid and grouted in place.

The forcemain alignment is located within the Town of Newmarket in an urban setting with residential, commercial, industrial, and institutional lands, and transportation and utility corridors.

Ten shafts will be required for the YDSS Modifications, four sending shafts (S1 to S4) and six receiving shafts (R1 to R6), which range in depth from approximately 10 to 16 mBGS. The shaft locations are shown on **Figure 1**.

The sending and receiving shafts will be constructed based on the geological and geotechnical characteristics at each location. The shafts are either 15 m or 10 m in diameter, depending on the shaft function (sending or receiving respectively).

Tunnel drives are as follows:

- S1 to R1: from Shaft S1, south within Holland River Floodplain to Shaft R1
- S1 to R2: from Shaft S1, north past Mulock Drive to Shaft R2 at Cane Parkway
- S2 to R2: from Shaft S2, south along Cane Parkway to Shaft R2 at Cane Parkway
- S2 to R3: from Shaft S1, east beneath Metrolinx railway to Shaft R3 near Pearson Street
- S2 to R4: from Shaft S2, north along Cotter Street to Shaft R4 north of Timothy Street
- S3 to R4: from Shaft S3, south to Shaft R4
- S3 to R5: from Shaft S3, north along Charles Street to Shaft R5 north of Davis Drive
- S4 to R5: from Shaft S4, south along Bayview Parkway to R5 north of Davis Drive
- S4 to R6: from Shaft S4, north along Bayview Pkwy to R6 at Newmarket Pump Station.

The slope of the tunnel ranges between 0.18 percent and 0.1 percent with ground cover over the tunnel ranging from about 5 m to 16 m.

Construction sites have been designated at each sending and receiving shaft location to facilitate the microtunneling shaft construction and operational activities, in addition to auxiliary construction staging areas (**Figure 1)**. Construction sites are generally situated within urbanized areas, where space is constrained and road closures and traffic diversions may be required. Power and water will be brought to each site, as needed, to facilitate MTBM and construction activities.

The MTBM will pass through glaciolacustrine clay deposits and till at shallow depths of about 5 m beneath the East Holland River and its tributaries in some areas and approximately 4 m within existing infrastructure i.e., the existing YDSS forcemain.

1.2 Study Background

The noise and vibration study area spans the length of the amended YDSS Modifications alignment, from St. John's Sideroad to Green Lane East (**Figure 1**) in the Town of Newmarket, York Region. Mulock Drive, Davis Drive West, and Green Lane East are all arterial roads that cross the study area, connecting to adjacent communities, industrial, commercial and residential zones, and major transportation routes, such as Highways 400 and 404. There are three crossings of the Metrolinx railway tracks.

This report references previous baseline noise monitoring work completed as part of the UYSS Environmental Assessment (EA) and summarises the findings from preliminary noise modelling which investigated the potential for adverse noise impacts on YDSS-adjacent sensitive receptors. **Section 5.0** recommends construction noise abatement (mitigation) and monitoring measures.

The noise modelling of anticipated locations and sound levels for the day and night period for the amended YDSS alignment are presented on **Figures 5A** to **5L**. The existing ambient noise and vibration impacts are dominated by road and air traffic at all times of the day. Some commercial and industrial activities are also present. **Figure 4** shows the locations of the noise and vibration sensitive receptors adjacent to the amended YDSS alignment.

Each of the identified construction sites is surrounded by one or two storey sensitive receptors with direct line-of-sight exposure to the planned construction activities. A sensitive receptor for noise means:

> *The living and sleeping quarters of dwellings, and sleeping quarters of noise sensitive commercial or institutional land uses.*
>
> *Examples include, but are not limited to: bedrooms, sleeping quarters such as patient rooms, living/dining rooms, eat-in kitchens, dens, lounges, classrooms, therapy or treatment rooms, assembly spaces for worship, sleeping quarters of detention centres.*[1]

In the event construction or microtunnelling activities generate noise and vibration, appropriate mitigation measures, monitoring activities and contingency responses are discussed in **Section 5.0** of this report.

[1] *MOECC NPC-300*

Section 2.0
Applicable Legislation

2.1 Noise

The focus of this assessment is on human annoyances resulting from excessive noise levels. The applicable legislative documents relate to residential impacts and not to impacts on construction workers, which is the responsibility of contractors performing the construction operations.

The acoustic character of the Study Area will be defined in accordance with the following guidelines, regulations, and protocol documents:

- NPC-300 Stationary and Transportation Sources-Approval and Planning
- NPC-103 Procedures
- NPC-104 Sound Level Adjustments
- NPC-115 Construction Equipment
- The Corporation of the Town of Newmarket Noise Control By-Law 2004-94

The Town of Newmarket Amended Noise By-law Number 2005-158 and previous By-law 2004-94 permits construction activities during the daytime hours only and prohibits construction from 8:00 p.m. to 7:00 a.m. Monday to Friday and extends the restriction from 8:00 p.m. to 9:00 a.m. on the weekend (Saturdays, Sundays, and holidays).

Construction noise monitoring is not required for by-law compliance but NPC-115 Construction Equipment requirements are detailed by the Ministry of the Environment and Climate Change (MOECC) as follows:

Table 2.1: NPC-115 Construction Equipment Requirements

	Excavation Equipment, Dozers, Loaders, Backhoes	Pneumatic Pavement Breakers*	Compressors*	Tracked Drills*
Power Rating < 75 kW	83 dBA	85 dBA	76 dBA/70dBA	100 dBA
Power Rating > 75 kW	85 dBA			

Notes: dBA: decibels (A weighted), * = Residential/Quiet Zone
The equipment requirement is based on a January 1, 1981, date of manufacturer or later. A power rating is not applicable for pavement breakers, compressors, or tracked drills.

Measurements are conducted at a 15 m reference distance and at the rated maximum RPM in accordance with SAE J88a procedures as referenced in NPC-103. Stationary or pass-by tests are appropriate following the procedure below:

> *3.3.6-For stationary tests, record the sound level obtained at a distance of 15 m (50 ft.) normal to the centers of the four major surfaces of the equipment at*

the microphone height. Generally, four major surfaces refer to front, rear, and sides of an imaginary box that would just fit over the machine but does not include attachment items such as buckets, dozers, and booms. In the case of a crane or an excavator, the upper (revolving superstructure) fore-and-aft centerline should be in line with the lower fore-and-aft centerline.

3.3.7-For moving tests, take measurements at a distance of 15 m (50 ft.) measured in a direction normal to a major side surface, which is parallel to the machine path.

3.3.8-The final reported sound level per this SAE Recommended Practice shall be the highest of the reported values obtained in paragraphs 3.3.6 and 3.3.7; the test report shall include the test mode, the machine operating conditions during the reported test mode, the stabilized maximum governed engine speed, the location of the microphone in relation to the construction machine, the surface description over which the machine operated, and the sound level measurements were made.

The major concerns of this report are human annoyances due to excessive noise and vibration levels, therefore, the applicable legislative documents that were followed relate to residential impacts and not to impacts on construction workers, which is the responsibility of contractors performing the construction operations.

2.2 Vibration

There are no defined limits for vibration levels under Town of Newmarket by-laws. However, it may be useful to consider appropriate construction vibration benchmarks (e.g., City of Toronto By-law No. 514 2008) during construction of the amended YDSS Modifications (see **Table 2.2**).

It should be noted that the City of Toronto construction vibration limits are not legally applicable within the Town of Newmarket and are defined here only as a benchmark for highlighting the potential for adverse structural affects buildings and infrastructure only. Furthermore, such limits do not account for the potential for personal nuisance or perceived adverse effects, which may be experienced at much lower vibration intensities based on personal tolerance levels.

Table 2.2: Benchmark Construction Vibration Levels[2]

Frequency of Vibration (hertz)	Vibration Peak Particle Velocity (mm/sec)
Less than 4	8
4 to 10	15
More than 10	25

The perceptibility of ground-borne vibration levels by humans may be determined using International Organization for Standardization (ISO) developed in 1983, or the American National Standards Institute (ANSI) criteria established in 1989, however it should be noted that

[2] *City of Toronto By-law No. 514 2008*

a more comprehensive analysis of the PPV data would be required, including root mean square (RMS) calculations in order to compare against these criteria.

Numerous studies also suggest that human response to vibration levels within buildings can be complex, and the degree of perception and annoyance experienced can relate to other phenomena such as rattling, noise, visual effects, and time of day. Therefore, meeting ISO/ANSI guidelines does not necessarily ensure the avoidance of complaints arising from subjective individual experiences. Perceptibility levels are very low and would be unreasonable to consider when establishing permissible limits for the construction activity since human perception is typically at or slightly elevated with respect to baseline conditions and well below any levels that could cause building damage. A summary of the ANSI criteria is presented in **Table 2.3**.

Table 2.3: Summary of ANSI Guidelines for Human Perception of Vibration

RMS Vibration Velocity Level (VdB) (relative to 10 to 6 in/sec)	RMS Particle Velocity (mm/s)	Human Response
65	0.05	Approximate threshold of perception
75	0.14	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find vibration at this level annoying
85	0.45	Vibration only acceptable only if there are an infrequent number of events per day

Section 3.0
Existing Conditions

The UYSS EA *Noise and Vibration Baseline Conditions Report* involved a review of available secondary information and field surveys conducted in 2011 and 2013[3]. This baseline monitoring aimed to characterize the existing ambient conditions along the EA-preferred alignment for the YDSS Modifications in order to estimate the potential noise and vibration impact exposure associated with the EA-preferred YDSS Modifications. The UYSS EA *Noise and Vibration Impact Assessment Report* analysed those potential effects, recommended associated impact management measures and identified the likely net effects of the EA-preferred YDSS Modifications, including on the existing buildings identified as immediately adjacent to the Preferred YDSS Modifications alignment[4].

The results from these UYSS EA reports have been carried forward for consideration in the modelling and impact assessment undertaken for the amended YDSS Modifications herein.

The approach to the YDSS Noise and Vibration Impact Assessment process involves the following elements:

- Modelling the characteristics of potential noise sources anticipated during construction
- Establishing an anticipated zone of influence (ZoI) for vibration effects
- Summarising the expected noise and vibration impacts arising from construction of the YDSS Modifications
- Recommending preliminary noise and vibration impact management measures for construction of the YDSS Modifications

To characterize the existing conditions in the area accurately, noise and vibration monitoring was required for sufficient time to be considered representative and to capture the peaks and lows experienced in the area.

Cadna (version 2017) acoustic modeling software generated sound level contour plots of the baseline noise conditions along the EA-preferred YDSS Modifications alignment - specifically in relation to the major roads in the study area. The contours provide a visual representation of the traffic generated sound, and how it propagates with distance, from the road corridor source. The locations and sound levels generated for the day and night period by the existing road traffic for the EA-preferred alignment are presented on **Figures 2** and **3**.

Road traffic noise was determined to be the predominant source of existing ambient noise in the YDSS study area, with the majority of the YDSS alignment estimated to be experiencing road traffic noise conditions between 50 dBA and 55 dBA; suggesting an acoustic character as *'urban'*. Ambient noise will fluctuate during a typical 24-hour period due to normal patterns of human activity, natural sounds, and fluctuations in traffic volumes and traffic composition.

[3] *CRA et al., 2013. 050278-RPT75-Noise and Vibration Baseline Conditions*

[4] *CRA et al., 2014. 050278-RPT102-Noise and Vibration Impact Assessment*

3.1 Noise

The *Noise and Vibration Baseline Conditions Report* confirmed that the majority of YDSS alignment experiences road traffic noise conditions between 50 dBA and 55 dBA during the day and 45 dBA during the night and was therefore urban in acoustic character.

The noise baseline conditions evaluated representative along the amended YDSS alignment were used to establish criteria to evaluate the potential for adverse noise and vibration impacts at each planned sending/receiving shaft and open-cut areas as shown in **Table** 3.1.

Table 3.1: Baseline Background Sound Levels at YDSS Construction Sites

Construction/Microtunnelling Site	Modelled Background Sound Levels (dBA)	
	Day 7:00 a.m.-11:00 p.m.	Night 11:00 p.m.-7:00 a.m.
Sending Shafts 1 to 4	50 to 55	45
Receiving Shafts 1 to 6	50 to 55	45
Open Cut Area 1	50 to 55	45
Open Cut Area 2	50 to 55	45

3.2 Vibration

Baseline vibration was observed to be environmentally insignificant as there were no significant sources of vibration in the UYSS EA study area.

Section 4.0
Impact Assessment and Management Measures

During the UYSS detailed design process, York Region opted to amend the YDSS Modifications design from a predominantly open-cut approach in the EA-preferred undertaking, to mostly trenchless construction, along with slight deviations from the EA-preferred forcemain alignment in some places. The UYSS detailed design process identified 145 existing buildings immediately adjacent to the amended YDSS Modifications alignment (compared to 118 under the UYSS EA).

4.1 Noise

To assess the potential effects of construction of the amended YDSS Modifications, GHD sought to augment the EA baseline monitoring information with additional acoustic modelling based on the amended YDSS Modifications detailed design (2017).

To assess compliance of noise source emissions, the estimated sound levels at points of reception will be compared with background sound level criteria established in the UYSS EA *Noise and Vibration Baseline Conditions Report* based on the principle of 'predictable worst-case'. This worst-case noise impact would occur during the hour when the difference between the predicted/measured sound level produced by the stationary source(s), is at a maximum versus the background sound level.

The description used in the impact assessment of noise is the one-hour equivalent continuous sound level (Leq) - the time-weighted energy average of the source. Leq is the preferred method to describe sound levels that vary over time, resulting in a single decibel (dBA) value, which takes into account the total sound energy over the period of interest, including the lows and the highs.

4.1.1 Noise Sources at Construction Sites

GHD was provided with a list of anticipated construction equipment and a typical YDSS modifications construction site plan - including open-cut sites and the periods of microtunnelling shaft construction (4 to 6-weeks). Sound power levels for seven pieces of construction equipment (crane, bulldozer, excavator, truck, generator, separation plant, and air compressor) were determined from published reference data for construction equipment or GHD measured values. The noise sources were modelled as individual point sources located at each construction site based on a typical layout.

A summary of the representative sound power levels anticipated for each equipment is presented in **Table 4.1**.

Table 4.1: Sound levels Anticipated from Construction Equipment

Equipment	Anticipated Sound Power Level (dBA)
Crane	100

Equipment	Anticipated Sound Power Level (dBA)
Bull Dozer	108
Excavator	104
Truck	110
Generator	103
Separation Plant	96
Air Compressor	99

The magnitude of noise impacts associated with construction will be dependent upon a number of factors including:

- The intensity of construction activities
- The location of construction activities
- The type of equipment used
- Existing local noise sources
- Intervening terrain
- The prevailing weather conditions

4.1.2 Noise Sources at Microtunnelling Sites

Figure 1 details the sending and receiving microtunnelling sites along the amended YDSS Modifications alignment.

Sound power levels for nine pieces of microtunnelling equipment (crane, forklift, three generators, shaft noise, shredder/shaker, and two pumps) were measured during normal operations, at a comparable microtunnelling site in Mississauga, Ontario in February 2017. Sound power levels were modelled as point sources at each proposed sending and receiving microtunnelling sites based on a typical layout, during microtunnelling operations. Construction of microtunnelling shafts is discussed in **Section 4.1.1**.

A summary of the representative sound power levels anticipated for each equipment are presented in **Table 4.2**.

Table 4.2: Sound levels Anticipated from Microtunnelling Equipment/Operations

Equipment	Anticipated Sound Power Level (dBA)	Equipment used at shaft sites: Sending/Receiving
Crane*	100	Yes/Yes
Generator*	103	Yes/No
Lighting Generator*	93	Yes/Yes
Shaft Noise*	97	Yes/No
Shredder/Shaker*	93	Yes/No
HP Pumps*	101	Yes/No
Bentonite Pump	87	Yes/No

Equipment	Anticipated Sound Power Level (dBA)	Equipment used at shaft sites: Sending/Receiving
Water Pump	91	No/Yes
Forklift	112	Yes/No
Truck	110	Yes/No
Note: * = Equipment measured by GHD at representative MTBM shaft site		

MTBMs are very similar to tunnel boring machines but on a smaller scale and operated remotely. The MTBM and jacking frame are set up in a sending shaft at the required depth. The operator is given constant feedback about the machine's location, orientation, and hydraulic devices.

The MTBM is launched through an entry eye of the sending shaft and pipes are pushed behind the machine. This is a process often called pipe jacking and is repeated until the MTBM reaches the receiving shaft. As the machine advances, more tunnel liner or pipe is pushed from the sending shaft, through the entry eye until it reaches the corresponding receiving shaft.

Most microtunnelling operations include a hydraulic jacking system to advance the MTBM and pipe string, a closed loop slurry system to transport the excavated spoils, a slurry cleaning system to remove the spoil from the slurry water, a lubrication system to lubricate the exterior of the pipe string during installation and a guidance system to provide line and grade control. Auxiliary equipment includes an electrical supply and power distribution system, a crane to hoist pipe sections into the sending shaft, and various trucks and loaders to transport spoil off site.

This above grade equipment is expected to be the dominant sources of noise at the sending shafts while the receiving shafts are relatively inactive, with the exception of lighting generators and water pumps to maintain the site.

4.1.3 Noise Modelling

Cadna A (version 2017) acoustical modelling software was used to model the potential impacts of the significant noise sources. Cadna A calculates sound level emissions based on the ISO 9613-2 standard Acoustics-Attenuation of Sound during Propagation Outdoors. The following Cadna A modelling assumptions were used:

- Reflection order-a maximum reflection order of 1 was used to evaluate indirect noise impact from one reflecting surface.
- Ground absorption-the models were set up with a ground absorption of 0.25 to represent paved asphalt surfaces; a ground absorption of 1.0 to represent grass. All roads were modelled with a ground absorption of 0.25.
- Receptor elevations-single family dwellings were modelled at a height of 4.5 m to represent the most-exposed and elevated second storey bedroom window.
- Building surfaces-buildings were modelled as reflective surfaces.

A review of all the 145 existing properties determined to be adjacent to the amended YDSS Modifications alignment was completed. By modelling the anticipated construction activities at each of the 12 planned construction sites, the predicted impacts were compared against the existing ambient conditions.

Due to the area containing a mix of one and two storey residential homes on either side of most of the planned construction sites, only the most exposed and impacted receptors were evaluated – the 'worst-case'. All facades of the buildings at each location were evaluated, however, only the highest impacts are presented in this report. **Table 4.3** and **Table 4.4** summarize the modelled noise impacts and the anticipated exceedances predicted at each key construction site. **Figure 5A** through **Figure 5L** present the generalized noise impact contours and highlight the most impacted receptors at each.

Construction activities have the potential to affect surrounding sensitive receptors adversely at all times of the day. Truck traffic, bulldozer, excavator and on-site generator noise are expected to be the most dominant noise sources at each of the construction sites.

The above grade equipment supporting the MTBMs is expected to be the dominant sources of noise at each sending shaft and the focus of the modelling evaluation.

The background ambient sound determined in the baseline report were used to generate day and night noise criteria to screen each site concerning the potential noise/vibration impact exposure due to construction activities. Sites that are predicted to experience a higher noise impact translate into a higher potential for nuisance noise complaints. The ambient conditions may also be used to establish sound level measurement triggers for complaint investigation or longer term monitoring, if deemed necessary. In the event construction activities generate such complaints, appropriate impact management measures may be required.

4.1.4 Noise Modelling Results

The modelled noise impact exposure for each site with and without hoarding was compared against the adjusted background sound levels during daytime and nighttime.

Table 4.3: Sound Levels at 'Worst-Case' Points of Reception - without Hoarding

Sound levels (dBA) during Day/Night					
Construction Site	**Background**	**1st Storey Worst-Case Modelled Impact**	**1st Storey Anticipated Exceedance**	**2nd Storey Worst-Case Modelled Impact**	**2nd Storey Anticipated Exceedance**
Open Cut Area 1	50/45	67/NA	17/NA	67/NA	17/NA
Open Cut Area 2	50/45	81/NA	31/NA	81/NA	31/NA
Sending Shaft 1	50/45	59/59	9/14	59/59	9/14
Sending Shaft 2	50/45	58/58	8/13	58/58	8/13
Sending Shaft 3	50/45	62/62	12/17	62/62	12/17
Sending Shaft 4	50/45	48/48	-/3	48/48	-/3
Receiving Shaft 1	50/45	46/46	-/1	46/46	-/1
Receiving Shaft 2 (plus Sending)	50/45	61/61	11/16	61/61	11/16

Receiving Shaft 3	50/45	63/63	13/18	63/63	13/18
Receiving Shaft 4	50/45	55/55	5/10	55/55	5/10
Receiving Shaft 5	50/45	61/61	11/16	61/61	11/16
Receiving Shaft 6	50/45	52/52	2/7	52/52	2/7
Sending Shaft 2/Receiving Shaft 3 Combined	50/45	66/66	16/21	67/67	17/22

Notes: “NA” = Not applicable during the nighttime period as construction will occur during daytime hours only or no hoarding recommended
“-“ = No exceedance

The results of the noise modelling for the worst-case point of reception associated with each of the proposed construction site are presented in **Table 4.3** and**Table 4.4**. The modelling with the proposed hoarding uses a typical height of 3 m, as detailed on **Figures 5A** to **5L** and in **Section 5.0**.

In order to present the worst-case anticipated exceedance in **Table 4.3** and **Table 4.4** the nighttime adjusted background sound level has been used as well as the modelled impacts during nighttime operations. The receptor height for most of the residences around the Sites was assumed as the worst-case second storey elevation modelled at 4.5 m above grade. Noise impacts at the first storey and any outdoors areas will be less than currently evaluated due to reduced line-of-sight to the construction activities. Detailed results for all Points of Reception can be found in **Appendix B**, Table B.2.

Table 4.4: Sound Levels at ‘Worst-Case’ Points of Reception - with 3 m Hoarding

Sound levels (dBA) during the Day/Night					
Construction Site	**Background***	**1st Storey Worst-Case Modelled Impact**	**1st Storey Anticipated Exceedance**	**2nd Storey Worst-Case Modelled Impact**	**2nd Storey Anticipated Exceedance**
Open Cut Area 1	50/45	59/NA	9/NA	61/NA	11/NA
Sending Shaft 1	50/45	55/55	5/10	58/58	8/13
Sending Shaft 2	50/45	55/55	5/10	57/57	7/12
Sending Shaft 3	50/45	57/57	7/12	61/61	11/16
Receiving Shaft 1	50/45	42/42	-/-	42/42	-/-
Receiving Shaft 2	50/45	56/56	6/11	56/56	6/11
Receiving Shaft 3	50/45	59/59	9/14	60/60	10/15
Receiving Shaft 4	50/45	51/51	1/6	54/54	4/9
Receiving Shaft 5	50/45	54/54	4/9	61/61	11/16
Sending Shaft 2/Receiving Shaft 3 combined	50/45	60/60	10/15	63/63	14/19

Notes: “NA” = Not applicable during the nighttime period as construction will occur during daytime hours only or no hoarding recommended
“-“ = No exceedance
(1) = Open Cut 2, Sending Shaft 4 and Receiving Shaft 6 are not shown as they are not recommended to have hoarding due to limited benefit and/or practical implementation issues due to line of sight exposure

It should be noted that **Table 4.3** and **Table 4.4** present the *worst-case* anticipated exceedances and that other points of reception surrounding each of the construction sites would experience a significantly reduced noise impact. For example, the worst-case impact with hoarding at points of reception surrounding Sending Shaft 1 is 58 dBA, the next highest anticipated exceedance is approximately 50 dBA.

Due to the dense urban environment at each of the key construction sites, the most exposed and impacted receptors were evaluated.

Receiving Shaft 1 is ranked the lowest in terms of potential for noise impact exposure. Open Cut Area 2 is the highest potential for noise impact exposure and nuisance complaints but will be restricted to daytime operations to reduce the potential for complaints.

The results of the detailed construction noise modelling and expected exceedances based on the ambient noise criteria for each site was presented in **Appendix B**, including Table B.2, which summarizes the worst-case modelled noise impacts and the anticipated exceedances predicted at each construction site. **Figures 5A** to **5L** present the generalized noise impact contours and highlight the most impacted receptors at each of the sites.

4.2 Vibration

It is anticipated that the zone of influence – i.e., the area that may potentially be impacted by vibrations emanating from the construction activity where the peak particle velocity (PPV) may be equal to or greater than 5 mm/sec-will extend a horizontal distance of up to 30 m from the construction site limits. At this distance and beyond, the vibration levels are anticipated to be relatively low risk for causing building damage. The analysis was based on using equipment with maximum rated energy of 25,000 to 30,000 ft.-lbs (27.2 to 40.7 kN-m).

The zone of influence presented above should be verified through the implementation of a construction vibration-monitoring program that includes the collection and analysis of vibration readings within the construction site and near surrounding properties within the zone of influence, during different stages of construction activities.

Based on the proposed scope of construction activities, it is not anticipated that ground-borne vibration intensities will exceed the outlined limits beyond the proposed 30 m zone of influence. However, as noted above, the perceived vibration levels in combination with noise and visual effects of heavy machinery working in close proximity to adjacent building and properties may result in complaints. 145 existing properties are located immediately adjacent to the amended YDSS Modifications alignment (versus 118 adjacent properties identified in the UYSS EA).

The potential adverse effects of the EA-preferred YDSS Modifications on identified cultural heritage resources (built or landscape) were also analysed as part of the UYSS EA. A review of all records pertaining to historically significant structures near construction was completed in the *Cultural Heritage Impact Assessment of Preferred Alt WRC Site WH1 and Preferred Alt YDSS Route A* (CRA et al. 2013). Vibration limits – and associated risk of adverse effects - for these types of cultural heritage resources are typically more stringent, and can only be established by a professional engineer based on the specific age and condition of the structure. The UYSS EA identified 15 built heritage resources and three cultural heritage landscapes adjacent to the

EA-preferred YDSS Modifications alignment. As part of this amended YDSS Modifications noise and vibration impact assessment, these identified cultural heritage resources were reviewed to determine their proximity to the anticipated zone of influence.

Based on this analysis, 23 of the 145 adjacent properties are within the 30 m zone of influence and have the potential to be adversely affected by vibration impacts from five of the construction sites, as indicated on **Figures 6A** to **6E**: Open Cut Area 2; Sending Shaft 3, and; Receiving Shafts 3, 4, and 5.

Of these, 12 are built heritage resources, whilst an additional one cultural heritage landscapes were identified as falling within the zone of influence for vibration.

Table 4.5: Properties within Vibration Zone of Influence for Construction Sites

Location	Construction Site	Nature of Site
327 Terry Carter Crescent	Open Cut Area 2	Regular property
325 Terry Carter Crescent	Open Cut Area 2	Regular property
329 Terry Carter Crescent	Open Cut Area 2	Regular property
331 Terry Carter Crescent	Open Cut Area 2	Regular property
333 Terry Carter Crescent	Open Cut Area 2	Regular property
567 Pearson Street	Open Cut Area 2	Built heritage
573 Pearson Street	Open Cut Area 2	Built heritage
574 Pearson Street	Open Cut Area 2	Built heritage
576 Pearson Street	Open Cut Area 2	Built heritage
578 Pearson Street	Open Cut Area 2	Built heritage
579 Pearson Street	Open Cut Area 2	Built heritage
580 Pearson Street	Open Cut Area 2	Built heritage
311 Prospect Street	Open Cut Area 2	Built heritage
322 Prospect Street	Open Cut Area 2	Built heritage
515 Queen Street	Sending Shaft 3	Regular property
535 Queen Street	Sending Shaft 3	Regular property
85 Concession Street	Sending Shaft 3	Built heritage
89 Concession Street	Sending Shaft 3	Regular property
313 Second Street	Receiving Shaft 3	Built heritage
543 Timothy Street	Receiving Shaft 4	Built heritage
29 Bayview Parkway	Receiving Shaft 5	Regular property
33 Bayview Parkway	Receiving Shaft 5	Regular property
NE of Charles Street and Queen Street	Sending Shaft 3	Cultural Historical Landscape 3

An additional 122 adjacent properties are located (horizontally/vertically) within 30 m of the alignment of the various microtunnelling drives between each shaft site, as indicated on **Figures 6F** to **6E**.

Table 4.6: Properties within the Vibration Zone of Influence for the Alignment

Location	Location	Location	Location
120 Bayview Parkway	540 Timothy Street	341 Gaston Place	69 Bayview Parkway

Location	Location	Location	Location
531 Davis Drive	546 Water Street	339 Gaston Place	73 Bayview Parkway
62 Bayview Parkway	315 Hamilton Street	337 Gaston Place	77 Bayview Parkway
534 Davis Drive	271 Cotter Street	326 Gaston Place	81 Bayview Parkway
554 Davis Drive	315 Cotter Street	520 Water Street	85 Bayview Parkway
540 Davis Drive	330 Second Street	580 Cane Parkway	89 Bayview Parkway
20 Charles Street	402 Mulock Drive	530 Cane Parkway	93 Bayview Parkway
30 Charles Street	307 Second Street	352 Roywood Crescent	97 Bayview Parkway
56 Charles Street	313 Second Street	350 Roywood Crescent	101 Bayview Parkway
3 Charles Street	266 Prospect Street	348 Roywood Crescent	105B Bayview Parkway
7 Charles Street	308 Prospect Street	346 Roywood Crescent	107B Bayview Parkway
11 Charles Street	314 Prospect Street	344 Roywood Crescent	109B Bayview Parkway
17 Charles Street	328 Prospect Street	342 Roywood Crescent	111 Bayview Parkway
21 Charles Street	330 Prospect Street	340 Roywood Crescent	113B Bayview Parkway
25 Charles Street	301 Prospect Street	338 Roywood Crescent	115B Bayview Parkway
29 Charles Street	561 Pearson Street	336 Roywood Crescent	117B Bayview Parkway
33 Charles Street	311 Court Street	360 Mulock Drive	119 Bayview Parkway
37 Charles Street	599 Pearson Street	350 Mulock Drive	121B Bayview Parkway
43 Charles Street	603 Pearson Street	567 Davis Drive	129 Bayview Parkway
49 Charles Street	609 Pearson Street	37 Bayview Parkway	380 Bayview Parkway
93 Concession Street	584 Pearson Street	41 Bayview Parkway	220 Bayview Parkway
535 Wellington Street	590 Pearson Street	45 Bayview Parkway	195 Bayview Parkway
534B Wellington Street	602 Pearson Street	49 Bayview Parkway	550 Heman Street
542 Wellington Street	309 Court Street	53 Bayview Parkway	552 Heman Street
128 Skelton Street	311 Hamilton Street	57 Bayview Parkway	551 Heman Street
240 Prospect Street	622 Gorham Street	61 Bayview Parkway	555 Heman Street
535 Timothy Street	319 Hamilton Street	65 Bayview Parkway	160 Bayview Parkway

Section 5.0
Construction Impact Management Measures

Table 5.1 lists all 145 sensitive receptors for the Study Area that may experience impacts from construction:

Table 5.1: Sensitive Receptors Near Each Construction Site/Alignment

Location	Location	Location	Location
29 Bayview Parkway	121 Bayview Parkway	313 Second Street	43 Charles Street
33 Bayview Parkway	121B Bayview Parkway	309 Court Street	432 Sydor Ct.
37 Bayview Parkway	129 Bayview Parkway	311 Court Street	530 Cane Parkway
41 Bayview Parkway	129B Bayview Parkway	311 Hamilton Street	531 Davis Drive
45 Bayview Parkway	160 Bayview Parkway	240 Prospect Street	534 Davis Drive
49 Bayview Parkway	195 Bayview Parkway	266 Prospect Street	534 Wellington Street
53 Bayview Parkway	215 Bayview Parkway	301 Prospect Street	534B Wellington Street
57 Bayview Parkway	220 Bayview Parkway	308 Prospect Street	535 Queen Street
61 Bayview Parkway	225 Bayview Parkway	311 Prospect Street	535 Timothy Street
61B Bayview Parkway	380 Bayview Parkway	314 Prospect Street	535 Wellington Street
62 Bayview Parkway	500 Bayview Parkway	328 Prospect Street	540 Davis Drive
65 Bayview Parkway	622 Gorham Street	330 Prospect Street	540 Timothy Street
69 Bayview Parkway	670 Madeline Heights	271 Cotter Street	542 Wellington Street
73 Bayview Parkway	7 Charles Street	315 Cotter Street	543 Timothy Street
77 Bayview Parkway	11 Charles Street	315 Hamilton Street	546 Water Street
81 Bayview Parkway	17 Charles Street	319 Hamilton Street	550 Heman Street
85 Bayview Parkway	20 Charles Street	322 Prospect Street	551 Heman Street
89 Bayview Parkway	21 Charles Street	325 Terry Carter Crescent	552 Heman Street
93 Bayview Parkway	25 Charles Street	326 Gaston Place	552B Heman Street
97 Bayview Parkway	29 Charles Street	327 Terry Carter Crescent	555 Heman Street
101 Bayview Parkway	3 Charles Street	336 Roywood Crescent	567 Davis Drive
105 Bayview Parkway	30 Charles Street	337 Gaston Place	580 Cane Parkway
105B Bayview Parkway	33 Charles Street	338 Roywood Crescent	554 Davis Drive
107 Bayview Parkway	37 Charles Street	339 Gaston Place	561 Pearson Street
107B Bayview Parkway	49 Charles Street	340 Roywood Crescent	567 Pearson Street
109 Bayview Parkway	56 Charles Street	341 Gaston Place	573 Pearson Street
109B Bayview Parkway	515 Queen Street	342 Roywood Crescent	574 Pearson Street
111 Bayview Parkway	520 Water Street	343 Gaston Place	576 Pearson Street
113 Bayview Parkway	128 Skelton Street	344 Roywood Crescent	578 Pearson Street
113B Bayview Parkway	260 Jelley Ave	346 Roywood Crescent	579 Pearson Street
115 Bayview Parkway	85 Concession Street	348 Roywood Crescent	580 Pearson Street
115B Bayview Parkway	89 Concession Street	350 Mulock Drive	584 Pearson Street
117 Bayview Parkway	93 Concession Street	350 Roywood Crescent	590 Pearson Street
117B Bayview Parkway	93B Concession Street	352 Roywood Crescent	599 Pearson Street
119 Bayview Parkway	330 Second Street	360 Mulock Drive	602 Pearson Street
120 Bayview Parkway	307 Second Street	402 Mulock Drive	603 Pearson Street
			609 Pearson Street

5.1 Noise Impact Management Measures

Construction activities have the potential to affect surrounding sensitive receptors adversely at all times of the day. Truck traffic, bulldozer, excavator, crane, high-pressure pumps, and on-site generator noise are expected to be the most dominant environmental noise sources.

The modelling documents impacts above the nighttime ambient background sound levels at all locations except Receiving Shaft 1. Based on the evaluation of the noise impacts at each construction site proposed hoarding was recommended where practical and considerate of site access and operations and where it would have a significant reduction on adjacent noise impacts.

Hoarding was recommended at the construction sites indicated in **Table 5.2**:

Table 5.2: Construction Sites with Proposed Hoarding

Proposed Construction Site	Proposed Construction Hoarding
Open Cut Area 1	Yes
Open Cut Area 2	No
Sending Shaft 1	Yes
Sending Shaft 2	Yes
Sending Shaft 3	Yes
Sending Shaft 4	Yes
Receiving Shaft 1	Yes
Receiving Shaft 2	Yes
Receiving Shaft 3	Yes
Receiving Shaft 4	Yes
Receiving Shaft 5	Yes
Receiving Shaft 6	No

Sound attenuating hoarding should be constructed per the requirements in NPC-300. Hoarding means a wall or similar structure, used as a noise control measure, and high enough to break the line-of-sight between the source and the receptor. The minimum surface density (face weight) is 20 kg/m^2. Subject to technical justification, the surface density can be reduced to no lower than 10 kg/m^2 for rooftop barriers; and temporary barriers for noise sources operating for a short duration, such as portable equipment. Any combination of material can be used (e.g., wood 1 to 1/2 inch thick) to construct the hoarding as long as it meets the appropriate surface density requirement.

The barrier should be structurally sound, appropriately designed to withstand wind and snow load, and constructed without cracks or surface gaps. Any gaps under the barrier that are necessary for drainage purposes should be minimized and localized, so that the acoustical performance of the barrier is maintained.

These measures were designed to conform to general requirements for work areas in the floodplain as shared by the LSRCA, including modelling and analysis for potential flooding up to and including a Regional flood event.[5] The hoarding proposed for the YDSS Modifications sites will include options for mitigating potential increased flood risk at certain sites e.g., a hinged panel at the bottom of the wall that will allow floodwater to pass freely during a flood event.

Due to the potential for adverse noise impacts, the following noise impact management measures should be considered, especially when warranted due to complaints:

1. Use of mobile barrier walls (hoarding) not less than 1 m higher than the tallest equipment on site (other than as already noted in this assessment)
2. Perform the highest noise generating activities during the daytime hours that benefit from and are masked by the most elevated background noise levels
3. Ensure all internal combustion engines operate as per NPC-115 requirements and are fitted with appropriate muffler systems and do not have a tonal character
4. Use of construction equipment or methods with lower noise levels, when possible
5. Use of a noise enclosure for mobile generator and air compressor
6. No on-site truck idling
7. Limiting truck travel paths on site
8. Use of high capacity compressed air storage to limit compressor usage
9. Consider operational duty cycles on construction equipment
10. Advise nearby residents of construction and anticipated schedule in advance of start-up
11. Administrative controls are required to eliminate uncontrolled tailgate banging and the use of experienced equipment operators
12. Implementation of complaint procedures
13. In the event of complaints, barrier walls could be implemented at the residence property line to achieve more effective sound level reductions in addition to the construction site hoarding

Increasing the separation distance between a noise source and a receptor and implementing noise exclusion zones is another effective method of reducing the impacts at the receptor. However, given the small footprint of each construction site and the proximity of the sensitive receptors, this option was not considered feasible.

[5] *LSRCA's general requirements: Determine the level of obstruction/impact of the sound attenuation, hoarding or other mitigation measures in a given flood event to the floodplain. An analysis is required for up to and including the Regional event*

Additional corrective/contingency actions are presented in **Section 5.4**, whilst a Complaint Protocol is included with the YDSS Modifications Environmental Management Plan and/or Communication Plan).[6]

5.2 Vibration Impact Mitigation Measures

Based on the proposed scope of construction activities, it is not anticipated that ground-borne vibration intensities will exceed the outlined limits beyond the proposed 30 m zone of influence. However, the perceived vibration levels in combination with noise levels and visual effects of heavy machinery working in close proximity to adjacent building and properties may result in complaints. Due to the potential for adverse vibration impacts, the following preliminary vibration mitigation measures are recommended:

- Distribution of notifications to the 145 adjacent properties - with specialized notices for property owners within the construction sites zone of influence - prior to the start of construction to advise them of the construction activity and to offer a pre-construction survey of their property.
- Establishment of construction monitoring plan consisting of pre-construction surveys of the 145 properties identified in the zone of influence to be carried out to document existing conditions of the properties by the construction contractor (Note: the UYSS EA Commitment was for 118 properties). The survey should include videos, photographs and hand drawn sketches and measurement of the interior of the main floor and all below grade levels (basement) and the exterior cladding of the first two storeys above grade, including exterior walkways, stairs, curbs, retaining walls, and sidewalks, in sufficient detail to facilitate comparison of pre-construction and post-construction conditions if required.
- Extra, more in depth surveys for cultural heritage properties are required as vibration limits - and associated risk of adverse effects - for these types of cultural heritage resources are typically more stringent, and can only be established by a professional engineer based on the specific age and condition of the structure."

Additional corrective/contingency actions are presented in **Section 5.4**, whilst a Complaint Protocol is included with the YDSS Modifications Environmental Management Plan and/or Communication Plan).[7]

5.3 Monitoring Program

Compliance with the applicable noise and vibration limits and guidelines is critical at all times. However, compliance is most critical when activities are scheduled to occur during the nighttime when individuals are most susceptible to sleep disturbance.

Real time, continuous noise and vibration monitoring is recommended during construction activities at properties/sites selected based on proximity/line-of-sight exposure and

[6] *YDSS Modifications Environmental Management Plan (084405-RPT163)*
[7] *YDSS Modifications Environmental Management Plan (084405-RPT163)*

heritage/sensitive use. Mobile seismograph units and noise meters will be setup as needed at locations between construction sites and the nearest sensitive receptor(s) during critical construction activities. These units will be moved to appropriate locations as construction activity progresses - as determined jointly by GHD and the contractor(s).

The continuous long-term monitoring program will require the use of monitoring units with data-logging capabilities and ‘always-on’ mobile data connections. These systems will have remote back-up/access capability to view real-time data. Furthermore, the systems will be set up with a built-in trigger (i.e., 5-minute Leq of 85 dBA measured 20 m from the construction activity or pre-established vibration threshold) to alert the Consultant/contractor when the trigger is exceeded. This enables corrective/contingency actions to be taken immediately (see **Section 5.4**) and, if necessary, the contractor can implement the relevant aspects of the YDSS Modifications Complaint Protocol as appropriate (see YDSS Modifications Environmental Management Plan and/or Communication Plan).[8]

Data reporting will be done in real-time and a private website can be set up where the contractor, GHD and York Region can access the real-time noise and vibration information. Weekly and monthly reports can be established for the purposes of maintaining historical record and GHD will discuss the monthly summary reports at regular construction progress meetings along with any recommendations for improvements.

5.4 Contingency Response and Corrective Measures

If construction equipment exceeds NPC-115 requirements and/or the expanded monitoring program determines that corrective action is warranted, the following corrective measures will be considered in consultation with York Region:

- Replacement of construction equipment
- Re routing of equipment and/or travel routes
- Construction stoppage and/or revisions to construction schedules
- Administrative controls such as staged construction to limit simultaneous operation of bad actors
- Implementation of controls, including exhaust mufflers, temporary noise barriers, enclosures on generators or compressors, etc.
- In extreme cases, temporary relocation of residents (budget permitting)

[8] *YDSS Modifications Environmental Management Plan (084405-RPT163)*

Section 6.0
References

City of Toronto Vibration By-law No. 514-2008, May 2008

The Corporation of the Town of Newmarket Noise By-law 2004-94, “Noise Control By-law”

CRA et al., 2013. Cultural Heritage Impact Assessment of Preferred Alt WRC Site WH1 West and Preferred Alt YDSS Mods Route A *(050278-RPT112)*

CRA et al., 2013. UYSS EA Noise and Vibration Baseline Conditions Report (050278-RPT75)

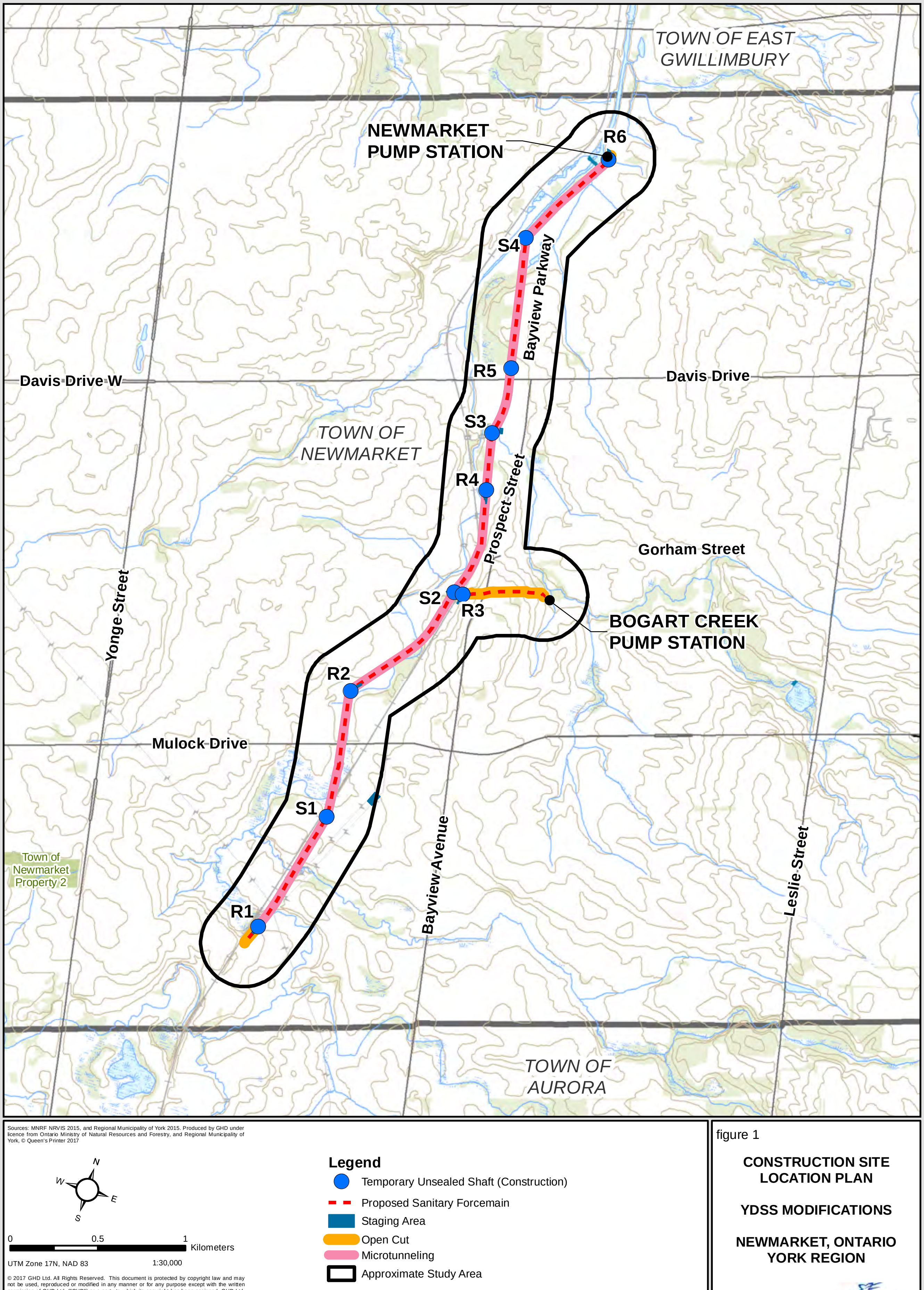
Ontario Ministry of the Environment and Climate Change Publication NPC-104, “Sound Level Adjustments”, 1978

Ontario Ministry of the Environment and Climate Change Publication NPC-115, “Construction Equipment”, 1977

Ontario Ministry of the Environment and Climate Change Publication NPC-103, “Procedures”, August 1978

Ontario Ministry of the Environment and Climate Change Publication NPC-300, “Stationary and Transportation Sources-Approval and Planning”, October 2013

FIGURES



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UTM Zone 17N, NAD 83 1:30,000

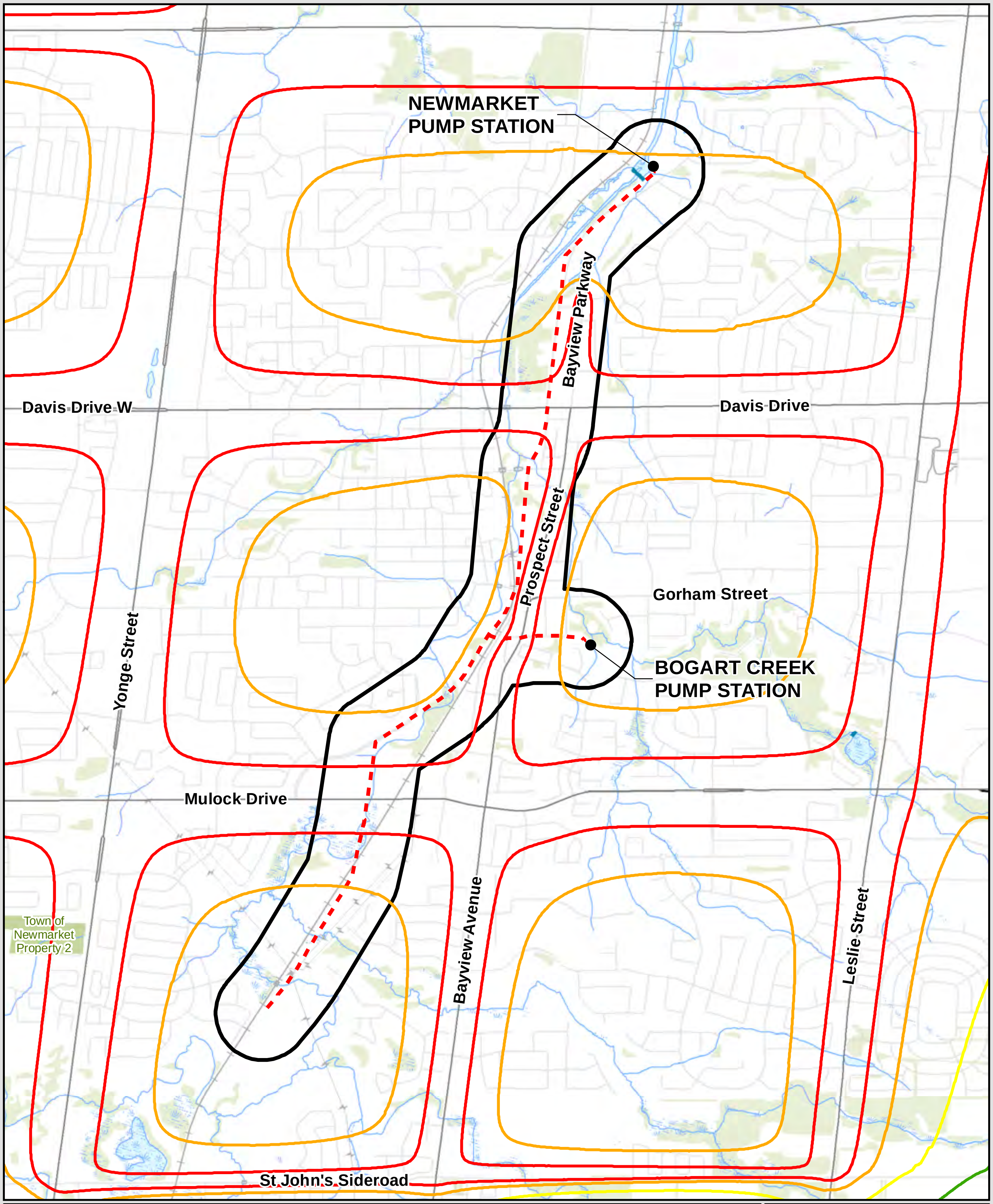
figure 1

CONSTRUCTION SITE LOCATION PLAN

YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region



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N W E S

0 0.5 1 Kilometers

UTM Zone 17N, NAD 83 1:30,000

Legend

dB Contours

- 40 dB
- 45 dB
- 50 dB
- 55 dB
- Approximate Study Area
- Proposed Sanitary Forcemain

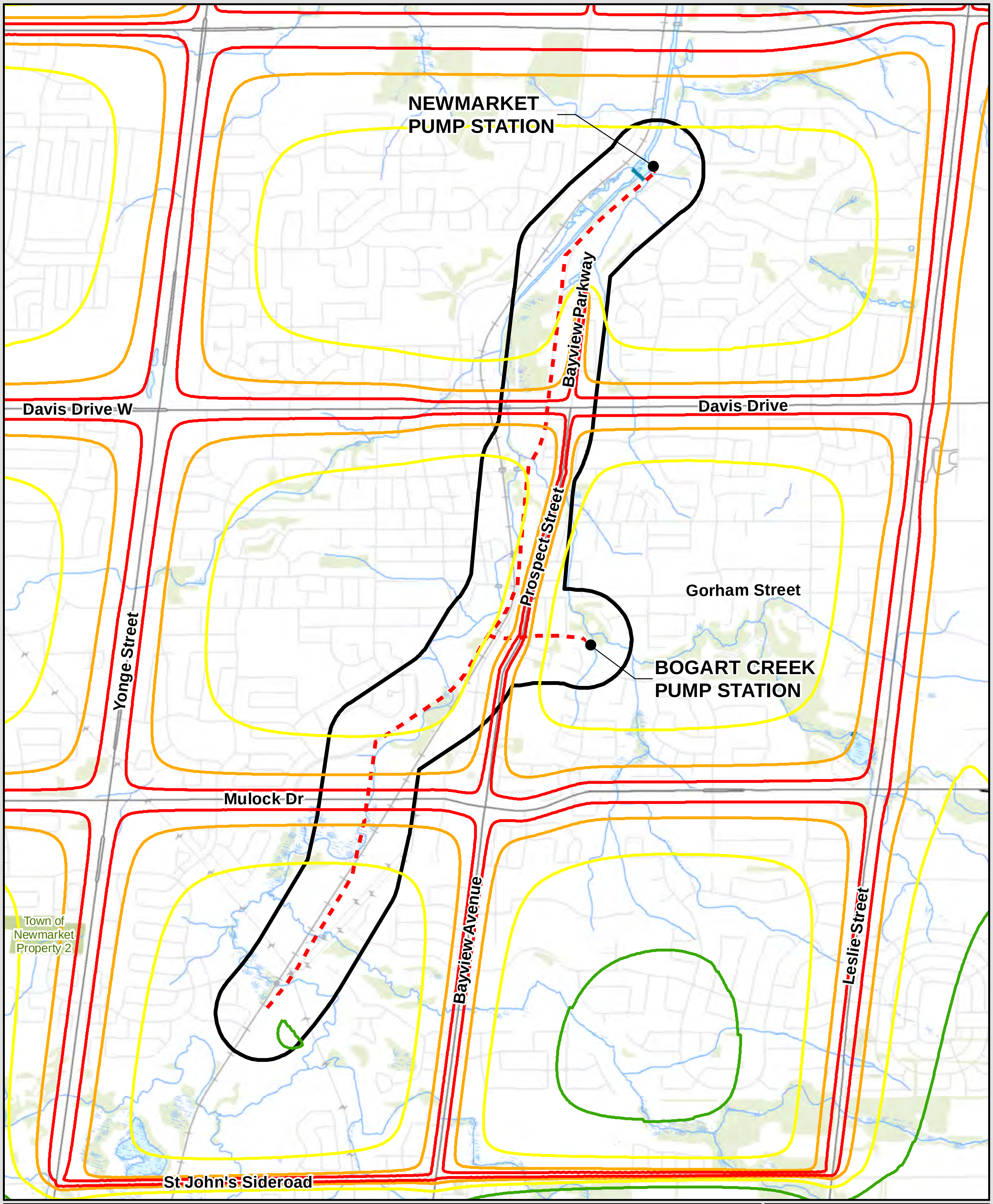
figure 2

BASELINE NOISE CONDITIONS CONTOUR PLOT - DAYTIME

YDSS MODIFICATIONS

NEWMARKET, ONTARIO YORK REGION

York Region



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N
W E
S

0 0.5 1 Kilometers

UTM Zone 17N, NAD 83 1:30,000

Legend

dB Contours

- 40 dB
- 45 dB
- 50 dB
- 55 dB
- Proposed Sanitary Forcemain
- Approximate Study Area

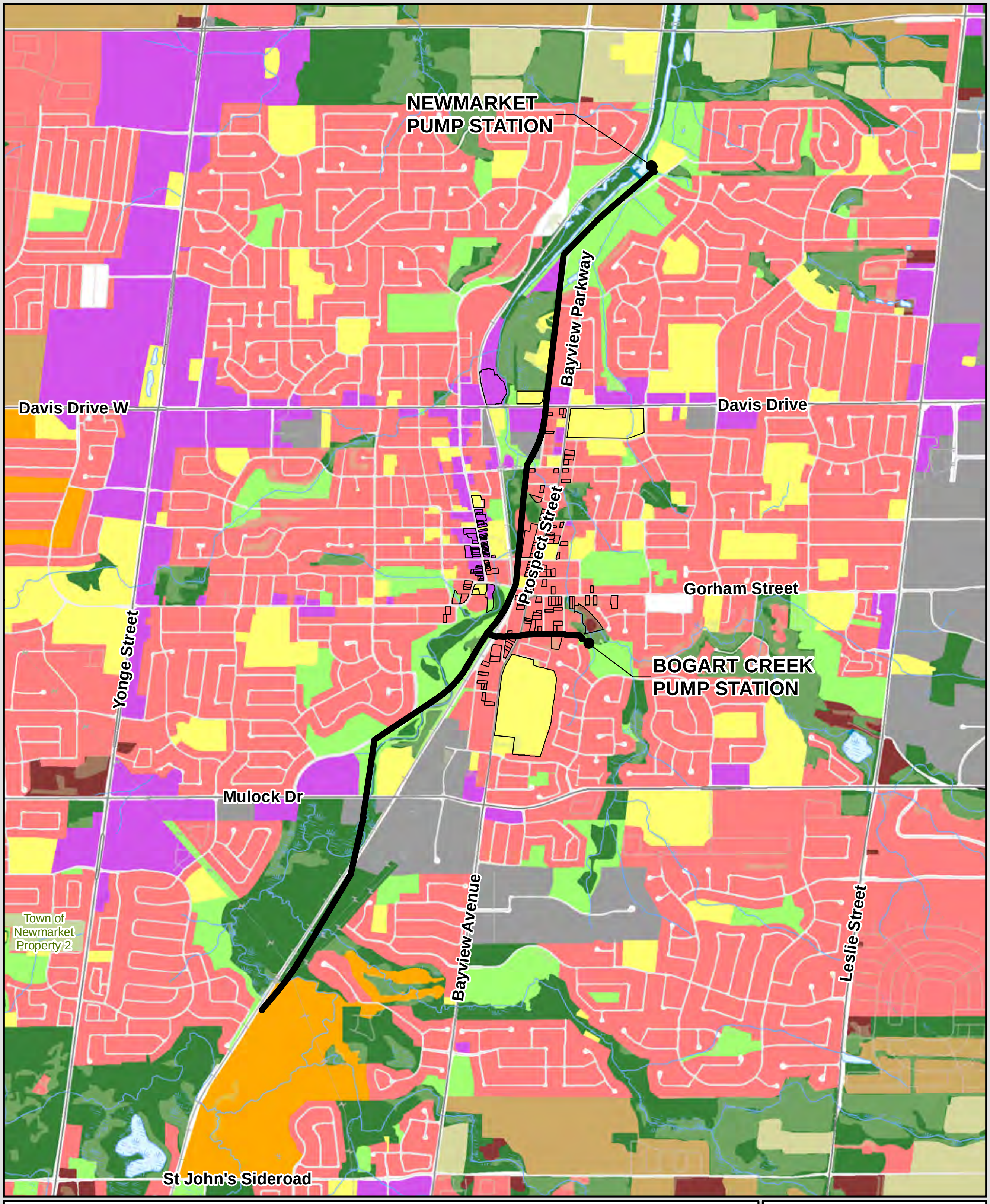
figure 3

BASELINE NOISE CONDITIONS CONTOUR PLOT - NIGHTTIME

YDSS MODIFICATIONS

NEWMARKET, ONTARIO YORK REGION

York Region



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N W E S

0 0.5 1 Kilometers

UTM Zone 17N, NAD 83

1:30,000

Legend

Land Use

- Active Aggregate
- Commercial
- Estate Residential
- Golf Course
- Industrial
- Institutional
- Intensive Agriculture
- Manicured Open Space
- Natural Heritage Feature
- Non-intensive Agriculture
- Rural Development
- Urban

figure 4

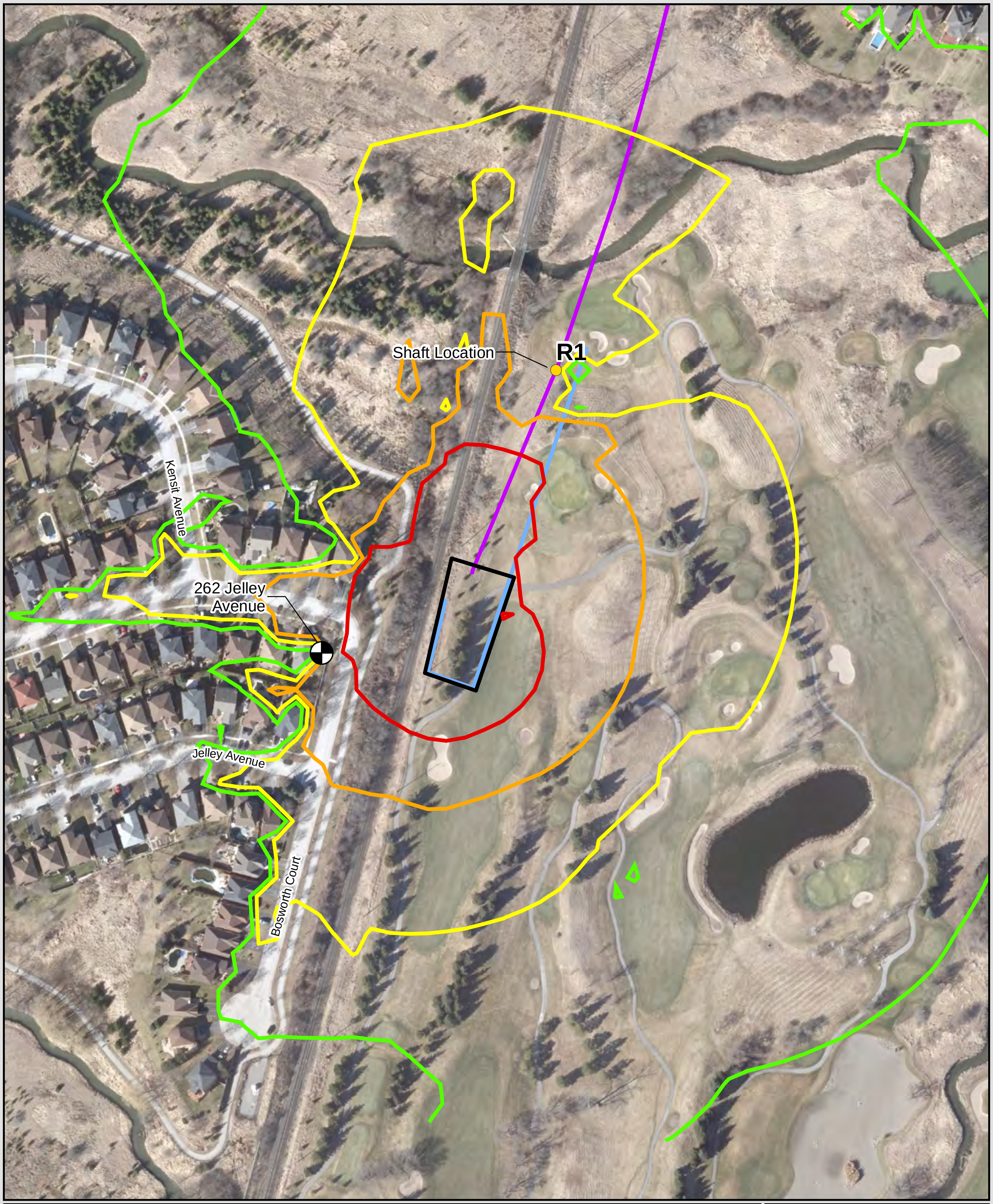
NOISE AND VIBRATION LAND USES AND CULTURAL AND HISTORIC STRUCTURES

YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA004 Sunday, July 23, 2017



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
  (R#) Receiving Shaft
- Receiver
- Construction Site
- YDSS Alignment
- Noise Barrier
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

figure 5A - Open Cut Area 1

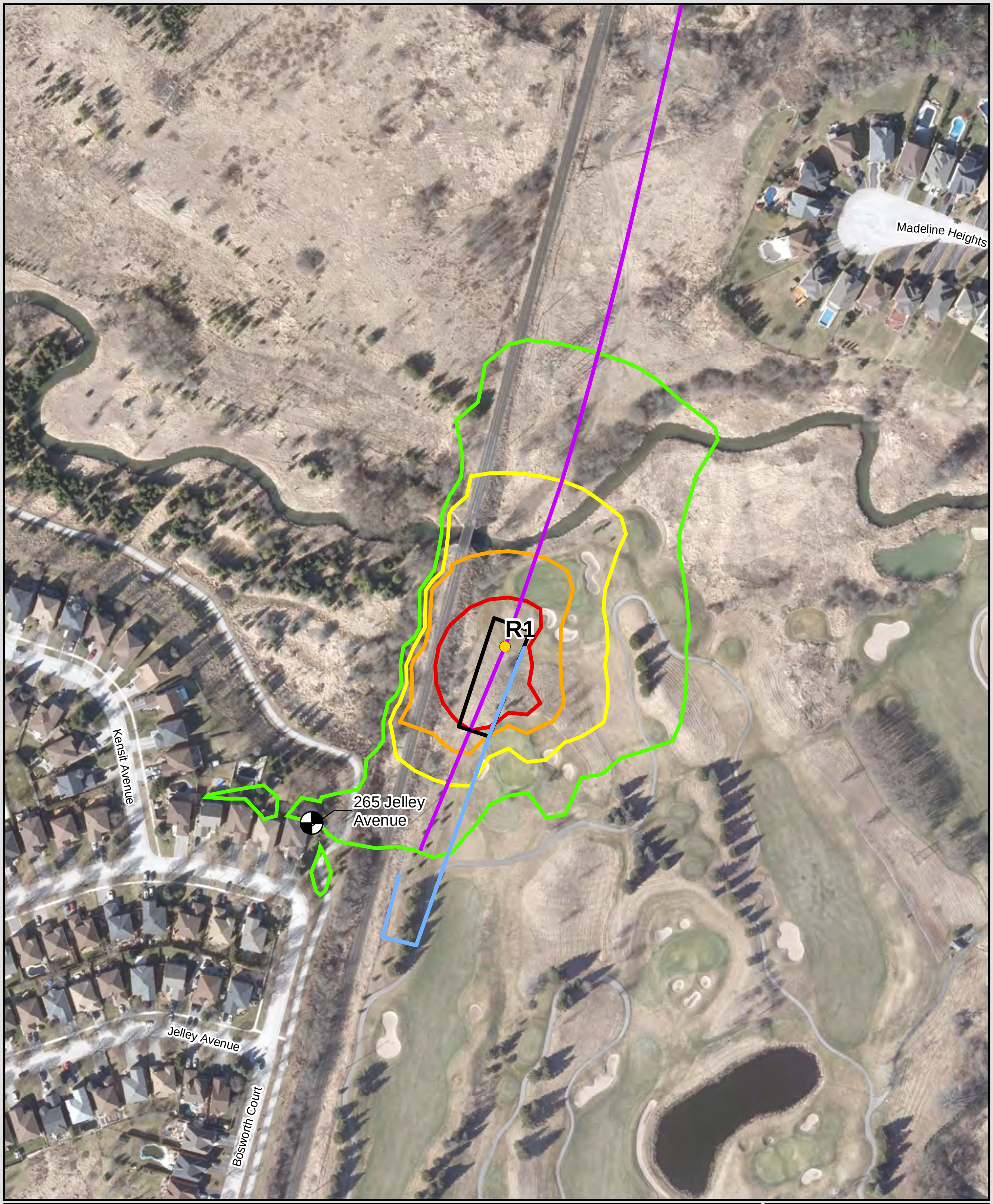
NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA005 Tuesday, July 25, 2017



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft (R#) Receiving Shaft
- Receiver
- Construction Site
- YDSS Alignment
- Noise Barrier
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

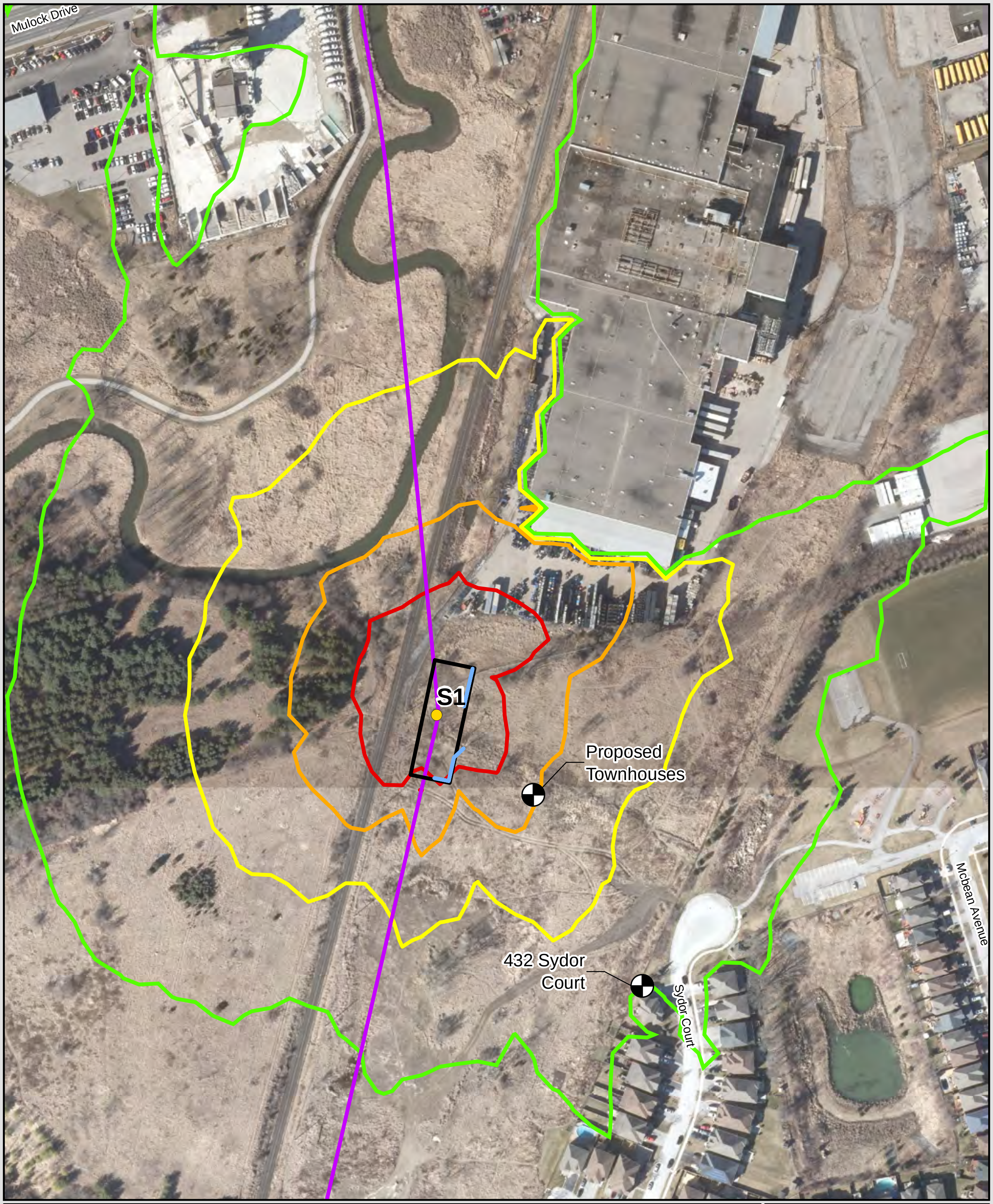
figure 5B - Receiving Shaft 1

NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO YORK REGION

York Region



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
  (R#) Receiving Shaft
- Receiver
- Construction Site
- YDSS Alignment
- Noise Barrier
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

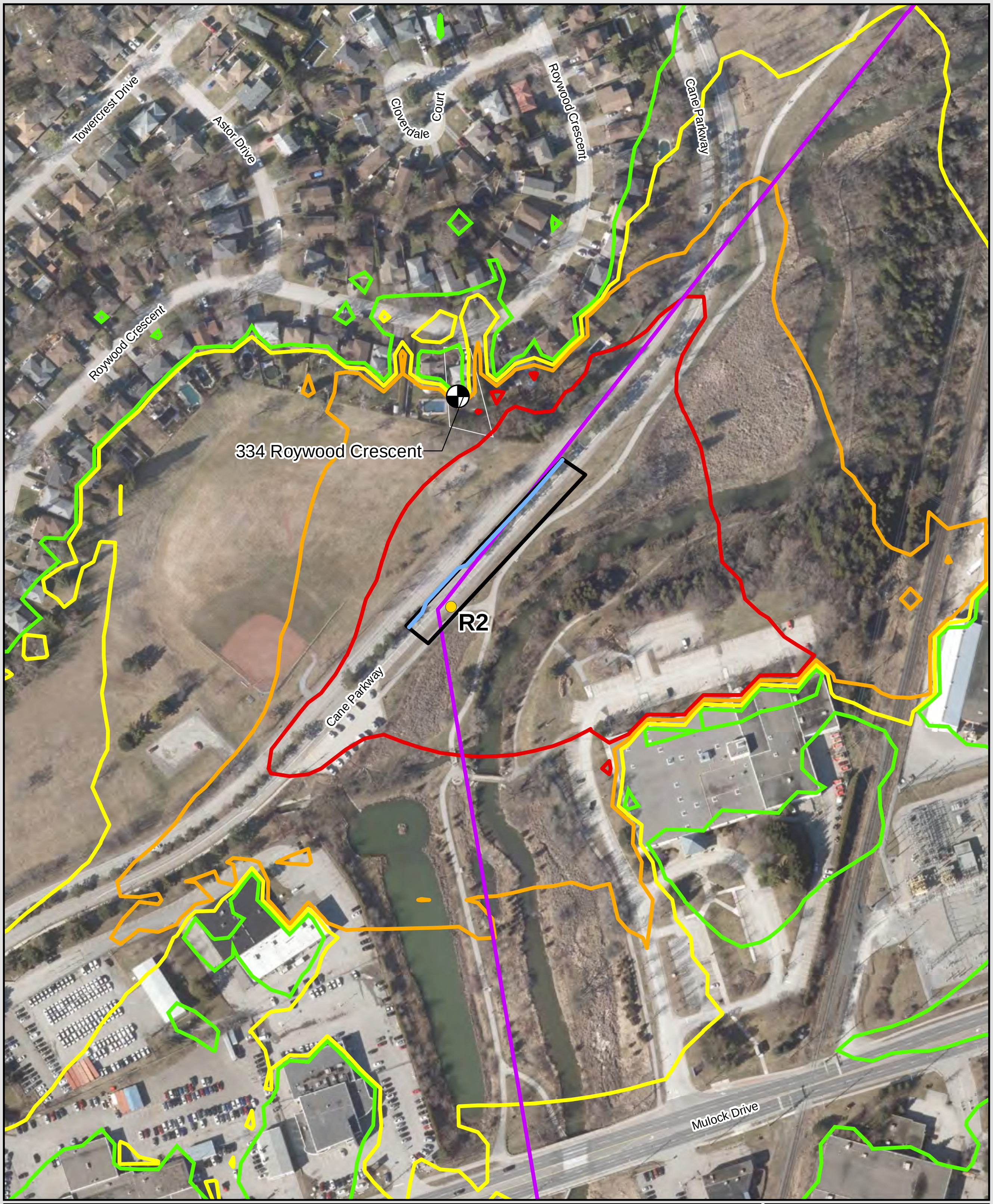
figure 5C - Sending Shaft 1

NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region



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N W E S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
- (R#) Receiving Shaft
- Receiver
- Construction Site
- YDSS Alignment
- Noise Barrier
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

figure 5D - Receiving/Sending Shaft 2

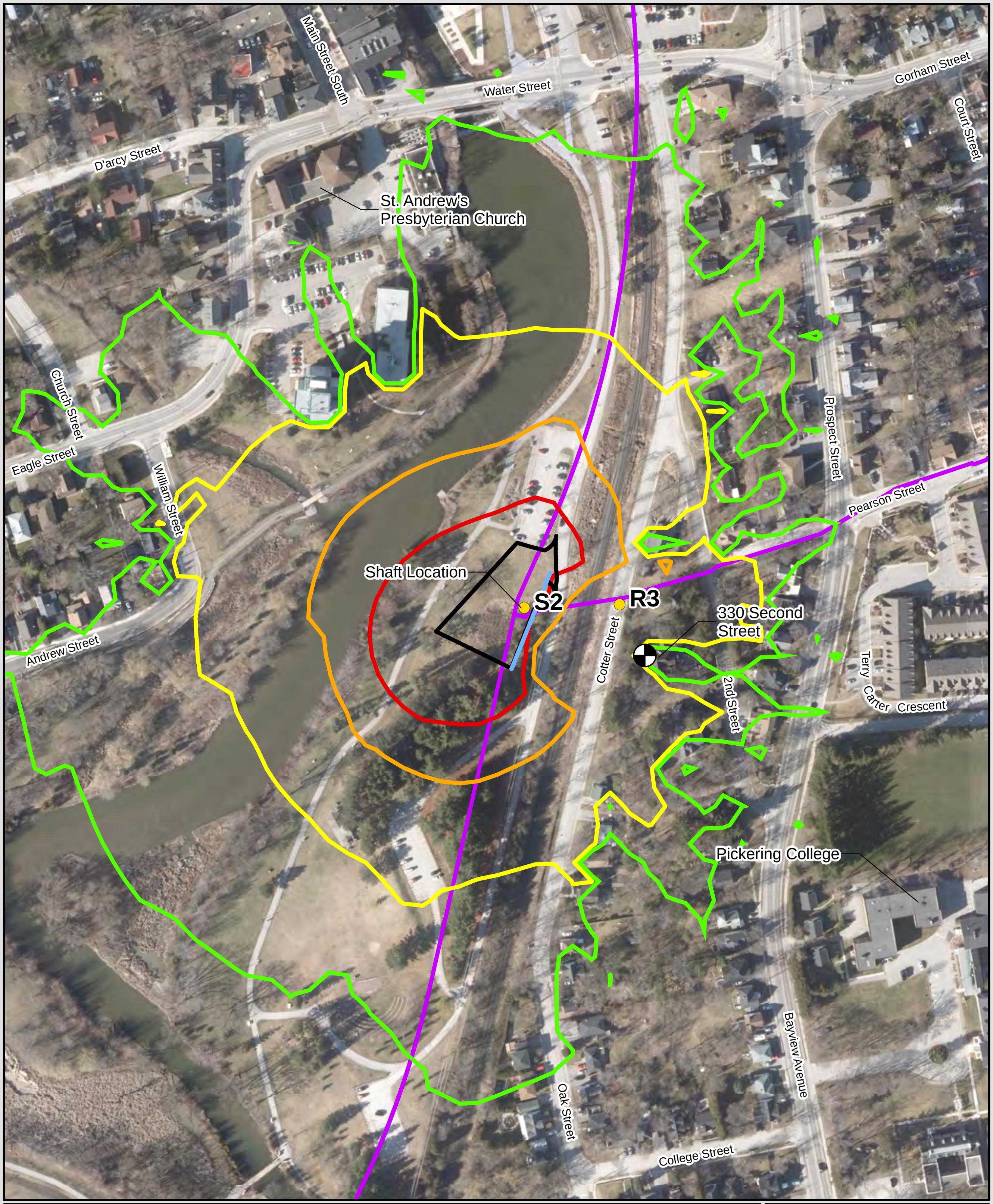
NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA006 Tuesday, July 25, 2017



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
  (R#) Receiving Shaft
- Receiver
- Construction Site
- YDSS Alignment
- Noise Barrier
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

figure 5E - Sending Shaft 2

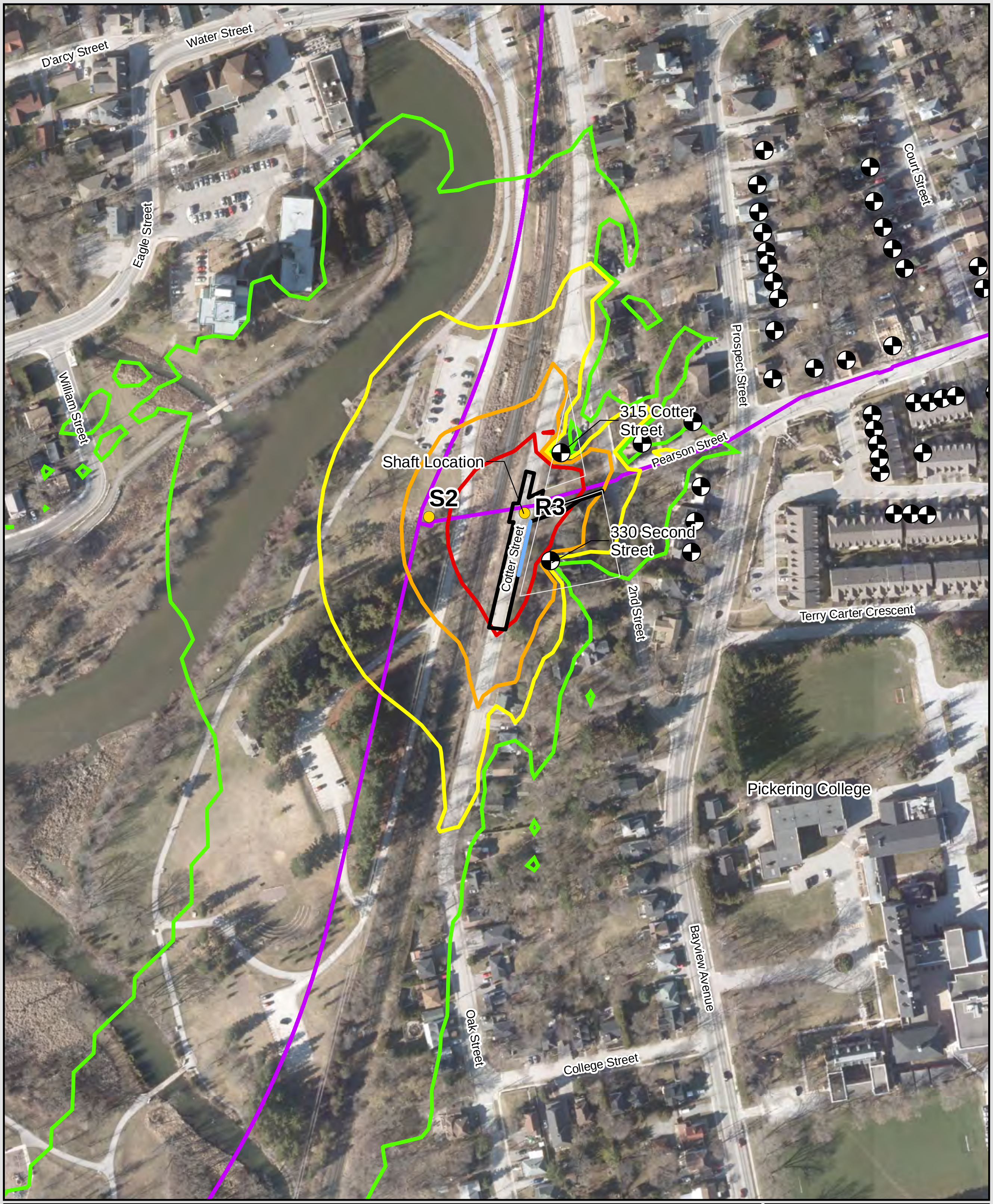
NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA010 Wednesday, August 02, 2017



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
- (R#) Receiving Shaft
- Receiver
- Construction Site
- YDSS Alignment
- Noise Barrier
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

figure 5F - Receiving Shaft 3

NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA011 Tuesday, July 25, 2017

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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- Receiver
- YDSS Alignment
- Construction Site
- Noise Barrier
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

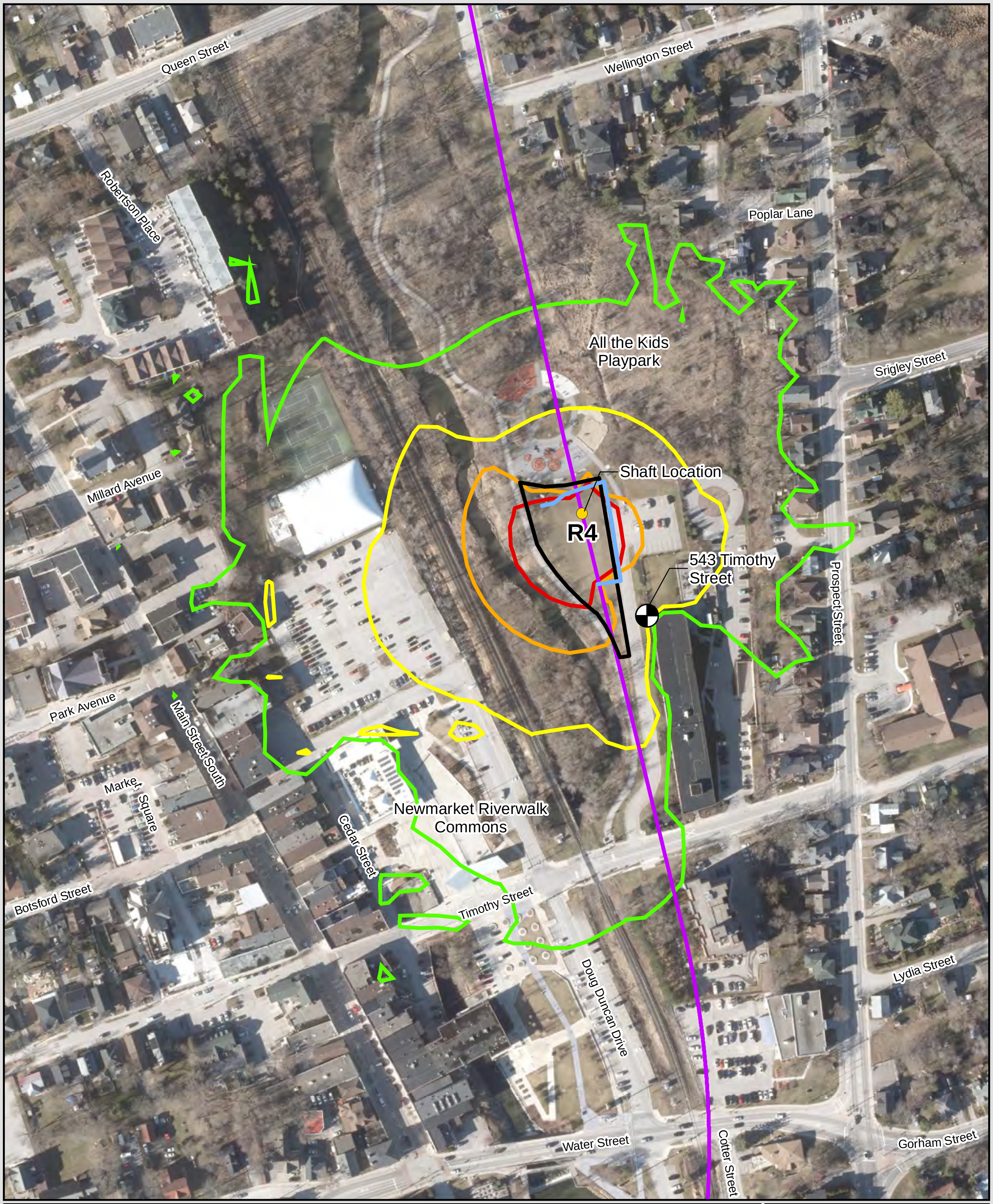
figure 5G - Open Cut Area 2

NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO YORK REGION

York Region



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
  (R#) Receiving Shaft
- Receiver
- YDSS Alignment
- Construction Site
- Noise Barrier
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

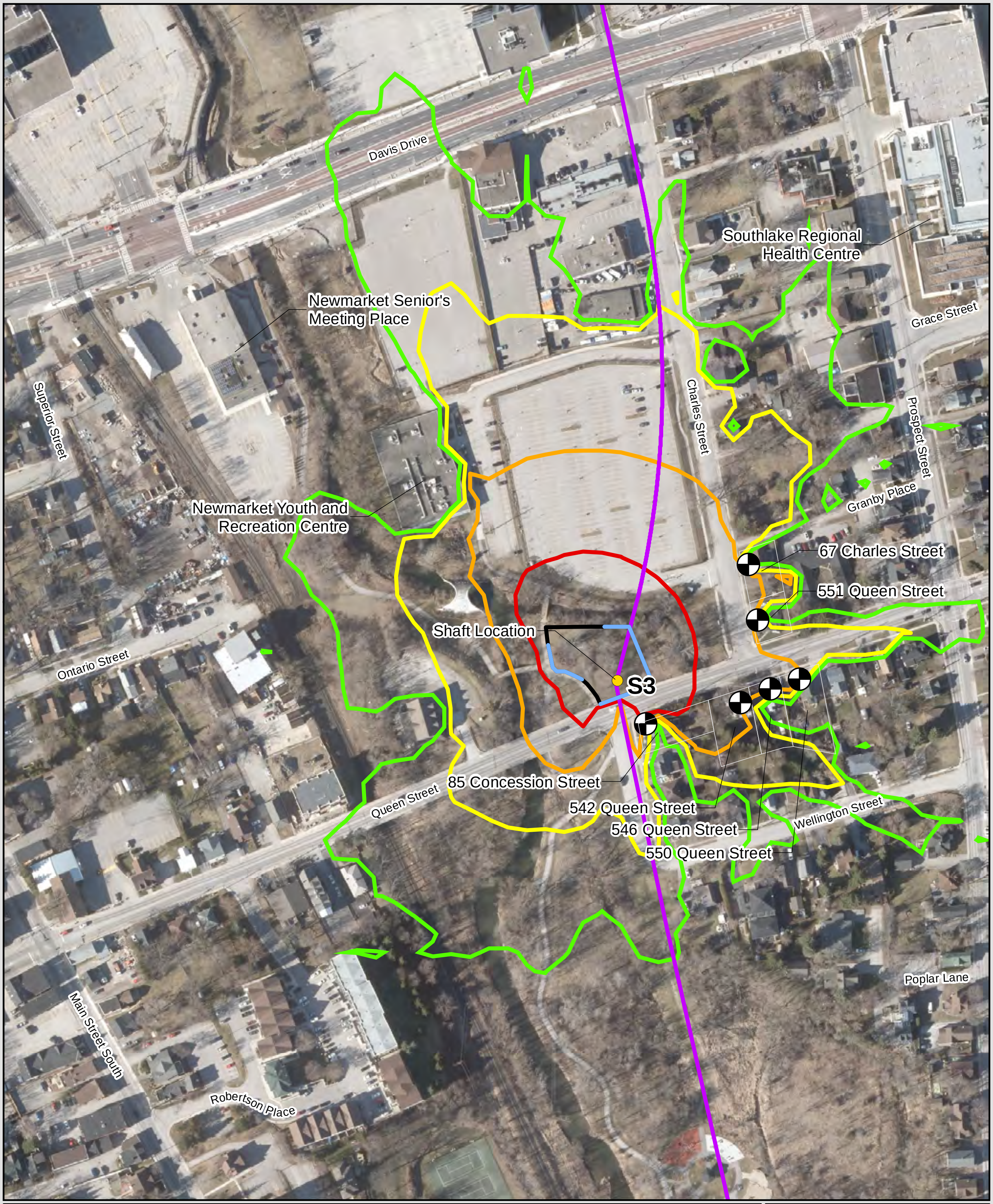
figure 5H - Receiving Shaft 4

NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
  (R#) Receiving Shaft
- Receiver
- Construction Site
- YDSS Alignment
- Noise Barrier
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

figure 5I - Sending Shaft 3 (Receiving?)

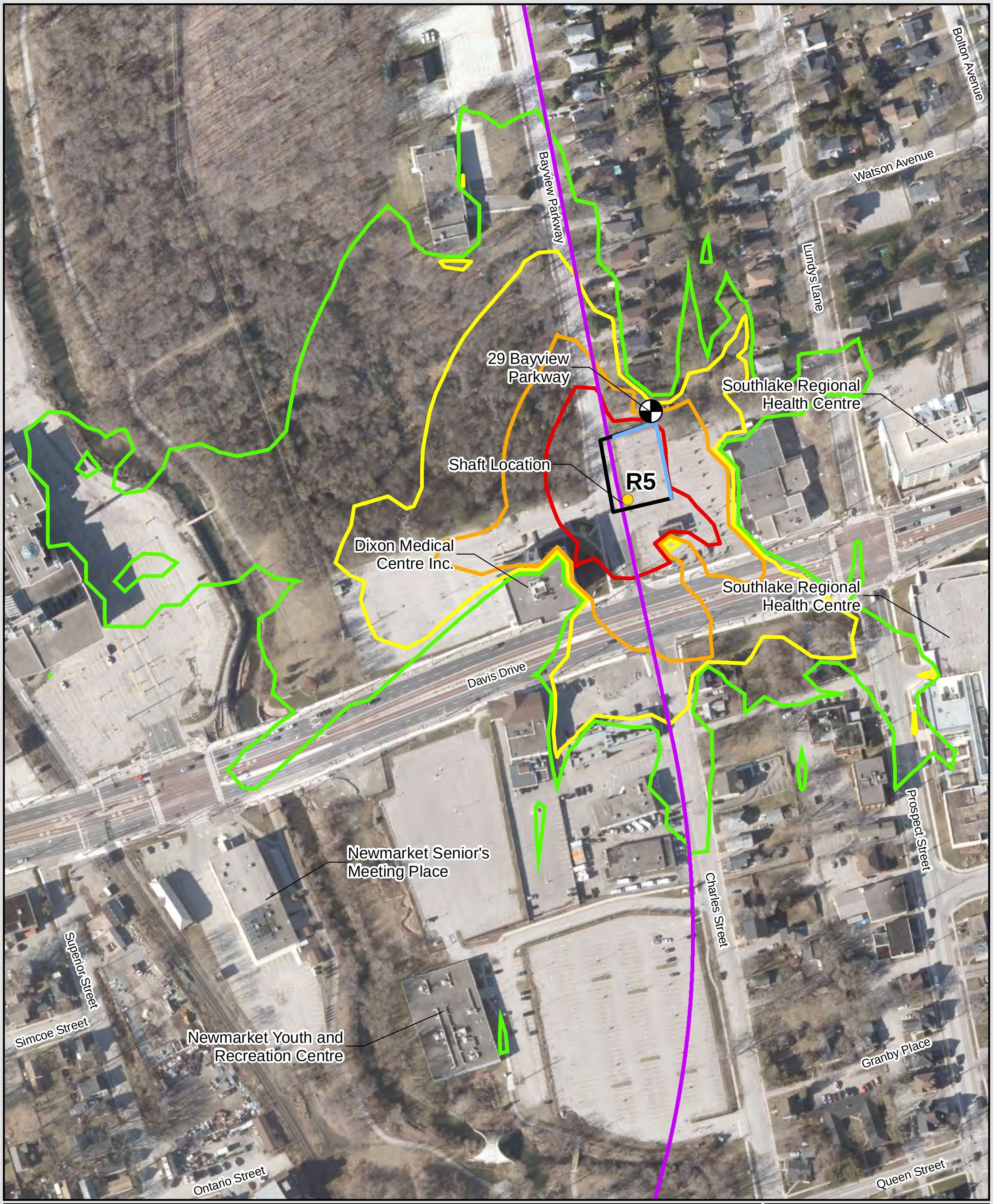
NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA014 Friday, October 20, 2017



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
- (R#) Receiving Shaft
- Receiver
- Construction Site
- YDSS Alignment
- Noise Barrier
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

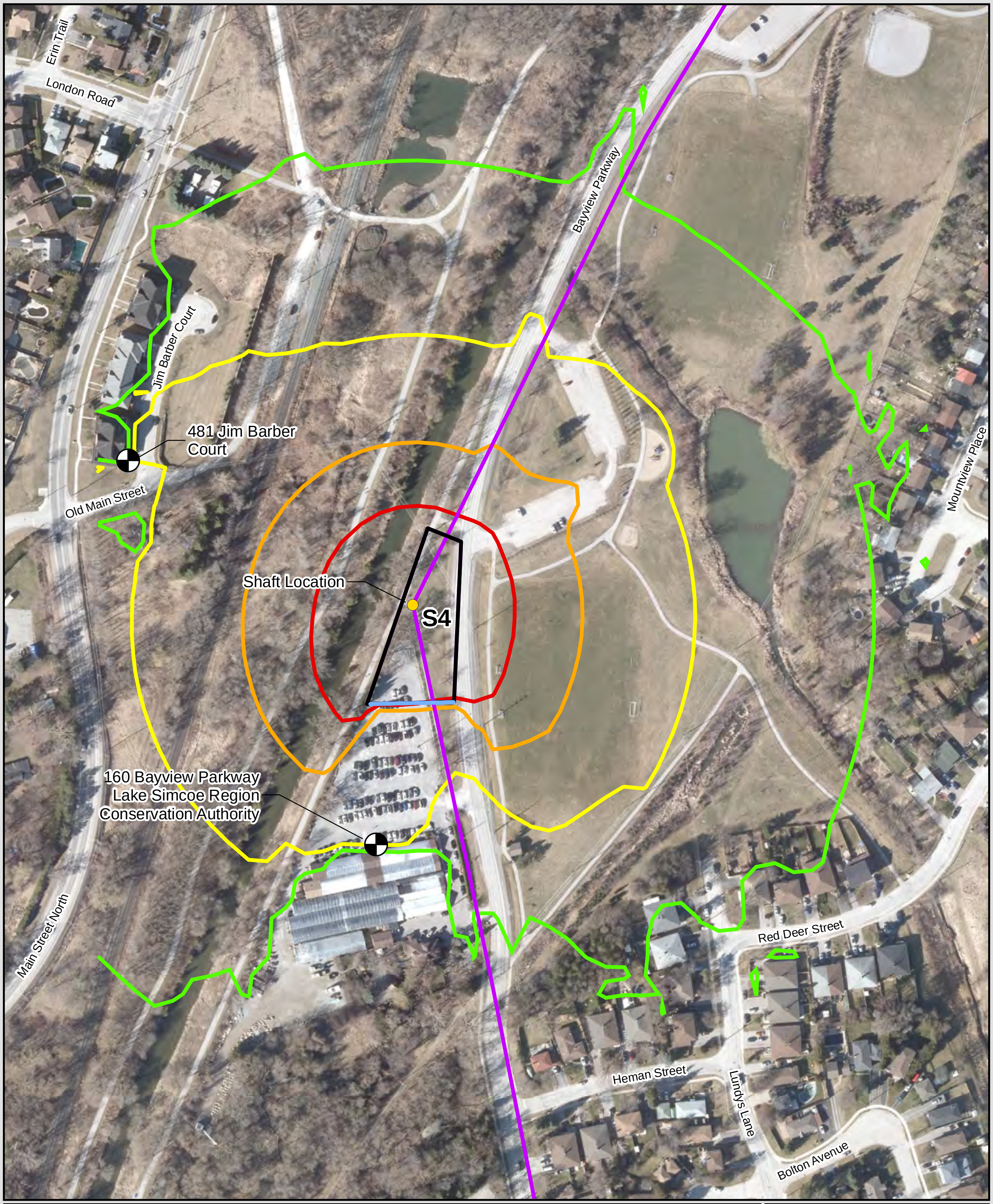
figure 5J - Receiving Shaft 5

NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
- (R#) Receiving Shaft
- Receiver
- Noise Barrier
- Construction Site
- YDSS Alignment
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

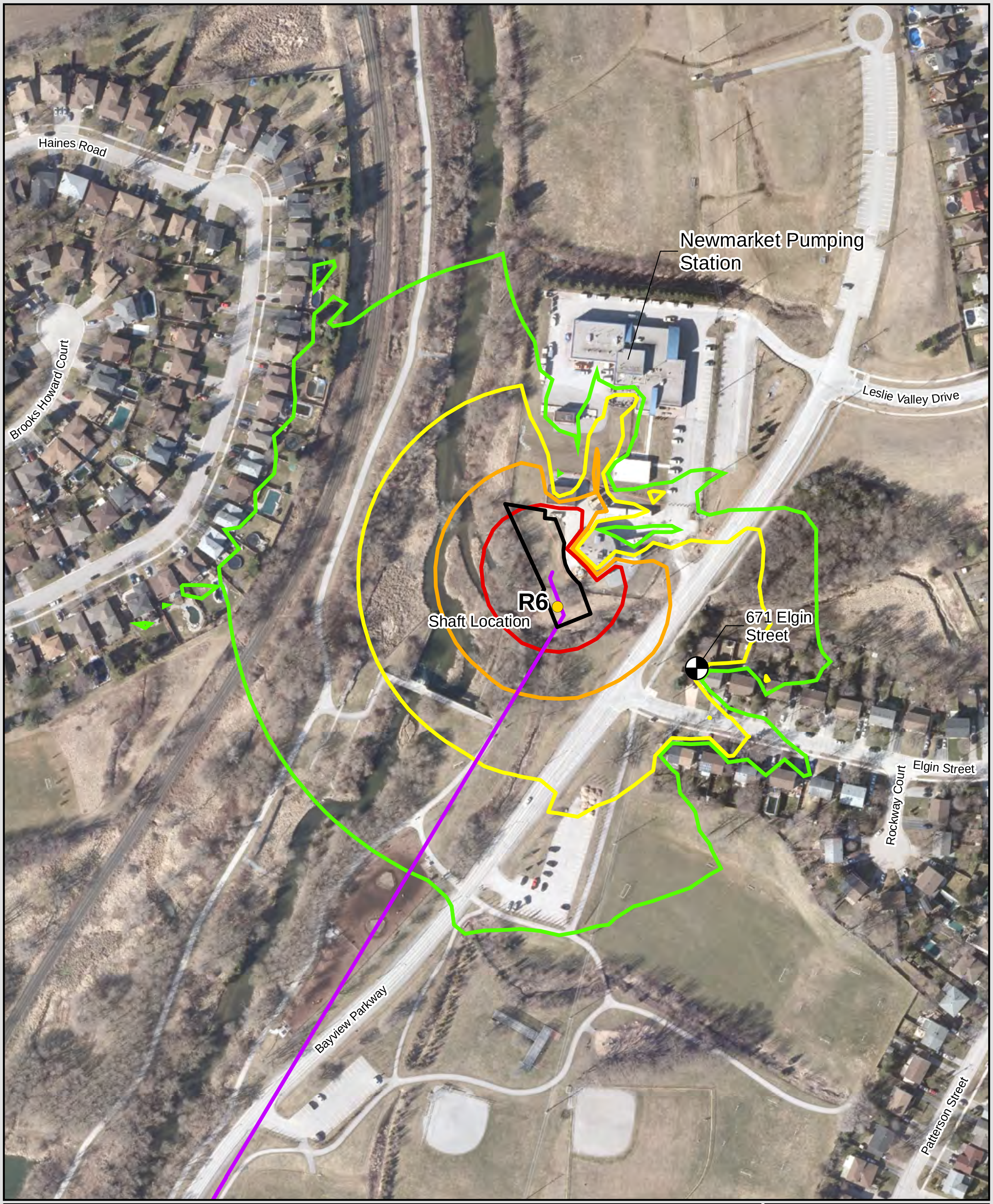
figure 5K - Sending Shaft 4

NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
- (R#) Receiving Shaft
- Receiver
- Construction Site
- YDSS Alignment
- <45 dB Noise Contour
- <50 dB Noise Contour
- <55 dB Noise Contour
- >60 dB Noise Contour

figure 5L - Receiving Shaft 6

NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA017 Tuesday, July 25, 2017

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N
W E
S

0 10 20 Meters

UTM Zone 17N, NAD 83 1:500

Legend

- (S#) Sending Shaft
- (R#) Receiving Shaft
- Noise Barrier
- Construction Site
- YDSS Alignment

figure 5M - Typical Open Cut

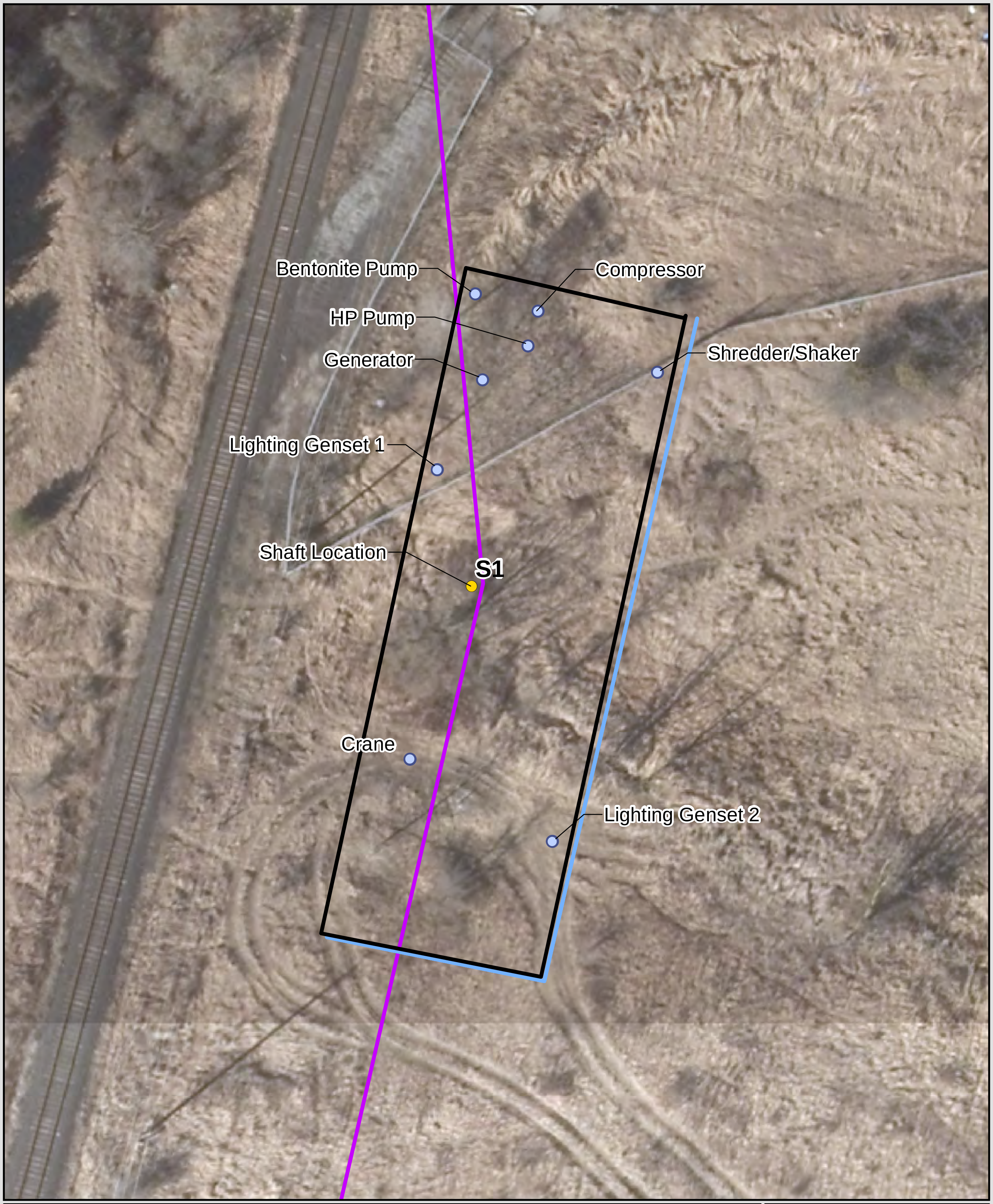
NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA020 Tuesday, July 25, 2017



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N
W E
S

0 10 20 Meters

UTM Zone 17N, NAD 83 1:500

Legend

- (S#) Sending Shaft
- (R#) Receiving Shaft
- Noise Barrier
- Construction Site
- YDSS Alignment

figure 5N - Typical Send Shaft

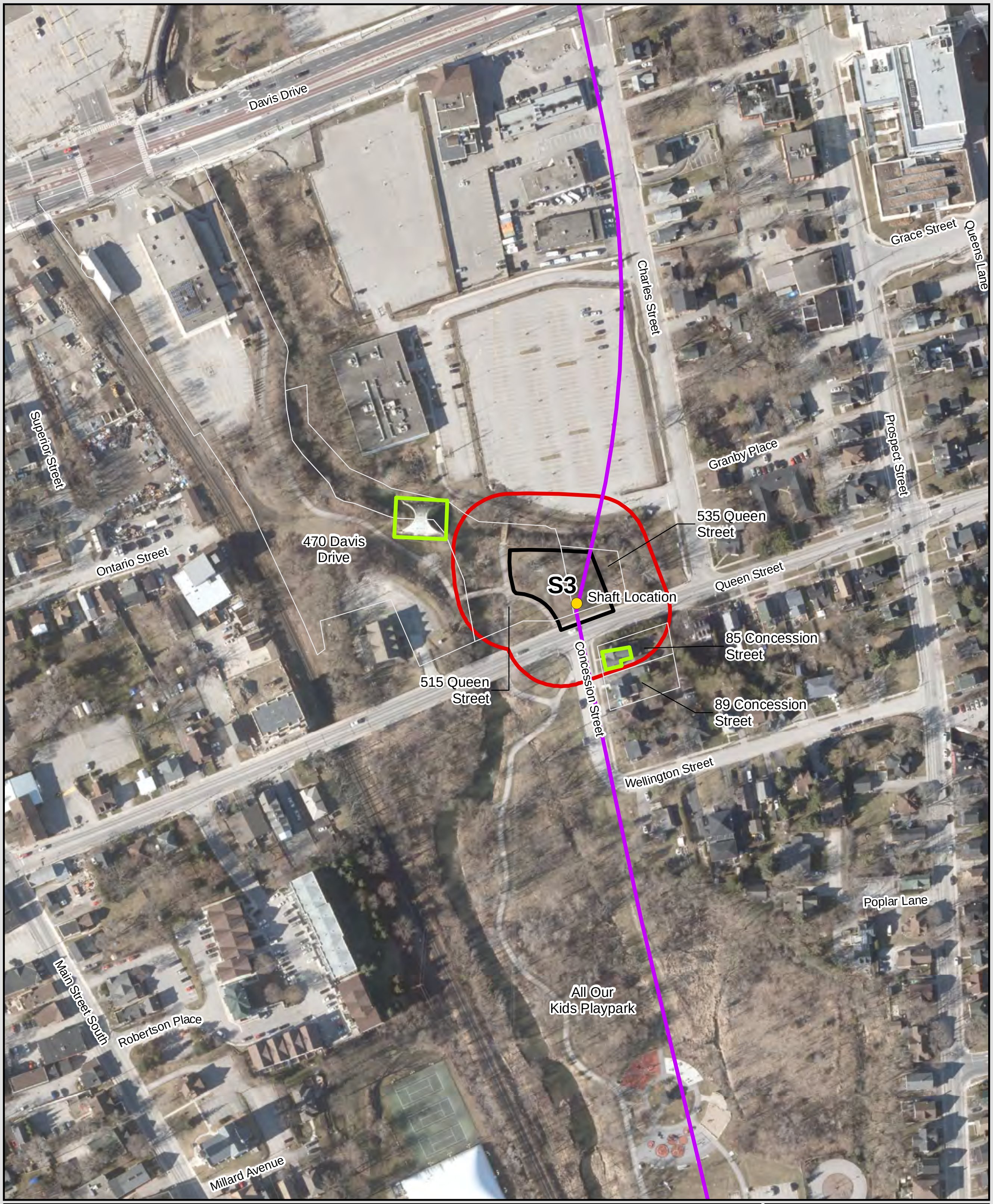
NOISE AND VIBRATION IMPACT ASSESSMENT

YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA021 Tuesday, July 25, 2017



Sources: MNRF NRVIS 2015, and Regional Municipality of York 2015. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, and Regional Municipality of York, © Queen's Printer 2017

N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft
  (R#) Receiving Shaft
- YDSS Alignment
- Historical Building within Vibration Zone of Influence
- Construction Site
- Vibration Zone of Influence (30 meter radius)

figure 6A - Sending Shaft 3

NOISE AND VIBRATION IMPACT ASSESSMENT
30 METRE VIBRATION ZONE OF INFLUENCE RADIUS

YDSS MODIFICATIONS
NEWMARKET, ONTARIO
YORK REGION

York Region

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N
W E
S

0 50 100 Meters
UTM Zone 17N, NAD 83 1:3,000

Legend

- (S#) Sending Shaft (R#) Receiving Shaft
- YDSS Alignment
- Historical Building within Vibration Zone of Influence
- Construction Site
- Vibration Zone of Influence (30 meter radius)

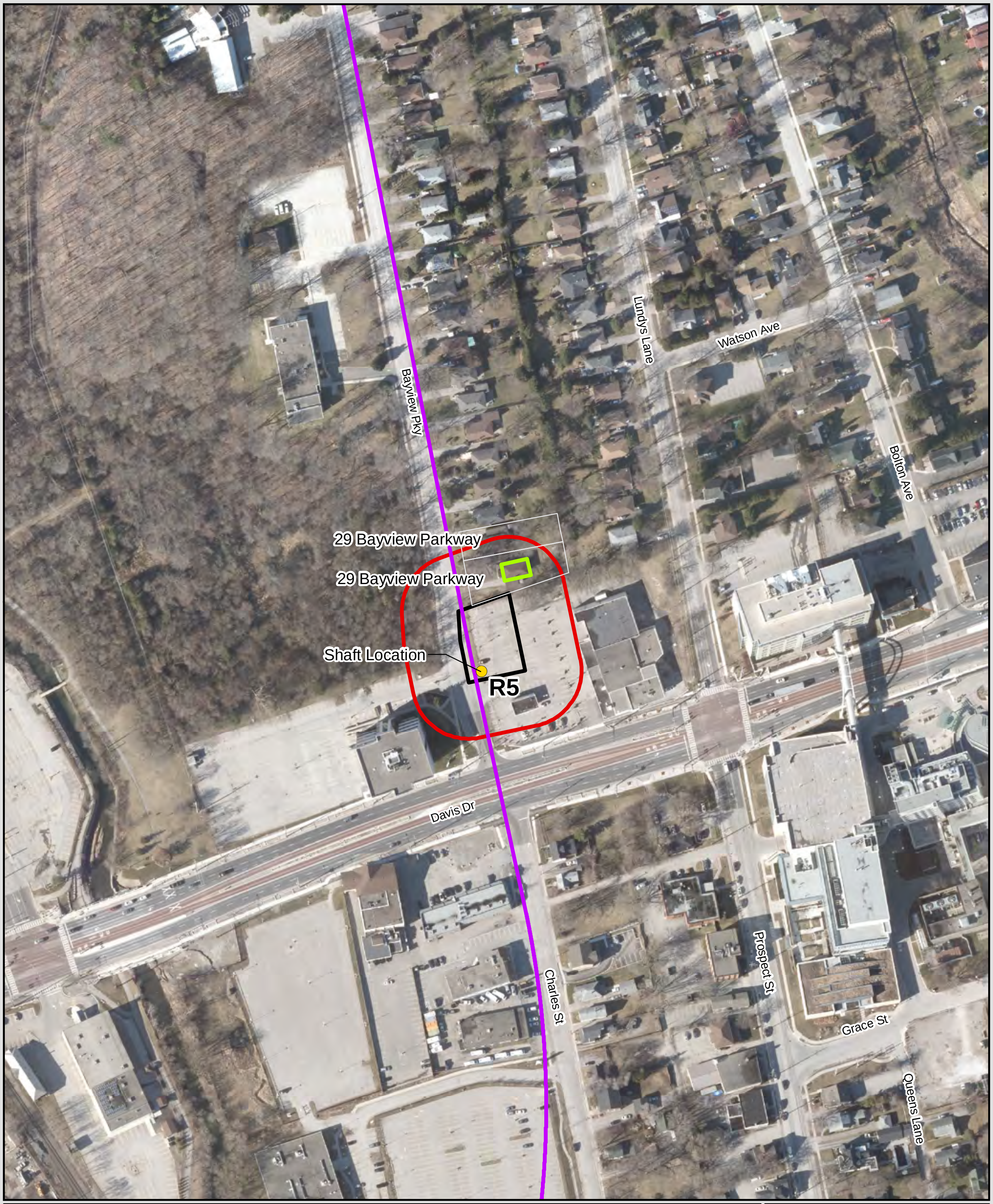
figure 6B - Receiving Shaft 4

NOISE AND VIBRATION IMPACT ASSESSMENT
30 METRE VIBRATION ZONE OF INFLUENCE RADIUS

YDSS MODIFICATIONS
NEWMARKET, ONTARIO
YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA019 Wednesday, August 02, 2017



Sources: MNRF NRVIS 2015, and Regional Municipality of York 2015. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, and Regional Municipality of York, © Queen's Printer 2017

N
W E
S

0 50 100 Meters
UTM Zone 17N, NAD 83 1:3,000

Legend

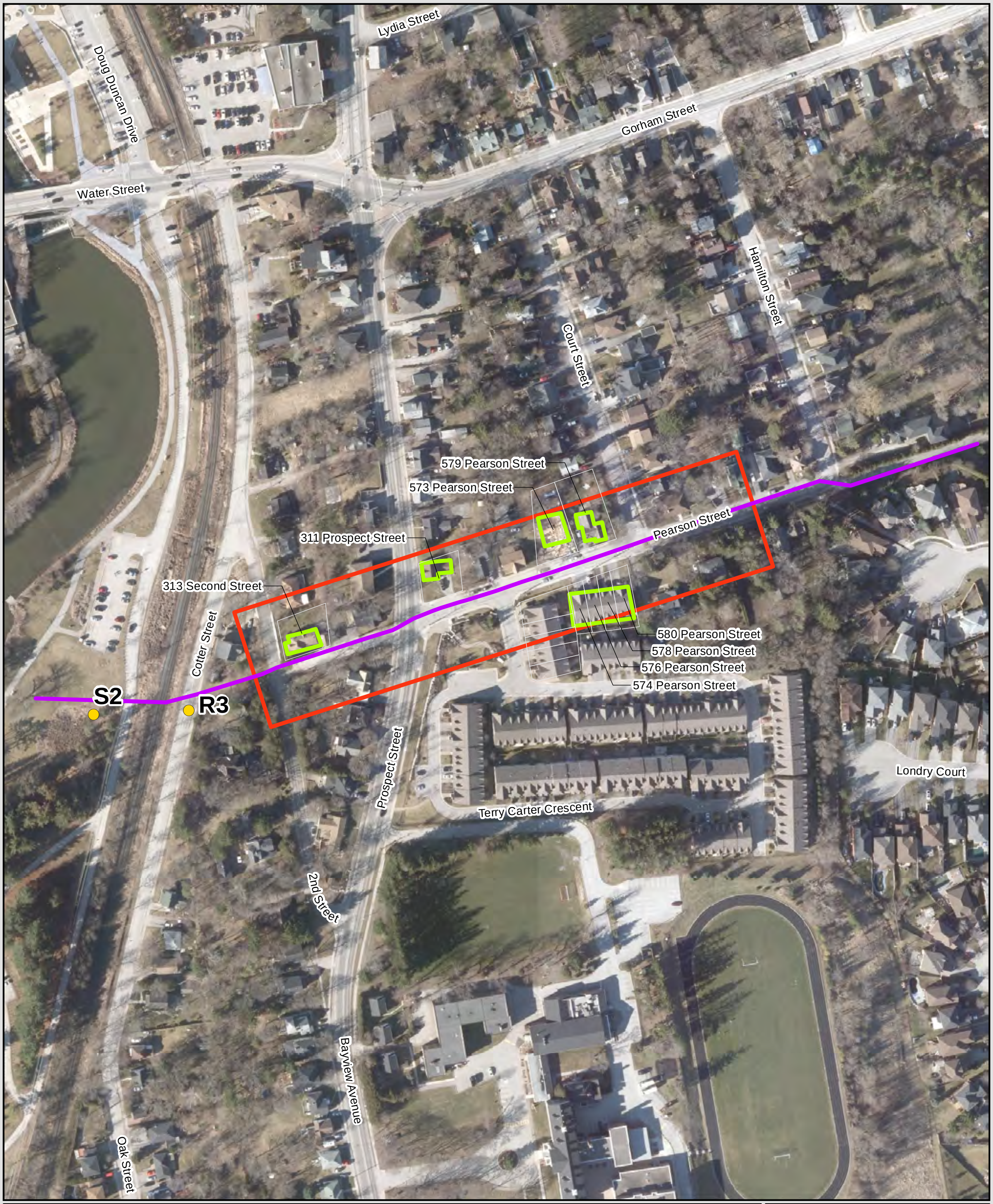
- (S#) Sending Shaft
  (R#) Receiving Shaft
- YDSS Alignment
- Historical Building within Vibration Zone of Influence
- Construction Site
- Vibration Zone of Influence (30 meter radius)

figure 6C - Receiving Shaft 5

NOISE AND VIBRATION IMPACT ASSESSMENT 30 METRE VIBRATION ZONE OF INFLUENCE RADIUS

YDSS MODIFICATIONS NEWMARKET, ONTARIO YORK REGION

York Region



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

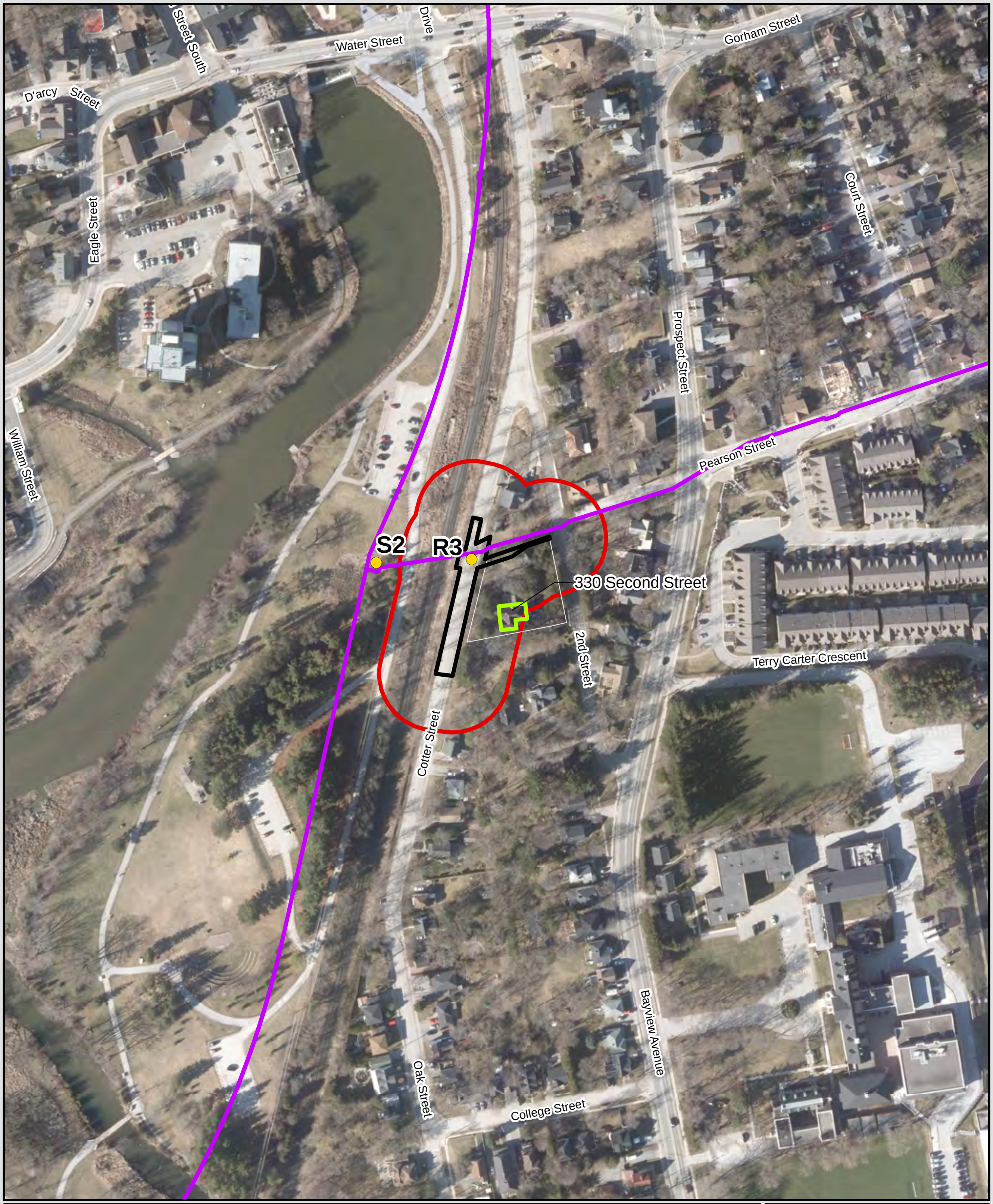
- (S#) Sending Shaft
  (R#) Receiving Shaft
- YDSS Alignment
- Historical Building within Vibration Zone of Influence
- Vibration Zone of Influence (30 meter radius)

figure 6D - Open Cut Area 2

NOISE AND VIBRATION IMPACT ASSESSMENT
30 METRE VIBRATION ZONE OF INFLUENCE RADIUS

YDSS MODIFICATIONS
NEWMARKET, ONTARIO
YORK REGION

York Region



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N
W E
S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,000

Legend

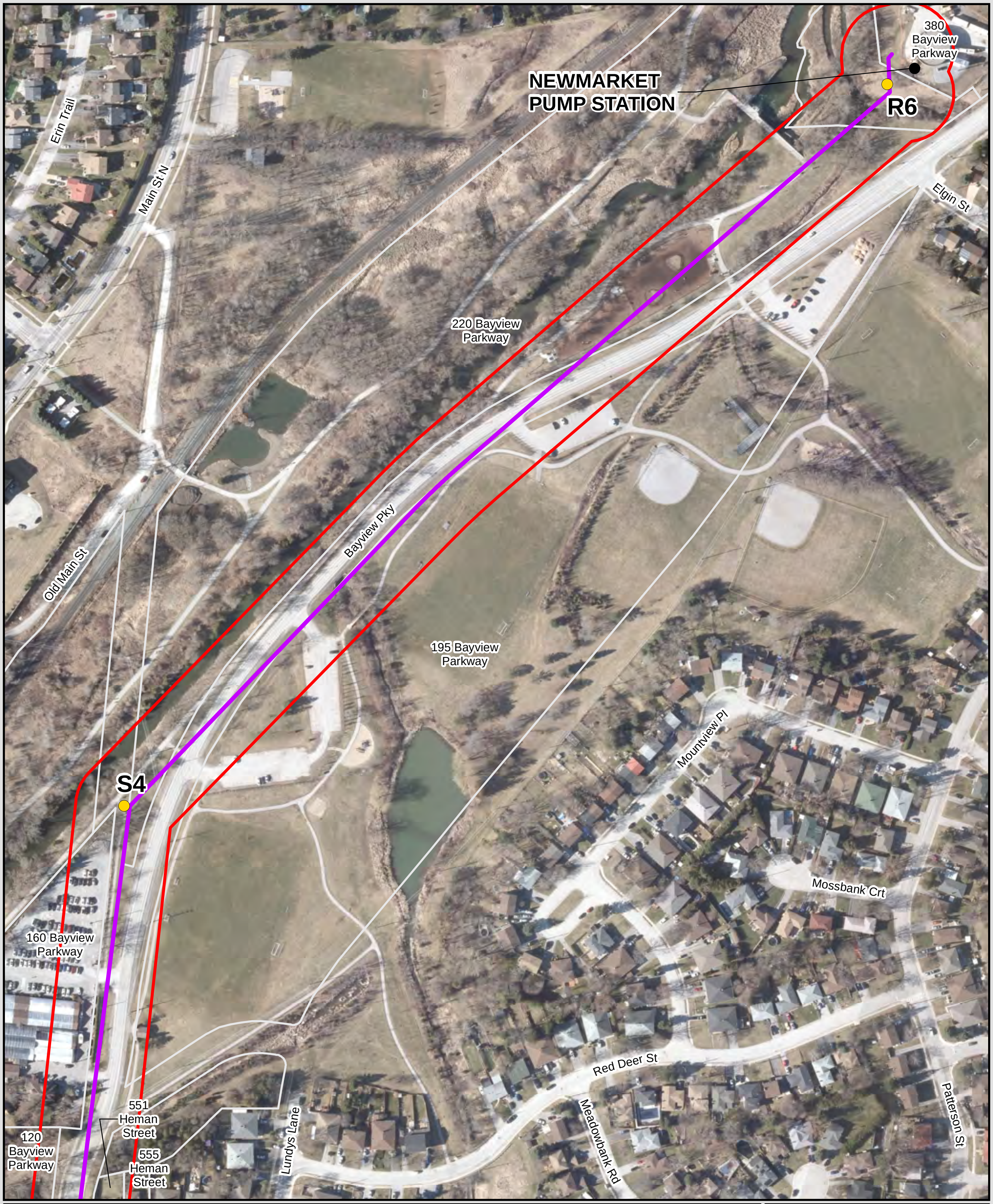
- (S#) Sending Shaft
  (R#) Receiving Shaft
- YDSS Alignment
- Historical Building within Vibration Zone of Influence
- Construction Site
- Vibration Zone of Influence (30 meter radius)

figure 6E - Receiving Shaft 3

NOISE AND VIBRATION IMPACT ASSESSMENT 30 METRE VIBRATION ZONE OF INFLUENCE RADIUS

YDSS MODIFICATIONS NEWMARKET, ONTARIO YORK REGION

York Region



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N W E S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,500

Legend

- (S#) Sending Shaft
  (R#) Receiving Shaft
- YDSS Alignment
- Vibration Zone of Influence (30m Radius)
- Parcels 30m from YDSS Alignment

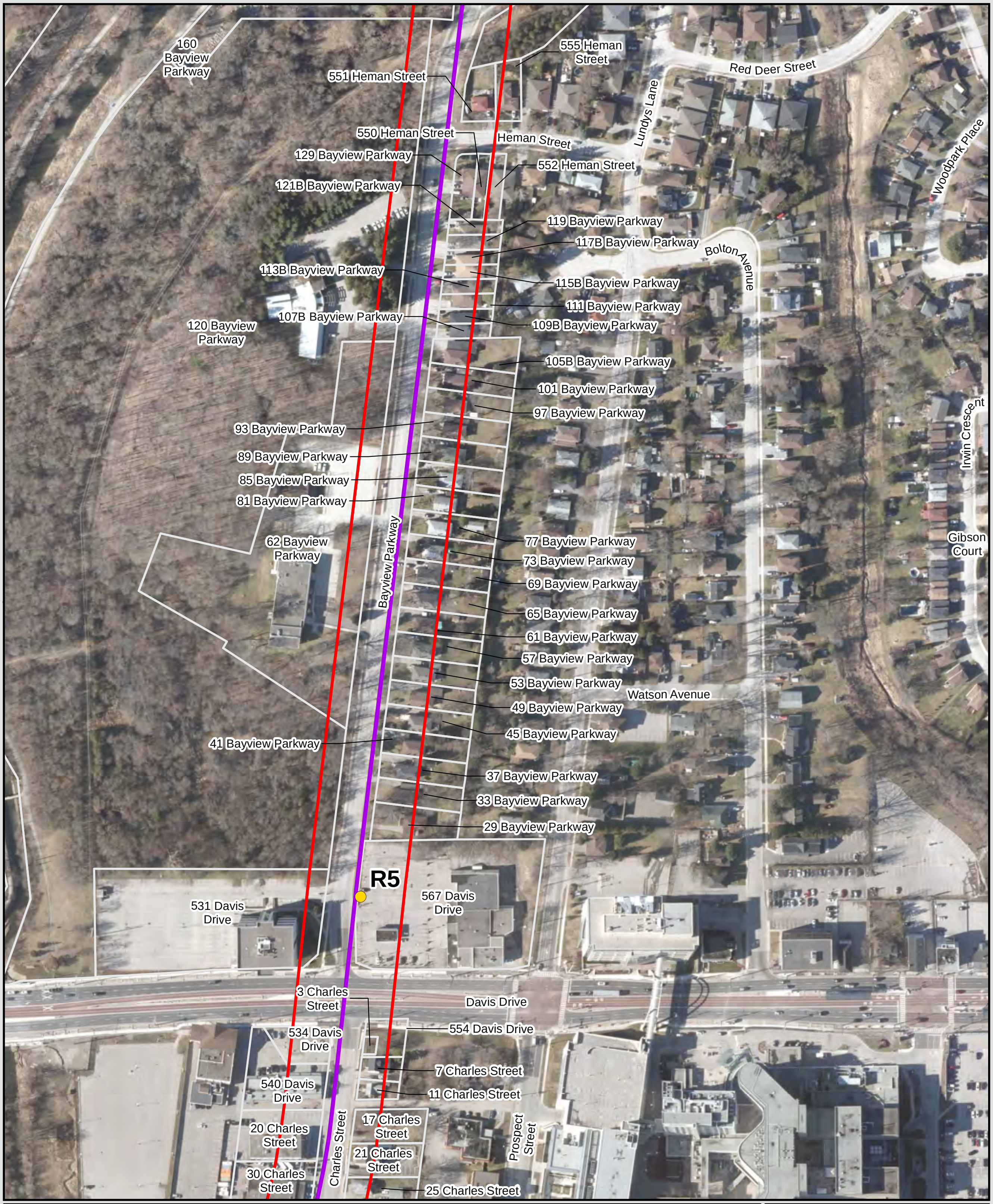
figure 6F

NOISE AND VIBRATION IMPACT ASSESSMENT
30 METRE VIBRATION ZONE OF INFLUENCE RADIUS FROM ALIGNMENT
YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA024 Wednesday, August 02, 2017



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N W E S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,500

Legend

- (S#) Sending Shaft
  (R#) Receiving Shaft
- YDSS Alignment
- Vibration Zone of Influence (30m Radius)
- Parcels 30m from YDSS Alignment

figure 6G

NOISE AND VIBRATION IMPACT ASSESSMENT
30 METRE VIBRATION ZONE OF INFLUENCE RADIUS FROM ALIGNMENT
YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region

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N W E S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,500

Legend

- (S#) Sending Shaft
  (R#) Receiving Shaft
- YDSS Alignment
- Vibration Zone of Influence (30m Radius)
- Parcels 30m from YDSS Alignment

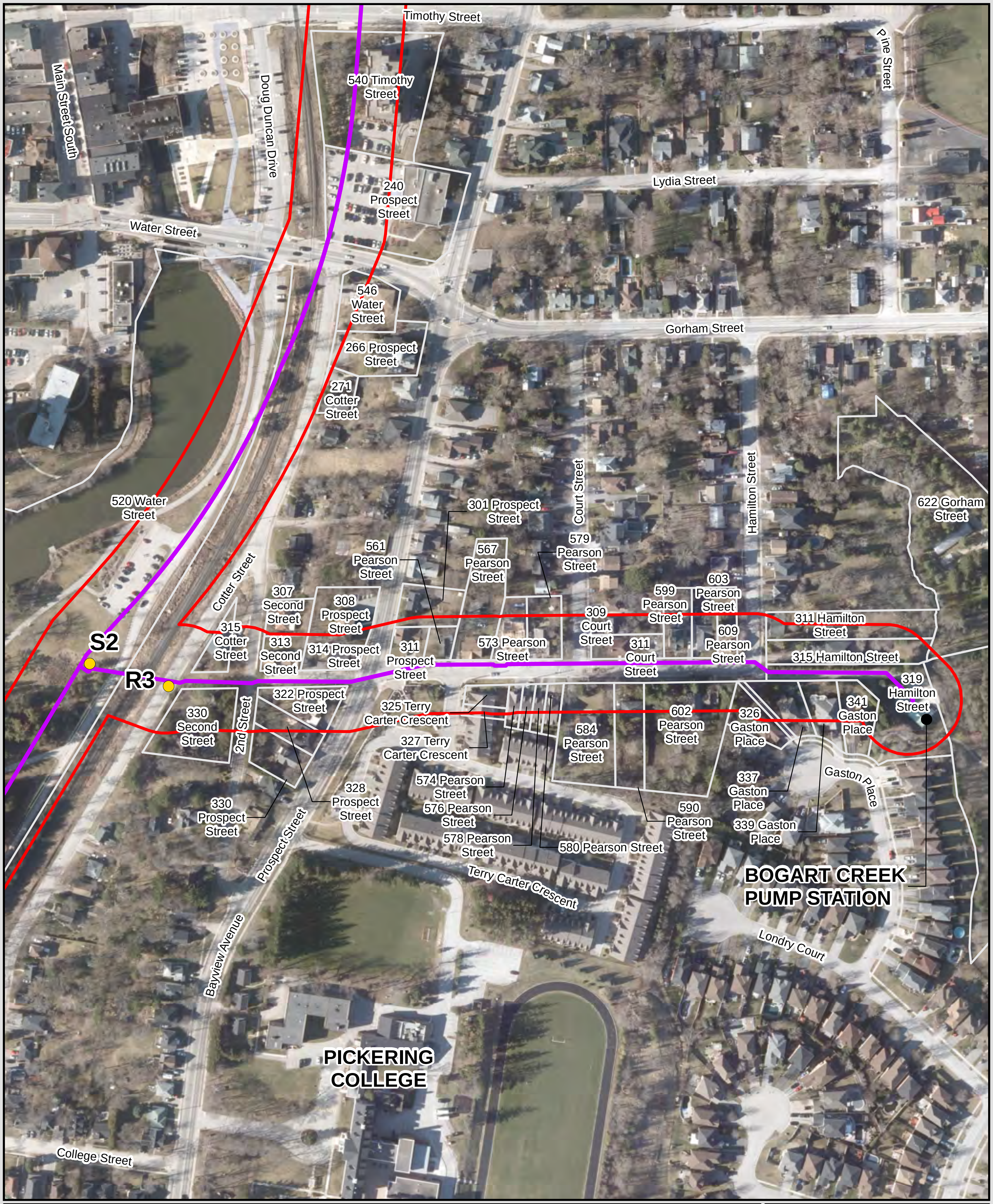
figure 6H

NOISE AND VIBRATION IMPACT ASSESSMENT 30 METRE VIBRATION ZONE OF INFLUENCE RADIUS FROM ALIGNMENT YDSS MODIFICATIONS

NEWMARKET, ONTARIO YORK REGION

York Region

Map Document: 84405-05(228)GIS-WA026 Wednesday, August 02, 2017



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N W E S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,500

Legend

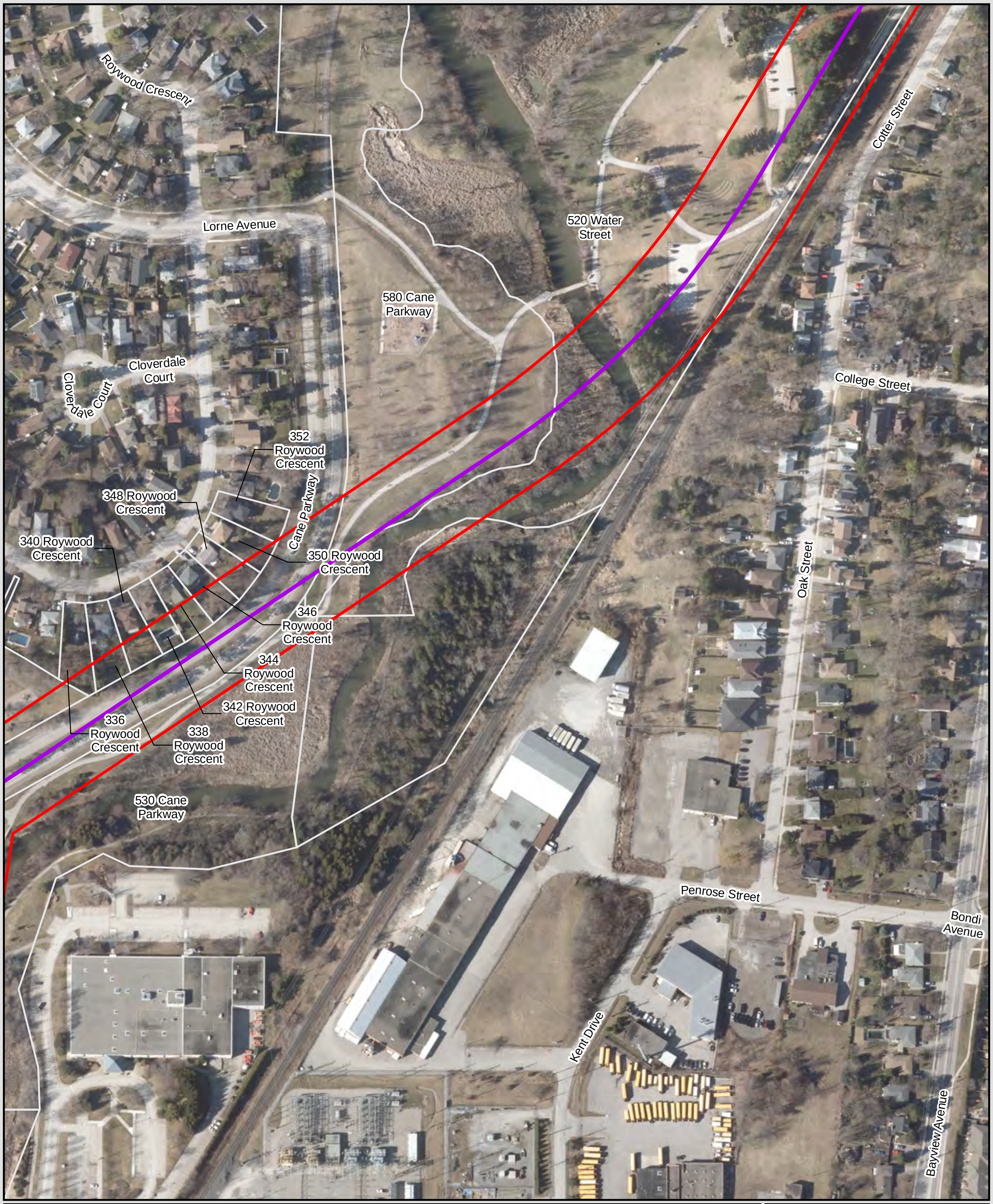
- (S#) Sending Shaft
- (R#) Receiving Shaft
- YDSS Alignment
- Vibration Zone of Influence (30m Radius)
- Parcels 30m from YDSS Alignment

figure 6I

NOISE AND VIBRATION IMPACT ASSESSMENT
30 METRE VIBRATION ZONE OF INFLUENCE RADIUS FROM ALIGNMENT
YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region



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N
W
E
S

0 50 100
Meters

UTM Zone 17N, NAD 83
1:3,500

Legend

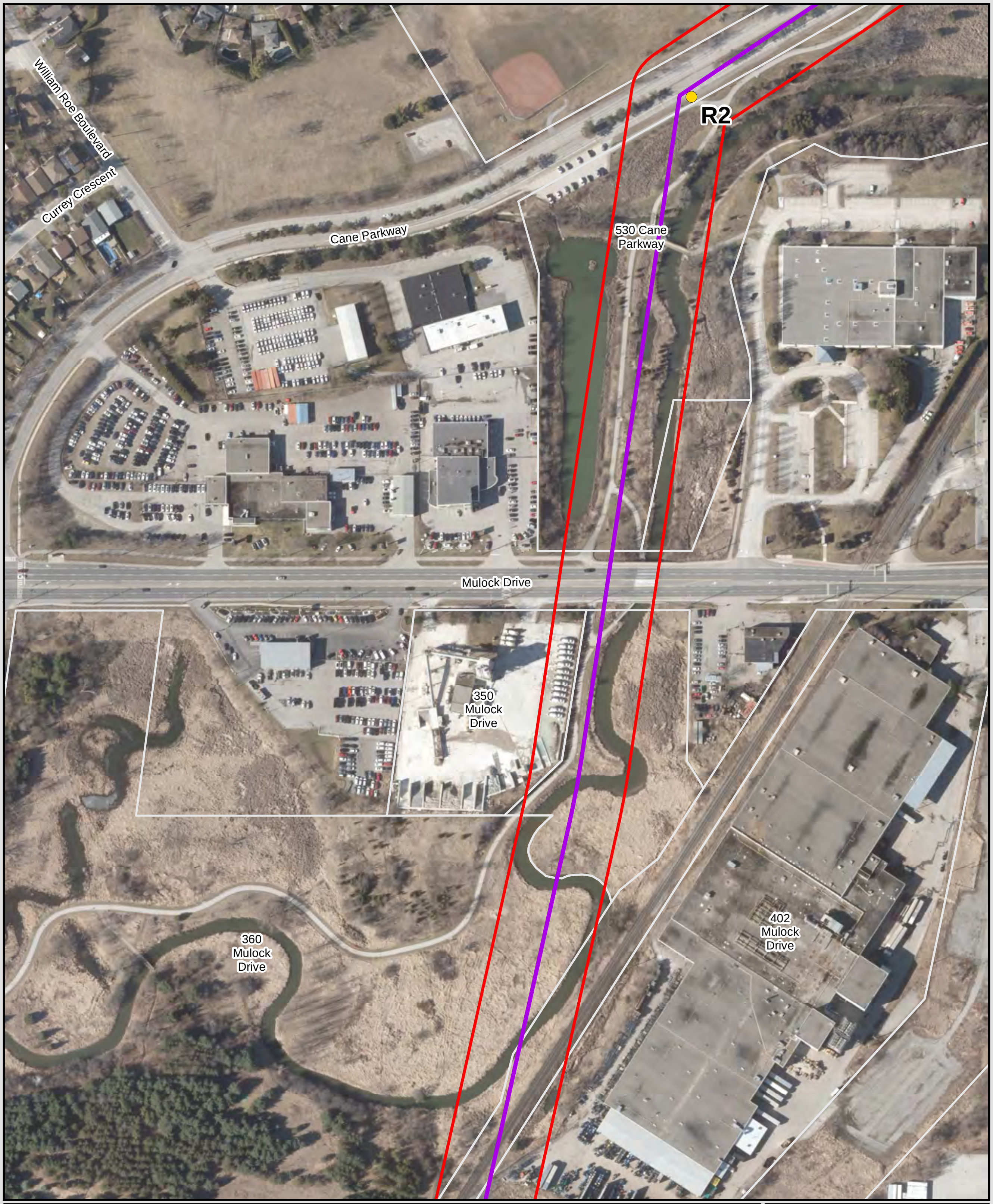
- (S#) Sending Shaft
  (R#) Receiving Shaft
- YDSS_Alignment
- Vibration Zone of Influence (30m Radius)
- Parcels 30m from YDSS Alignment

figure 6J

NOISE AND VIBRATION IMPACT ASSESSMENT
30 METRE VIBRATION ZONE OF INFLUENCE RADIUS FROM ALIGNMENT
YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region



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N W E S

0 50 100 Meters

UTM Zone 17N, NAD 83 1:3,500

Legend

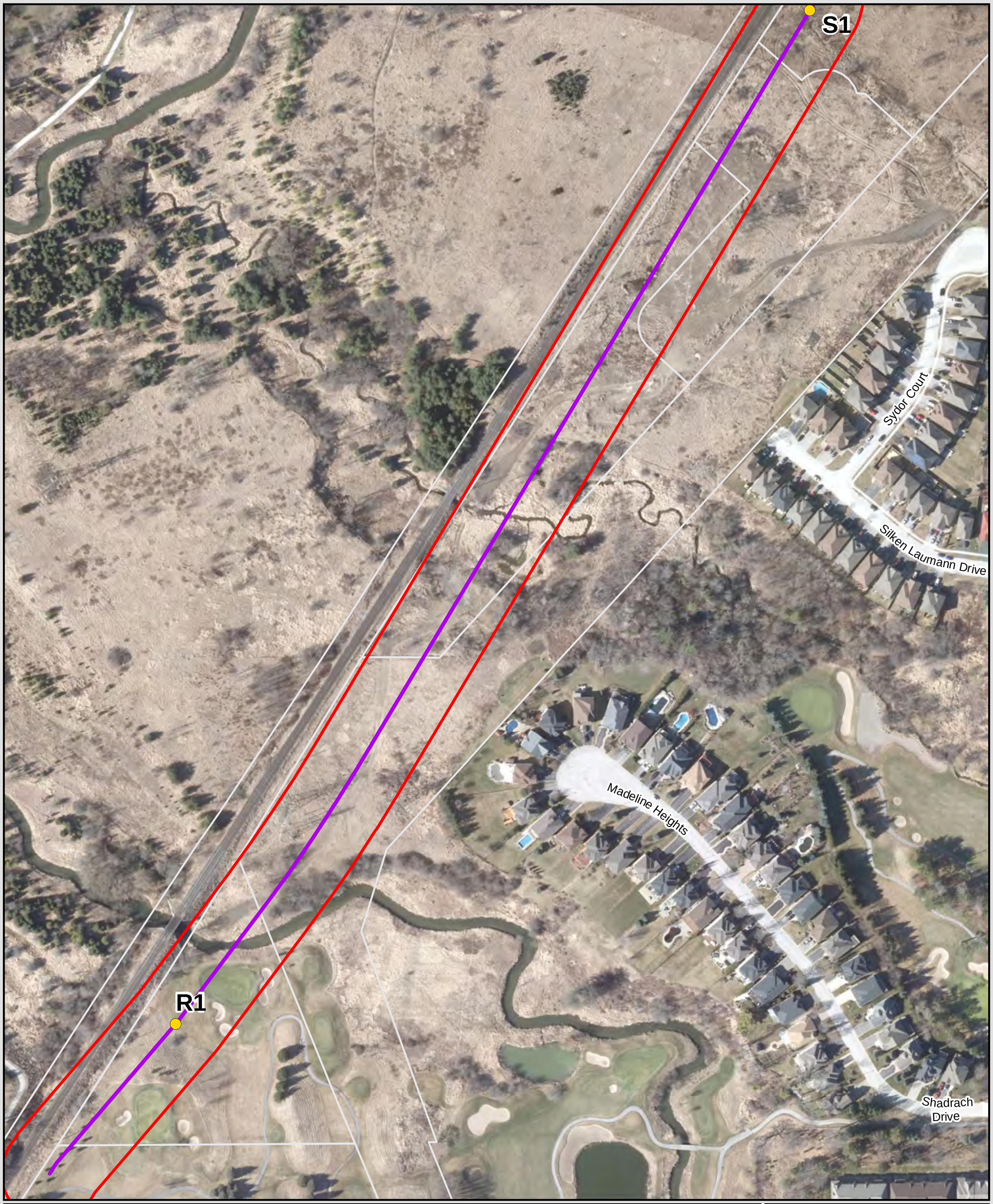
- (S#) Sending Shaft
  (R#) Receiving Shaft
- YDSS Alignment
- Vibration Zone of Influence (30m Radius)
- Parcels 30m from YDSS Alignment

figure 6K

NOISE AND VIBRATION IMPACT ASSESSMENT
30 METRE VIBRATION ZONE OF INFLUENCE RADIUS FROM ALIGNMENT
YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region



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N W E S

0 50 100 Meters

UTM Zone 17N, NAD 83

1:3,500

Legend

- (S#) Sending Shaft
- (R#) Receiving Shaft
- YDSS_Alignment
- Vibration Zone of Influence (30m Radius)
- Parcels 30m from YDSS Alignment

figure 6L

NOISE AND VIBRATION IMPACT ASSESSMENT
30 METRE VIBRATION ZONE OF INFLUENCE RADIUS FROM ALIGNMENT
YDSS MODIFICATIONS

NEWMARKET, ONTARIO
YORK REGION

York Region

APPENDICES

Appendix A
MOECC Noise Pollution Control (NPC) Guideline-115

Appendix B
Noise Modelling Results

Appendix A

Appendix A – MOECC Noise Pollution Control (NPC) Guideline-115

NPC-115 Construction Equipment requirements are detailed by the Ministry of the Environment and Climate Change (MOECC) as follows:

	Excavation Equipment, Dozers, Loaders, Backhoes	Pneumatic Pavement Breakers – Residential / Quiet Zone	Compressors – Residential / Quiet Zone	Tracked Drills – Residential / Quiet Zone
Power Rating < 75 kW	83 dBA	85 dBA	76 dBA / 70 dBA	100 dBA
Power Rating > 75 kW	85 dBA			

The equipment requirement is based on a January 1, 1981, date of manufacturer or later. A power rating is not applicable for pavement breakers, compressors or tracked drills.

Measurements are conducted at a 15 m reference distance and at the rated maximum RPM in accordance with SAE J88a procedures as referenced in NPC-103. Stationary or pass-by tests are appropriate following the procedure below:

3.3.6 - For stationary tests, record the sound level obtained at a distance of 15 m (50 ft) normal to the centers of the four major surfaces of the equipment at the microphone height. Generally, four major surfaces refer to front, rear, and sides of an imaginary box that would just fit over the machine but does not include attachment items such as buckets, dozers, and booms. In the case of a crane or an excavator, the upper (revolving superstructure) fore-and-aft centerline should be in line with the lower fore-and-aft centerline.

3.3.7 - For moving tests, take measurements at a distance of 15m (50ft) measured in a direction normal to a major side surface which is parallel to the machine path.

3.3.8 - The final reported sound level per this SAE Recommended Practice shall be the highest of the reported values obtained in paragraphs 3.3.6 and 3.3.7; the test report shall include the test mode, the machine operating conditions during the reported test mode, the stabilized maximum governed engine speed, the location of the microphone in relation to the construction machine, the surface description over which the machine operated and the sound level measurements were made.

Appendix B

Table B.1

Point-of-Reception Noise Impact Summary
Noise Vibration Impact Assessment
York Region

Name	Send Shaft 1 Worst-Case Residence	Send Shaft 2 Worst-Case Residence	Send Shaft 3 Worst-Case Residence	Send Shaft 4 Worst-Case Residence	Receive Shaft 1 Worst-Case Residence	Receive Shaft 2 Worst-Case Residence	Receive Shaft 3 Worst-Case Residence	Receive Shaft 4 Worst-Case Residence	Receive Shaft 5 Worst-Case Residence	Receive Shaft 6 Worst-Case Residence	Open Cut Area 1 Worst-Case Residence	Open Cut Area 2 Worst-Case Residence
Open Cut Area 1											**67.1**	
Comp Air Compressor											51.7	
Crane											53.8	
Dozer											62.2	
Excavator											58.1	
Generator											57	
Seperation Plant											43.9	
Truck											62.9	
With Proposed Hoarding											**60.8**	
Open Cut Area 2												**80.5**
Comp Air Compressor												59.7
Crane												70.5
Dozer												77.7
Excavator												69.9
Generator												65.5
Seperation Plant												53.1
Truck												74.3
With Proposed Hoarding												**NA**
Send Shaft 1	**59**											
Bentonite Pump	36											
Compressor	50.6											
Crane	51.7											
Generator	52.7											
HP Pump	52.6											
Lighting Genset 1	42.8											
Lighting Genset 2	46.1											
Open Shaft	47.7											
Shredder/Shaker	43											
Forklift Route	43											
With Proposed Hoarding	**58.2**											
Send Shaft 2		**57.8**										
Bentonite Pump		40.4										
Compressor		49										
Crane		52.5										
Generator		49.7										
HP Pump		50.6										
Lighting Genset 1		42.2										
Lighting Genset 2		41.5										
Open Shaft		48.5										
Shredder/Shaker		41.9										
Forklift Route		40.6										
With Proposed Hoarding		**56.5**										

Table B.1

Point-of-Reception Noise Impact Summary
Noise Vibration Impact Assessment
York Region

Name	Send Shaft 1 Worst-Case Residence	Send Shaft 2 Worst-Case Residence	Send Shaft 3 Worst-Case Residence	Send Shaft 4 Worst-Case Residence	Receive Shaft 1 Worst-Case Residence	Receive Shaft 2 Worst-Case Residence	Receive Shaft 3 Worst-Case Residence	Receive Shaft 4 Worst-Case Residence	Receive Shaft 5 Worst-Case Residence	Receive Shaft 6 Worst-Case Residence	Open Cut Area 1 Worst-Case Residence	Open Cut Area 2 Worst-Case Residence
Send Shaft 3			**62.2**									
Bentonite Pump			44.8									
Compressor			52									
Crane			56.9									
Generator			53.9									
HP Pump			54.3									
Lighting Genset 1			48									
Lighting Genset 2			44.7									
Open Shaft			54.6									
Shredder/Shaker			46.9									
Forklift Route			44.9									
With Proposed Hoarding			**61.1**									
Send Shaft 4				**48.2**								
Bentonite Pump				31.8								
Compressor				38.8								
Crane				41.8								
Generator				41.9								
HP Pump				41.1								
Lighting Genset 1				33.7								
Lighting Genset 2				32.8								
Open Shaft				36.3								
Shredder/Shaker				31.9								
Forklift Route				34.2								
With Proposed Hoarding				**47.2**								
Receive Shaft 1					**45.8**							
Crane					45							
Water Pumps					35.7							
Lighting Generator					33.9							
With Proposed Hoarding					**42.3**							
Receive Shaft 2						**61.1**						
Comp. Air Compressor						50.6						
Crane						48.7						
Dozer						59.1						
Shredder/Shaker						42.1						
Water Pump						37.4						
Lighting Generator						38.9						
Open Shaft						48						
Bentonite Pump						41.7						
HP Pump						52.6						
With Proposed Hoarding						**55.9**						
Receive Shaft 3							**63.2**					
Crane							61.4					
Water Pumps							54.7					
Lighting Generator							56.5					
With Proposed Hoarding							**59.6**					

Table B.1

Point-of-Reception Noise Impact Summary
Noise Vibration Impact Assessment
York Region

Name	**Send Shaft 1 Worst-Case Residence**	**Send Shaft 2 Worst-Case Residence**	**Send Shaft 3 Worst-Case Residence**	**Send Shaft 4 Worst-Case Residence**	**Receive Shaft 1 Worst-Case Residence**	**Receive Shaft 2 Worst-Case Residence**	**Receive Shaft 3 Worst-Case Residence**	**Receive Shaft 4 Worst-Case Residence**	**Receive Shaft 5 Worst-Case Residence**	**Receive Shaft 6 Worst-Case Residence**	**Open Cut Area 1 Worst-Case Residence**	**Open Cut Area 2 Worst-Case Residence**
Receive Shaft 4								**54.8**				
Crane								52.9				
Water Pumps								45.9				
Lighting Generator								48.1				
With Proposed Hoarding								**54.1**				
Receive Shaft 5									**60.8**			
Crane									60.1			
Water Pumps									48.2			
Lighting Generator									50.5			
With Proposed Hoarding									**60.6**			
Receive Shaft 6										**52**		
Crane										51.4		
Water Pumps										39.9		
Lighting Generator										41		
With Proposed Hoarding										**52**		

Table B.2

Noise Modelling Impact Summary
Noise Vibration Impact Assessment
York Region

Point of Reception ID	Point of Reception Description	Worst-Case Modelled Impact (dBA)	Background Sound Level (dBA)	Anticipated Exceedance (dBA)
Noise Levels without Hoarding				
Daytime Operations - 7 a.m. to 7 p.m.				
Open Cut Area 1	Open Cut Area 1 Worst-Case Residence	67 (dBA)	50 (dBA)	17
Open Cut Area 2	Open Cut Area 2 Worst-Case Residence	81 (dBA)	50 (dBA)	31
Send Shaft 1	Send Shaft 1 Worst-Case Residence	59 (dBA)	50 (dBA)	9
Send Shaft 2	Send Shaft 2 Worst-Case Residence	58 (dBA)	50 (dBA)	8
Send Shaft 3	Send Shaft 3 Worst-Case Residence	62 (dBA)	50 (dBA)	12
Send Shaft 4	Send Shaft 4 Worst-Case Residence	48 (dBA)	50 (dBA)	-
Receive Shaft 1	Receive Shaft 1 Worst-Case Residence	46 (dBA)	50 (dBA)	-
Receive Shaft 2	Receive Shaft 2 Worst-Case Residence	61 (dBA)	50 (dBA)	11
Receive Shaft 3	Receive Shaft 3 Worst-Case Residence	63 (dBA)	50 (dBA)	13
Receive Shaft 4	Receive Shaft 4 Worst-Case Residence	55 (dBA)	50 (dBA)	5
Receive Shaft 5	Receive Shaft 5 Worst-Case Residence	61 (dBA)	50 (dBA)	11
Receive Shaft 6	Receive Shaft 6 Worst-Case Residence	52 (dBA)	50 (dBA)	2
Nighttime Operations - 7 p.m. to 7 a.m.				
Open Cut Area 1	Open Cut Area 1 Worst-Case Residence	NA	45 (dBA)	NA
Open Cut Area 2	Open Cut Area 2 Worst-Case Residence	NA	45 (dBA)	NA
Send Shaft 1	Send Shaft 1 Worst-Case Residence	59 (dBA)	45 (dBA)	14
Send Shaft 2	Send Shaft 2 Worst-Case Residence	58 (dBA)	45 (dBA)	13
Send Shaft 3	Send Shaft 3 Worst-Case Residence	62 (dBA)	45 (dBA)	17
Send Shaft 4	Send Shaft 4 Worst-Case Residence	48 (dBA)	45 (dBA)	3
Receive Shaft 1	Receive Shaft 1 Worst-Case Residence	46 (dBA)	45 (dBA)	1
Receive Shaft 2	Receive Shaft 2 Worst-Case Residence	61 (dBA)	45 (dBA)	16
Receive Shaft 3	Receive Shaft 3 Worst-Case Residence	63 (dBA)	45 (dBA)	18
Receive Shaft 4	Receive Shaft 4 Worst-Case Residence	55 (dBA)	45 (dBA)	10
Receive Shaft 5	Receive Shaft 5 Worst-Case Residence	61 (dBA)	45 (dBA)	16
Receive Shaft 6	Receive Shaft 6 Worst-Case Residence	52 (dBA)	45 (dBA)	7

Table B.2

Noise Modelling Impact Summary
Noise Vibration Impact Assessment
York Region

Point of Reception ID	Point of Reception Description	Worst-Case Modelled Impact (dBA)	Background Sound Level (dBA)	Anticipated Exceedance (dBA)
Noise Levels with Hoarding				
Daytime Operations - 7 a.m. to 7 p.m.				
Open Cut Area 1	Open Cut Area 1 Worst-Case Residence	61 (dBA)	50 (dBA)	11
Open Cut Area 2	Open Cut Area 2 Worst-Case Residence	81 (dBA)	50 (dBA)	31
Send Shaft 1	Send Shaft 1 Worst-Case Residence	58 (dBA)	50 (dBA)	8
Send Shaft 2	Send Shaft 2 Worst-Case Residence	57 (dBA)	50 (dBA)	7
Send Shaft 3	Send Shaft 3 Worst-Case Residence	61 (dBA)	50 (dBA)	11
Send Shaft 4	Send Shaft 4 Worst-Case Residence	47 (dBA)	50 (dBA)	-
Receive Shaft 1	Receive Shaft 1 Worst-Case Residence	42 (dBA)	50 (dBA)	-
Receive Shaft 2	Receive Shaft 2 Worst-Case Residence	56 (dBA)	50 (dBA)	6
Receive Shaft 3	Receive Shaft 3 Worst-Case Residence	60 (dBA)	50 (dBA)	10
Receive Shaft 4	Receive Shaft 4 Worst-Case Residence	54 (dBA)	50 (dBA)	4
Receive Shaft 5	Receive Shaft 5 Worst-Case Residence	61 (dBA)	50 (dBA)	11
Receive Shaft 6	Receive Shaft 6 Worst-Case Residence	52 (dBA)	50 (dBA)	2
Nighttime Operations - 7 p.m. to 7 a.m.				
Open Cut Area 1	Open Cut Area 1 Worst-Case Residence	NA	45 (dBA)	NA
Open Cut Area 2	Open Cut Area 2 Worst-Case Residence	NA	45 (dBA)	NA
Send Shaft 1	Send Shaft 1 Worst-Case Residence	58 (dBA)	45 (dBA)	13
Send Shaft 2	Send Shaft 2 Worst-Case Residence	57 (dBA)	45 (dBA)	12
Send Shaft 3	Send Shaft 3 Worst-Case Residence	61 (dBA)	45 (dBA)	16
Send Shaft 4	Send Shaft 4 Worst-Case Residence	47 (dBA)	45 (dBA)	2
Receive Shaft 1	Receive Shaft 1 Worst-Case Residence	42 (dBA)	45 (dBA)	-
Receive Shaft 2	Receive Shaft 2 Worst-Case Residence	56 (dBA)	45 (dBA)	11
Receive Shaft 3	Receive Shaft 3 Worst-Case Residence	60 (dBA)	45 (dBA)	15
Receive Shaft 4	Receive Shaft 4 Worst-Case Residence	54 (dBA)	45 (dBA)	9
Receive Shaft 5	Receive Shaft 5 Worst-Case Residence	61 (dBA)	45 (dBA)	16
Receive Shaft 6	Receive Shaft 6 Worst-Case Residence	52 (dBA)	45 (dBA)	7

Note:

(1) Minimum MOECC sound level limits defined in Noise and Vibration Baseline Conditions Report (CRA et al., 2013)