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MEMORANDUM

DATE:	2025-10-10	RWDI Reference No.: 2512374
TO:	Derek Judson	EMAIL: judson@parkin.ca
FROM:	Jordan Gilmour	EMAIL: Jordan.Gilmour@rwdi.com
	Kyle Hellewell	EMAIL: Kyle.Hellewell@rwdi.com
RE:	Noise Design Review Queensway Carlton Hospital Nepean, Ontario	

Dear Derek,

We have completed the environmental noise design review of the Queensway Carlton Hospital's (QCH) renovations and new additions which include a new mechanical/generator room, a new parking garage, a level 1 expansion of the Material Management & E.V.S, a three level addition to the inpatient tower, a three level addition to the transitional care tower and a one level addition to the emergency department. The review was intended to identify where proposed sources may have environmental noise emissions that will cause the overall facility levels to exceed the regulatory maximum levels. This memorandum summarizes all results and recommendations for external sources of noise.

Introduction

Points of Reception

For offsite impacts of stationary source noise, the area around QCH would be characterized per NPC-300 as a Class 1 acoustic environment, as it is typical of a major population centre, where the background sound level is dominated by the activities of people, usually road traffic, often referred to as "urban hum."

Representative points of reception around the proposed development are evaluated. For typical dwellings an outdoor point is assessed at 1.5 m above grade, and the façade is assessed at the bedroom windows: 1.5 m or 4.5 m for 10 or 2-storey dwellings respectively.

It was confirmed by QCH that there are no operable windows on the façades of the hospital buildings and therefore no points of reception have been assessed at the hospital façades. The representative points of reception assessed for this review are shown in **Figure 1**.

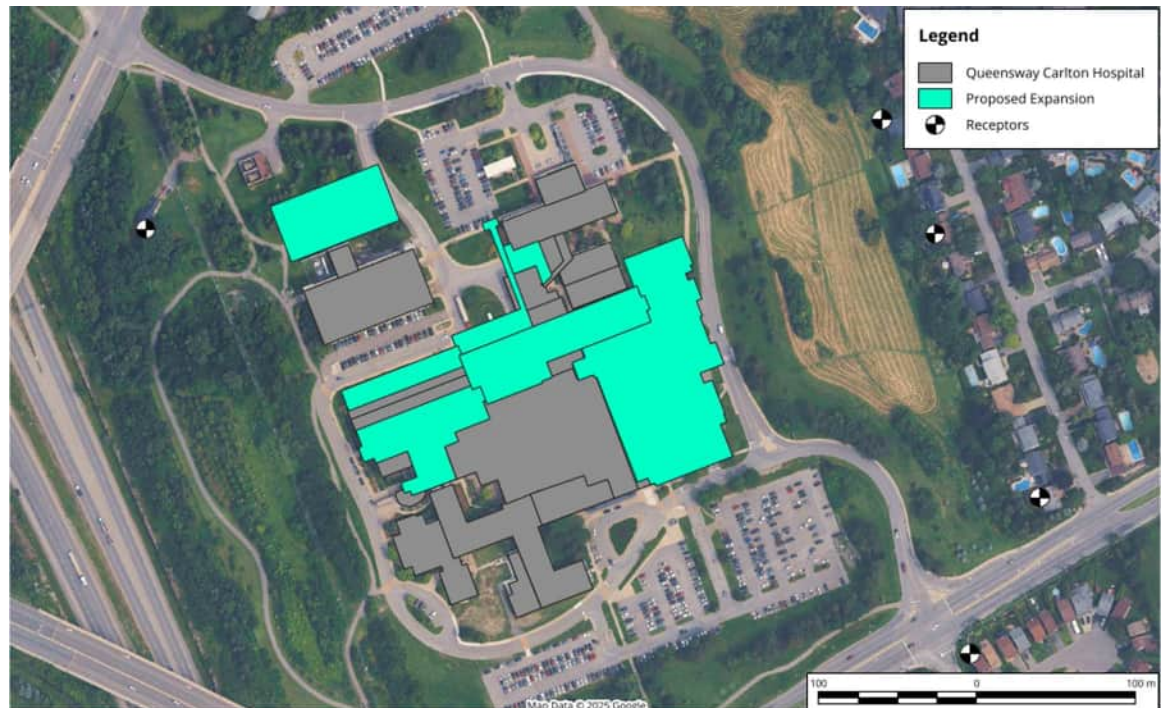


Figure 1: Assessed Point of Reception Locations

Sources of Noise

The QCH renovations and new additions include two mechanical rooms, one on the ground level and one on level 5 of the inpatient tower addition. The ground level mechanical room includes a total of four generators, which exhaust through the roof and contain intake and exhaust airways. Level 5 of the inpatient tower includes a total of three Air Handling Units (AHUs) ducted to exhaust louvers. Additional sources of noise associated with the renovations and new additions are four rooftop AHUs and five Cooling Towers (CT). The mechanical schedule and room layouts are attached in **Appendix A**. No mechanical cutsheets or manufacturer data was provided for the future proposed mechanical units. In the absence of proposed sound levels, maximum allowable sound power levels (PWL) were calculated to comply with Class 1 limits. Further, the PWLs used in this assessment will become the performance specification for the proposed mechanical equipment. Existing noise sources were modelled based on sound levels from the Acoustic Assessment Report published in 2010 by Hugh Williams Associates Inc., which is attached in **Appendix B**.

Rooftop Mechanical Units

Rooftop mechanical units include AHUs and CTs located on the roof of the new mechanical room, Material Management & E.V.S, and the Emergency Department addition. **Table 1** outlines the maximum allowable PWLs that must be emitted.



Table 1: Target Rooftop Mechanical Unit Sound Power Level

Equipment	Target Sound Power Level (dBA)
Cooling Towers	85
Air Handling Units	85
AHU 4A-1 & AHU 4A-2	90

Compared with typical equipment sound levels, the levels presented in **Table 1** are restrictive. It's likely that equipment selections will require low noise equipment, or possibly installation of additional sound attenuation such as silencers, compressor blankets, or low noise fans.

Level 5 Inpatient Tower AHUs

In the level 5 Inpatient Tower mechanical room, AHUs are connected to the building façade through outside air intake (OA) and exhaust air (EA) plenums. Considering typical EA and OA sound levels, it's likely that both outside air intake and exhaust air will require silencers to meet the applicable guidelines and maximum allowable PWL shown in **Table 2**. We anticipate that meeting these requirements may require as large as a 3 foot long silencer. At this point in the design, consideration should be given to leaving space in the mechanical room for this equipment.

Table 2: Target Level 5 AHU Sound Power Level

Equipment	Target Sound Power Level (dBA)
Air Handling Unit Exhaust Air	85
Air Handling Unit Outside Air Intake	85

Generators

The four generators are to be located in the new mechanical room. There are four combustion exhaust stacks which are ducted through to the roof, along with a cooling exhaust and air intake plenum. The maximum allowable PWLs for the combustion exhaust stacks, air intake and cooling exhaust plenums are shown in **Table 3**.



Table 3: Target Generator Sound Power Level

Equipment	Target Sound Power Level (dBA)
Combustion Exhaust	82
Air Intake	80
Cooling Exhaust	80

The maximum allowable PWLs for the combustion exhaust stacks are likely achievable using a “Hospital Plus” grade silencer. The target levels for the air intake and cooling exhaust would require a silencer on these connections, likely in excess of 10 feet in length.

Conclusion

The future renovations and additions at QCH have been considered in the context of sound levels at nearby receptors. The future additions will require the procurement of equipment with specific sound power levels, which are likely to be restrictive. Low sound level models may be available from some manufactures, or the inclusion of silencers may be necessary to ensure the applicable NPC-300 noise limits are met. No sound level data was available for the future mechanical units. It is recommended that a revised study and review be completed once mechanical selections have been made.

If sound levels discussed herein cannot be met, other routes to compliance can be investigated. Given the cumulative nature of the noise assessment, the mitigation of new sources in certain cases can be lessened if compensatory mitigation is made on other new or existing sources.

Once equipment selections are finalized, the facility's Environmental Compliance Approval must be updated, prior to the commissioning and operation of the new equipment.

Yours truly,

Kyle Hellewell, P.Eng.
Technical Director
RWDI

October 10, 2025
Attach.

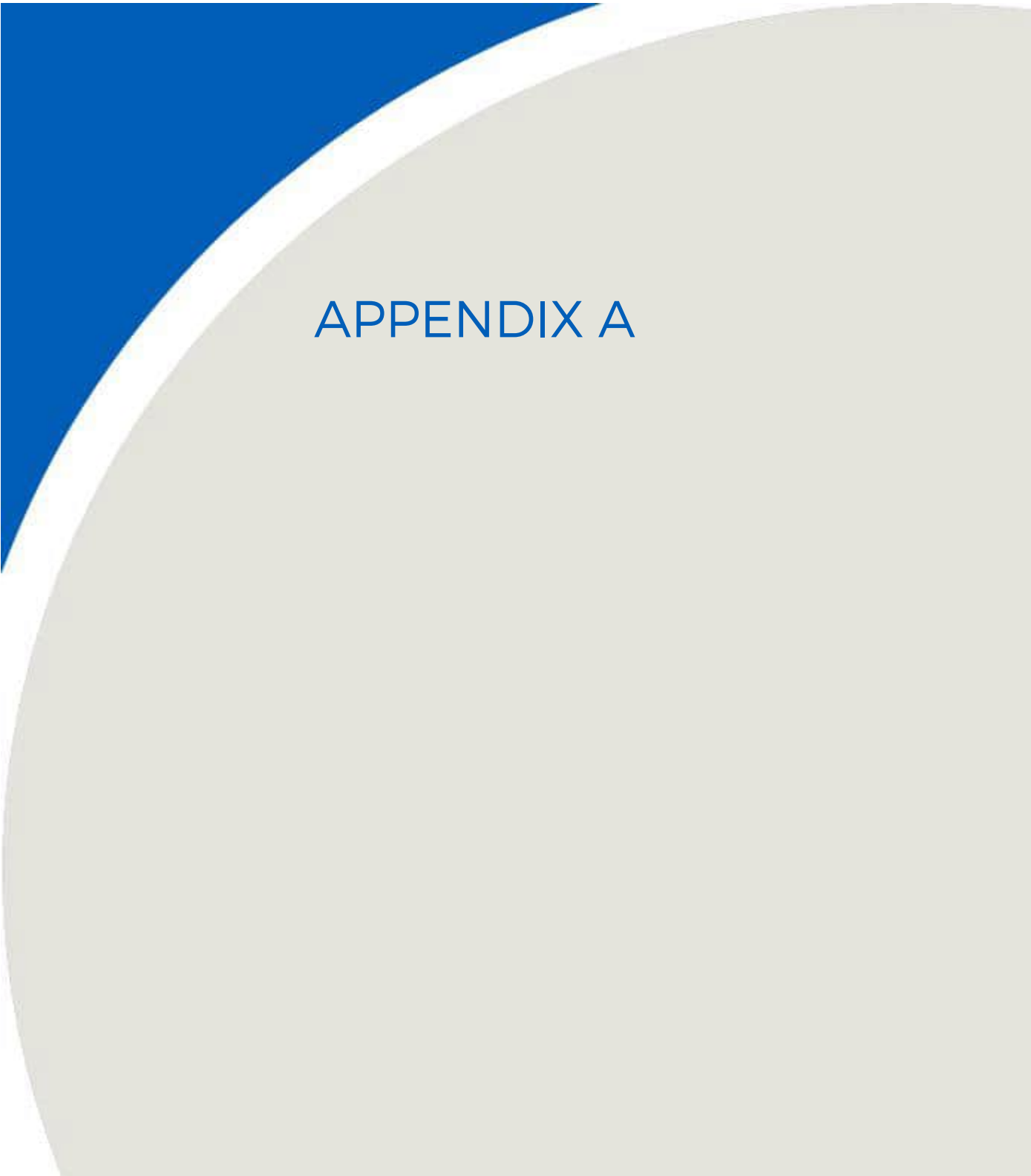


Statement of Limitations

This memorandum entitled Noise Design Review Queensway Carlton Hospital and dated October 9, 2025, was prepared by Rowan Williams Davis Irwin ("RWDI") for Queensway Carleton Hospital ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final stages of the project to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein to understand the different factors which may impact the conclusions and recommendations provided.

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APPENDIX A

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GENERAL STANDPIPE NOTES

1. DESIGN, CONSTRUCTION, INSTALLATION AND TESTING OF THE SYSTEM SHALL BE IN CONFORMANCE WITH NFPA 14, INSTALLATION OF STANDPIPE AND HOSE SYSTEMS; AND NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 13, INSTALLATION OF AUTOMATIC SPRINKLER SYSTEMS.
2. FOLLOW REQUIREMENTS OF OCCUPATIONAL HEALTH AND SAFETY ACT, O.C. 2019/13 - CONSTRUCTION PROJECTS, FIRE SAFETY SECTION.
A. THE SYSTEM SHALL BE A TWO OR MORE HOSE CONNECTIONS OR TEMPORARY STANDPIPE SHALL BE INSTALLED TO WITHIN TWO FEET OF THE UPPEMOST WORK LEVEL.
3. INSULATE STANDPIPE MAN FROM TAKE OFF FROM DOMESTIC WATER TO A POINT APPROXIMATELY 4 FEET ABOVE THE FIRST ELECTRICALLY SUPERVISED WATER VALVE.
4. STANDPIPE SYSTEM PIPING SHALL BE PROTECTED FROM MECHANICAL DAMAGE. STANDPIPES SHOULD NOT BE PLACED IN UNPROTECTED AREAS OF COMBUSTIBLE CONSTRUCTION.
5. FEED MAIN, THE PORTION OF A STANDPIPE SYSTEM THAT SUPPLIES WATER TO ONE OR MORE STANDPIPES.
A. THE FEED MAIN, THE HORIZONTAL PORTION OF THE SYSTEM PIPING THAT DELIVERS THE WATER SUPPLY FOR TWO OR MORE HOSE CONNECTIONS, AND FOR SPRINKLERS ON ONE OR MORE FLOORS.
B. BRANCH LINE, A PIPING SYSTEM, GENERALLY IN A HORIZONTAL PLANE, CONNECTING NOT MORE THAN ONE HOSE CONNECTION WITH A FEED MAIN.
C. STANDPIPE RISER PIPING IS A SYSTEM PIPING THAT DELIVERS THE WATER SUPPLY FOR HOSE CONNECTIONS, VERTICALLY FROM FLOOR TO FLOOR, INCLUDING HORIZONTAL "CROSS" PORTIONS.
6. NAIL, BALLS, SPRINKLER, OR UNSPRINKLED, STANDPIPE SYSTEM RISER PIPING SHALL BE PROTECTED WITH A MINIMUM OF 1/2" THICK, NON-FLAMMABLE INSULATION. VERTICAL SERVICE SPACE SHALL BE SEPARATED FROM THE ADJACENT FLOOR AREA BY A MINIMUM OF 1/2" THICK, NON-FLAMMABLE INSULATION. STANDPIPE RISER PIPING TO HAVE A MIN 1 HOUR FIRE-RESISTANCE RATING.
A. WITH 1.5 HOUR FIRE-RESISTANCE RATING, THE FIRE-RESISTANCE RATING VERTICAL SERVICE SPACE SHALL BE PROTECTED WITH A MINIMUM OF 1/2" THICK, NON-FLAMMABLE INSULATION. STANDPIPE RISER PIPING SHALL HAVE A MINIMUM OF 1 HOUR FIRE-RESISTANCE RATING ON THE OUTSIDE OF THE RISER.
7. STANDPIPE RISER PIPING LOCATED OUTSIDE OF FIRE-RATED VERTICAL SERVICE SPACE SHALL REQUIRE PROTECTION IN FORM OF RATED FIRE WRAP DESIGNED AND LISTED SPECIFICALLY FOR PROTECTING FIRE-RATED RISER PIPING.
A. FIRE WRAP FIRE-RATED TO WITH MINIMUM REQUIREMENTS ALLOWED FOR VERTICAL SERVICE SPACE SHALL MATCH WITH ROOM ASSEMBLY.
8. FIRE WRAP SHALL CLIMB, OR BE EQUAL, MATERIAL, AND BE INSTALLED TO COVER THE ENTIRE RISER PIPING INSTRUCTIONS TO PROTECT FIREWRAP AGING, CLUSTING, CORROSION, AND INSTALLATION OF STANDPIPE PIPING TO FIRE WRAP TO PREVENT INTERFERENCE WITH CONNECTIONS.
9. FEED MAINS, HORIZONTAL STANDPIPES, AND BRANCHLINES SUPPLIED BY STANDPIPES DESIGNED MULTIPLE, UNSPRINKLED BUILDINGS SHALL BE PROTECTED BY A DESIGNATED FIRE-RESISTANCE EQUAL TO THAT REQUIRED FOR ENCLOSURE EXITS ANYWHERE IN THE BUILDING IN WHICH THEY ARE LOCATED.
10. BUILDINGS EQUIPPED WITH AN APPROVED AUTOMATIC SPRINKLER SYSTEM, FEED MAINS, HORIZONTAL STANDPIPES, AND BRANCHLINES SHALL NOT BE REQUIRED TO BE PROTECTED BY A DESIGNATED FIRE-RESISTANCE EQUAL TO THAT REQUIRED FOR ENCLOSURE EXITS ANYWHERE IN THE BUILDING IN WHICH THEY ARE LOCATED.
11. PIPING CONNECTING STANDPIPES TO 1-1/2 IN. OR SMALLER CONNECTIONS SHALL NOT BE REQUIRED TO BE PROTECTED.

NATURAL GAS NOTES

1. CONFORM TO THE LATEST EDITION OF CSA B149:1 Natural Gas and Propane Installation Code.

2. PIPING OR TUBING SHALL NOT BE SUPPORTED BY OTHER PIPING OR TUBING, AND SHALL BE INSTALLED WITH INDIVIDUAL SUPPORTS OF SUFFICIENT STRENGTH AND QUALITY.

3. SUPPORTS SHALL BE SPACED IN ACCORDANCE WITH TABLE BELOW

ORIENTATION	PIPE SIZING	MAX. SPACING OF SUPPORTS
HORIZONTAL	1/2" (15MM) OR LESS	6 FT (2 M)
	3/4" (1 1/2" (20-25MM)	8 FT (2.5 M)
	1" (25-30MM)	10 FT (3 M)
	1 1/2" (38-50MM)	15 FT (4.5 M)
	2" (50-60MM)	20 FT (6 M)
HORIZONTAL OR TUBING	3" (75-90MM) OR LARGER	25 FT (8 M)
	ALL SIZES	EVERY FLOOR BUT NOT MORE THAN 100% OF HORIZONTAL SPACING
VERTICAL & HORIZONTAL	TUBING (ALL SIZES)	6 FT (2 M)

4. PIPING OR TUBING MAY BE SUPPORTED WITH TREATED WOOD BLOCKS OR MATERIAL HAVING AT LEAST EQUIVALENT CHARACTERISTICS AS WOOD BLOCKS AND PROTECTION AGAINST OIL OR DISCOLORATION.

5. THE ROOF SUPPORT SPACING FOR PIPING SHALL: 1" (25mm) AND GREATER SHALL COMPLY WITH TABLE ABOVE AND SUPPORT SHALL BE PROVIDED FOR EVERY TIRAZED TIGHTING.

6. ROOF TYPING SHALL LESS THAN 1" (25mm) AND ALL TUBING SHALL BE SUPPORTED WITH TREATED WOOD BLOCKS OR MATERIAL HAVING AT LEAST EQUIVALENT CHARACTERISTICS AS WOOD BLOCKS AND PROTECTION AGAINST OIL OR DISCOLORATION.

7. PLUMBING SHALL BE SUPPORTED CONTINUOUSLY WITH TREATED WOOD BLOCKS AND PLUMBING IS LAD ON ROOF.

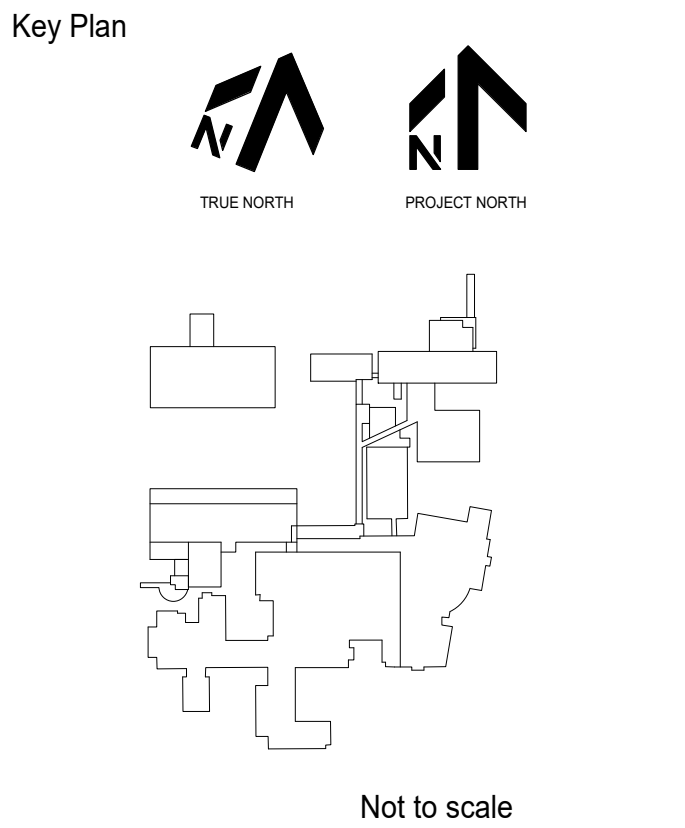
8. PIPING OR TUBING THAT CANNOT BE SUPPORTED BY GAS PIPING IS NOT ALLOWED. BARE STEEL, PRIMER, AND FITTINGS SHALL BE CLEANED AFTER ASSEMBLY, PAINTED WITH A METAL PRIMER, AND GIVEN AT LEAST ONE COAT OF EXTERIOR ENAMEL PAINT.

9. NEARS FOR TIGHTENING OF PIPING AND FITTINGS SHALL BE PROVIDED. EXPANSION COUPLERS SHOULD BE USED ON PIPES SIZES OF 2" (50mm) OR LARGER. WHENEVER THE UNITS SUPPORTED PIPE LENGTHS AT LEAST 10' (3 M), INSTALL LARGE DIAMETER PIPING WITH EXPANSION JOINTS.

10. THE CONTROL LOOP CONSISTS OF OFF SETS TO THE MAIN PIPE RUN AND IT PROVIDES AN OPENED BOLD CONNECTION. PIPE SUPPORTS TO PREVENT THE FREE MOVEMENT OF PIPE INVERT DURING SPANDED AND CONTRACTS

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MECHANICAL DRAWING LIST	
M030	Mechanical Shop Exting
M031	Mechanical Shop Plan Complete
M032	Mechanical Shop Production Schematic
M041	Mechanical Material Gauge Schematic - West
M042	Mechanical Material Gauge Schematic - East
M043	Mechanical Domestic Water Schematic
M044	Mechanical Chilled Water Schematic
M011	Mechanical Floor Plan - Level 1 - EVS Shanty Lane
M012	Mechanical Floor Plan - Level 1 - Temporary Loading Dock
M013	Mechanical Floor Plan - Level 1 - EVS & Materials Management
M014	Mechanical Floor Plan - Level 1 - Floor Finish
M015	Mechanical Floor Plan - Level 1 - Generators Room
M016	Mechanical Floor Plan - Level 1 - Generators Room Roof
M017	Mechanical Floor Plan - Level 1 - MM Roof
M022	Mechanical Floor Plan - Level 2 - Entry Deck, Part 1
M023	Mechanical Floor Plan - Level 2 - Entry Deck, Part 2, Case
M024	Mechanical Floor Plan - Level 2 - Ambulatory Care
M025	Mechanical Floor Plan - Level 2 - Emergency Room
M026	Mechanical Floor Plan - Level 2 - Mechanical Room
M027	Mechanical Floor Plan - Level 2 - Inpatient Tower
M028	Mechanical Floor Plan - Level 2 - Inpatient Tower
M029	Mechanical Floor Plan - Level 2 - Inpatient Tower



2	ISSUED FOR MOH 2.1 RE-SUBMISSION	25/07/2005
1	ISSUED FOR MOH 2.1 SUBMISSION	28/02/2005
NO.	ISSUED	DATE

All measurements are to be checked and verified on site by the contractor before proceeding with work

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Project No: 9915-96
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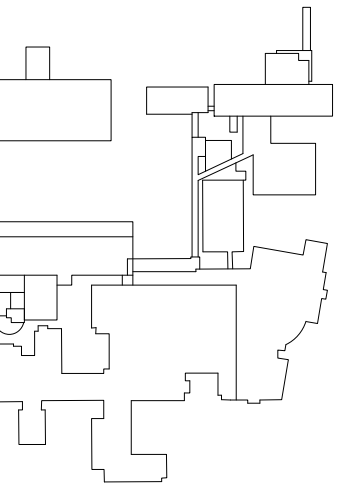
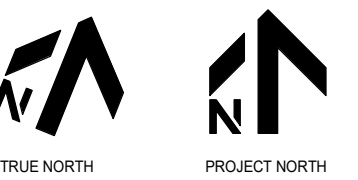
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Sheet
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**Mechanical Drawing List
And Notes**

Drawing
No. **M000**

Queensway Carleton Hospital - Part 4 Expansion

Key Plan



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2	ISSUED FOR MOH 2.1 RE-SUBMISSION	25/07/2021
1	ISSUED FOR MOH 2.1 SUBMISSION	28/03/2021
NO.	ISSUED	DATE

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Project No: 9915-96
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Existing

Drawing
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M030

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Project No: 9915-96
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Drawing
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M031

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Issues

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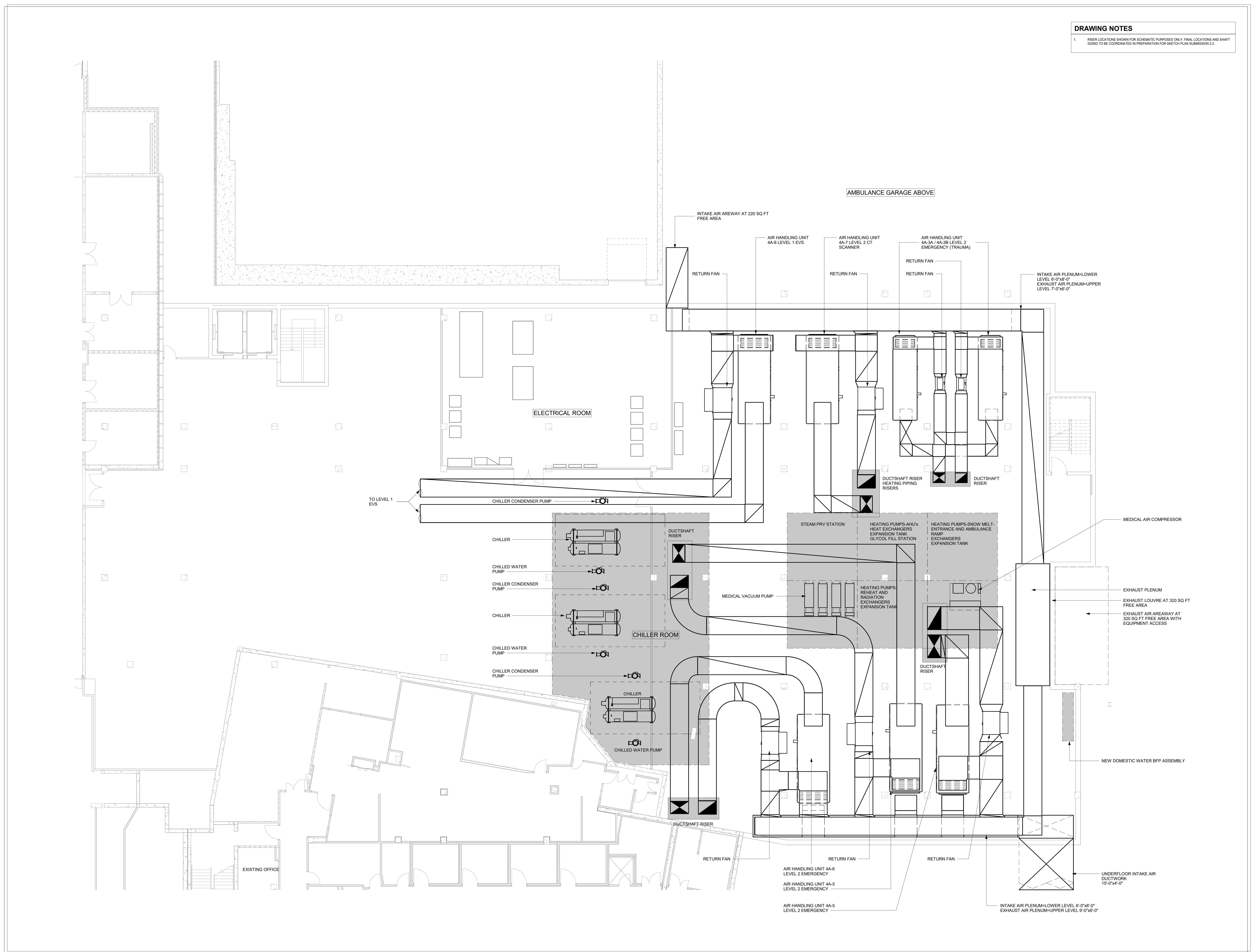
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Level 1 - EVS Shelled-In
Space

Drawing

No.
M211



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Issues

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Project No: 9915-96

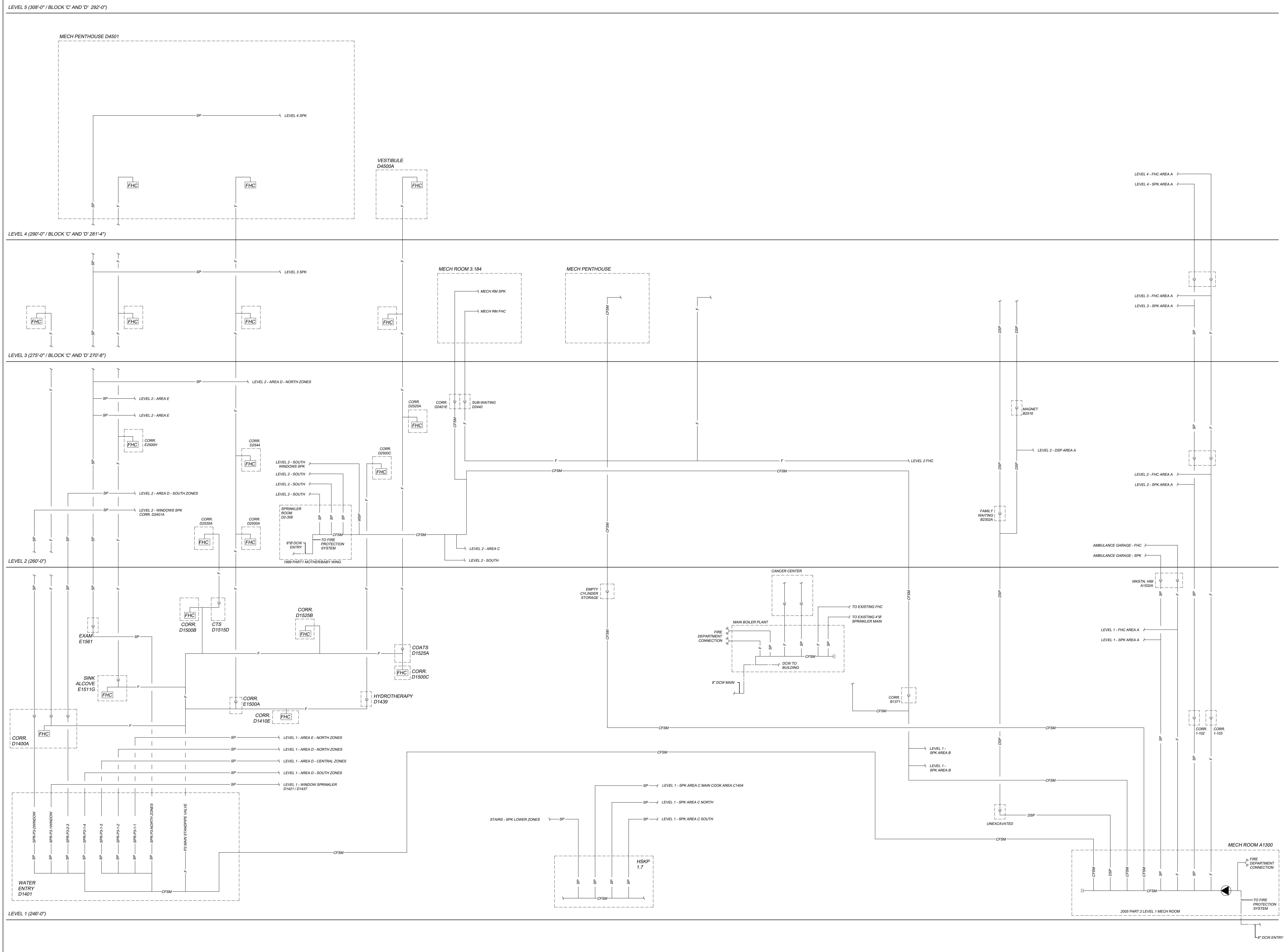
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Mechanical Fire Protection Schematic

Drawing No.

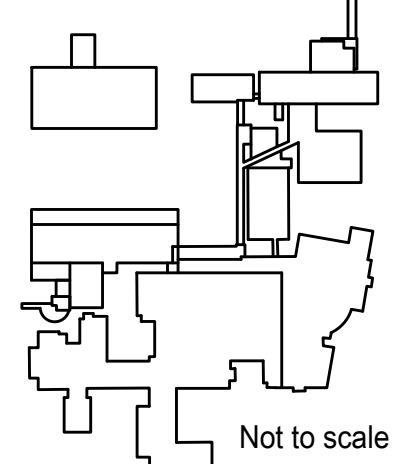
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Queensway Carleton Hospital - Part 4a Expansion

Key Plan



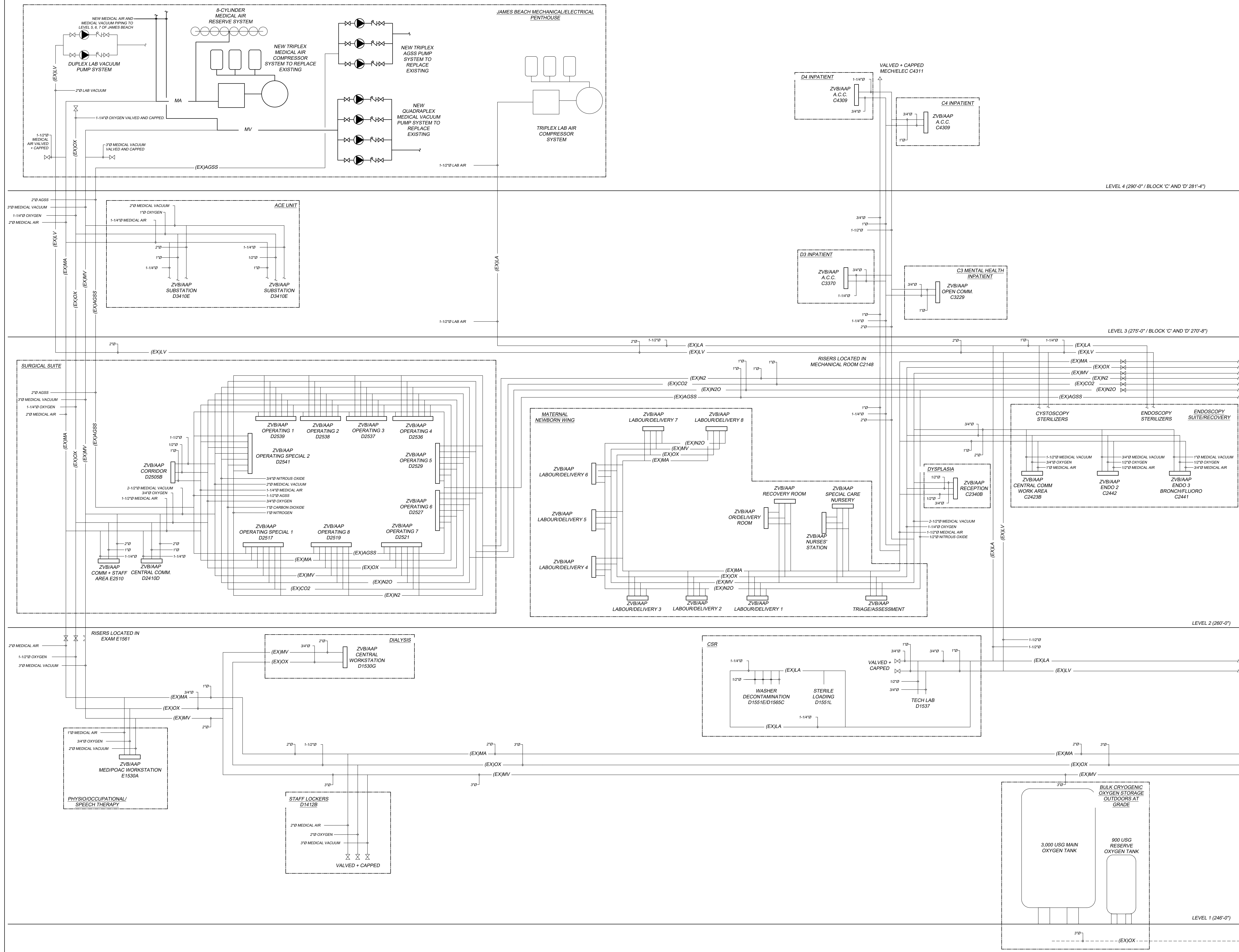
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LEVEL 4 (290'-0" / BLOCK 'C' AND 'D' 281'-4")

LEVEL 3 (275'-0" / BLOCK 'C' AND 'D' 270'-8")

LEVEL 2 (260'-0")

LEVEL 1 (246'-0")



1	ISSUED FOR MOH 2.1 RE-SUBMISSION	25/07/2020
2	ISSUED FOR MOH 2.1 SUBMISSION	28/02/2020
NO.	ISSUED	DATE

Issues

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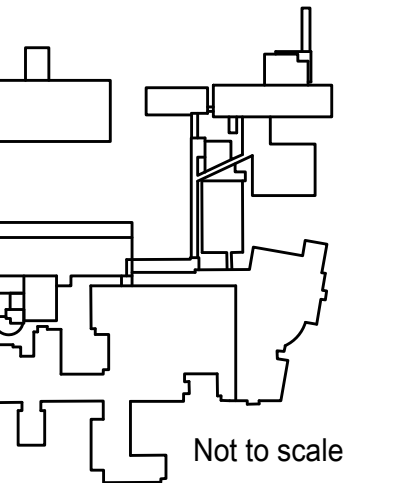
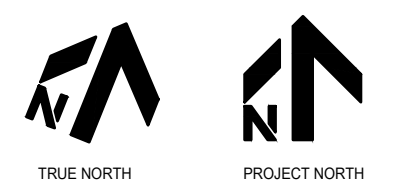
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Mechanical Medical Gas Schematic - West

Drawing No.

M041

Key Plan

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Issues

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Project No: 9915-96

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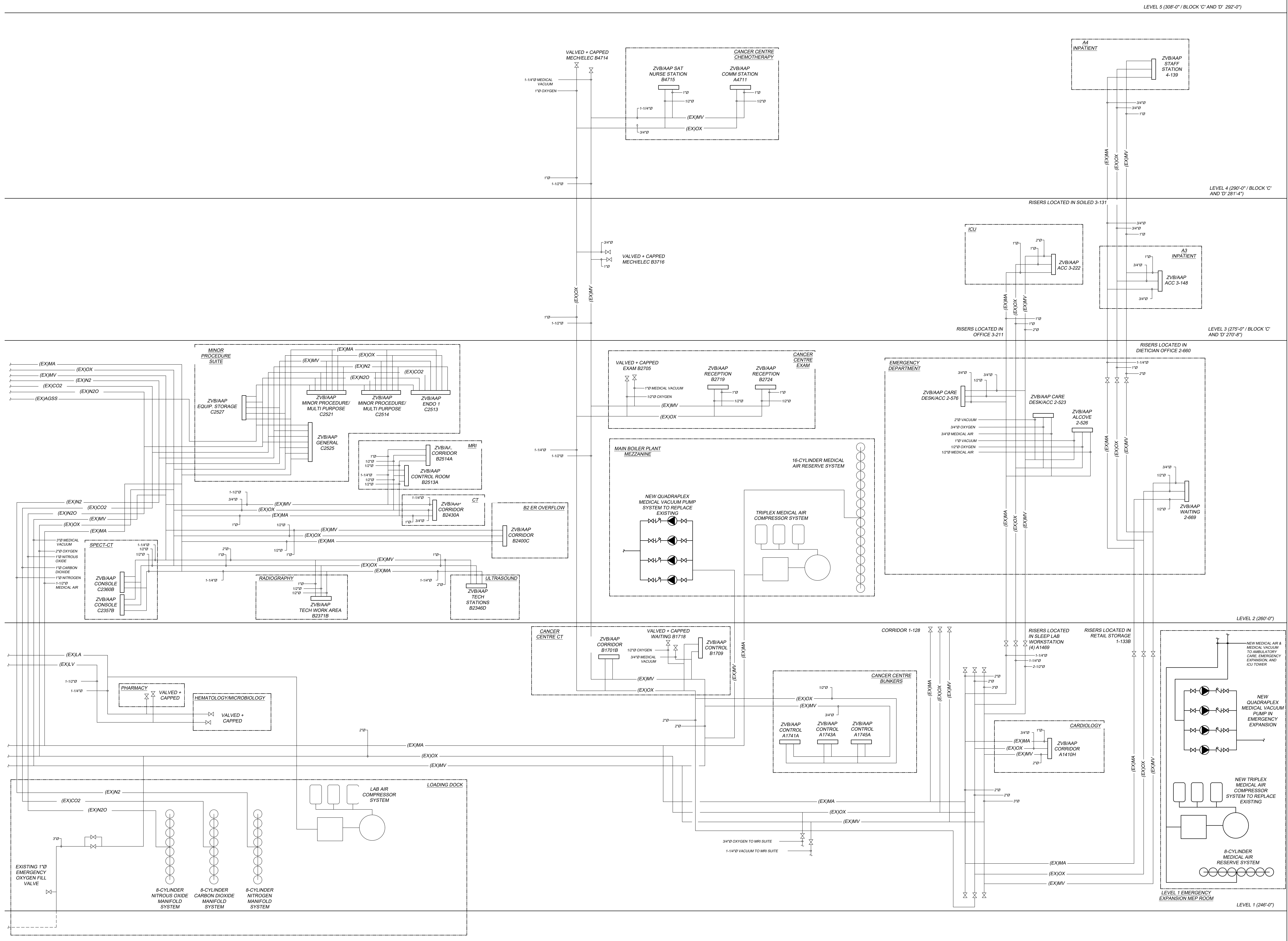


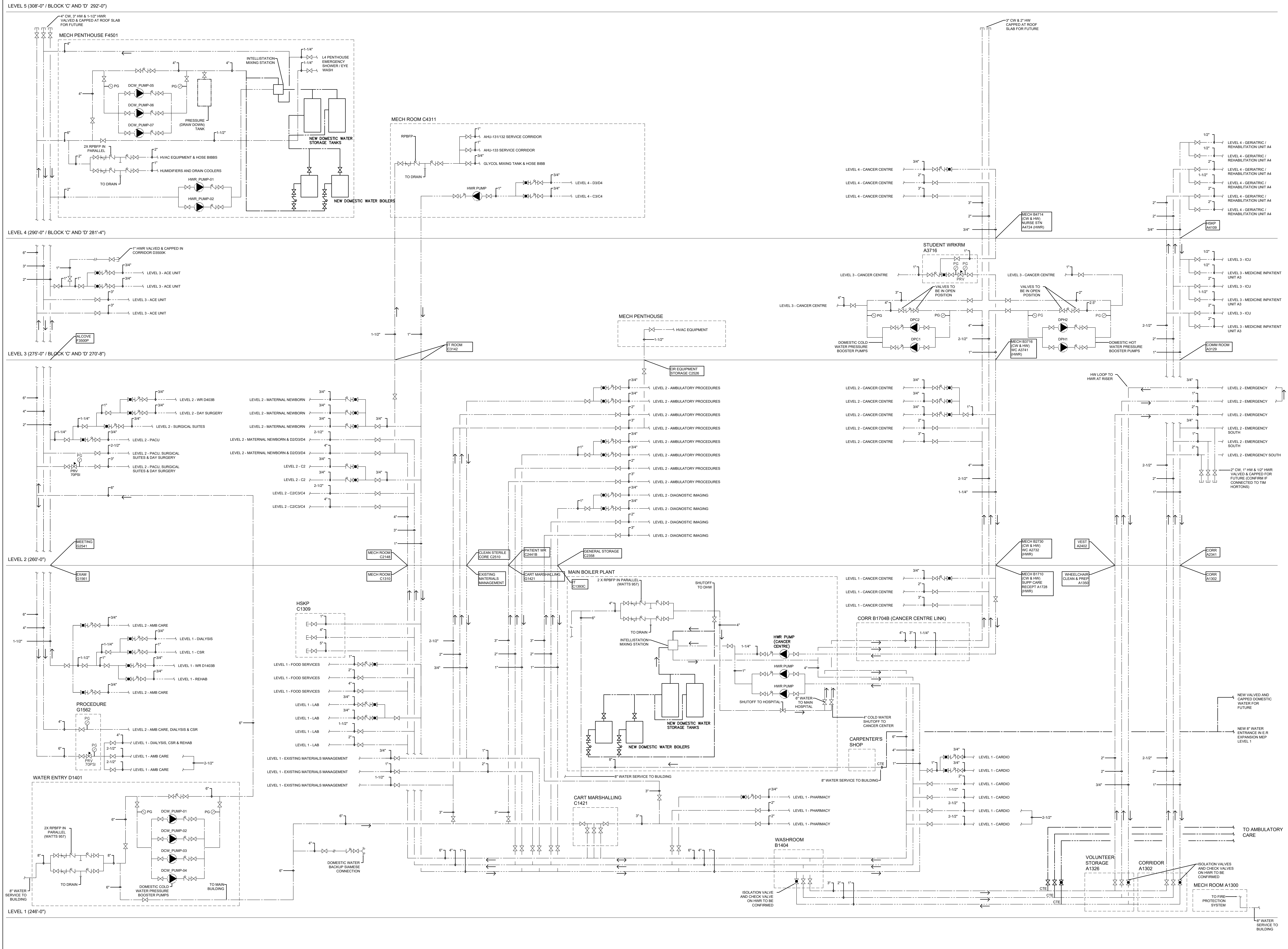
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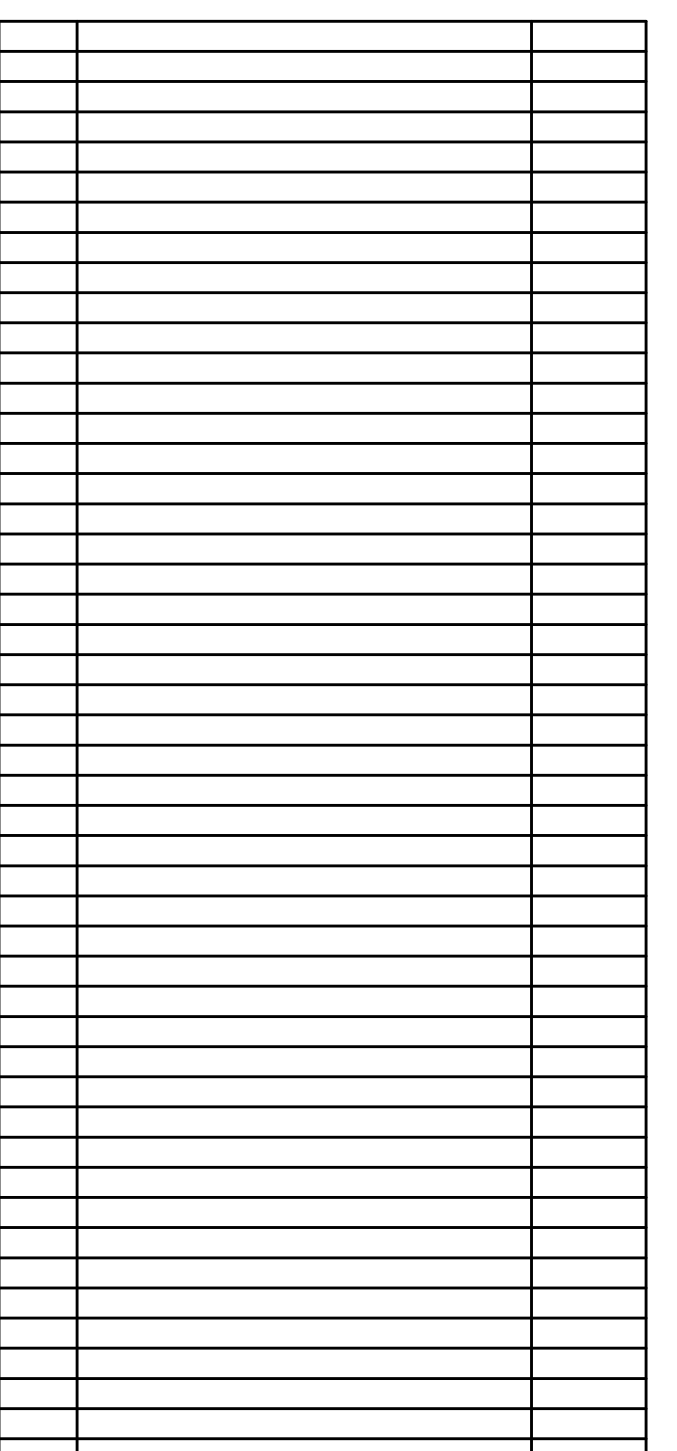
Mechanical Medical
Gas Schematic -
East

Drawing No.

M042



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1	ISSUED FOR MOH 2.1 SUBMISSION	28/02/2025
NO.	ISSUED	DATE

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Project No: 9915-96

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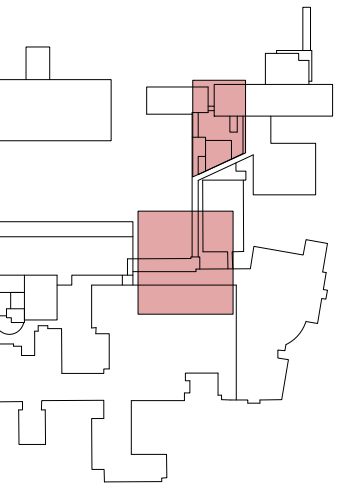
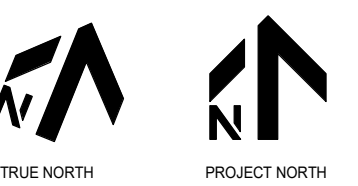
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Sheet Title:

Mechanical Chilled
Water Schematic

Drawing No.

M044



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Project No: 9915-96
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Level 1 - Temporary
Loading Dock

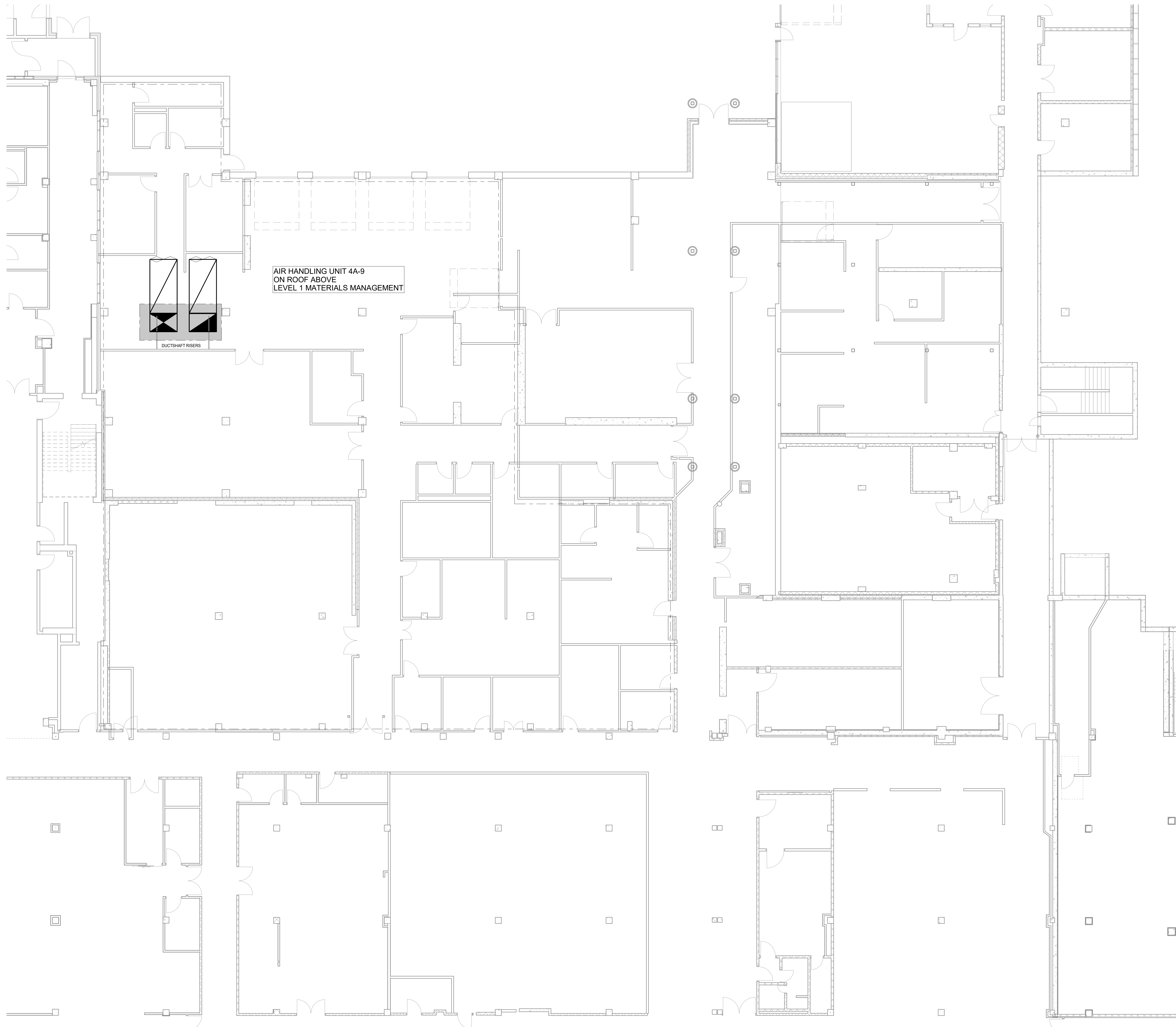
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M212

DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.

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DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.

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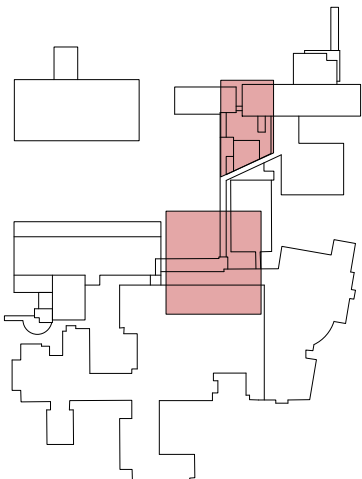
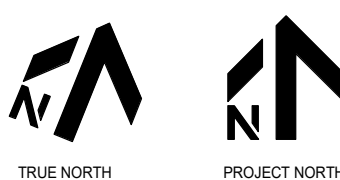
Parkin Architects Limited
20 JAMES STREET, SUITE 200, OTTAWA, CANADA, K2P 0T6 615-739-7700



Queensway Carleton
Hospital

Queensway Carleton
Hospital - Part 4
Expansion

Key Plan



Not to scale

NO.	ISSUED FOR	DATE
2	ISSUED FOR MCH 2.1 RE-SUBMISSION	25/07/2025
1	ISSUED FOR MCH 2.1 SUBMISSION	26/03/2025

Issues

All measurements are to be checked and verified on site by the contractor before proceeding with work.

Do not scale drawings

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Original Issue Date: Issue Date
Project No: 9915-96
Scale: 1 : 100

Consultants:



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Sheet

Title:

Mechanical Floor Plan -
Level 1 -EVS & Materials
Management

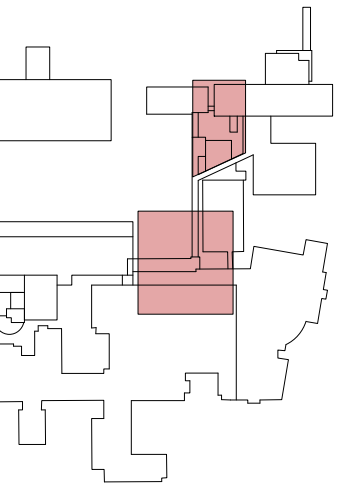
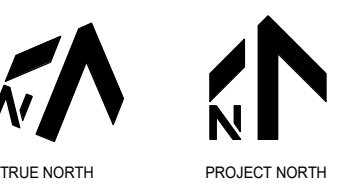
Drawing

No.

M213

1 NEW MECHANICAL PLAN, LEVEL1, ENVIROMENTAL SERVICES & MATERIALS MANAGEMENT

1 : 100



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Issues

All measurements are to be checked and verified on site by the contractor before proceeding with work

Do not scale drawings

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Original Issue Date: Issue Date
Project No: 9915-96
Scale: 1 : 100

Consultants:



Sheet

Title: Mechanical Floor Plan -
Level 1 - Food Services

Drawing
No. _____

M214

DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT

PROVIDE UPDATES TO HEATING, VENTILATION AND AIR CONDITIONING AS REQUIRED FOR FOOD SERVICE RENOVATION.
REPLACEMENT AND UPGRADES TO EXISTING AIR HANDLING UNIT AND ASSOCIATED EXHAUST SYSTEMS.

MAKEUP AIR UNIT
FOOD SERVICES



Queensway Carleton
Hospital - Part 4
Expansion

Key Plan

Not to scale

2	ISSUED FOR MCH 2.1 RE-SUBMISSION	25/07/2025
1	ISSUED FOR MCH 2.1 SUBMISSION	28/03/2025
NO.	ISSUED	DATE

Issues

All measurements are to be checked and verified on site by the contractor before proceeding with work.

Do not scale drawings

Drawn by: AS
Checked by: IF
Original Issue Date: Issue Date
Project No: 9915-96
Scale: 1 : 100

Consultants:

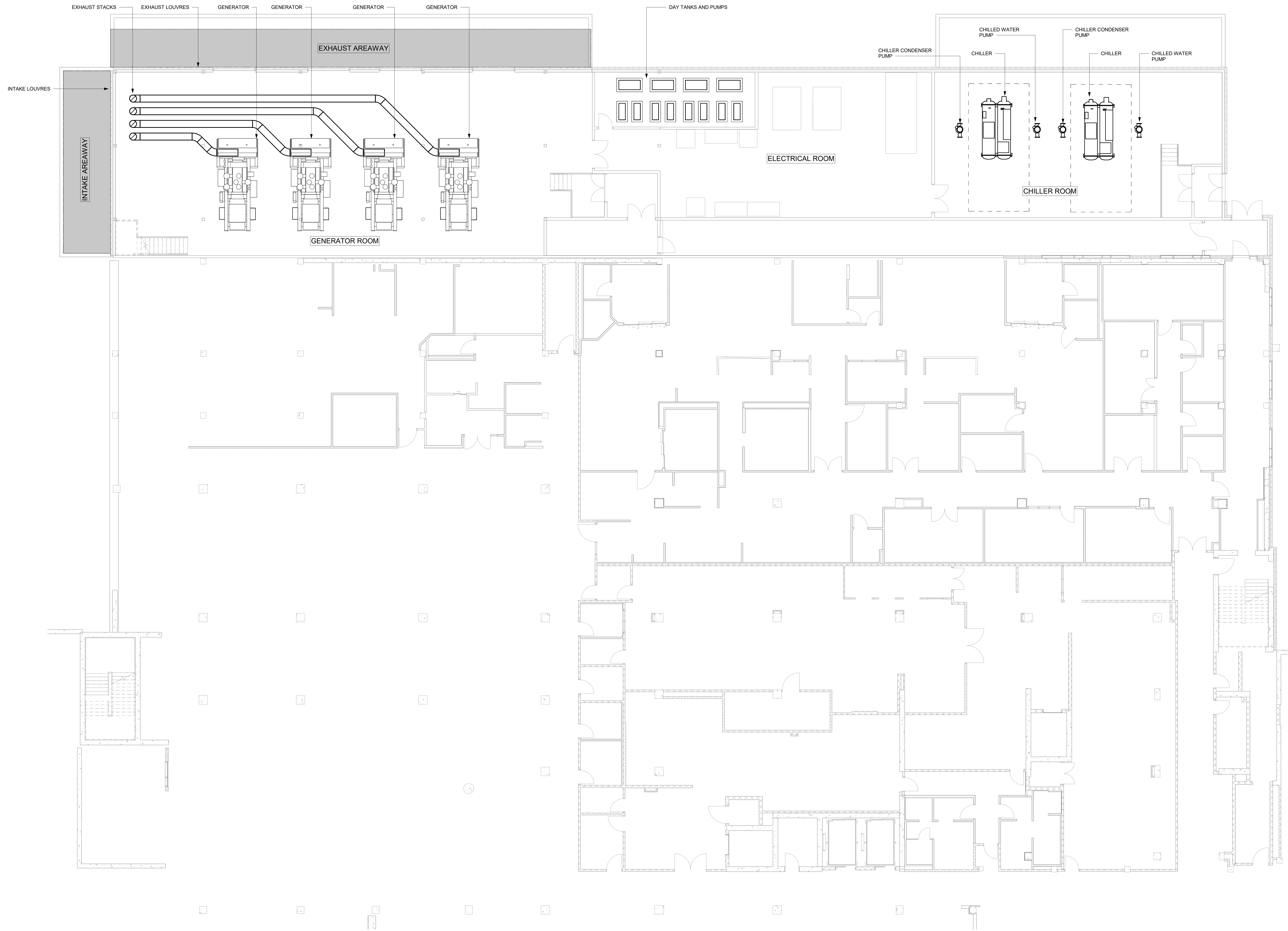
VR
ENGINEERING FORWARD
Vanderweil & Rutherford Associates Inc.
Mechanical & Electrical Engineers
London, Ontario
www.vreng.ca | 613-563-2100

Sheet
Title:
Mechanical Floor Plan -
Level 1 - Generators Room

Drawing
No.
M215

DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.



1 NEW MECHANICAL PLAN, LEVEL 1, GENERATOR ROOM
1 : 100

[illegible]

ssues

All measurements are to be checked and verified on site by the contractor before proceeding with work

Do not scale drawings
 Drawn by: AS
 Checked by: IF
 Original Issue Date: Issue Date
 Project No: 9915-96
 Scale: 1 : 100

Consultants:

VR
ENGINEERING FORWARD
Vanderweyten & Rutherford Associates Inc.
Mechanical & Electrical Engineers
London • Ottawa
www.vreng.ca | 613-563-2100

Sheet
Title:
Mechanical Floor Plan -
Level 1 - Generators Room
Roof

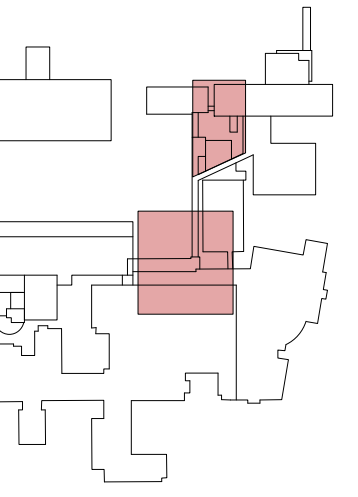
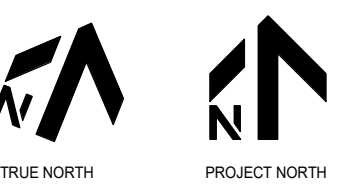
Drawing
No. **M216**

DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.

1 NEW MECHANICAL FLOOR PLAN, LEVEL 2, GENERATOR ROOM ROOF

1 : 100



not to scale

[illegible]

Issues

All measurements are to be checked and verified on site by the contractor before proceeding with work

Do not scale drawings

Drawn by: AS
Checked by: IF
Original Issue Date: Issue Date
Project No: 9915-96
Scale: 1 : 100

Consultants:



Sheet

Title:

Mechanical Floor Plan - Level 2 - MM Roof

Drawing

No.

M221

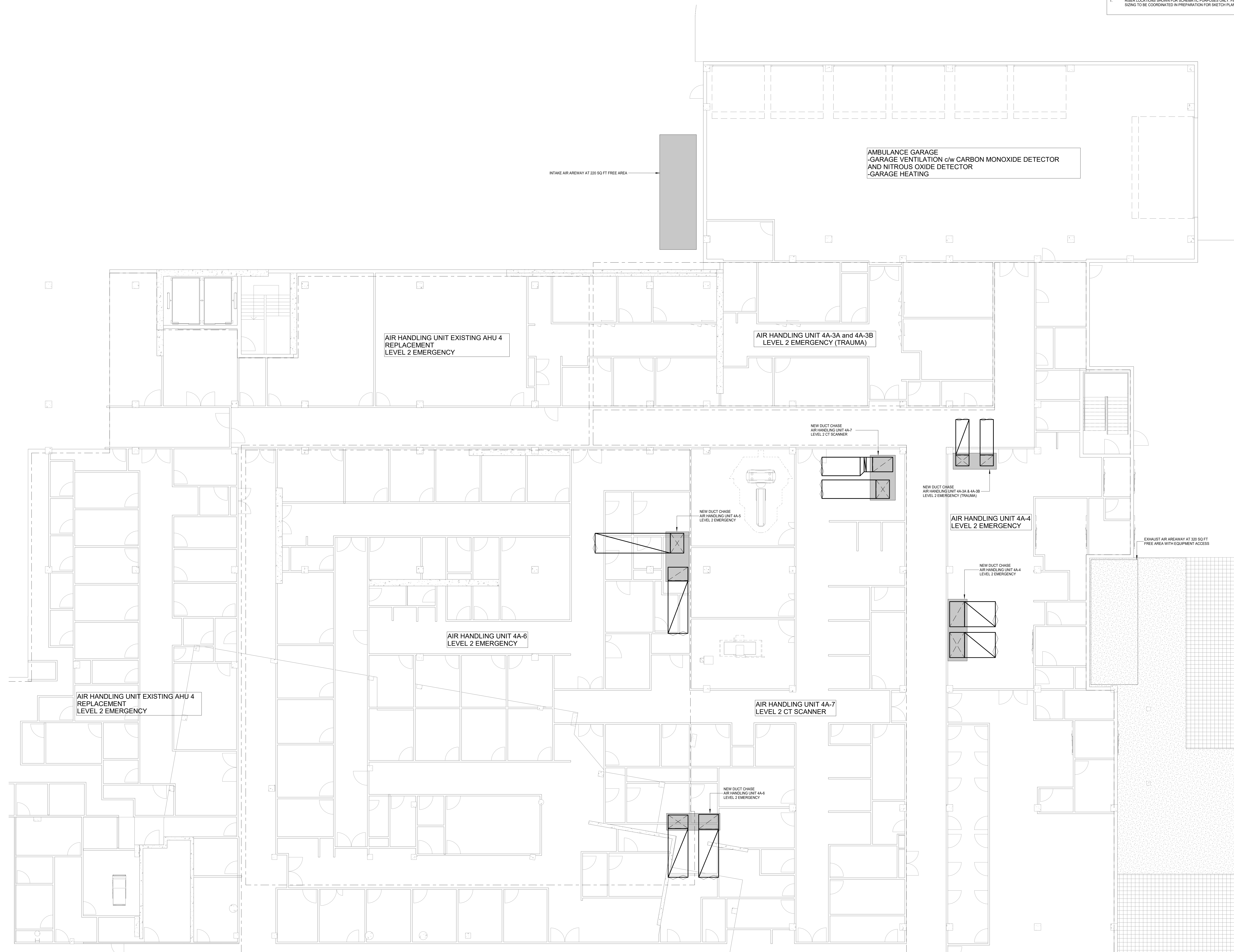
DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.

ROOFTOP UNIT 4A-9
LEVEL 1 MATERIALS MANAGEMENT

DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.



2	ISSUED FOR MCH 2.1 RE-SUBMISSION	25/07/2025
1	ISSUED FOR MCH 2.1 SUBMISSION	28/03/2025
NO.	ISSUED	DATE

Issues

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Do not scale drawings
 Drawn by: AS
 Checked by: IF
 Original Issue Date: Issue Date
 Project No: 9915-96
 Scale: 1 : 100

Consultants:

VR
 ENGINEERING FORWARD
 Vanderveen & Rutherford Associates Inc.
 Mechanical & Electrical Engineers
 LONDON - OTTAWA
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Sheet
 Title:
 Mechanical Floor Plan -
 Level 2 - Emergency Dept.,
 Part 1

Drawing
 No.
M222

DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.

2	ISSUED FOR MCH 2.1 RE-SUBMISSION	25/07/2025
1	ISSUED FOR MCH 2.1 SUBMISSION	28/03/2025
NO.	ISSUED	DATE

Issues

All measurements are to be checked and verified on site by the contractor before proceeding with work.

Do not scale drawings

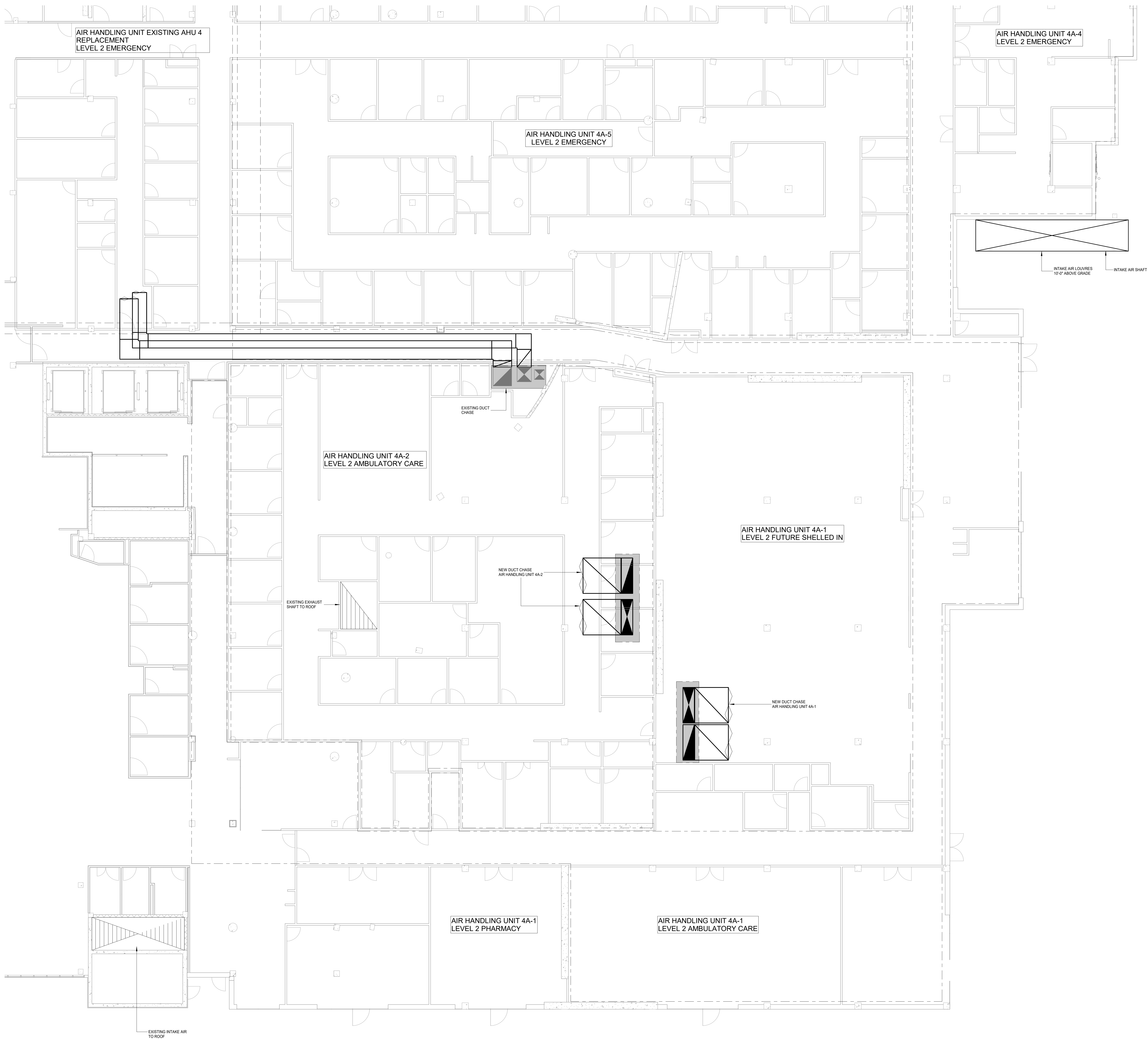
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Project No: 9915-96
Scale: 1 : 100

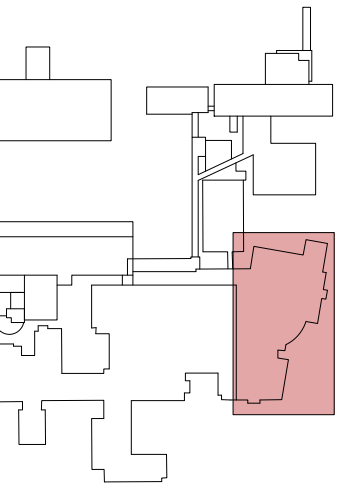
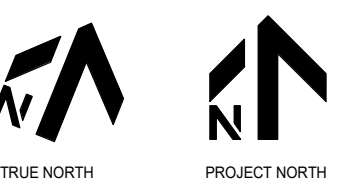
Consultants:

VR
ENGINEERING FORWARD
Vanderweil & Rutherford Associates Inc.
Mechanical & Electrical Engineers
London - Ottawa
www.vreng.ca | 613-563-2100

Sheet
Title:
Mechanical Floor Plan -
Level 2 - Emerg. Dept.
Pt.2, Amb. Care

Drawing
No.
M223





not to scale

[illegible]

Issues

All measurements are to be checked and verified on site by the contractor before proceeding with work

Do not scale drawings

Drawn by: AS
Checked by: IF
Original Issue Date: Issue Date
Project No: 9915-96
Scale: 1 : 100

Consultants:



Sheet

Title:

Mechanical Floor Plan -
Level 3 - Ambulatory Care
Roof

Drawing

No.

M231

DRAWING NOTES

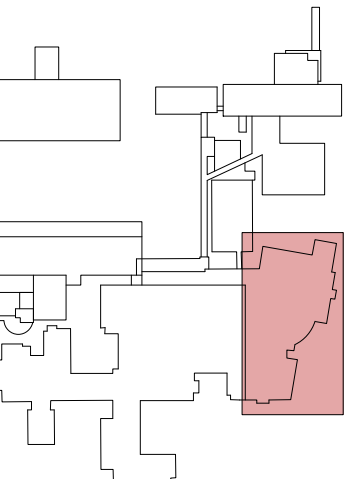
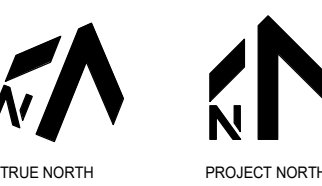
1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.

ROOFTOP UNIT 4A-2
LEVEL 2 AMBULATORY CARE

ROOFTOP UNIT 4A-1
LEVEL 2 FUTURE SHELLING IN

NEW MECHANICAL PLAN, LEVEL 3, AMBULATORY CARE ROOF

1 : 100



not to scale

[illegible]

2	ISSUED FOR MOH 2.1 RE-SUBMISSION	25/07/2025
1	ISSUED FOR MOH 2.1 SUBMISSION	28/03/2025
NO.	ISSUED	DATE

ssue

All measurements are to be checked and verified on site by the contractor before proceeding with work

Do not scale drawings

Drawn by: AS
Checked by: IF
Original Issue Date: Issue Date
Project No: 9915-96
Scale: 1 : 100

Consultants



Shee

Title: Mechanical Floor Plan -
Level 3 - Emergency Roof

Drawing

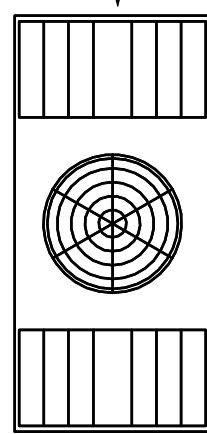
No. _____

M232

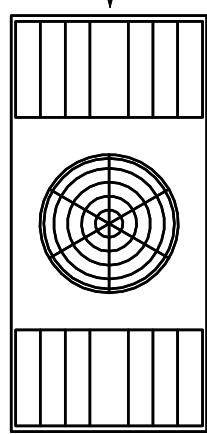
DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.

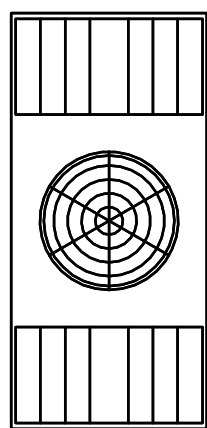
COOLING TOWER



- COOLING TOWER

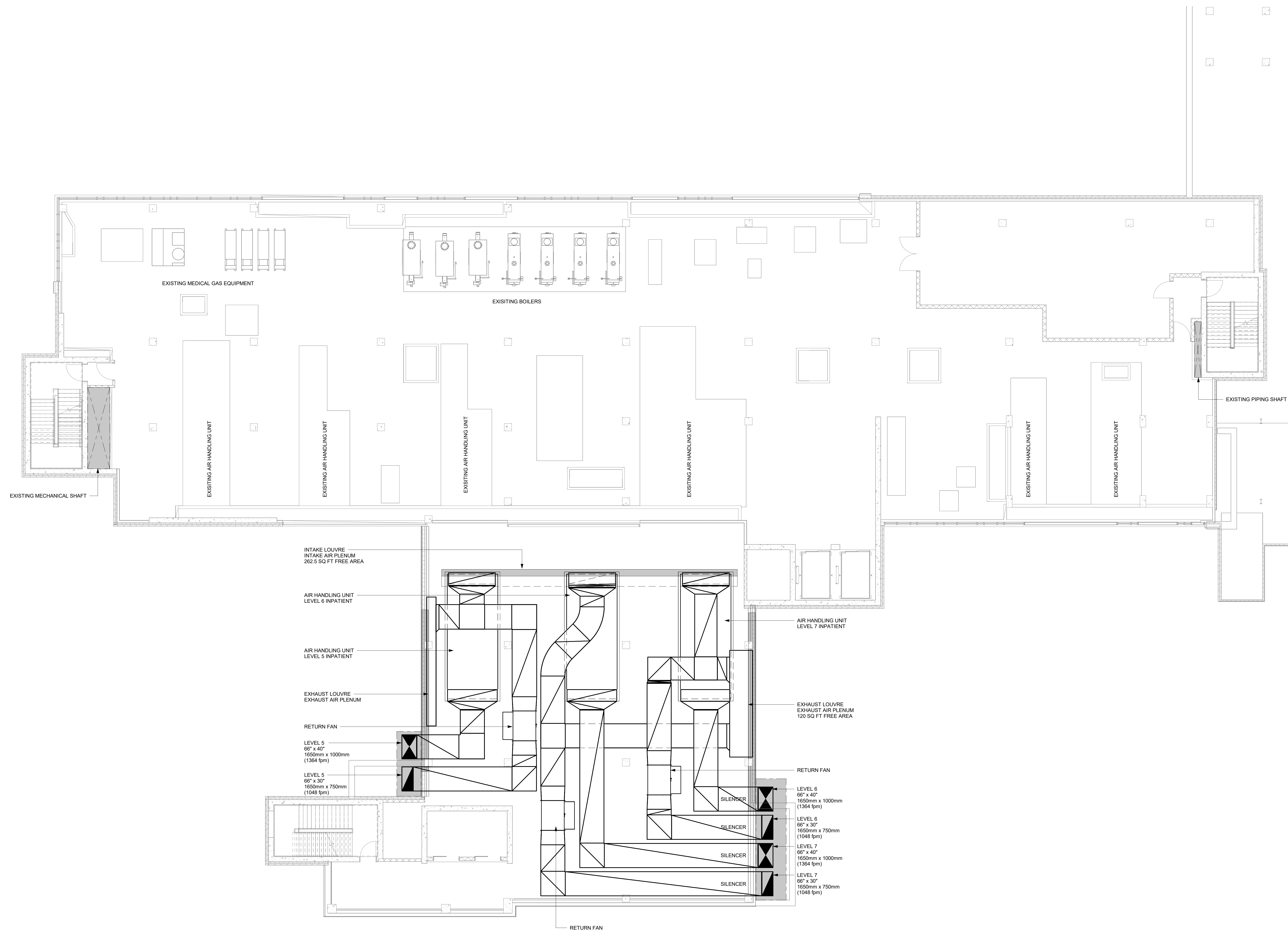
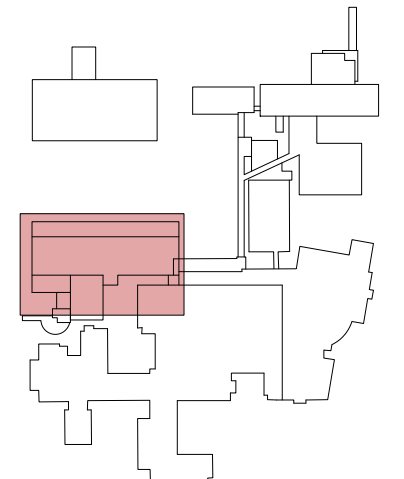
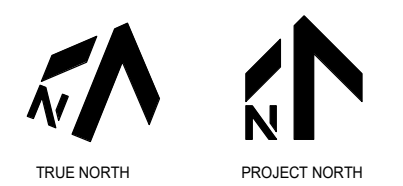


- COOLING TOWER



NEW MECHANICAL PLAN, LEVEL 3, EMERGENCY SERVICES ROOF

1 : 100



2	ISSUED FOR MCH 2.1 RE-SUBMISSION	25/07/2025
1	ISSUED FOR MCH 2.1 SUBMISSION	28/03/2025
NO.	ISSUED	DATE

Issues

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Do not scale drawings

Drawn by: AS
Checked by: IF
Original Issue Date: Issue Date
Project No: 9915-96
Scale: 1 : 100

Consultants:

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Vanderweil & Rutherford Associates Inc.
Mechanical & Electrical Engineers
London - Ottawa
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Sheet

Title:

Mechanical Floor Plan -
Level 4 - Mechanical Room

Drawing
No.

M241

2	ISSUED FOR MCH 2.1 RE-SUBMISSION	25/07/2025
1	ISSUED FOR MCH 2.1 SUBMISSION	28/03/2025
NO.	ISSUED	DATE

Issues

All measurements are to be checked and verified on site by the contractor before proceeding with work.

Do not scale drawings

Drawn by: AS
Checked by: IF
Original Issue Date: Issue Date
Project No: 9915-96
Scale: 1 : 100

Consultants:

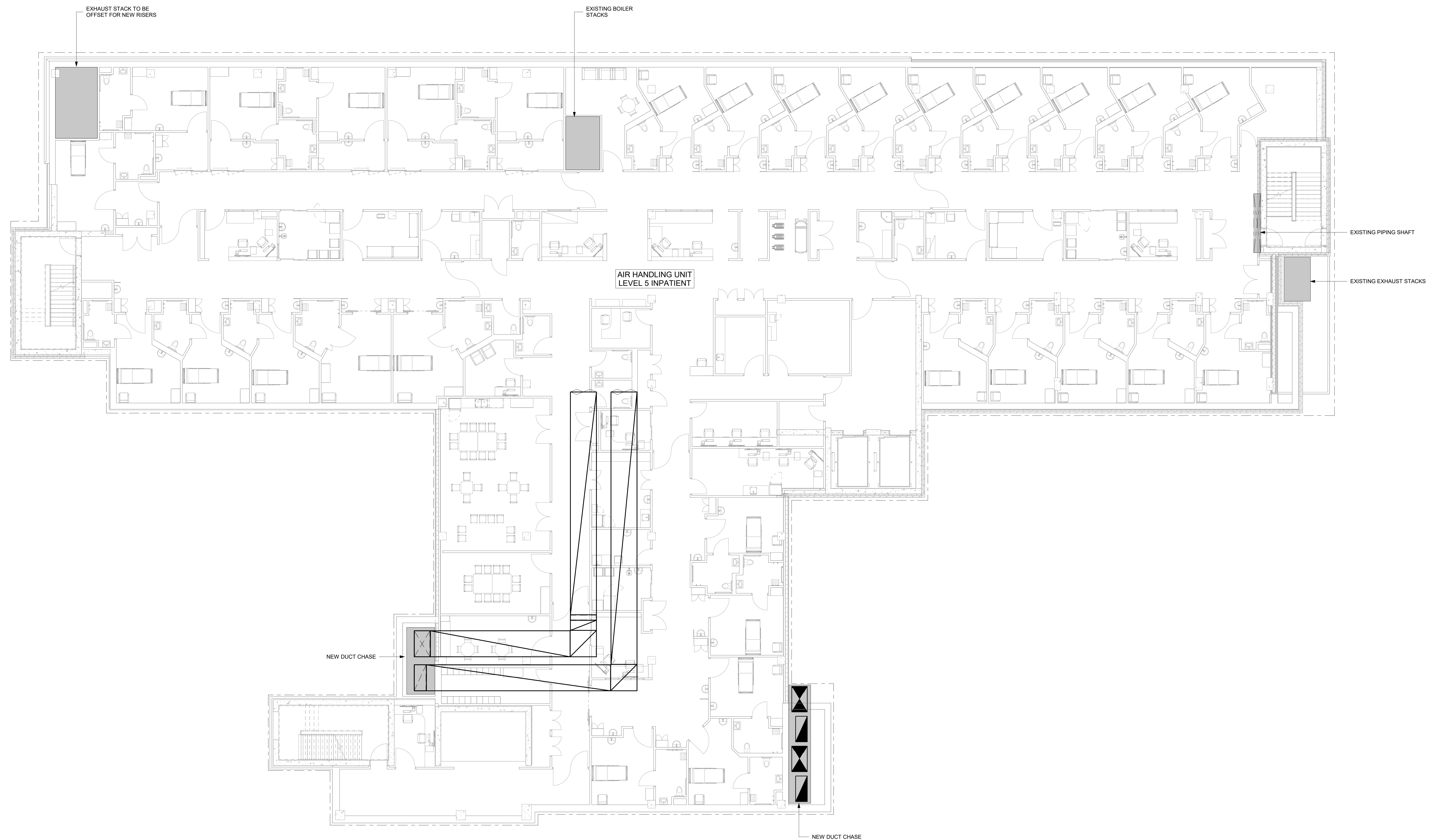
VR
ENGINEERING FORWARD
Vanderweil & Rutherford Associates Inc.
Mechanical & Electrical Engineers
London, Ottawa
www.vreng.ca | 613-563-2100

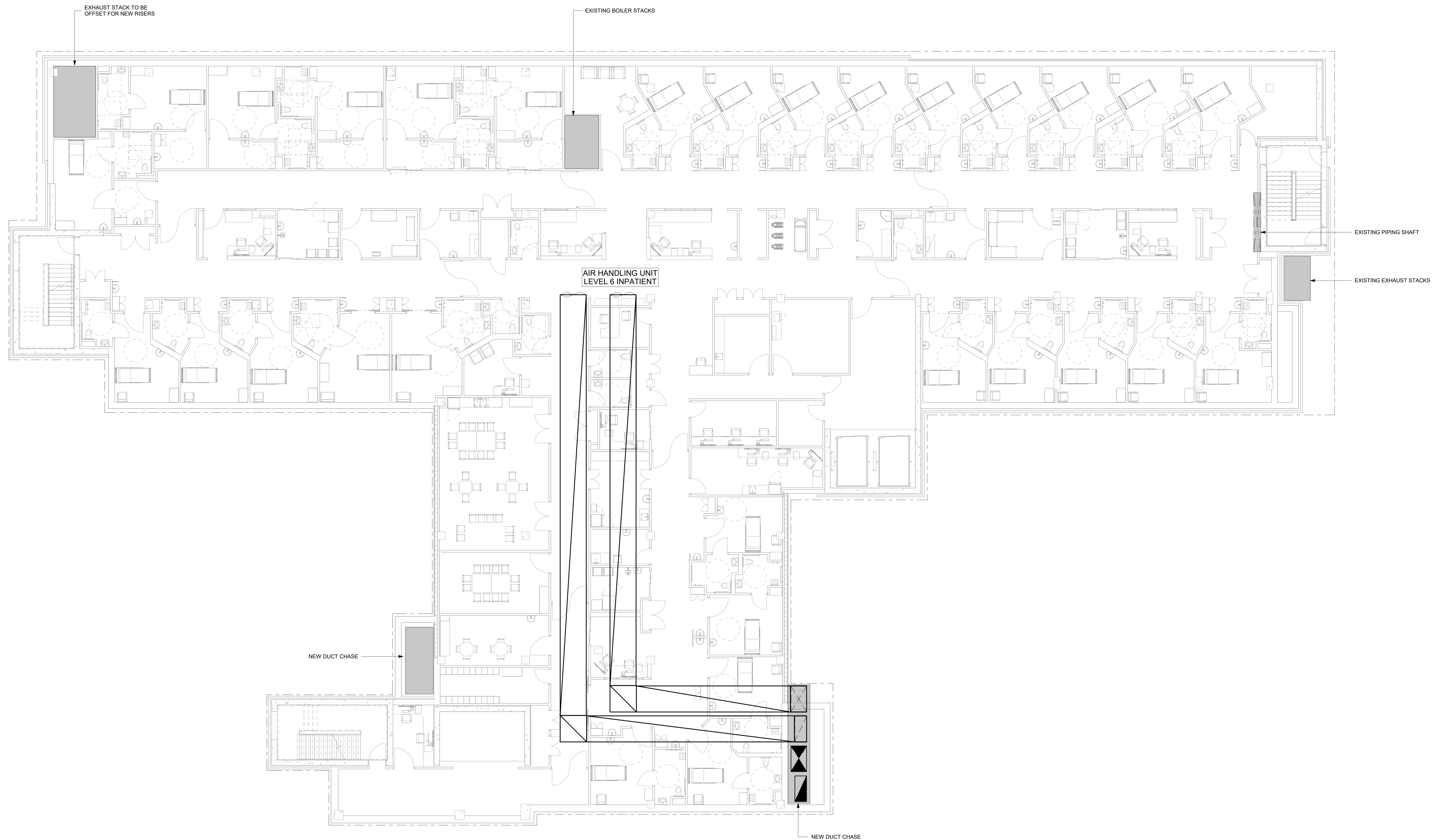
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Title:
Mechanical Floor Plan -
Level 5 - Inpatient Tower

Drawing
No.
M251

DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.





DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.

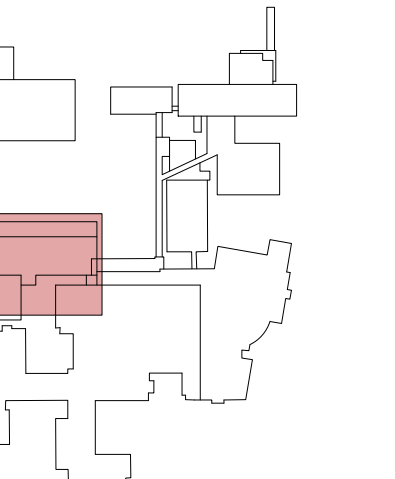
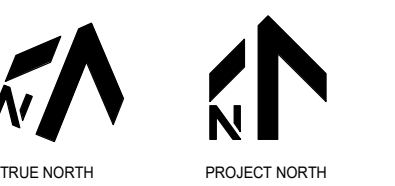
PARKIN

Parkin Architects Limited
20 JAMES STREET, SUITE 200, OTTAWA, CANADA, K2P 0T6 615-739-7700



Queensway Carleton
Hospital - Part 4
Expansion

Key Plan



Not to scale

2	ISSUED FOR MCH 2.1 RE-SUBMISSION	25/07/2025
1	ISSUED FOR MCH 2.1 SUBMISSION	28/03/2025
NO.	ISSUED	DATE

Issues

All measurements are to be checked and verified on site by the contractor before proceeding with work.

Do not scale drawings

Drawn by: AS
Checked by: IF
Original Issue Date: Issue Date
Project No: 9915-96
Scale: 1 : 100

Consultants:



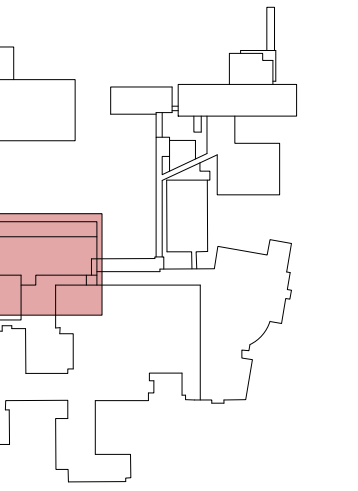
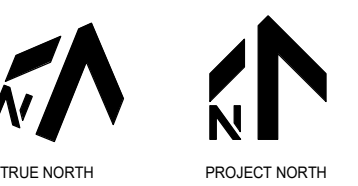
Sheet
Title:
Mechanical Floor Plan -
Level 6 - Inpatient Tower

Drawing
No.

M261

NEW MECHANICAL PLAN, LEVEL 6, INPATIENT TOWER

1 : 100



not to scale

[illegible]

Issues

All measurements are to be checked and verified on site by the contractor before proceeding with work

Do not scale drawings

Drawn by: AS
Checked by: IF
Original Issue Date: Issue Date
Project No: 9915-96
Scale: 1 : 100

Consultants:



Sheet

Title:

Mechanical Floor Plan - Level 7 - Inpatient Tower

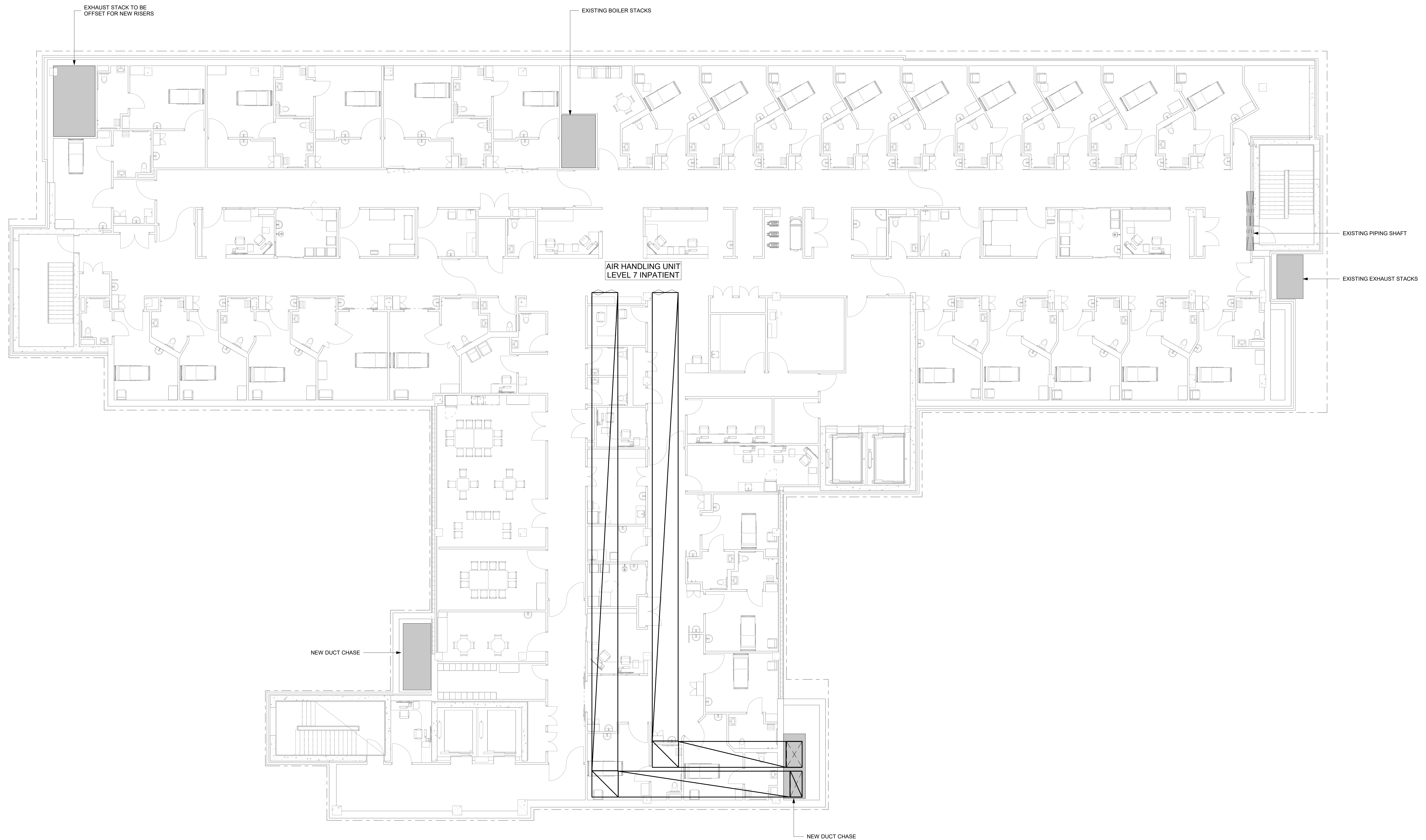
Drawing

No.

M271

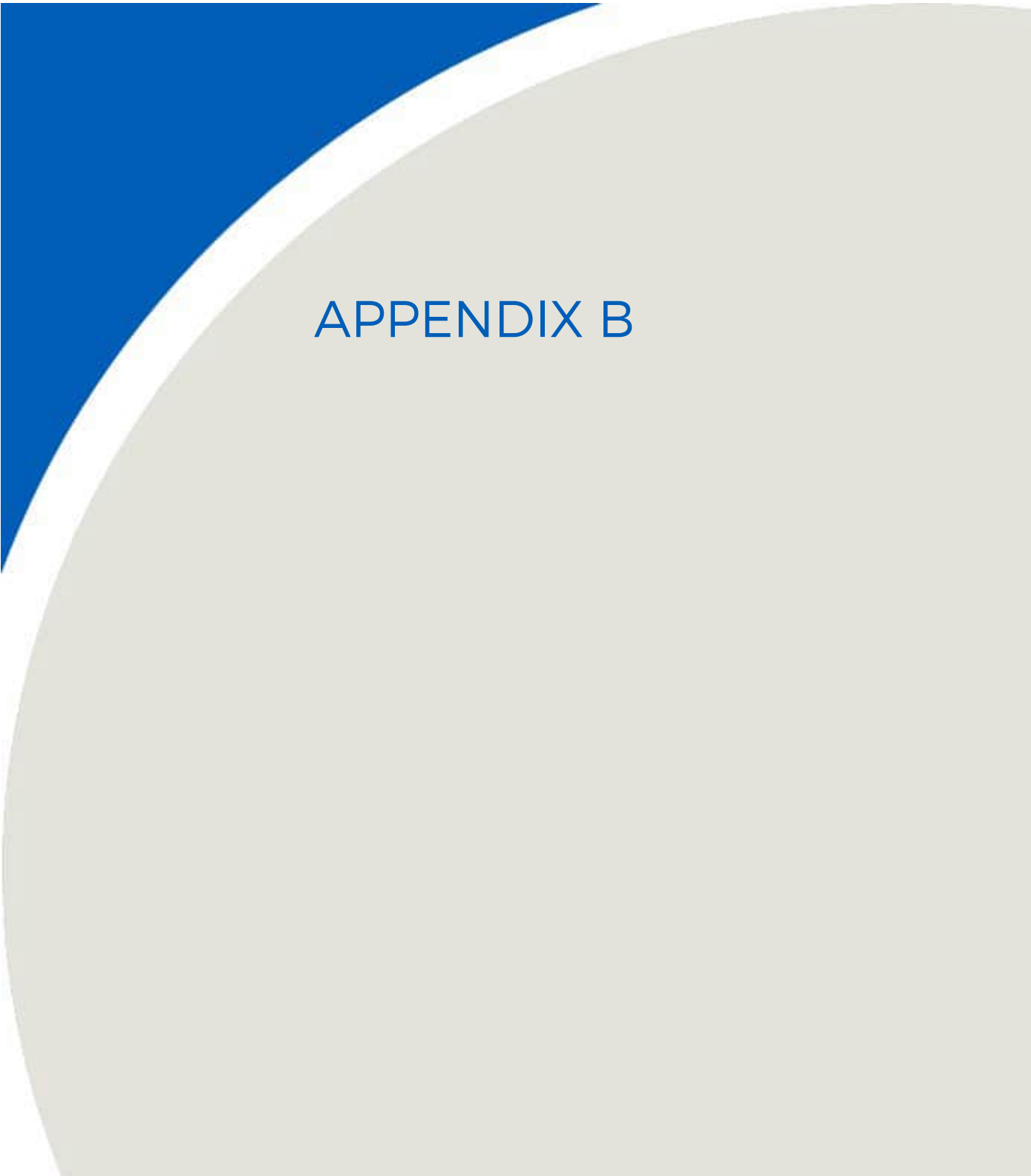
DRAWING NOTES

1. RISER LOCATIONS SHOWN FOR SCHEMATIC PURPOSES ONLY. FINAL LOCATIONS AND SHAFT SIZING TO BE COORDINATED IN PREPARATION FOR SKETCH PLAN SUBMISSION 2.2.

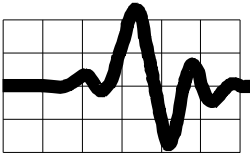


NEW MECHANICAL PLAN, LEVEL 7, INPATIENT TOWER

1 : 100

A decorative background graphic featuring a large, light gray circular shape on the right side of the page. On the left side, there is a blue triangular shape pointing towards the center, separated from the gray circle by a thin white curved line.

APPENDIX B



HUGH WILLIAMSON ASSOCIATES INC.

350 Fernhill Road, Ottawa, Ontario, K1M 0W8, Canada

ACOUSTIC ASSESSMENT REPORT

FOR THE

QUEENSWAY CARLETON HOSPITAL

3045 Baseline Road, Ottawa, Ontario

Prepared for

Queensway Carleton Hospital

Prepared by

Hugh Williamson Associates Inc.

23 December 2010



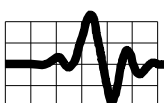
ACOUSTIC ASSESSMENT REPORT FOR THE QUEENSWAY CARLETON HOSPITAL, 3045 BASELINE ROAD, OTTAWA, ONTARIO

Executive Summary

This Acoustic Assessment Report contains the results of an acoustic assessment of the Queensway Carleton Hospital (QCH), 3045 Baseline Road, Ottawa, Ontario. The Report has been prepared to support an application by the Queensway Carleton Hospital for an amendment to an existing Certificate of Approval (Air and Noise) dated 7 August 2002 (CofA # 6945-5CRRY2).

The assessment takes into account all relevant QCH buildings including all relevant noise sources identified in the WESA 2006 assessment⁴, and, new noise sources related to the more recent the Cancer Centre extension and the proposed Part 3 extension. The assessment also considers nearby residential points of reception, hospital points of reception and the nature of the surrounding lands. Noise source data is based on manufacturer's data, measurements made on-site by Hugh Williamson Associates and data from the WESA 2006 assessment⁴.

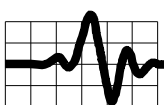
It is concluded that, with the recommended mitigation measures, the operation of the Queensway Carleton Hospital during the day, evening and night, 00:00 to 24:00, will be in compliance with MoE Noise Guidelines².



ACOUSTIC ASSESSMENT REPORT FOR THE QUEENSWAY CARLETON HOSPITAL, OTTAWA, ONTARIO

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Section	Page
Executive Summary	i
Table of Contents	ii
Acoustic Assessment Report Checklist	
1.0 Introduction	1
2.0 Facility Description	3
3.0 Noise Source Summary	4
4.0 Point of Reception Summary	8
5.0 Assessment Criteria, Performance Limits	10
6.0 Impact Assessment	11
7.0 Mitigation Measures	13
8.0 Conclusions	14
References	15

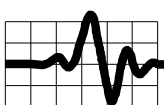


Tables

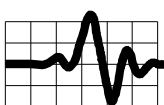
- Table 1: Noise Source Summary Table
- Table 2: Sound Level Limits
- Table 3: Comparison of Predictions, All Sources vs. Only Significant Sources
- Table 4: Acoustic Assessment Summary Table – Day (07:00 – 19:00)
- Table 5: Acoustic Assessment Summary Table – Evening (19:00 – 23:00)
- Table 6: Acoustic Assessment Summary Table – Night (23:00 – 07:00)
- Table 7: Silencer Recommendations for Part 3 HVAC
- Table 8: Acoustic Lining Recommendation for Part 3 HVAC

Figures

- Figure 1: Aerial Photo and Residential Receptors
- Figure 2: Zoning Plan, City of Ottawa
- Figure 3: Site Plan and Nearby Receptors
- Figure 4: Noise Sources and Points of Reception
- Figure 5: New Generator Building and Recommended Noise Barrier
- Figure 6: Predicted Noise Contours - Day
- Figure 7: Predicted Noise Contours - Evening
- Figure 8: Predicted Noise Contours - Night
- Figure 9: Western Part of the Mechanical Room, Level 4, Part 3
- Figure 10: Eastern Part of the Mechanical Room, Level 4, Part 3



Appendix 1	Acoustic Modeling Details
Appendix 2	Noise Source Data, Measurements and Manufacturer's Data
Appendix 3	Outdoor to Indoor Sound Level Estimates
Appendix 4	Selected Drawings
Attachment:	Resume, Dr. Hugh Williamson



ACOUSTIC ASSESSMENT REPORT CHECK-LIST

Company Name: Queensway Carleton Hospital

Company Address: 3045 Baseline Road
Ottawa, Ontario

Location of Facility: 3045 Baseline Road
Ottawa, Ontario

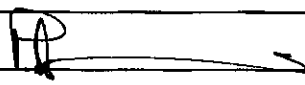
The attached Acoustic Assessment Report was prepared in accordance with the guidance in the ministry document "Information to be Submitted for Approval of Stationary Sources of Sound" (NPC 233) dated October 1995 and the minimum required information identified in the check-list on the reverse of this sheet has been submitted.

Company Contact: _____

Name: Peter Thompson

Title: Director of Planning & Facility Redevelopment

Phone Number: 613 721 2000 x5619

Signature: 

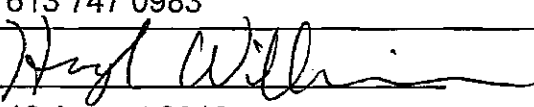
Date: 19 AUG 2010.

Technical Contact: _____

Name: Hugh Williamson

Representing: Hugh Williamson Associates Inc.

Phone Number: 613 747 0983

Signature: 

Date: 18 August 2010

ACOUSTIC ASSESSMENT REPORT CHECKLIST

Required Information		Submitted	Explanation/Reference
1.0	Introduction (Project Background and Overview)	☒ Yes	Section 1.0
2.0	Facility Description		
	2.1 Operating hours of facility and significant Noise Sources	☒ Yes	Sections 2.0 & 3.0
	2.2 Site Plan identifying all significant Noise Sources	☒ Yes	Figures 1, 3 & 4
3.0	Noise Source Summary		
	3.1 Noise Source Summary Table	☒ Yes	Table 1
	3.2 Source noise emissions specifications	☒ Yes	Table1, Appendices 2&4
	3.3 Source power/capacity ratings	☒ Yes	Table1, Appendices 2&4
	3.4 Noise control equipment description and acoustical specifications	☒ Yes	Table1, Appendices 2&4
4.0	Point of Reception Noise Impact Calculations		
	4.1 Point of Reception Noise Impact Table	☒ Yes	Tables 4 - 6 & A1.7
	4.2 Point(s) of Reception (POR) list and description	☒ Yes	Section 4.0
	4.3 Land-use Zoning Plan	☒ Yes	Figure 2
	4.4 Scaled Area Location Plan	☒ Yes	Figure 3
	4.5 Procedure used to assess noise impacts at each POR	☒ Yes	Section 6.0
	4.6 List of parameters/assumptions used in calculations	☒ Yes	Section 6.0 & Appendix 1
5.0	Acoustic Assessment Summary		
	5.1 Acoustic Assessment Summary Table	☒ Yes	Tables 4 - 6
	5.2 Rationale for selecting applicable noise guideline limits	☒ Yes	Section 5.0
	5.3 Predictable Worst Case Impacts Operating Scenario	☒ Yes	Section 6.0
6.0	Conclusions		
	6.1 Statement of compliance with the selected noise performance limits	☒ Yes	Section 8.0
7.0	Appendices (Provide details such as)	☒ Yes	
	Listing of Insignificant Noise Sources	☒ Yes	Table 1
	Manufacture's Noise Specifications	☒ Yes	Table1, Appendices 2&4
	Calculations	☒ Yes	Appendix 1
	Instrumentation	☒ Yes	Appendix 2
	Meteorology during Sound Level Measurements	☐ Yes	Not relevant
	Raw Data from Measurements	☒ Yes	Table1, Appendices 2&4
	Drawings (Facility / Equipment)	☒ Yes	Appendix 4

ACOUSTIC ASSESSMENT REPORT CHECK-LIST

Company Name: Queensway Carleton Hospital

Company Address: 3045 Baseline Road
Ottawa, Ontario

Location of Facility: 3045 Baseline Road
Ottawa, Ontario

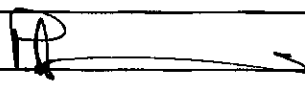
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Name: Peter Thompson

Title: Director of Planning & Facility Redevelopment

Phone Number: 613 721 2000 x5619

Signature: 

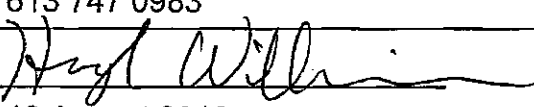
Date: 19 AUG 2010.

Technical Contact: _____

Name: Hugh Williamson

Representing: Hugh Williamson Associates Inc.

Phone Number: 613 747 0983

Signature: 

Date: 18 August 2010

ACOUSTIC ASSESSMENT REPORT CHECKLIST

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	4.3 Land-use Zoning Plan	☒ Yes	Figure 2
	4.4 Scaled Area Location Plan	☒ Yes	Figure 3
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6.0	Conclusions		
	6.1 Statement of compliance with the selected noise performance limits	☒ Yes	Section 8.0
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	Manufacture's Noise Specifications	☒ Yes	Table1, Appendices 2&4
	Calculations	☒ Yes	Appendix 1
	Instrumentation	☒ Yes	Appendix 2
	Meteorology during Sound Level Measurements	☐ Yes	Not relevant
	Raw Data from Measurements	☒ Yes	Table1, Appendices 2&4
	Drawings (Facility / Equipment)	☒ Yes	Appendix 4

ACOUSTIC ASSESSMENT REPORT FOR THE QUEENSWAY CARLETON HOSPITAL 3045 BASELINE ROAD, OTTAWA, ONTARIO

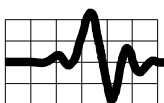
1.0 Introduction

The Queensway Carleton Hospital (QCH), located at 3045 Baseline Road, Ottawa, Ontario, (see Figures 1 and 3) provides public health care services. This report contains the results of an acoustical assessment of relevant hospital plant and equipment carried out by Hugh Williamson Associates at the request of the QCH. The purpose of the Report is to support an application to the Ministry of Environment (MoE) for an amendment to an existing Certificate of Approval (Air and Noise), C of A # 6945-5CRRY2, for the QCH.

This report has been prepared in accordance with the MoE Document NPC-233, *Information to be Submitted for Approval of Stationary Sources of Sound*, October 1995¹. Noise from the facility has been assessed according to MoE Guideline NPC-205, *Sound Level Limits for Stationary Sources in Class 1 and 2 (Urban) Areas*, October 1995². The report follows the MoE recommended format, *Sample Application Package, Basic Comprehensive certificate of Approval (Air and Noise)*, July 2009³.

The noise assessment methodology is summarised below.

- Identification of points of reception, PORs, in the vicinity of the hospital. Points of reception include any of the following existing or zoned for future use premise: permanent or seasonal residences, hotels/motels, nursing/retirement homes, rental residences, hospitals, campgrounds and noise sensitive buildings such as schools and places of worship. Points of reception within the hospital were also identified; these include the windows of patient rooms and treatment rooms.



- Determination of the MoE sound level limits which will apply at each of the points of reception.
- Identification of the sources of noise that arise from the various hospital plant and equipment. The strengths of the various noise sources were assessed through sound measurements, manufacturer's data and via data from a previous acoustical study⁴ of the QCH conducted in 2006 by Water and Earth Science Associates Ltd. (WESA).
- Based on the strengths of the individual noise sources, noise levels due to the operation of the hospital plant and equipment were predicted at all POR's, including POR's at nearby residential receptors and within the hospital. The MoE methodology requires that compliance be assessed under predictable "worst case" conditions of normal operations.
- Compliance with MoE sound level limits was determined for the worst case conditions of hospital operations. Where appropriate, mitigation measures have been recommended such that compliance with MoE sound level limits is achieved at all points of reception.

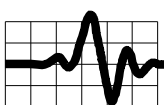
Surrounding Lands, Acoustic Environment and Critical Receptors

Figures 1 and 3 show the location of the QCH. The Hospital is located at 3045 Baseline Road, close to the intersection with Richmond Road, in the City of Ottawa and within a Greenbelt Zone. The land is zoned Rural Institutional (City of Ottawa Zone RI[307r]H(20), Consolidation Date June 25, 2008. The surrounding land-use is zoned Greenbelt, Parks and Recreation and Residential to the east and southeast (see Figure 2). To the west, land is occupied by major roads, i.e. Richmond Road and Highway 416. The land surrounding the hospital is essentially flat, open and, with the exception of the residential areas, covered with vegetation and, hence, acoustically absorptive.

Directions in this report are relative to Site North as shown in Figures 1 and 3.

Apart from the hospital itself, the nearest sensitive receptors are residences to the east and southeast, R1, R3, R6 and R7, and one residence to the northwest, R4, which is a residence located on land belonging to the National Capital Commission (NCC).

Nearby roads, Highway 416, Baseline Road and Richmond Road carry a significant amount of road traffic during the day, evening and night. This road traffic elevates the 1-hour average background sound levels for adjacent residences as discussed later in this report.



2.0 Facility Description

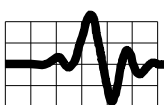
The Queensway Carleton Hospital (QCH) provides public health care services to the residents of Ottawa and surrounding areas in Eastern Ontario. The hospital operates 24 hours / day, 7 days / week, year round. Services and facilities provided include the following.

- Emergency services
- Operating rooms
- A maternity ward
- A morgue
- A pharmacy
- Various laboratories
- Radiology
- Diagnostic imaging
- Mental health services
- A retail food outlet

An expansion completed in 2009 included a cancer clinic, an expanded central heating and cooling plant, additional operating rooms and a separate multi-storey garage with attached emergency power substation. Planned expansion up to 2011 includes the relocation of several departments and the addition of new patient wards (Part 3 Addition).

The main parts of the QCH are listed below (see Figure 3).

- “Old Part” – including the 4 storey Old Building
- Maternity Wing
- Part 2 Addition – 2005/06 Emergency Services
- Operating Rooms Addition – 2005/06
- Power Plant Building, expanded with Cancer addition
- Cancer Treatment facility (2009)
- Multi-storey Car Park (2009)
- New Generator Building & Sub-station (2009)
- Part 3 Addition – planned for 2011



3.0 Noise Source Summary

The primary and significant sources of noise associated with the QCH include sources related to various expansion and upgrade projects undertaken, or planned to be undertaken, at the hospital.

While each major part of QCH has many noise sources, only some of the sources have been shown, through analysis, to be significant. The sources shown Figure 4 and listed Table 1 include significant as well as insignificant noise sources. The numbering of the sources is, as far as practical, consistent with the corresponding *Emission Summary and Dispersion Modelling Report*⁵, being simultaneously prepared by WESA. The numbering system, up to source 113, is also consistent with the WESA 2006 noise report⁴.

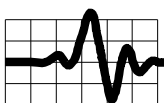
In the Figures, noise sources have an 'S' prefix, e.g. Source 48 becomes S48 in the Figures.

Table 1, the Noise Source Summary Table, also contains the following information for each noise source.

- Year of installation and general location
- Sound power level
- Time of day adjustments, indicating hours of operation and intermittence (where applicable)
- Sound characteristics, categorized according to MoE guidelines³
- Data source
- Existing noise control measures
- Required Mitigation

Noise source data for individual sources has been obtained in a number of ways as indicated below.

- WESA 2006 Noise Report⁴. This study was conducted by a qualified acoustical consultant and has been used for noise source data for sources installed up to that time, approximately 2006.
- Manufacturer's data from project drawings and shop drawings for the Cancer Expansion Project, including the new generators and transformers. This data was provided by the project design engineers, Vanderwesten, Rutherford, Mantecon Inc., VRM.
- Manufacturer's data and drawings from tender ready project drawings for the Part 3 Expansion, also supplied by VRM.
- Assessment of selected existing sound sources was undertaken by Hugh Williamson Associates as indicated by '2010' in the Data source column of Table 1. This included a re-evaluation of some sources previously considered in the 2006 WESA Report⁴, including an air cooled condenser – 4 fans (source 41), the cooling towers (sources 48).



49 and 120), steam boilers #1 & #2 exhaust stack (source 81), hot water boilers #1 & #2 exhaust stacks (sources 92 and 94).

Appendix 2 contains analysis, manufacturer's data and noise measurement results for all sources assessed in detail by Hugh Williamson Associates, i.e. those sources marked '2010' in the Data Source column of Table 1. For items marked 'WESA 2006' in the Data Source column of Table 1, this report relies on data contained in the WESA 2006 Noise Report⁴ – this primarily applies to sources installed in 2006 or before.

The following paragraphs describe the equipment and noise sources in more detail, including a description of items added or to be added under various expansion projects.

Power Plant Building, New Generator Building and Parking Garage

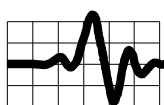
The Power Plant Building contains much of the mechanical plant for the operation of the hospital.

In 2005-2006, a Central Plant Upgrade project was undertaken which included the following.

- One natural gas fired reciprocating cogeneration unit for electricity production and waste heat recovery. The cogeneration unit rated for 2779 kW fuel input (sources 75, 93A and 93B).
- Replacement of one existing natural gas boiler with one new natural gas boiler for heating purposes (source 92). The new boiler is rated 1757 kW fuel input.
- Removal of the biomedical incinerator (Revocation of C of A # 8-4027-87-006 is requested).
- Removal of the existing cooling tower.
- Installation of one new cooling tower (BAC double cell) to reject heat from the chillers. (With modifications in 2009, there are now three identical BAC Model 3552A cooling towers located on the roof of the Power Plant Extension (sources 48, 49 and 120) as shown in Figure 4.)
- Relocation of several exhaust vents from the boiler room roof.

With the Cancer addition, completed in 2009, further upgrades were made to the Power Plant Building. In particular, two older diesel generators (a 500 kW Kato and a 600 kW Kohler, sources 66 – 69) were decommissioned and replaced by three new 750 kW diesel generators (sources 125 – 129) located in a new Generator Building attached to a new multi-storey car park, see Figure 4. Associated with the new Generator Building is an Electrical Sub-station (transformer yard) containing two 5000 kVA transformers (sources 190 and 191).

The cogeneration unit, and the three new 750 kW generators are used both as emergency back-up power and for the generation of electricity during non-emergency periods. Hence noise from these sources has been considered on a 24-hour basis.



Operating Room Addition

The main sources related to the Operating Room Addition project are as follows.

- Expansion of a mechanical penthouse with intake and exhaust fans servicing the new operating rooms.
- The new mechanical penthouse houses a new air handling unit, AHU-10 (source 114), with a flow rate of 20,000 cfm (9.4 m³/s).
- CVAC (Centralized Airborne Evacuation Piping) exhaust serving surgical suites, (source 115).

Part 2 Expansion, including the Emergency Department

The main noise sources associated with the Part 2 Expansion include the following.

- Air handling units #4 - #7 (sources 95 and 96)
- Exhaust fans (sources 97 – 105)

Ottawa Hospital Regional Cancer Centre – QCH Site Cancer Clinic

The main sources related to the Ottawa Hospital Regional Cancer Centre – QCH Site Cancer Clinic project include the following.

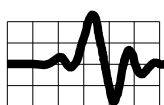
- One (1) additional boiler to be located in the Central Plant (source 152).
- Five (5) air handling units with outdoor air intakes and exhausts (sources 130 – 134 & 201 – 204).
- Various exhaust fans serving the Cancer Centre (sources 135 – 149).

Part 3 Addition Expansion

Tender documents have now been issued and the construction of Part 3 is anticipated for 2011. The noise sources related to the Part 3 Addition include the following.

- Three (3) additional natural gas-fired hot water boilers, (sources 154 – 156).
- Four (4) additional natural gas-fired steam boilers, (sources 162 – 165).
- Air intakes and Exhausts for Air Handling Units to serve Part 3 (sources 159.1, 159.2, 160, 170 and 171). (The west building air intake was split into two sources, 159.1 and 159.2 to reflect the long length of the intake louvre and partial shielding with respect to nearby POR's.)

Noise source data for Part 3 has been based on 'issued for tender' documents provided by design engineers, VRM.



Some of the air-handling units which are specified in the Part 3 tender documents are to be installed in other parts of QCH. These include the following.

- AHU-11: To be installed in mechanical penthouse above the OR Addition (Sources 180 and 181)
- AHU-12: To be installed in the basement of Part 2, but with an exhaust near the Power Plant Building (source 183)
- AHU-13: Serving an MRI suite near the Power Plant Building, located on the roof (source 182)
- AHU-14: Serving the Main Entry area, located on the roof (source 184)

Miscellaneous Sources

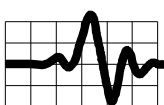
Miscellaneous sources include:

- A paper shredding truck which visits QCH once per week and shreds paper for a maximum of 30 minutes (source 111),
- Delivery vehicles at the loading dock, immediately below the Operating Room Addition, day only (source 112).

Summary of Noise Sources

In summary, 185 noise sources have been assessed in this study, of which 101 have been assessed quantitatively. Of the 101 sources which have been assessed quantitatively, 41 were found to be significant, as discussed in Section 6.0.

Noise data expressed in 1/3-octave band levels for each quantitatively assessed source is contained in Appendix 1.



4.0 Point of Reception Summary

The points of reception (POR's) selected for analysis are shown in Figures 1, 2 and 4. These points have been selected on a worst case basis and include the following.

- Residential receptors, POR's 1, 4, 5, 6 and 7; selected on the basis of being the closest residences to the noise sources at QCH.
- Hospital patient rooms or treatment rooms, POR's 2, 3 11 - 51. These POR's were selected on the basis of being the closest plane of window points of reception, for patient rooms or treatment rooms, to significant noise sources at QCH.

For consistency, POR's 1, 2, 3 and 4 are identical to the POR's used in the WESA 2006 noise report⁴.

Note that in some Tables and Figures, POR's have simply been designated with the letter R, hence, POR1 is labeled R1, etc. This has been done for clarity of presentation in drawings and tables which are dense with information.

Detailed Descriptions of POR's

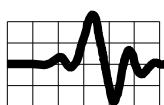
POR's 1, 5 and 6: Two storey residences located on Sioux Crescent, approximately 200 m to the east of QCH. The POR is taken to be the second storey window of each residence, being a worst case for noise at night.

POR 4: A two storey residence located to the north west of QCH located on NCC land, approximately 100 m from the New Generator Building. The POR is taken to be the second storey window, being a worst case for noise at night.

POR 7: A two storey residence located at 2 Shadow Court, approximately 200 m southeast of QCH. The POR is taken to be the second storey window, being a worst case for noise at night.

POR's 11, 12, 13 and 14: Points of reception for the Cancer Building on Levels 1 to 4 respectively, and corresponding to patient treatment rooms which are in use only during the day. The locations, on the south side of the Cancer Building, were chosen due to its proximity to the Cooling Towers (sources 48, 49 & 120). The POR's are plane of window locations.

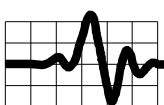
POR's 2, 21 and 22: Points of reception for the Part 2 Building at Level 4, corresponding to patient rooms or treatment rooms. These POR's were selected due to their relative proximity to sources from the Power Plant Building and sources on the lower roof of the Central Building. The POR's are plane of window locations.



POR's 31, 32, 33 and 34: Points of reception for the Part 3 Building at the 3rd Floor, corresponding to patient rooms or treatment rooms. These POR's were selected due to their relative proximity to the air intakes and air exhausts for the mechanical floor, the 4th Floor, of the Part 3 Building. The POR's are plane of window locations.

POR's 3, 41, 42, 43 and 44: Points of reception for the Old Building on Levels 4, and corresponding to patient rooms. The locations were chosen due to their proximity to various mechanical equipment including: equipment located on the roof of the Central Building and the roof of the Maternity Wing, and the air exhaust louvres of the Part 3 Building.

POR 51: This POR corresponds to operating rooms immediately below the mechanical penthouse of the Operating Room Addition. This POR is also close to various sources from the Power Plant Building and close to the loading dock and paper shredding truck locations. There are no windows in the operating rooms.



5.0 Assessment Criteria, Performance Limits

Sound level limits in the MoE guidelines² depend on the acoustical classification of the area as Class 1, 2 or 3.

Class 1 Area (Urban) 'an area with an acoustical environment typical of a major urban area, where the background noise is dominated by urban hum (primarily road traffic noise)'

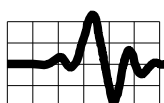
Class 2 Area (Urban) 'an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 Areas, and in which a low ambient sound level, normally occurring between 23:00 and 07:00 hours in Class 1 areas, will typically be realised as early as 19:00 hours.'

Class 3 Area (Rural) 'acoustical environment that is dominated by natural sounds having little or no road traffic'

The area in which the hospital is located is a Class 1 Area (Urban). This is due to its proximity to Baseline and Richmond Roads, both of which carry significant traffic volumes, the primary noise source, 24 hours per day. For a Class 1 Area (Urban), the applicable outdoor sound limits at noise sensitive receptors, based on 1-hour equivalent sound levels, L_{EQ} , are either the outdoor exclusion noise limits given in Table 2, or higher limits if established by an assessment of background noise. For the 2006 WESA noise study⁴, background sound level measurements were conducted, with results indicating that the MOE exclusion limits were the applicable limits. In the current study, as conditions are not likely to have changed significantly, background sound levels were not measured. Accordingly, for points of reception surrounding the hospital, the applicable outdoor sound level limits are 50 dBA during the day (07:00 to 19:00); 47 dBA during the evening (19:00 to 23:00) and 45 dBA during the night (23:00 to 07:00).

The QCH patient rooms and treatment rooms are all contained in fully air-conditioned buildings, with windows which are inoperable. Under these circumstances, the MoE allow the application of indoor noise limits as specified in Document LU-131⁶, and listed under indoor limits in Table 2. These limits have been applied to all POR's within QCH itself.

Note: When noise from an industry complies with the above sound level limits, this ensures that any of this noise which is audible at a receptor location is at a relatively low level. This does not mean that the noise from the industry will be inaudible (i.e. not be heard under any circumstances). The audibility and degree of perception of a low level noise by an individual depends on many factors, including: the background sound level, distraction from other activities taking place at the same time, and, the individual's sensitivities to noise.



6.0 Impact Assessment

Noise levels have been predicted at all selected POR's using "predictable worst case" assumptions and using the ISO outdoor sound propagation methodology⁷ as implemented in the sound prediction software Cadna-A, version 4.0.135.

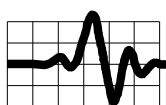
The "predictable worst case" is interpreted as meaning the greatest noise impact anticipated under normal operating conditions. The ISO methodology provides a conservative (i.e. high) estimate of sound propagation to a receptor taking into account adverse wind and meteorological conditions. Other factors which make the noise predictions in this study conservative are as follows.

- All fans and motors are assumed for modelling to be operating at maximum speed, apart from the time of day factors listed in Table 1. In fact, many of the noise sources associated with QCH operate with Variable Speed Drive, VSD, such that the speeds of fans and motors vary with demand. A circumstance where all fans and drives are operating at maximum speed is theoretically possible, but is very unlikely in practice, even during extreme weather conditions.
- It is assumed for noise modelling that all three new generators, the cogen plant and all three cooling towers are operating simultaneously at full capacity. Current plans and operating procedures are to operate a maximum of two of the new generators and two of the cooling towers, leaving one generator and one cooling tower as back-up redundant units.

The noise modelling includes the recommended mitigation measures as detailed in Section 7.0 of this Report.

Selection of Significant Noise Sources

Acoustic modelling was initially carried out using all of the 101 noise sources which have been quantitatively assessed. The most significant sources for all POR's were then selected as follows. The outdoor impacts of all sources were ranked at each POR. Less significant sources were progressively eliminated until the difference in predicted levels, between the case of all 101 sources and the case of reduced sources, became 2.5 dBA or less, see Table 3. This left a total of 41 significant noise sources which have been identified in Table 1. (In the Cadna-A model, it is possible to switch on and off the insignificant sources using the variant options. The Cadna-A electronic noise modeling file is being provided to the MoE Environmental Assessment and Approvals Branch for their exclusive use for review of this C of A Application.)



Predicted Indoor Sound Levels for Hospital POR's

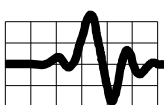
To assess compliance with indoor sound level limits for hospital receptors, outdoor levels at the plane of window or building external surface, are first calculated using Cadna-A software. Then the indoor sound level for each room is estimated using the acoustical properties of the glazing and standard outdoor to indoor sound transmission techniques. To simplify this calculation, rooms of typical sizes, window area and room absorption have been assumed. Details of these estimates for each QCH POR are contained in Appendix 3.

Results

In Tables 4, 5 and 6, predicted outdoor and, where appropriate, indoor sound levels are given for each POR due to significant sound sources for day, evening and night conditions respectively. Tables 4, 5 and 6 also compare predicted levels with MoE performance Limits. These tables show that with the proposed mitigation, noise from QCH is in compliance at all POR's. Figures 6, 7 and 8 show noise contours due to significant sound sources for day, evening and night conditions respectively.

Details of acoustic modeling are given in Appendix 1. Table A1.7 A, B, C in Appendix 1 provides the noise impacts of the individual significant sound sources at each POR.

It is concluded that, with the mitigation measures recommended in Section 7.0, the noise sources associated with current and planned operations at the Queensway Carleton Hospital during the day-time, evening and night-time hours will be in compliance with MoE Guidelines^{2, 6}.



7.0 Mitigation Measures

The following noise mitigation measures are recommended for QCH in order to ensure compliance with MoE sound level limits.

7.1 Silencing Treatments for HVAC Equipment in Part 3

It was found that sound level limits for POR's on the proposed Part 3 building, POR31 – POR34, would be exceeded without further mitigation. Hence a series of silencing treatments have been recommended for the Heating Ventilating and Air Conditioning, HVAC, equipment located on Level 4 of the proposed Part 3 Building. The silencing treatments are specified in Tables 7 and 8 and the locations of the treatments are shown in Figures 9 and 10. The treatments consist of the following.

- A silencer for the intake of Supply Fan #2
- Silencers for the exhausts of AHU's, #15, 16, 18 & 20
- Silencers behind the air intake louvres
- Acoustical Lining of an Elbow for Exhaust Fan #5

Calculations justifying the selected treatments are contained in Appendix 2.

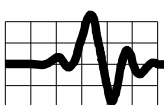
7.2 Noise Barrier for the New Generator Building

It was found that, without mitigation, the sound levels would exceed MoE limits at POR4, the two storey house to the north west of the new generator building. The major source causing high noise levels at POR4 is source 128, the three air intakes for the generator building. Secondary sources which also contribute to the noise at POR 4 are the two 5000 kVA transformers, sources 190 and 191, see Figure 5.

Recommended Noise Barrier

There is an existing 3 m high brick wall on the north side of the transformer yard which partially shields POR4. However, to provide adequate mitigation, a 3 m high acoustic barrier is required on the west side of the transformer yard as shown in Figure 5. For maintenance access purposes, the wall will require a person door and larger gates. The recommended acoustic barrier, including the access doors and gates, must have the following characteristics.

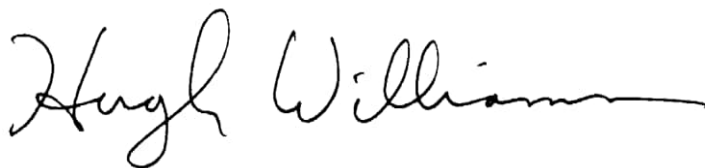
- provide a continuous solid barrier along its length
- have a surface density no less than 20 kg/m^2



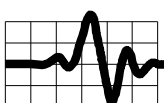
8.0 Conclusion

An acoustic assessment of the Queensway Carleton Hospital in Ottawa, Ontario has been conducted according to MoE guidelines¹⁻³. The assessment takes into account the nature of the operations, the proximity of nearby noise sensitive points of reception surrounding and within the hospital and the nature of the surrounding lands. Noise source levels have been assessed from manufacturer's data, through on-site measurements by Hugh Williamson Associates for some existing plant and equipment, or taken from information contained in the 2006 WESA noise study. Manufacturers' data has been used for not yet installed or planned equipment, i.e. for the proposed Part 3 Addition.

It is concluded that, with the mitigation measures recommended in Section 7.0, the operation of the Queensland Carleton Hospital during the day-time, evening and night-time (24) hours will be in compliance with MoE Noise Guidelines^{2,6}.

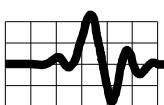


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Member, Canadian Acoustical Society



References

1. Ministry of Environment Publication NPC-233, *Information to be Submitted for Approval of Stationary Sources of Sound*, October 1995.
2. Ministry of Environment Publication NPC-205, *Sound Level Limits for Stationary Sources in Class 1 and 2 (Urban) Areas*, October 1995.
3. Ministry of Environment, *Sample Application Package, Basic Comprehensive Certificate of Approval (Air and Noise)*, July 2009.
4. Water and Earth Science Associates Ltd. (WESA), *Acoustic Assessment of Queensway Carleton Hospital*, May 2006.
5. Water and Earth Science Associates Ltd. (WESA), *Emission Summary and Dispersion Modelling Report, Queensway Carleton Hospital*, 2010.
6. Ministry of Environment Publication LU-131, *Noise Assessment Criteria in Land Use Planning: Requirements, Procedures and Implementation*, October 1997.
7. International Standards Organization, *Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation*, ISO 9613-2: 1996(E).



Tables

Contents:

- Table 1: Noise Source Summary Table
- Table 2: Sound Level Limits
- Table 3: Comparison of Predictions, All Sources vs. Only Significant Sources
- Table 4: Acoustic Assessment Summary Table – Day (07:00 – 19:00)
- Table 5: Acoustic Assessment Summary Table – Evening (19:00 – 23:00)
- Table 6: Acoustic Assessment Summary Table – Night (23:00 – 07:00)
- Table 7: Silencer Recommendations for Part 3 HVAC
- Table 8: Acoustic Lining Recommendation for Part 3 HVAC

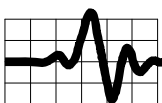


Table 1: Noises Source SummaryTable, Queensway Carleton Hospital

(Includes significant and insignificant noise sources, significant sources are highlighted. See notes at end of table for symbols.)

Source ID #	Source Description	Year Installed	General Location/Phase/P roject	Sound Power dBA ^{1, 2}	Time of Day Adjustments dBA ³	Sound ⁴ Characteristics	Data Source	Existing Noise Control Measures ⁵	Required Mitigation ⁶
1	Isolation room exhaust vents	Unknown	Original Bldg	88.9		S	WEAS 2006	U	U
2	Block B exhaust vent	Unknown	Original Bldg	92.3		S	WEAS 2006	U	U
3	Air intake louvres for quads 1 to 4	Unknown	Original Bldg	78.0		S	WEAS 2006	U	U
4	Elevator unit air intake louvres	Unknown	Original Bldg	N.A.		S	WEAS 2006	U	U
5	Block C exhaust vent	Unknown	Original Bldg	N.A.		S	WEAS 2006	U	U
6	Core laboratory fumehood exhaust vent (1 vent)	1975	Original Bldg	N.A.		S	WEAS 2006	U	U
7	Core laboratory fumehood exhaust vent (3 vents)	1975	Original Bldg	N.A.		S	WEAS 2006	U	U
8	Main mechanical room air intake vents	1974	Original Bldg	N.A.		S	WEAS 2006	U	U
9	Main mechanical room air exhaust vent #1	1974	Original Bldg	95.5		S	WESA 2006	U	U
10	Main mechanical room air exhaust vent #2	1974	Original Bldg	96.3		S	WESA 2006	U	U
11	Main mechanical room air exhaust vent #3	1974	Original Bldg	96.3		S	WESA 2006	U	U
12	Main mechanical room air exhaust vent #4	1974	Original Bldg	96.3		S	WESA 2006	U	U
13	Main mechanical room air exhaust vent #5	1974	Original Bldg	97.0		S	WESA 2006	U	U
14	General exhaust fan	Unknown	Original Bldg	92.0		T	WESA 2006	U	U
15	Sanitary exhaust fan	Unknown	Original Bldg	74.0		T	WESA 2006	U	U
16	Air handling unit #1 (5000 cfm, 8' wc, 3379 rpm, 15 HP, Haakon industries)	Unknown	Original Bldg	91.0		S	WESA 2006	U	U
17	Radiology X-Ray process ventilation exhaust stack	1974	Original Bldg	N.A.		S	WESA 2006	U	U
18	Morgue fumehoods #1 and 2 exhaust vent	1999	Original Bldg	N.A.		S	WESA 2006	U	U
19	Cardiology area air intake louvers	Unknown	Original Bldg	N.A.		S	WESA 2006	U	U
20	Washroom exhaust vent	Unknown	Original Bldg	N.A.		T	WESA 2006	U	U
21	Washroom exhaust fan	Unknown	Original Bldg	N.A.		T	WESA 2006	U	U
22	Washroom exhaust fan	Unknown	Original Bldg	N.A.		T	WESA 2006	U	U
23	Washroom exhaust fan	Unknown	Original Bldg	N.A.		T	WESA 2006	U	U
24	Change room exhaust (Mother/Baby)	1999	Mother/Baby Addition	N.A.		T	WESA 2006	U	U
25	Washroom Exhaust (penthouse)	1999	Mother/Baby Addition	80.3		S	WESA 2006	U	U
26	Penthouse exhaust (Mother/Baby)	1999	Mother/Baby Addition	79.0		S	WESA 2006	U	U
27	Exhaust fan louvre (Mother/Baby)	1999	Mother/Baby Addition	N.A.		S	WESA 2006	U	U
28	Scavenging system exhaust vent #1 (Birth Unit)	1999	Mother/Baby Addition	79.3		S	WESA 2006	U	U
29	Scavenging system exhaust vent #2 (Birth Unit)	1999	Mother/Baby Addition	79.3		S	WESA 2006	U	U

Table 1: Noises Source SummaryTable, Queensway Carleton Hospital

(Includes significant and insignificant noise sources, significant sources are highlighted. See notes at end of table for symbols.)

Source ID #	Source Description	Year Installed	General Location/Phase/P roject	Sound Power dBA ^{1, 2}	Time of Day Adjustments dBA ³	Sound ⁴ Characteristics	Data Source	Existing Noise Control Measures ⁵	Required Mitigation ⁶
30	EF-1-12 fan (washroom exhaust fan)	1999	Mother/Baby Addition	74.3		S	WESA 2006	U	U
31	Maternity ward HVAC exhaust vent	1999	Mother/Baby Addition	N.A.		S	WESA 2006	U	U
32	Maternity ward HVAC exhaust vent	1999	Mother/Baby Addition	N.A.		S	WESA 2006	U	U
33	EF-1-11 fan (washroom exhaust fan)	1999	Mother/Baby Addition	75.1		S	WESA 2006	U	U
34	Penthouse air intake louvre	1999	Mother/Baby Addition	75.0		S	WESA 2006	U	U
35	EF-1-10 fan (washroom exhaust fan)	1999	Mother/Baby Addition	84.0		S	WESA 2006	U	U
36	HVAC exhaust vent	Unknown	Original Bldg	81.1	0, -3, -3	S	WESA 2006	U	U
37	HVAC air intake louvre	Unknown	Mother/Baby Addition	84.6	0, -3, -3	S	WESA 2006	U	U
38	CT Scan - 3 ton refrigeration unit	Unknown	Original Bldg	80.5	0, -3, -3	S	WESA 2006	U	U
39	Schreiber Pro Med 1055 AC Chiller	Unknown	Original Bldg	86.5	0, -3, -3	S	WESA 2006	U	U
40	Larkin air cooled condenser (1 fan)	Unknown	Original Bldg	89.0	0, -3, -3	S	WESA 2006	U	U
41	Air cooled condenser (4 fans)	Unknown	Original Bldg	93.2	0, -3, -3	S	2010 Measured by HWA	U	U
42	Quarantine area exhaust (level 2)	Unknown	Original Bldg	91.7		T	WESA 2006	U	U
43	Galley exhaust (level 2)	Unknown	Original Bldg	83.0		T	WESA 2006	U	U
44	Washroom exhaust fan	Unknown	Original Bldg	Removed			WESA 2006		
45	HVAC system exhaust vent (Trane)	Unknown	Original Bldg	Removed			WESA 2006		
46	Chiller room exhaust fan	Unknown	Original Bldg (Power Plant)	91.9		S	WESA 2006	U	U
47	Chiller room air intake louver	Unknown	Original Bldg (Power Plant)	96.3		S	WESA 2006	U	U
48/49/120	Cooling towers Model 3552A) (BAC	#1 & 2 – 2006	Original Bldg (Power Plant)	99.7	0, -3, -6	S	2010	U	U
		#3 - 2009	Original Bldg (Power Plant)	99.7	0, -3, -6	S	2010	U	U
50	Boiler plant air intake louvre	Unknown	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
51	Boiler plant air exhaust vent	Unknown	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
52/53	Combustion air intake louvres – generator room	Unknown	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
54	Thermo air ventilation unit air intake	2003	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
55	Thermo air ventilation unit air exhaust	2003	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
56	Cogeneration room exhaust fan #1	2003	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U

Table 1: Noises Source SummaryTable, Queensway Carleton Hospital

(Includes significant and insignificant noise sources, significant sources are highlighted. See notes at end of table for symbols.)

Source ID #	Source Description	Year Installed	General Location/Phase/P roject	Sound Power dBA ^{1, 2}	Time of Day Adjustments dBA ³	Sound ⁴ Characteristics	Data Source	Existing Noise Control Measures ⁵	Required Mitigation ⁶
57	Cogeneration room exhaust fan #2	2003	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
58	Electric room intale louver for fan #1	Unknown	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
59	Electric room intale louver for fan #2	Unknown	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
60	AHU unit #8 intake louver	Unknown	Original Bldg (Power Plant)	80.5		S	WESA 2006	S	U
61	AHU unit #8 exhaust (grill)	Unknown	Original Bldg (Power Plant)	80.5		S	WESA 2006	S	U
62	MRI Safety Vent	Unknown	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
63	Stack for the MRI device exhaust fan	Unknown	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
64	Air cooled condenser (2 fans)	Unknown	Part 2 Addition	93.0	0, -3, -3	S	WESA 2006	U	U
65	Medical Air Intake	1999	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
66	Diesel generator day tanks vent	1999	Original Bldg (Power Plant)	Removed			2010		
67	Diesel generator room louvered exhaust air penthouse	Unknown	Original Bldg (Power Plant)	Removed			2010		
68	Kato diesel generator exhaust stack	1974	Original Bldg (Power Plant)	Removed			2010		
69	Kohler diesel generator exhaust stack	1999	Original Bldg (Power Plant)	Removed			2010		
70	EF-02-01 (elect vault exhaust)	1999	Original Bldg (Power Plant)	84.0		S	WESA 2006	U	U
71	EF-02-02 (elect vault exhaust)	1999	Original Bldg (Power Plant)	84.0		S	WESA 2006	U	U
72	Washroom exhaust fan	1974	Original Bldg (Power Plant)	88.9		S	WESA 2006	U	U
73	Autopsy ventilation exhaust vent	1976	Original Bldg (Power Plant)	89.6		S	WESA 2006	U	U
74	Med Vac exhaust stack (air-way mgmt. And includes the scavenging system for the main building)	1999	Original Bldg (Power Plant)	97.0		T	WESA 2006	U	U
75	Cogeneration Room exhaust fan #3	2003	Original Bldg (Power Plant)	90.0		T	WESA 2006	U	U
76	Condensate tank vent	1974	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
77	#1 HW Boiler gas train vent	1974	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
78	#2 HW Boiler gas train vent	1974	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
79	#3 Hot Water Boiler gas train vent	Unknown	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U

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(Includes significant and insignificant noise sources, significant sources are highlighted. See notes at end of table for symbols.)

Source ID #	Source Description	Year Installed	General Location/Phase/P roject	Sound Power dBA ^{1, 2}	Time of Day Adjustments dBA ³	Sound ⁴ Characteristics	Data Source	Existing Noise Control Measures ⁵	Required Mitigation ⁶
80	Carpentry exhaust vent	Unknown	Original Bldg (Power Plant)	90.8		S	WESA 2006	U	U
81	#1 & #2 STM boiler stack.	1986	Original Bldg (Power Plant)	83.3		S	2010	U	U
82	#1 & #2 STM boiler gas stack	1986	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
83	#1 STM boiler safety valve vent	1986	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
84	#2 STM boiler safety valve vent	1986	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
85	STM header safety valve vent 'A'	1974	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
86	STM header safety valve vent 'B'	1974	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
87	Mixing station gas vent	1974	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
88	Blowdown tank vent	1974	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
89	Deaerator vent 'A'	1974	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
90	Deaerator vent 'B'	1974	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
91	Deaerator safety valve vent	1974	Original Bldg (Power Plant)	N.A.			WESA 2006	U	U
92	Hot water boiler #1 exhaust (1757 kW, natural gas-fired)	1974	Original Bldg (Power Plant)	80.3		S	2010	U	U
93A	Cogeneration unit exhaust stack (by- passing the exhaust steam generator unit)	2003	Original Bldg (Power Plant)	89.4		S	WESA 2006	S	U
93B	Cogeneration unit exhaust stack (exhaust through the exhaust steam generator unit)	2003	Original Bldg (Power Plant)	69.0		S	WESA 2006	S	U
94	Hot water boiler #2 exhaust stack (7356 kW, natural gas-fired)	1974	Original Bldg (Power Plant)	93.5		S	2010	U	U
95	AHU units #4-#7 intake louver	Unknown	Part 2 Addition	90.2		S	WESA 2006	S	U
96	AHU units #4-#7 exhaust (grill)	Unknown	Part 2 Addition	90.2		S	WESA 2006	S	U
97	Isolation room exhaust vent (Level 2)	Unknown	Part 2 Addition	85.3		T	WESA 2006	U	U
98	Isolation room exhaust vent (Level 3)	Unknown	Part 2 Addition	85.4		T	WESA 2006	U	U
99	Isolation room exhaust vent (Level 3)	Unknown	Part 2 Addition	85.4		T	WESA 2006	U	U
100	Isolation room exhaust vent (Level 4)	Unknown	Part 2 Addition	87.5		T	WESA 2006	U	U
101	Isolation room exhaust vent (Level 4)	Unknown	Part 2 Addition	88.5		T	WESA 2006	U	U
102	Galley exhaust (Level 4)	Unknown	Part 2 Addition	86.0		T	WESA 2006	U	U

Table 1: Noises Source SummaryTable, Queensway Carleton Hospital

(Includes significant and insignificant noise sources, significant sources are highlighted. See notes at end of table for symbols.)

Source ID #	Source Description	Year Installed	General Location/Phase/P roject	Sound Power dBA ^{1, 2}	Time of Day Adjustments dBA ³	Sound ⁴ Characteristics	Data Source	Existing Noise Control Measures ⁵	Required Mitigation ⁶
103	Sanitary exhaust (Level 3)	Unknown	Part 2 Addition	101.0		T	WESA 2006	U	U
104	Sanitary exhaust (Level 4)	Unknown	Part 2 Addition	101.0		T	WESA 2006	U	U
105	Sanitary exhaust (Level 4)	Unknown	Part 2 Addition	101.0		T	WESA 2006	U	U
106	Ambulance garage intake	Unknown	Part 2 Addition	N.A.			WESA 2006	U	U
107	Ambulance garage exhaust fan	Unknown	Part 2 Addition	N.A.			WESA 2006	U	U
108	Soiled room exhaust	Unknown	Part 2 Addition	N.A.			WESA 2006	U	U
109	Decontamination room exhaust	Unknown	Part 2 Addition	N.A.			WESA 2006	U	U
110	"Welding hood fan"	Unknown	Main Bldg	Removed					
111	Truck for paper shredding	Temporary	Adjacent to Power Plant	106.5	-3, day only	S	WESA 2006	U	U
112	Truck in front of loading dock	Temporary	Loading Dock	104.5	-9, day only	S	WESA 2006	U	U
113	Gas Meter	Unknown	n/a	72.3		S	WESA 2006	U	U
114	Air Handling Unit Serving New Operating Rooms (Q=9.4m3/s), AHU- 10 & 11 combined, see 180 & 181	2007	OR Addition	see 180 & 181			2010		
115	CVAC Exhaust	2007	OR Addition	N.A.			2010		
116	Steam release vents from SPD area and Level 3 Surgical Addition	2007	OR Addition	N.A.			2010		
117	N2, CO2, N2O Cylinder relief vents	2007	OR Addition	N.A.			2010		
118	Sanitary Exhaust for OR Addition	2007	OR Addition	N.A.			2010		
119	General Exhaust for OR Addition	2008	OR Addition	N.A.			2010		
120	New Cooling Tower CT-3 (BAC Model 3552A)	2008	Head Start Project (Power Plant)	99.7	0, -3, -6	S	2010	U	U
121	New Chiller (York 750 Tonnes)	2008	Head Start Project (Power Plant)	Internal N.A.		S	2010		
122	Chiller Room Exhaust Fan (Head Start Project) Included with Sources 46 & 47	2008	Head Start Project (Power Plant)	N.A.		S	2010		
123	Electrical Room Exhaust Fan (Head Start Project)	2008	Head Start Project (Power Plant)	N.A.		S	2010		
124	Mezzanine Area Exhaust Fan (Head Start Project)	2008	Head Start Project (Power Plant)	N.A.		S	2010		
125	750 kW Generator #1 Stack (New)	2009	Parking Structure	92.0		S	2010	S Hospital Plus	U
126	750 kW Generator #2 Stack (New)	2009	Parking Structure	92.0		S	2010	S Hospital Plus	U
127	750 kW Generator #3 Stack (New)	2009	Parking Structure	92.0		S	2010	S Hospital Plus	U
128	Generator Building Air Intakes (three)	2009	Parking Structure	95.5 each		S	2010	S Intake Silencer	B See Section 7

Table 1: Noises Source SummaryTable, Queensway Carleton Hospital

(Includes significant and insignificant noise sources, significant sources are highlighted. See notes at end of table for symbols.)

Source ID #	Source Description	Year Installed	General Location/Phase/P roject	Sound Power dBA ^{1, 2}	Time of Day Adjustments dBA ³	Sound ⁴ Characteristics	Data Source	Existing Noise Control Measures ⁵	Required Mitigation ⁶
129	Generator Building Air Exhausts (three)	2009	Parking Structure	94.5 each		S	2010	S Exhaust Silencer	U
130	Cancer Clinic AHU-1 Intake Serving Level 1 (Q = 13.7 m3/s)	2009	Cancer Centre	81.3		S	2010	S Duct Attenuation	U
131	Cancer Clinic AHU-2 Intake Serving Level 2 (Q = 9.5 m3/s)	2009	Cancer Centre	79.7		S	2010	S Duct Attenuation	U
132	Cancer Clinic AHU-3 Intake Serving Level 3 (Q = 7.9 m3/s)	2009	Cancer Centre	86.5		S	2010	S Duct Attenuation	U
133	Cancer Clinic AHU-4 Intake Serving Level 4, (Q = 9.9 m3/s)	2009	Cancer Centre	81.2		S	2010	S Duct Attenuation	U
134	Cancer Clinic AHU-5 Intake Serving Bunker (Q = 3.5 m3/s)	2009	Cancer Centre	79.1		S	2010	S Duct Attenuation	U
135	Cancer Clinic EF-1 (Level 1Washrooms, soiled laundry, showers, locker rooms)	2009	Cancer Centre	N.A.		S	2010	U	U
136	Cancer Clinic Washroom and Soiled Laundry Exhaust, EF-2	2009	Cancer Centre	N.A.		S	2010	U	U
137	Cancer Clinic Level 3 Washroom & Janitor Closet Exhaust, EF-3	2009	Cancer Centre	N.A.		S	2010	U	U
138	Cancer Clinic Level 4 Washroom & Janitor Closet Exhaust, EF-4	2009	Cancer Centre	N.A.		S	2010	U	U
139	Cancer Clinic Level 1 Lab Workroom Exhaust (EF-5, 3 m stack on roof)	2009	Cancer Centre	71.3		S	2010	U	U
140	Cancer Clinic Level 4 Isolation Room Exhaust (passes through HEPA filter) EF-6A	2009	Cancer Centre	83.9		S	2010	U	U
141	Cancer Clinic Level 4 Isolation Room Exhaust (passes through HEPA filter) EF-6B	2009	Cancer Centre	83.9		S	2010	U	U
142	Cancer Clinic Chemo Prep Room EF- 7A	2009	Cancer Centre	82.2		S	2010	U	U
143	Cancer Clinic Chemo Prep Room EF- 7B	2009	Cancer Centre	82.2		S	2010	U	U
144	Cancer Clinic Elevator Shaft Exhaust Fan EF-8	2009	Cancer Centre	N.A.		S	2010	U	U
145	Cancer Clinic Elevator Shaft Exhaust Fan EF-9	2009	Cancer Centre	N.A.		S	2010	U	U
146	Cancer Clinic Elevator Shaft Exhaust Fan EF-10	2009	Cancer Centre	N.A.		S	2010	U	U
147	Cancer Clinic Dry Process Darkroom Exhaust Fan, EF-11	2009	Cancer Centre	N.A.		S	2010	U	U
148	Cancer Clinic Bunker Mechanical Room Exhaust EF-15	2009	Cancer Centre	N.A.		S	2010	U	U
149	Cancer Clinic, General Exhaust, EF- 18	2009	Cancer Centre	N.A.		S	2010	U	U

Table 1: Noises Source SummaryTable, Queensway Carleton Hospital

(Includes significant and insignificant noise sources, significant sources are highlighted. See notes at end of table for symbols.)

Source ID #	Source Description	Year Installed	General Location/Phase/P roject	Sound Power dBA ^{1, 2}	Time of Day Adjustments dBA ³	Sound ⁴ Characteristics	Data Source	Existing Noise Control Measures ⁵	Required Mitigation ⁶
150	Cancer Clinic, Level 1 Natural Gas Fireplace	2009	Cancer Centre	N.A.		S	2010	U	U
151	Cancer Clinic, Level 2 Natural Gas Fireplace	2009	Cancer Centre	N.A.		S	2010	U	U
152	Cancer Clinic, Hot Water Boiler #3	2009	Cancer Centre Project (located in Power Plant)	80.3		S	2010	U	U
153	Histology Cutting Bench (New)	2009	Original Building	N.A.		S	2010	U	U
154	Hot Water Boiler #4	2011	Part 3 Addition (2011)	79.3		S	2010	U	U
155	Hot Water Boiler #5	2011	Part 3 Addition (2011)	79.3		S	2010	U	U
156	Hot Water Boiler #6	2011	Part 3 Addition (2011)	79.3		S	2010	U	U
157	Steam Boiler #3		Part 3 Addition (2011)	Eliminated from design					
158	Steam Boiler #4		Part 3 Addition (2011)	Eliminated from design					
159.1	Part 3 addition Mechanical Room Air Intake (West), Western Louvre	2011	Part 3 Addition (2011)	86.1	0, -3, -6	S	2010	U	S Louvre Silencers See Section 7 & Appendix XXX
159.2	Part 3 addition Mechanical Room Air Intake (West), Eastern Louvre	2011	Part 3 Addition (2011)	86.1	0, -3, -6	S	2010	U	S Louvre Silencers See Section 7 & Appendix XXX
160	Part 3 addition Mechanical Room Air Intake (East)	2011	Part 3 Addition (2011)	85.2	0, -3, -6	S	2010	U	S Louvre Silencers See Section 7 & Appendix XXX
161	Hot Water Boiler #7		Part 3 Addition (2011)	Eliminated from design			2010		
162	Steam Boiler #5	2011	Part 3 Addition (2011)	83.3		S	2010	U	U
163	Steam Boiler #6	2011	Part 3 Addition (2011)	83.3		S	2010	U	U
164	Steam Boiler #7	2011	Part 3 Addition (2011)	83.3		S	2010	U	U
165	Steam Boiler #8	2011	Part 3 Addition (2011)	83.3		S	2010	U	U
170	Part 3 addition Mechanical Room Air Exhaust (West)	2011	Part 3 Addition (2011)	93.8		S	2010	U	S Silencers See Section 7 & Appendix XXX

Table 1: Noises Source SummaryTable, Queensway Carleton Hospital

(Includes significant and insignificant noise sources, significant sources are highlighted. See notes at end of table for symbols.)

Source ID #	Source Description	Year Installed	General Location/Phase/P roject	Sound Power dBA ^{1, 2}	Time of Day Adjustments dBA ³	Sound ⁴ Characteristics	Data Source	Existing Noise Control Measures ⁵	Required Mitigation ⁶
171	Part 3 addition Mechanical Room Air Exhaust (East)	2011	Part 3 Addition (2011)	93.2		S	2010	U	S Silencers See Section 7 & Appendix XXX
180	Air Intake OR Mechanical Room, AHU-11 to be added in 2011 as part of Part 3 Expansion, AHU-10 (source 114) existing	2011	OR Addition	94.1		S	2010	U	U
181	Air Exhaust OR Mechanical Room, AHU-11 to be added in 2011 as part of Part 3 Expansion, AHU-10 (source 114) existing	2011	OR Addition	89.8		S	2010	U	U
182	AHU-13 for MRI, to be added as part of Part 3 addition in 2011, intake and exhaust treated as combined source	2011	Original Bldg (Power Plant)	84.8		S	2010	U	U
183	AHU-12 located in basement of Part 2, to be added as part of Part 3 Expansion, exhaust on roof of Power Plant	2011	Original Bldg (Power Plant)	94.7		S	2010	U	U
184	AHU-14 for main lobby, to be added as part of Part 3 addition in 2011, intake and exhaust treated as combined source	2011	Roof, Near Main Entry	90.0		S	2010	U	U
190	Transformer #1 5000kVA	2009	Parking Structure	84.5		T	2010	U	B See Section 7
191	Transformer #2 5000kVA	2009	Parking Structure	84.5		T	2010	U	B See Section 7
201	Cancer AHU-1 Exhaust and Return Fan	2009	Cancer Centre	91.5		S	2010	U	U
202	Cancer AHU-2 Exhaust and Return Fan	2009	Cancer Centre	84.0		S	2010	U	U
203	Cancer AHU-3 Exhaust and Return Fan	2009	Cancer Centre	87.5		S	2010	U	U
204	Cancer AHU-4 Exhaust and Return Fan	2009	Cancer Centre	85.5		S	2010	U	U

Notes for this Table:

1. Sound Power refers to sound power with mitigation such as silencers for HVAC equipment as set out in Section 7.0. Where a sound source is tonal (T), the sound power includes a 5 dBA penalty as per NPC-104. N.A. means assessed as Not Applicable (Insignificant), without measurement. Typically, noise too low to measure.

2. All sources are Outdoor sources, unless noted.

Table 1: Noises Source SummaryTable, Queensway Carleton Hospital

(Includes significant and insignificant noise sources, significant sources are highlighted. See notes at end of table for symbols.)

Source ID #	Source Description	Year Installed	General Location/Phase/Project	Sound Power dBA ^{1, 2}	Time of Day Adjustments dBA ³	Sound ⁴ Characteristics	Data Source	Existing Noise Control Measures ⁵	Required Mitigation ⁶
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3. Time of Day Adjustment
Adjustments in dBA for time periods, including intermittence
X, Y, Z = adjustments in dBA for day(07:00 to 19:00), evening(19:00 - 23:00) and night(23:00 - 07:00), respectively.

4. Sound Characteristics:
S - Steady
Q - Quasi Steady Impulsive
I - Impulsive
B - Buzzing
T - Tonal
C - Cyclic

5. Existing Noise Control Measures
S - silencer, acoustic louver, muffler
A - acoustic lining, plenum
B - barrier, berm, screening (not including shielding provided by obstacles, such as buildings)
L - Lagging
E - acoustic enclosure
O - other
U - uncontrolled

6. Required Mitigation
S - silencer, acoustic louver, muffler
A - acoustic lining, plenum
B - barrier, berm, screening
L - Lagging
E - acoustic enclosure
O - other
U - uncontrolled

Table 2: Sound Level Limits by Time of Day

Time of Day	OUTDOOR*	INDOOR**
	Exclusion Sound Level Limits Class 1 Area (Urban) ² L _{EO} (dBA)	Sound Level Limits ⁶ (For fully air-conditioned buildings with inoperable windows) L _{EO} (dBA)
07:00 – 19:00	50	45
19:00 – 23:00	47	45
23:00 – 07:00	45	40

* Applicable to residential POR's

** Applicable to POR's corresponding to Hospital Patient and Treatment Rooms

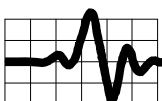


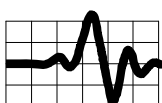
Table 3: Comparison of Predictions, All Sources vs. Only Significant Sources

Source Name	ID	All Sources			Significant Sources Only			Difference		
		Day (dBA)	Evening (dBA)	Night (dBA)	Day (dBA)	Evening (dBA)	Night (dBA)	Day (dBA)	Evening (dBA)	Night (dBA)
26 Sioux Crescent	1	45.0	44.3	43.8	43.5	42.4	41.8	1.5	1.9	2.0
Part 2, Level 4, North, Patient Room	2	61.5	61.1	61.0	59.8	59.4	59.2	1.7	1.7	1.8
Old Building, Level 4, North, Patient Room	3	54.1	53.7	53.5	52.0	51.4	51.1	2.1	2.3	2.4
Residence NCC Land, 2 storey	4	45.0	43.9	43.5	43.5	42.0	41.2	1.5	1.9	2.3
20 Sioux Crescent	5	45.5	44.6	44.2	43.8	42.5	41.7	1.7	2.1	2.5
42 Sioux Crescent	6	42.0	41.1	40.6	40.7	39.5	38.7	1.3	1.6	1.9
2 Shadow Court	7	40.4	40.0	39.8	38.5	37.8	37.5	1.9	2.2	2.3
Cancer Level 1 - day use only	11	65.3	62.8	60.6	64.9	62.1	59.4	0.4	0.7	1.2
Cancer Level 2 - day use only	12	68.3	65.4	62.8	68.1	65.1	62.3	0.2	0.3	0.5
Cancer Level 3 - day use only	13	68.6	65.6	63.3	68.4	65.2	62.6	0.2	0.4	0.7
Cancer Level 4 - day use only	14	68.2	65.2	63.0	67.9	64.7	62.1	0.3	0.5	0.9
Part 2, Level 4 , West A, Patient Rooms	21	66.7	65.8	65.8	66.1	65.0	65.0	0.6	0.8	0.8
Part 2, Level 4 , West B, Patient Rooms	22	60.5	60.3	60.3	59.6	59.5	59.5	0.9	0.8	0.8
Part 3 Receptor, 3rd Floor, North , East Side	31	65.9	63.0	60.4	65.8	62.9	60.1	0.1	0.1	0.3
Part 3 Receptor, 3rd Floor, North, West Side	32	66.3	63.4	60.6	66.2	63.3	60.5	0.1	0.1	0.1
Part 3 Receptor, 3rd Floor, South, East End	33	63.5	63.0	62.7	63.4	62.9	62.6	0.1	0.1	0.1
Part 3 Receptor, 3rd Floor, South, West End	34	58.7	55.8	53.0	58.6	55.7	52.9	0.1	0.1	0.1
Old Building, Level 4, East, Patient Room	41	60.1	60.0	60.0	59.8	59.8	59.8	0.3	0.2	0.2
Patient Room, Old Part West, A	42	58.1	58.0	58.0	57.9	57.8	57.8	0.2	0.2	0.2
Patient Room, Old Part West, B	43	56.5	56.2	56.2	56.2	55.9	55.9	0.3	0.3	0.3
Patient Room, Old Part West, C	44	50.0	47.8	47.8	49.7	47.4	47.4	0.3	0.4	0.4
Operating Rooms, no windows	51	65.0	57.9	57.2	64.7	56.1	55.0	0.3	1.8	2.2

Highlight > 2.0

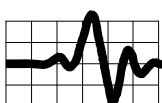
**Table 4: Acoustic Assessment Summary Table - Day (07:00 – 19:00)
(With Proposed Mitigation)**

POR ID	POR Description	Estimated Outdoor Sound Level at POR (Worst Case) dBA (Leq)	Estimated Indoor Sound Level at POR (Worst Case) dBA (Leq)	Verified by Acoustic Audit	Performance Limit dBA (Leq)	Compliance with Performance Limit (Yes/No)
R1	Residence, 2 Storey 26 Sioux Crescent	43.5	-	No	50 dBA	Yes
R2	Part 2, Patient Room, Level 4, North Side	59.8	25.1	No	45 dBA (Indoor)	Yes
R3	Old Building, Patient Room Level 4, North Side	52.0	23.9	No	45 dBA (Indoor)	Yes
R4	Residence, 2 Storey NCC Land	43.5	-	No	50 dBA	Yes
R5	Residence, 2 Storey 20 Sioux Crescent	43.8	-	No	50 dBA	Yes
R6	Residence, 2 Storey 42 Sioux Crescent	40.7	-	No	50 dBA	Yes
R7	Residence, 2 Storey 2 Shadow Court	38.5	-	No	50 dBA	Yes
R11	Cancer, Treatment Room Level 1 - day use only	64.9	36.5	No	45 dBA (Indoor)	Yes
R12	Cancer, Treatment Room Level 2 - day use only	68.1	39.7	No	45 dBA (Indoor)	Yes
R13	Cancer, Treatment Room Level 3 - day use only	68.4	40.0	No	45 dBA (Indoor)	Yes
R14	Cancer, Treatment Room Level 4 - day use only	67.9	39.4	No	45 dBA (Indoor)	Yes



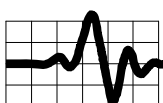
POR ID	POR Description	Estimated Outdoor Sound Level at POR (Worst Case) dBA (Leq)	Estimated Indoor Sound Level at POR (Worst Case) dBA (Leq)	Verified by Acoustic Audit	Performance Limit dBA (Leq)	Compliance with Performance Limit (Yes/No)
R21	Part 2, Patient Rooms, Level 4 , West Side, North	66.1	36.4	No	45 dBA (Indoor)	Yes
R22	Part 2, Patient Rooms, Level 4 , West Side, South	59.6	28.5	No	45 dBA (Indoor)	Yes
R31	Part 3, Patient Room, 3rd Floor, North Side, East	65.8	37.3	No	45 dBA (Indoor)	Yes
R32	Part 3, Patient Room, 3rd Floor, North Side, West	66.2	38.1	No	45 dBA (Indoor)	Yes
R33	Part 3, Patient Room, 3rd Floor, South Side, East	63.4	34.8	No	45 dBA (Indoor)	Yes
R34	Part 3, Patient Room, 3rd Floor, South Side, West	58.6	31.7	No	45 dBA (Indoor)	Yes
R41	Old Building, Patient Room Level 4, East	59.8	28.3	No	45 dBA (Indoor)	Yes
R42	Old Building, Patient Room Level 4, West Side, North	57.9	27.9	No	45 dBA (Indoor)	Yes
R43	Old Building, Patient Room Level 4, West Side, South	56.2	25.0	No	45 dBA (Indoor)	Yes
R44	Old Building, Patient Room Level 4, South Side	49.7	19.8	No	45 dBA (Indoor)	Yes
R51	Operating Rooms, no windows, Level 3	64.7	24.5	No	45 dBA (Indoor)	Yes

Notes: Performance limits are based on 1-hour equivalent sound levels.



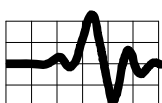
**Table 5: Acoustic Assessment Summary Table - Evening (19:00 – 23:00)
(With Proposed Mitigation)**

POR ID	POR Description	Estimated Outdoor Sound Level at POR (Worst Case) dBA (Leq)	Estimated Indoor Sound Level at POR (Worst Case) dBA (Leq)	Verified by Acoustic Audit	Performance Limit dBA (Leq)	Compliance with Performance Limit (Yes/No)
R1	Residence, 2 Storey 26 Sioux Crescent	42.4	-	No	47 dBA	Yes
R2	Part 2, Patient Room, Level 4, North Side	59.4	24.7	No	45 dBA (Indoor)	Yes
R3	Old Building, Patient Room Level 4, North Side	51.4	23.3	No	45 dBA (Indoor)	Yes
R4	Residence, 2 Storey NCC Land	42.0	-	No	47 dBA	Yes
R5	Residence, 2 Storey 20 Sioux Crescent	42.5	-	No	47 dBA	Yes
R6	Residence, 2 Storey 42 Sioux Crescent	39.5	-	No	47 dBA	Yes
R7	Residence, 2 Storey 2 Shadow Court	37.8	-	No	47 dBA	Yes
R11	Cancer, Treatment Room Level 1 - day use only	62.1	33.7	No	45 dBA (Indoor) Not in use	Yes
R12	Cancer, Treatment Room Level 2 - day use only	65.1	36.7	No	45 dBA (Indoor) Not in use	Yes
R13	Cancer, Treatment Room Level 3 - day use only	65.2	36.8	No	45 dBA (Indoor) Not in use	Yes
R14	Cancer, Treatment Room Level 4 - day use only	64.7	36.2	No	45 dBA (Indoor) Not in use	Yes



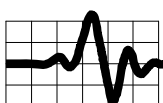
POR ID	POR Description	Estimated Outdoor Sound Level at POR (Worst Case) dBA (Leq)	Estimated Indoor Sound Level at POR (Worst Case) dBA (Leq)	Verified by Acoustic Audit	Performance Limit dBA (Leq)	Compliance with Performance Limit (Yes/No)
R21	Part 2, Patient Rooms, Level 4 , West Side, North	65.0	35.3	No	45 dBA (Indoor)	Yes
R22	Part 2, Patient Rooms, Level 4 , West Side, South	59.5	28.4	No	45 dBA (Indoor)	Yes
R31	Part 3, Patient Room, 3rd Floor, North Side, East	62.9	34.4	No	45 dBA (Indoor)	Yes
R32	Part 3, Patient Room, 3rd Floor, North Side, West	63.3	35.1	No	45 dBA (Indoor)	Yes
R33	Part 3, Patient Room, 3rd Floor, South Side, East	62.9	34.3	No	45 dBA (Indoor)	Yes
R34	Part 3, Patient Room, 3rd Floor, South Side, West	55.7	28.7	No	45 dBA (Indoor)	Yes
R41	Old Building, Patient Room Level 4, East	59.8	28.3	No	45 dBA (Indoor)	Yes
R42	Old Building, Patient Room Level 4, West Side, North	57.8	27.8	No	45 dBA (Indoor)	Yes
R43	Old Building, Patient Room Level 4, West Side, South	55.9	24.8	No	45 dBA (Indoor)	Yes
R44	Old Building, Patient Room Level 4, South Side	47.4	17.5	No	45 dBA (Indoor)	Yes
R51	Operating Rooms, no windows, Level 3	56.1	16.1	No	45 dBA (Indoor)	Yes

Notes: Performance limits are based on 1-hour equivalent sound levels.



**Table 6: Acoustic Assessment Summary Table - Night (23:00 – 07:00)
(With Proposed Mitigation)**

POR ID	POR Description	Estimated Outdoor Sound Level at POR (Worst Case) dBA (Leq)	Estimated Indoor Sound Level at POR (Worst Case) dBA (Leq)	Verified by Acoustic Audit	Performance Limit dBA (Leq)	Compliance with Performance Limit (Yes/No)
R1	Residence, 2 Storey 26 Sioux Crescent	41.8	-	No	45 dBA	Yes
R2	Part 2, Patient Room, Level 4, North Side	59.2	24.5	No	40 dBA (Indoor)	Yes
R3	Old Building, Patient Room Level 4, North Side	51.1	23.0	No	40 dBA (Indoor)	Yes
R4	Residence, 2 Storey NCC Land	41.2	-	No	45 dBA	Yes
R5	Residence, 2 Storey 20 Sioux Crescent	41.7	-	No	45 dBA	Yes
R6	Residence, 2 Storey 42 Sioux Crescent	38.7	-	No	45 dBA	Yes
R7	Residence, 2 Storey 2 Shadow Court	37.5	-	No	45 dBA	Yes
R11	Cancer, Treatment Room Level 1 - day use only	59.4	31.9	No	40 dBA (Indoor) Not in Use	Yes
R12	Cancer, Treatment Room Level 2 - day use only	62.3	33.8	No	40 dBA (Indoor) Not in Use	Yes
R13	Cancer, Treatment Room Level 3 - day use only	62.6	33.4	No	40 dBA (Indoor) Not in Use	Yes
R14	Cancer, Treatment Room Level 4 - day use only	62.1	33.7	No	40 dBA (Indoor) Not in Use	Yes



POR ID	POR Description	Estimated Outdoor Sound Level at POR (Worst Case) dBA (Leq)	Estimated Indoor Sound Level at POR (Worst Case) dBA (Leq)	Verified by Acoustic Audit	Performance Limit dBA (Leq)	Compliance with Performance Limit (Yes/No)
R21	Part 2, Patient Rooms, Level 4 , West Side, North	65.0	35.3	No	40 dBA (Indoor)	Yes
R22	Part 2, Patient Rooms, Level 4 , West Side, South	59.5	28.4	No	40 dBA (Indoor)	Yes
R31	Part 3, Patient Room, 3rd Floor, North Side, East	60.1	32.6	No	40 dBA (Indoor)	Yes
R32	Part 3, Patient Room, 3rd Floor, North Side, West	60.5	32.3	No	40 dBA (Indoor)	Yes
R33	Part 3, Patient Room, 3rd Floor, South Side, East	62.6	34.0	No	40 dBA (Indoor)	Yes
R34	Part 3, Patient Room, 3rd Floor, South Side, West	52.9	25.8	No	40 dBA (Indoor)	Yes
R41	Old Building, Patient Room Level 4, East	59.8	28.3	No	40 dBA (Indoor)	Yes
R42	Old Building, Patient Room Level 4, West Side, North	57.8	27.8	No	40 dBA (Indoor)	Yes
R43	Old Building, Patient Room Level 4, West Side, South	55.9	24.8	No	40 dBA (Indoor)	Yes
R44	Old Building, Patient Room Level 4, South Side	47.4	17.5	No	40 dBA (Indoor)	Yes
R51	Operating Rooms, no windows, Level 3	55.0	16.1	No	40 dBA (Indoor)	Yes

Notes: Performance limits are based on 1-hour equivalent sound levels.

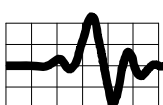


Table 7 Silencer Recommendations

Silencer Description (See Notes below)	Estimated Pressure Drop “ H ₂ O	Minimum Dynamic Insertion Loss, dB							
		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
SLS-2X (associated with the Intake of SF-2) Based on Vibro-Acoustics 48 X 40-RFL-HV-F4 X 36 Size: 48" X 40" X 36" Long, flow 24,000 cfm	0.13	3	4	8	13	14	11	9	5
SLS-15X (associated with the exhausts of AHU-15 and RF-15) Based on Vibro-Acoustics 84 X 36-RFL-HV-F5 X 36 Size: 84" X 36" X 36" Long, flow 34,000 cfm	0.12	1	3	7	11	14	14	10	4
SLS-16X (associated with the exhaust of AHU-16) Based on Vibro-Acoustics 40 X 20-RFL-HV-F6 X 36 Size: 40" X 20" X 36" Long, flow 11,000 cfm	0.02	1	3	6	11	14	16	11	4
SLS-18X (associated with the exhaust of AHU-18) Based on Vibro-Acoustics 100 X 32-RFL-HV-F6 X 36 Size: 100" X 32" X 36" Long, flow 43,000 cfm	0.16	1	3	6	11	14	16	11	4
SLS-20X (associated with the exhausts of AHU- 20 and RF-20) Based on Vibro-Acoustics 60 X 26-RFL-HV-F6 X 36 Size: 60" X 26" X 36" Long, flow 25,000 cfm	0.20	1	3	6	11	14	16	11	4
Silencers Behind Intake Louvers (South Side, Level 4) Based on Vibro-Acoustics SRD, 12" long	0.03	3	8	6	11	13	15	15	11

Notes: (1) All silencers to have Tedlar film linings.
(2) All silencer casing, except louvre silencers, to be Minim 10 gauge HTL casings

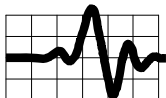
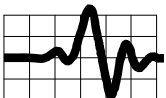


Table 8 Recommendation for Lined Elbow for EF-5

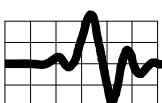
Description	Anticipated Dynamic Insertion Loss, dB (as estimated using ASHRAE HVAC Applications Handbook, 2007)							
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Elbow for EF-5 - This refers to 60" X 32" 90° Elbow immediately before the Exhaust Louvre. - Elbow to be lined with a minimum 1" thick acoustical lining (e.g. semi-rigid fibreglass) then covered with a Tedlar film lining and protected by a screen or perforated metal sheet.	6	11	10	10	10	10	10	10

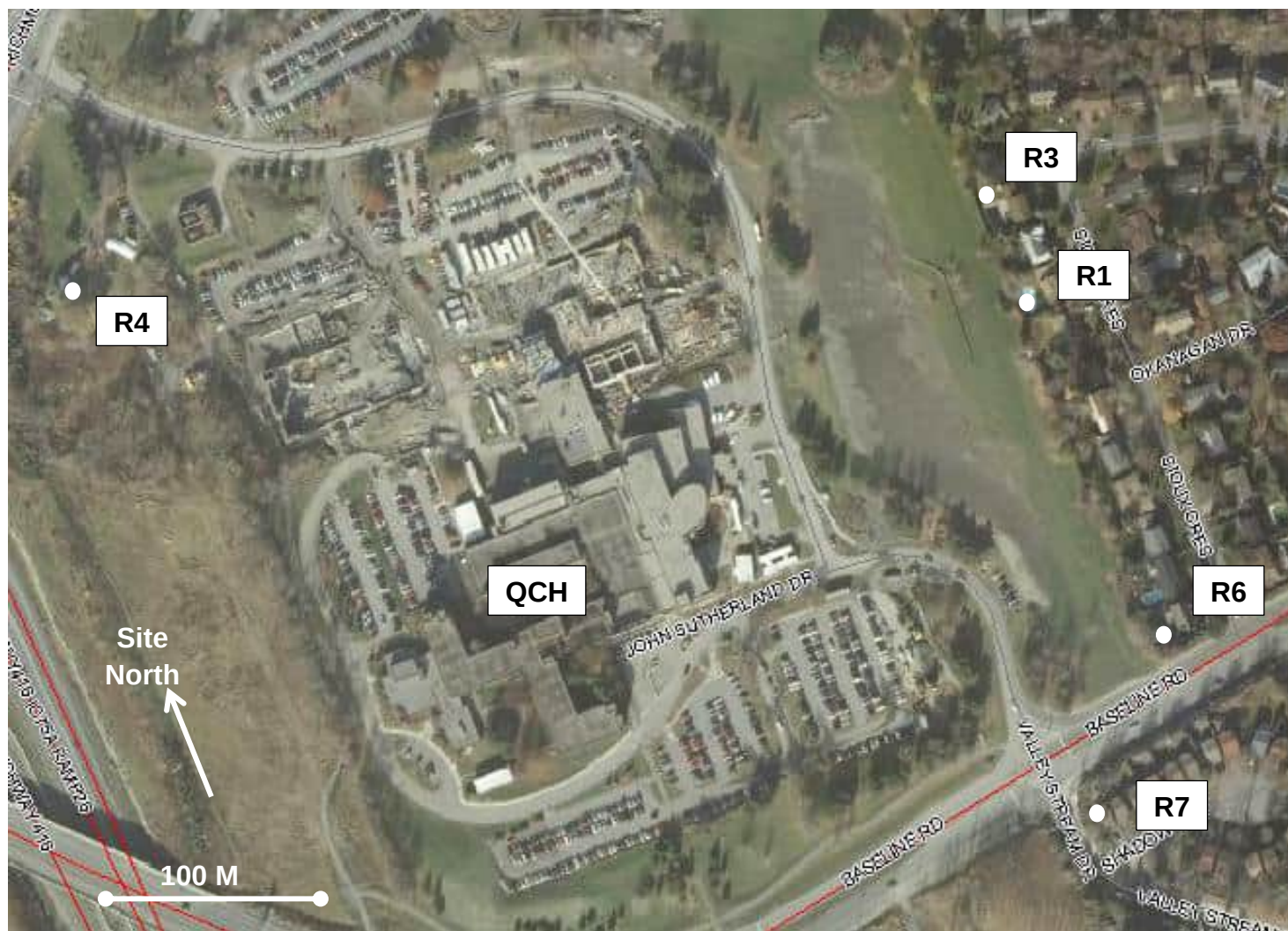


Figures

Contents:

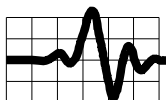
- Figure 1: Aerial Photo and Residential Receptors
- Figure 2: Zoning Plan, City of Ottawa
- Figure 3: Site Plan and Nearby Receptors
- Figure 4: Noise Sources and Points of Reception
- Figure 5: New Generator Building and Recommended Noise Barrier
- Figure 6: Predicted Noise Contours - Day
- Figure 7: Predicted Noise Contours - Evening
- Figure 8: Predicted Noise Contours - Night
- Figure 9: Western Part of the Mechanical Room, Level 4, Part 3
- Figure 10: Eastern Part of the Mechanical Room, Level 4, Part 3





Source: City of Ottawa Aerial Photo, 2008

Figure 1: Aerial Photo & Residential Receptors



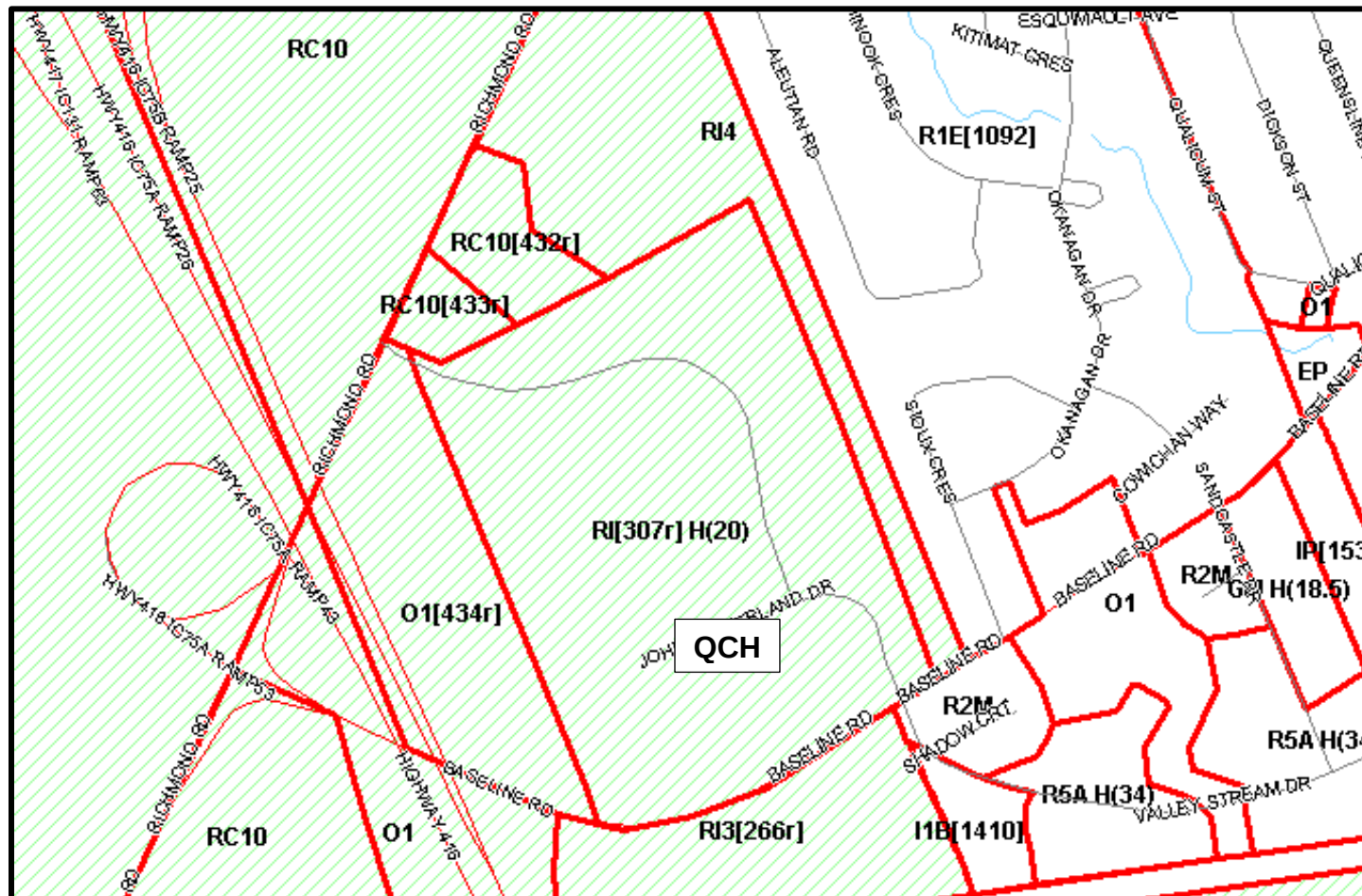


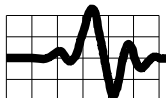
Figure 2: City of Ottawa Zoning

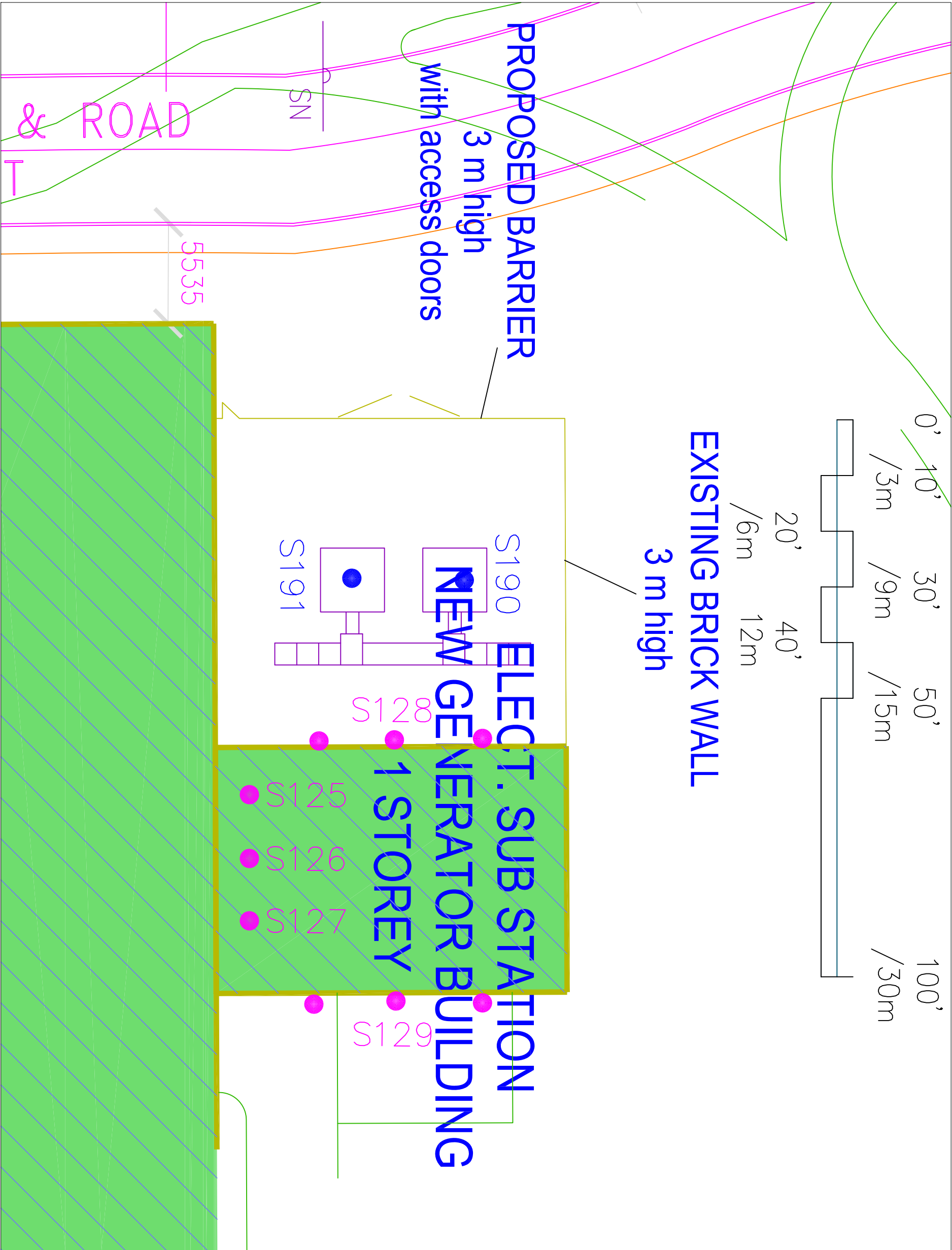
Zoning Legend:

RI = Rural Institutional
RC = Rural Commercial

R2 = Residential
R1 = Residential

O1 = Parks and Open Space





LEGEND

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PROJECT NUMBER: B3622	MODIFIED BY: HW	DESIGNED BY: JG.
DATE: 12 AUGUST 2010	CHECKED BY:	
SCALE:	CAD FILE NO.: B3622-SP-APR09	

FIGURE: 5
NEW GENERATOR BUILDING
QUEENSWAY CARLETON HOSPITAL
OTTAWA, ONTARIO

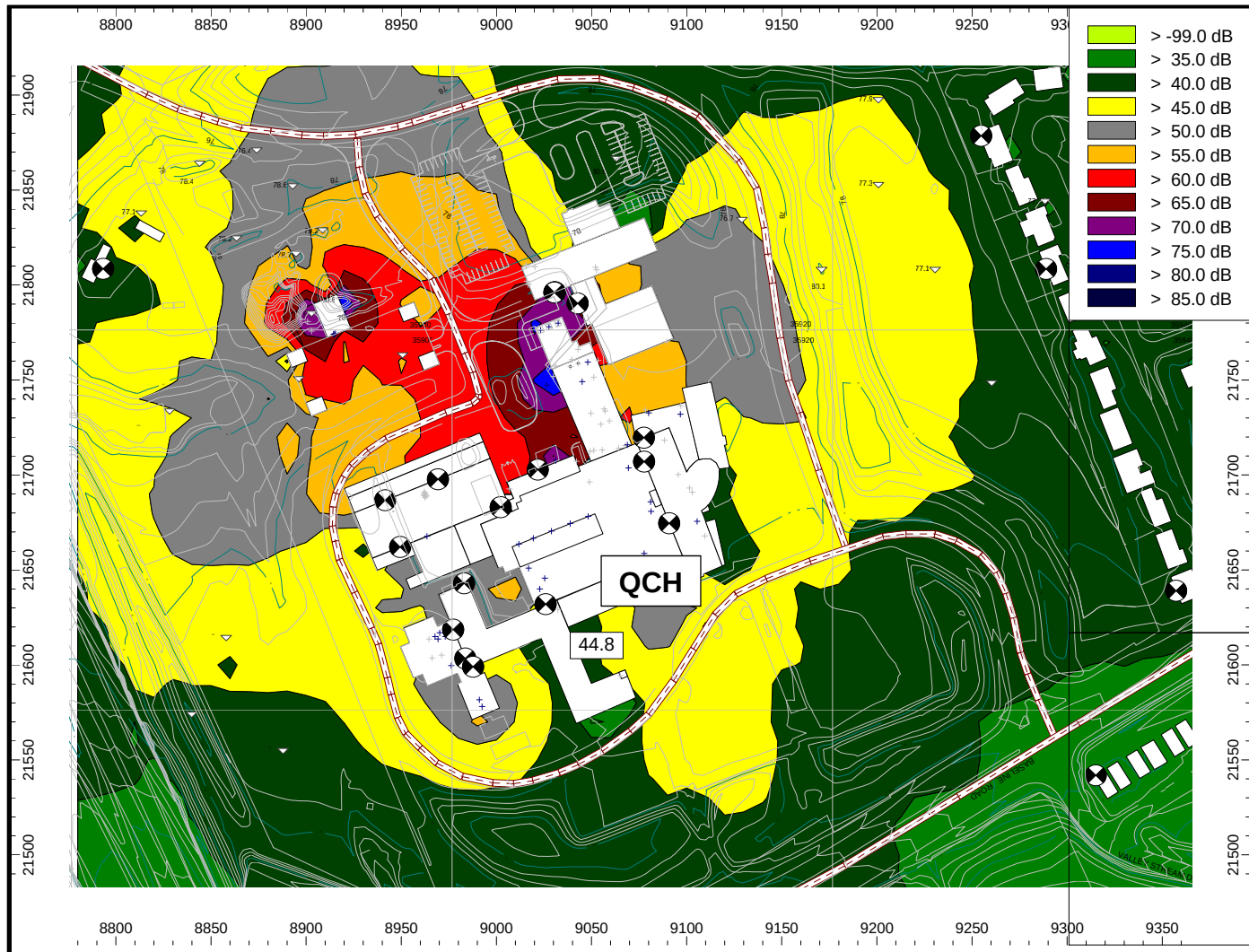
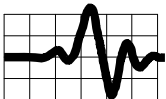


Figure 6: Predicted Outdoor Noise Contours, Day, Significant Sources Only, (at 4.5 m above ground)



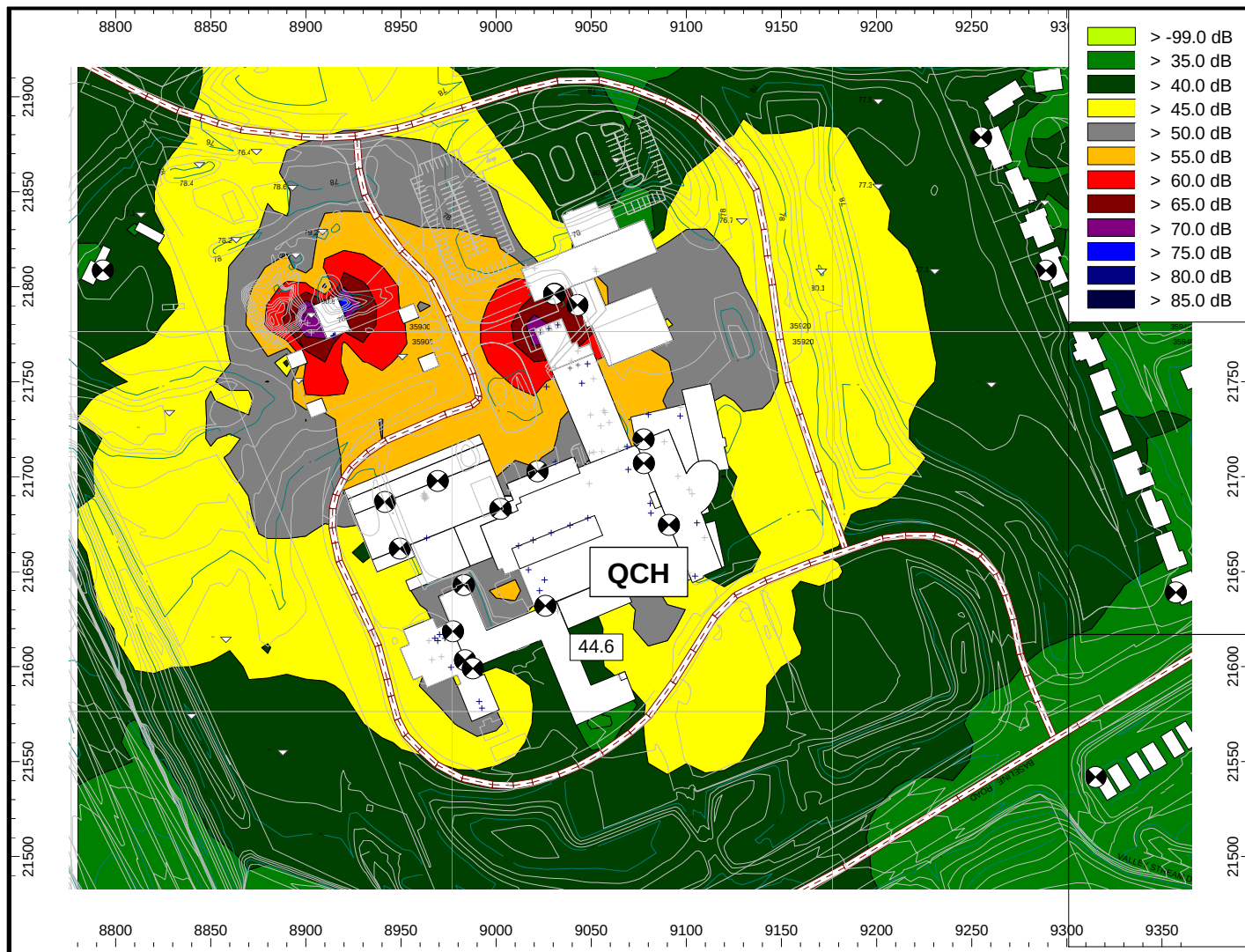
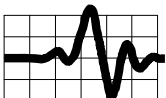


Figure 7: Predicted Outdoor Noise Contours, Evening, Significant Sources Only, (at 4.5 m above ground)



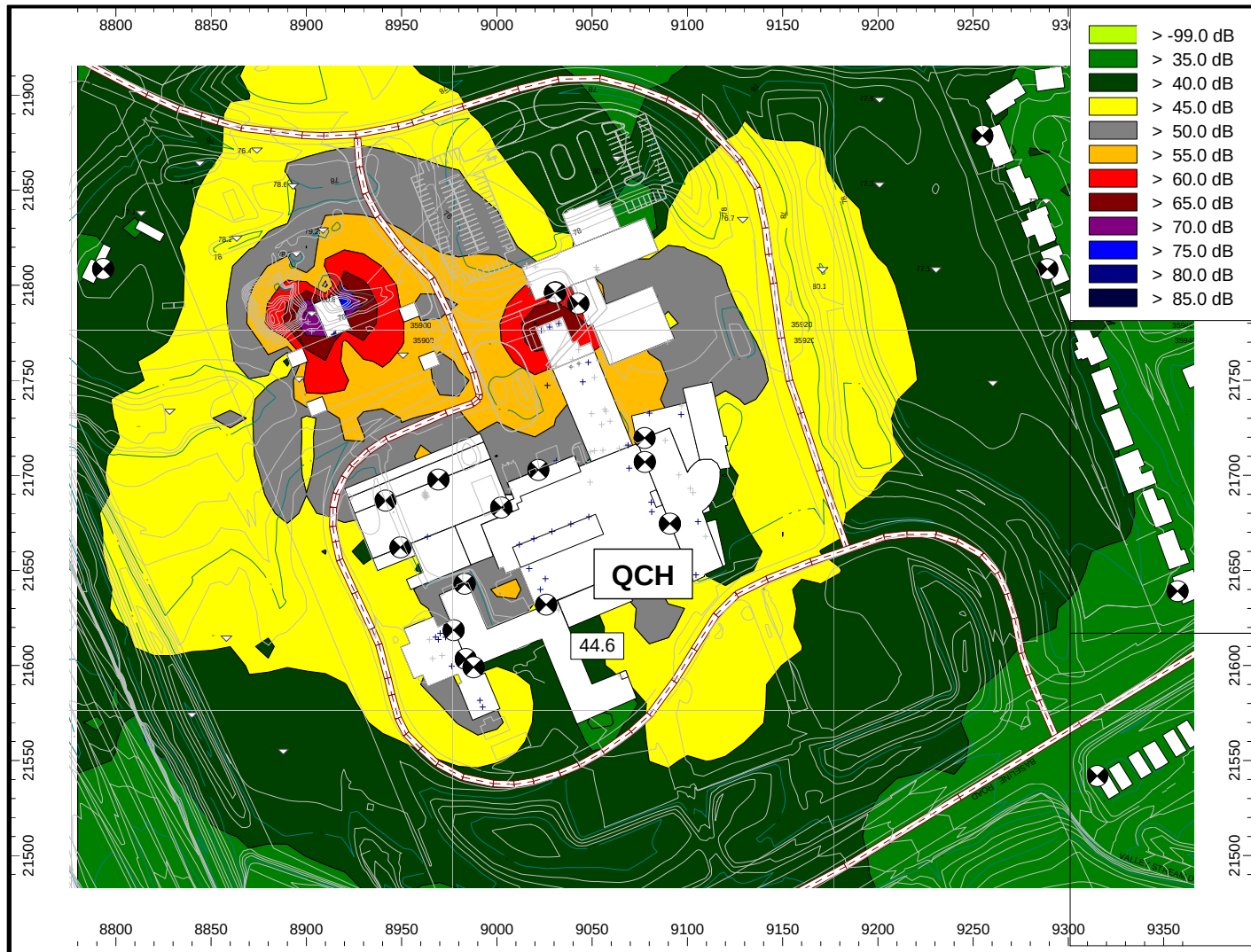
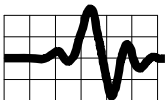


Figure 8: Predicted Outdoor Noise Contours, Night, Significant Sources Only, (at 4.5 m above ground)



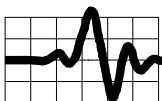
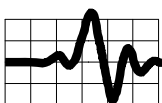
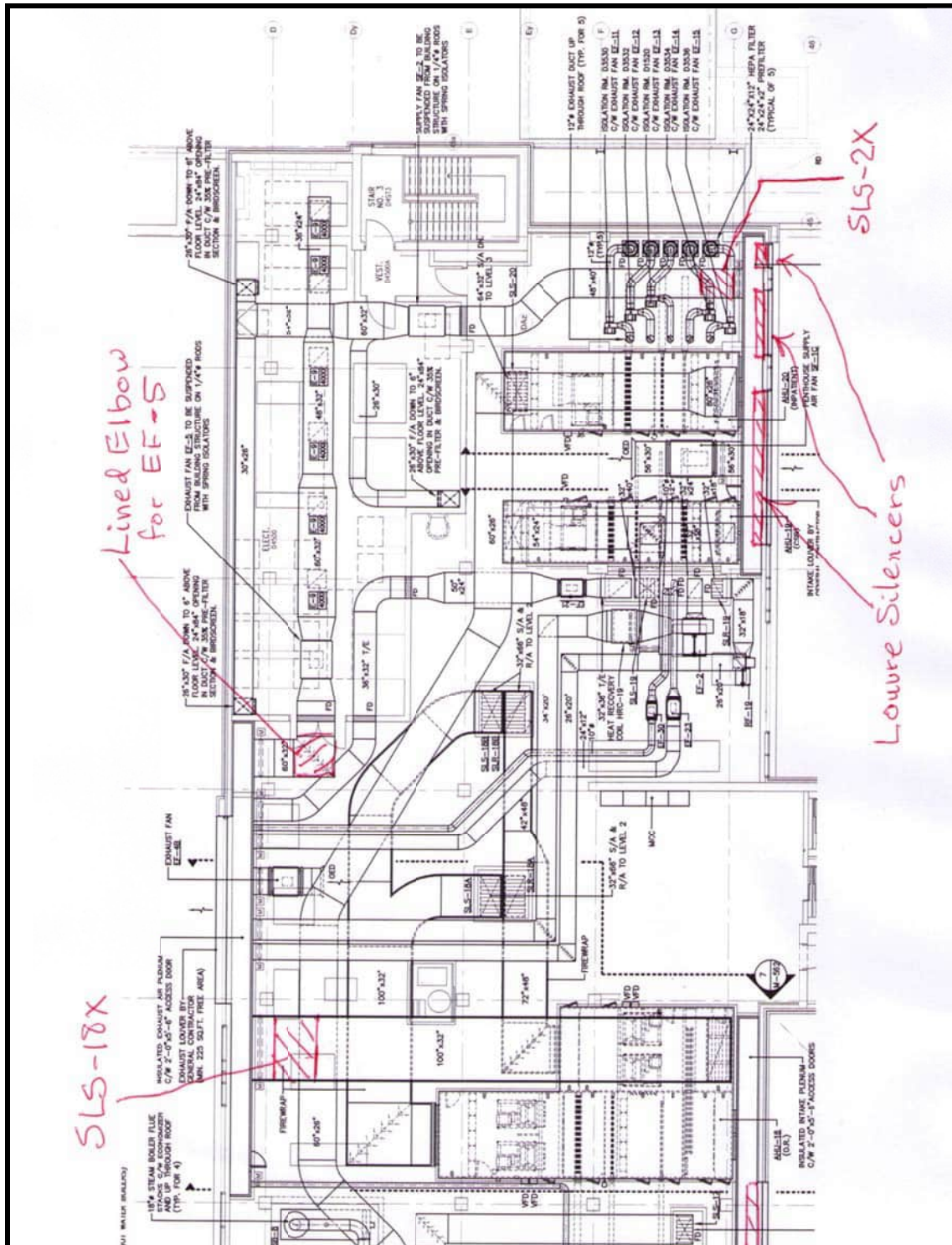
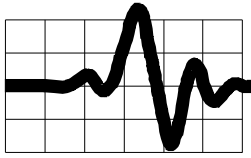
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Figure 10 Eastern Part of the Mechanical Room, Level 4, Part 3
 (Drawing 9915-49-M-540)





RESUMÉ: Dr. HUGH WILLIAMSON, P.Eng.

QUALIFICATIONS:

Ph.D. Mechanical Engineering, University of New South Wales, 1972
B.Sc. Mechanical Engineering, (with Distinction), University of Alberta, 1967
Member, Professional Engineers, Ontario
Member, Canadian Acoustical Association
Member, American Society of Heating, Refrigeration and Air-conditioning Engineers

KEY COMPETENCIES:

- Environmental noise and vibration assessments, Environmental Compliance Approval (ECA). Noise assessment for land use planning
- Architectural and building acoustics, acoustics of office spaces, meeting rooms, auditoriums and studios, noise and vibration control of building mechanical services.
- Industrial noise and vibration assessment and control.
- Transportation noise and vibration.

PROFESSIONAL EXPERIENCE:

Hugh Williamson is a professional engineer with many years of experience in the measurement, analysis and control of noise and vibration. Hugh Williamson Associates was incorporated in 1997 and provides consulting services in architectural, building, industrial, transportation and environmental acoustics and vibration. Clients include architects, engineering firms, industrial firms and government departments. Prior to establishing Hugh Williamson Associates, his career included extensive periods in industry as well as university level research and teaching. He is a former Director of the Acoustics and Vibration Unit at the Australian Defence Force Academy. He has published over 50 engineering and scientific papers and has been an invited speaker on noise and vibration at national and international conferences. He has more than 20 years of experience as a consultant.

CLIENT LIST:

Hugh Williamson Associates provides consulting services to large and small clients including: National Research Council, National Capital Commission, J. L. Richards & Associates, Barry Padolsky Associates, HOK Urbana Architects, Genivar, Nasittuq Corporation, PWGSC, R. W. Tomlinson, Geo. Tackaberry Construction and Miller Paving.

APPENDIX 1

Acoustic Modelling Details

Modelling Notes:

1. Acoustic model developed using Cadna-A software, Version 4.0.135.
2. Sound propagation modeled according to ISO 9613-2: 1996(E).
3. All ground is treated as absorptive.
4. Order of Reflection in the Cadna-A model has been set to 3. It was found that increasing the Order of Reflection above had no significant effect on the predictions.

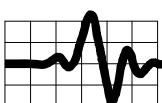


Table A1.1 Calculation Configuration

Configuration	
Parameter	Value
General	
Country	(user defined)
Max. Error (dB)	0.00
Max. Search Radius (m)	2000.00
Min. Dist Src to Rcvr	0.00
Partition	
Raster Factor	0.50
Max. Length of Section (m)	1000.00
Min. Length of Section (m)	1.00
Min. Length of Section (%)	0.00
Proj. Line Sources	On
Proj. Area Sources	On
Ref. Time	
Reference Time Day (min)	960.00
Reference Time Night (min)	480.00
Daytime Penalty (dB)	0.00
Recr. Time Penalty (dB)	6.00
Night-time Penalty (dB)	10.00
DTM	
Standard Height (m)	0.00
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	3
Search Radius Src	100.00
Search Radius Rcvr	100.00
Max. Distance Source - Rcvr	1000.00 1000.00
Min. Distance Rcvr - Reflector	1.00 1.00
Min. Distance Source - Reflector	0.10
Industrial (ISO 9613)	
Lateral Diffraction	some Obj
Obst. within Area Src do not shield	On
Screening	Excl. Ground Att. over Barrier Dz with limit (20/25)
Barrier Coefficients C1,2,3	3.0 20.0 0.0
Temperature (°C)	10
rel. Humidity (%)	70
Ground Absorption G	1.00
Wind Speed for Dir. (m/s)	3.0
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (Schall 03)	
Strictly acc. to Schall 03 / Schall-Transrapid	
Aircraft (???)	
Strictly acc. to AzB	

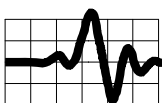
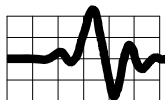
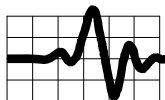


Table A1.2 Noise Source Library

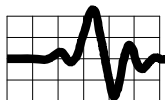
ID	Type												Source
		31.5	63	125	250	500	1000	2000	4000	8000	A	lin	
S93A	Lw	0.0	103.0	89.0	91.0	88.0	84.0	77.0	67.0	59.0	89.4	103.6	WESA 2006
C_AHU1_In	Lw	0.0	93.0	102.0	96.0	86.0	81.0	77.0	72.0	69.0	91.3	103.5	SD 015730-1, Twin City
C_AHU1_Out	Lw	0.0	96.0	99.0	95.0	91.0	87.0	83.0	77.0	72.0	93.2	102.3	SD 015730-1, Twin City
C_AHU2_In	Lw	0.0	87.0	100.0	95.0	84.0	79.0	75.0	70.0	67.0	89.7	101.5	SD 015730-1, Twin City
C_AHU2_Out	Lw	0.0	92.0	97.0	95.0	89.0	85.0	80.0	75.0	70.0	91.6	100.4	SD 015730-1, Twin City
C_AHU3_In	Lw	0.0	87.0	97.0	102.0	96.0	82.0	78.0	73.0	67.0	96.5	104.1	SD 015730-1, Twin City
C_AHU3_Out	Lw	0.0	90.0	94.0	101.0	97.0	89.0	85.0	78.0	70.0	97.4	103.5	SD 015730-1, Twin City
C_AHU4_In	Lw	0.0	88.0	101.0	97.0	85.0	80.0	76.0	71.0	68.0	91.2	102.7	SD 015730-1, Twin City
C_AHU4_Out	Lw	0.0	93.0	98.0	96.0	91.0	87.0	81.0	76.0	71.0	93.1	101.5	SD 015730-1, Twin City
C_AHU5_In	Lw	0.0	89.0	90.0	91.0	88.0	82.0	79.0	75.0	70.0	89.1	96.0	SD 015730-1, Twin City
C_AHU5_Out	Lw	0.0	100.0	96.0	93.0	83.0	82.0	78.0	74.0	68.0	88.9	102.2	SD 015730-1, Twin City
C_RF1_Out	Lw	0.0	90.0	92.0	98.0	96.0	93.0	90.0	88.0	76.0	98.4	102.2	SD 015820-1, Cook QMX
C_RF2_Out	Lw	0.0	93.0	93.0	88.0	88.0	83.0	74.0	66.0	59.0	88.3	97.4	SD 015820-1, Cook SQI-B
C_RF2_In	Lw	0.0	87.0	90.0	83.0	81.0	78.0	72.0	65.0	58.0	83.1	92.8	SD 015820-1, Cook SQI-B
C_RF3_Out	Lw	0.0	90.0	91.0	84.0	85.0	80.0	70.0	63.0	77.0	85.7	94.8	SD 015820-1, Cook SQI-B
C_RF3_In	Lw	0.0	84.0	88.0	79.0	78.0	75.0	68.0	62.0	56.0	80.0	90.3	SD 015820-1, Cook SQI-B
C_RF4_Out	Lw	0.0	91.0	92.0	85.0	86.0	81.0	72.0	64.0	58.0	86.3	95.7	SD 015820-1, Cook SQI-B
C_RF4_In	Lw	0.0	85.0	89.0	80.0	79.0	76.0	70.0	63.0	57.0	81.1	91.3	SD 015820-1, Cook SQI-B
C_CU1	Li	0.0	61.5	57.5	54.5	52.5	49.0	48.0	48.0	42.5	56.0	64.2	Shop Drg. 1m from case
C_CU1	Lw	14.5	76.0	72.0	69.0	67.0	63.5	62.5	62.5	57.0	70.5	78.7	Shop Drg. sound power (11 + 20Log1.5)
C_CU2	Li	0.0	62.5	58.5	55.5	53.0	49.5	49.0	49.0	43.0	56.8	65.2	Shop Drg. 1m from case
C_CU2	Lw	14.5	77.0	73.0	70.0	67.5	64.0	63.5	63.5	57.5	71.3	79.7	Shop Drg. sound power (11 + 20Log1.5)
C_CU3	Li	0.0	53.0	52.0	50.5	46.0	47.0	42.0	38.0	28.0	50.7	57.7	Shop Drg., 1 m from case



C_CU3	Lw	12.0	65.0	64.0	62.5	58.0	59.0	54.0	50.0	40.0	62.7	69.7	Shop Drg. sound power (11 + 20Log1.1)
C_CU4	Li	0.0	59.9	54.4	51.1	50.4	46.5	42.2	36.1	39.3	52.0	61.9	Shop Drg. 1m from case
C_CU4	Lw	12.0	71.9	66.4	63.1	62.4	58.5	54.2	48.1	51.3	64.0	73.9	Shop Drg. sound power (11 + 20Log1.1)
C_EF5	Lw	0.0	69.0	67.0	67.0	69.0	68.0	62.0	54.0	45.0	71.3	75.3	Shop Drg. Cook CPV, inlet +4
C_EF6AB	Lw	4.0	79.0	86.0	84.0	82.0	79.0	74.0	70.0	64.0	83.9	90.0	Shop Drg. Cook CPV, inlet +4
C_EF7AB	Lw	4.0	85.0	92.0	89.0	86.0	83.0	78.0	74.0	68.0	88.2	95.3	Shop Drg. Cook CPV, inlet +4
GEN_EXH	Lw	0.0	114.4	122.5	130.3	129.7	128.1	123.5	117.9	110.5	132.1	135.0	Gal Power/ MTU
GEN_RAD	Lw	0.0	100.1	102.8	105.8	107.6	113.5	113.2	114.1	111.8	119.9	119.8	Gal Power, MTU
CT_2009	Lw	0.0	104.0	103.0	103.0	98.0	93.0	87.0	82.0	78.0	99.7	108.7	Manufacturer Data: BAC 22 July 2009
S81	Lw	0.0	73.0	77.0	77.0	80.0	81.0	72.0	68.0	61.0	83.3	85.7	2010 HW, Manufacturer's data
S111	Lw	0.0	99.0	102.0	102.0	104.0	101.0	100.0	94.0	89.0	106.5	109.6	WESA 2006 Report
S1	Lw		93.0	89.0	88.0	85.0	84.0	82.0	75.0	68.0	88.9	96.2	WESA 2006 Report
S2	Lw	0.0	91.0	90.0	93.0	92.0	87.0	80.0	68.0	67.0	92.3	98.1	WESA 2006 Report
S3	Lw	0.0	89.0	78.0	76.0	75.0	74.0	68.0	66.0	60.0	78.0	89.8	WESA 2006 Report
S9	Lw	0.0	98.0	96.0	98.0	95.0	88.0	85.0	74.0	63.0	95.5	103.2	WESA 2009 Report
S10	Lw	0.0	98.0	97.0	99.0	96.0	88.0	85.0	74.0	63.0	96.3	103.8	WESA 2009 Report
S13	Lw	0.0	101.0	99.0	99.0	95.0	91.0	88.0	77.0	66.0	97.0	105.3	WESA 2009 Report
S14	Lw	5.0	91.0	96.0	91.0	89.0	88.0	83.0	75.0	67.0	92.0	99.1	WESA 2006 Report
S15	Lw	5.0	78.0	83.0	78.0	76.0	75.0	70.0	62.0	54.0	79.0	86.1	WESA 2006 Report
S16	Lw	0.0	93.0	91.0	89.0	90.0	86.0	82.0	72.0	64.0	91.0	97.5	WESA 2006 Report
S25	Lw	0.0	79.0	81.0	82.0	77.0	76.0	71.0	63.0	55.0	80.3	86.7	WESA 2006 Report
S26	Lw	4.5	78.5	78.5	81.5	75.5	74.5	69.5	61.5	53.5	79.0	85.5	WESA 2006 Report
S28_29	Lw	0.0	78.0	80.0	81.0	76.0	75.0	70.0	62.0	54.0	79.3	85.7	WESA 2006 Report
S30	Lw	0.0	73.0	75.0	76.0	71.0	70.0	65.0	57.0	47.0	74.3	80.7	WESA 2006 Report
S33	Lw	0.0	73.0	75.0	76.0	72.0	71.0	66.0	58.0	50.0	75.1	81.0	WESA 2006 Report
S34	Lw	0.0	76.0	78.0	74.0	72.0	71.0	66.0	59.0	50.0	75.0	82.1	WESA 2006 Report
S35	Lw	0.0	88.0	88.0	82.0	80.0	77.0	77.0	75.0	70.0	84.0	92.2	WESA 2006 Report
S36	Lw	0.0	84.0	83.0	81.0	77.0	76.0	73.0	70.0	66.0	81.1	88.5	WESA 2006 Report



S37	Lw	0.0	89.0	88.0	86.0	83.0	78.0	75.0	71.0	62.0	84.6	93.3	WESA 2006 Report
S38	Lw	0.0	78.0	79.0	79.0	78.0	76.0	72.0	68.0	62.0	80.5	85.4	WESA 2006 Report
S39	Lw	0.0	84.0	85.0	85.0	84.0	82.0	78.0	74.0	62.0	86.5	91.4	WESA 2006 Report
S40	Lw	0.0	91.0	91.0	89.0	87.0	83.0	80.0	78.0	70.0	89.0	96.2	WESA 2006 Report
S41	Lw	90.5	98.4	102.1	95.5	92.2	84.0	79.3	71.6	63.7	93.2	104.7	Measurement 11 August 2009
S42	Lw	0.0	78.0	85.0	90.0	88.0	88.0	84.0	76.0	68.0	91.7	94.7	WESA 2006 Report
S43	Lw	0.0	82.0	87.0	82.0	80.0	79.0	74.0	66.0	61.0	83.0	90.1	WESA 2006 Report
S46	Lw	0.0	96.0	98.0	94.0	91.0	85.0	78.0	71.0	65.0	91.9	101.6	WESA 2006 Report
S47	Lw	0.0	96.0	98.0	94.0	91.0	93.0	89.0	80.0	75.0	96.3	102.3	WESA 2006 Report
S61	Lw	0.0	83.0	80.0	81.0	78.0	77.0	68.0	62.0	46.0	80.5	87.4	WESA 2006 Report
S64	Lw	0.0	95.0	95.0	93.0	91.0	87.0	84.0	82.0	74.0	93.0	100.2	WESA 2006 Report
S70_71	Lw	0.0	85.0	88.0	87.0	82.0	78.0	72.0	68.0	59.0	84.0	92.3	WESA 2006 Report
S72	Lw	0.0	87.0	93.0	91.0	86.0	83.0	79.0	75.0	71.0	88.9	96.5	WESA 2006 Report
S73	Lw	0.0	90.0	90.0	88.0	89.0	83.0	80.0	77.0	74.0	89.6	95.8	WESA 2006 Report
S74	Lw	4.9	88.9	100.9	103.9	91.9	86.9	76.9	74.9	74.9	97.0	106.0	WESA 2006 Report
S75	Lw	5.5	89.5	94.5	88.5	87.5	84.5	82.5	74.5	65.5	90.0	97.4	WESA 2006 Report
S80	Lw	0.0	89.0	94.0	92.0	89.0	85.0	81.0	75.0	70.0	90.8	97.9	WESA 2006 Report
S92	Lw	0.0	70.0	74.0	74.0	77.0	78.0	69.0	65.0	58.0	80.3	82.7	2010 HW, Manufacturer's data
S94	Lw	0.0	84.0	87.0	86.0	91.0	91.0	82.0	78.0	71.0	93.5	95.9	2010 HW, Manufacturer's data
S96	Lw	0.0	87.0	87.0	90.0	88.0	84.0	82.0	79.0	75.0	90.2	95.0	WESA 2006 Report
S97	Lw	0.0	77.0	83.0	82.0	82.0	82.0	77.0	69.0	61.0	85.3	88.9	WESA 2006 Report
S98_99	Lw	0.0	68.0	76.0	83.0	81.0	82.0	78.0	70.0	62.0	85.4	87.8	WESA 2006 Report
S100	Lw	0.0	75.0	82.0	87.0	84.0	84.0	79.0	71.0	63.0	87.5	91.1	WESA 2006 Report
S101	Lw	0.0	76.0	83.0	88.0	85.0	85.0	80.0	72.0	64.0	88.5	92.1	WESA 2006 Report
S102	Lw	0.0	85.0	90.0	85.0	83.0	82.0	77.0	69.0	62.0	86.0	93.1	WESA 2006 Report
S103	Lw	5.0	90.0	95.0	90.0	88.0	87.0	82.0	74.0	66.0	91.0	98.1	WESA 2006 Report
S104	Lw	5.0	85.0	90.0	85.0	83.0	82.0	77.0	69.0	61.0	86.0	93.1	WESA 2006 Report
S105	Lw	5.0	85.0	90.0	85.0	83.0	82.0	77.0	69.0	61.0	86.0	93.1	WESA 2006 Report



S112	Lw	0.0	103.0	104.0	101.0	100.0	100.0	98.0	93.0	84.0	104.5	109.4	WESA 2006 Report
S113	Lw	0.0	75.0	73.0	73.0	69.0	64.0	64.0	64.0	60.0	72.3	79.4	WESA 2006 Report
S154_156	Lw	0.0	68.0	72.0	73.0	76.0	77.0	68.0	64.0	57.0	79.3	81.5	2010 HW, Manufacturer's data
S159.1	Lw	0.0	85.5	81.0	91.2	85.7	75.2	68.5	64.1	60.5	86.1	93.5	VRM Specifications, June 2010
S159.2	Lw	0.0	87.2	82.8	93.7	90.2	79.6	72.4	66.8	63.0	89.8	96.3	VRM Specifications, June 2010
S160	Lw	0.0	84.2	82.1	89.6	85.3	73.8	67.8	63.8	59.9	85.2	92.3	VRM Specifications, June 2010
S170	Lw	0.0	102.0	99.0	97.3	91.4	85.6	83.5	77.7	74.8	93.8	104.9	VRM Specifications, June 2010
S171	Lw	0.0	101.2	96.4	96.6	90.5	86.1	83.4	78.0	71.4	93.2	103.8	VRM Specifications, June 2010
AHU11in	Lw	0.0	89.0	91.0	90.0	82.0	78.0	76.0	73.0	67.0	85.9	95.2	Part 3 Schedule, 9915-49-M-700, 27 April 2010
AHU11out	Lw	0.0	92.0	96.0	95.0	89.0	84.0	81.0	78.0	71.0	91.5	100.0	Part 3 Schedule, 9915-49-M-700, 27 April 2010
AHU13in	Lw	0.0	63.0	62.0	70.0	69.0	67.0	66.0	58.0	55.0	72.2	75.0	Part 3 Schedule, 9915-49-M-700, 27 April 2010
AHU13out	Lw	0.0	84.0	80.0	81.0	83.0	79.0	77.0	72.0	66.0	84.5	89.2	Part 3 Schedule, 9915-49-M-700, 27 April 2010
AHU12in	Lw	0.0	96.0	97.0	101.0	100.0	98.0	91.0	85.0	80.0	101.8	106.0	Part 3 Schedule, 9915-49-M-700, 27 April 2010
AHU14out	Lw	0.0	89.0	85.0	88.0	88.0	84.0	82.0	76.0	70.0	89.6	94.5	Part 3 Schedule, 9915-49-M-700, 27 April 2010
AHU14in	Lw	0.0	72.0	71.0	78.0	78.0	73.0	70.0	65.0	58.0	78.9	82.8	Part 3 Schedule, 9915-49-M-700, 27 April 2010
S190	Lw	81.1	87.1	89.1	84.1	84.1	78.1	73.1	68.1	61.1	84.5	93.1	Shop Drawing 16320-1, 26 May 2008

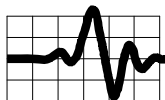


Table A1.3 Sound Reduction Indices

Name	ID	Spectrum (dB)									Source
		31.5	63	125	250	500	1000	2000	4000	8000	
Elbow, unlined, 1500 mm wide	ElbowU1500	0	1	5	8	4	3	3	3	3	ASHRAE 2007, Applications, Ch 47, Table 17
End reflection loss, free space, 910 mm dia	EndRef910	0	6	3	1	0	0	0	0	0	ASHRAE 2007, Applications, Ch 47, Table 23
Silex Hospital Plus Silencer, JDDPR-12-SI	HOSPITALPLUS	15	20	45	45	40	39	41	42	42	Silex, Gal Power
Generator Air Inlet Silencer	GEN_AIR_IN_SIL	0	8	17	28	47	50	35	20	15	SD 15830-05, Kinetics Noise Control, HTS
Generator Air Exhaust Silencer	GEN_AIR_EX_SIL	0	8	17	31	49	50	43	21	16	SD 15830-05, Kinetics Noise Control, HTS

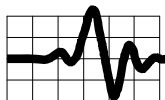
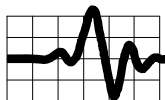
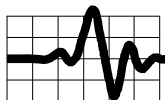


Table A1.4 Point Sources

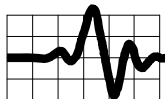
Name	M.	ID	Result. PWL					Correction				Direct.	Height	
			Day	Evening	Night	Type	Value	norm.	Day	Evening	Night		(m)	
			(dBA)	(dBA)	(dBA)			dB(A)	dB(A)	dB(A)	dB(A)			
Isolation Room Exhaust Vent	~	I01!1	88.9	88.9	88.9	Lw	S1		0	0	0	(none)	2	g
Block B Exhaust Vent	~	I01!2	92.3	92.3	92.3	Lw	S2		0	0	0	(none)	91.5	a
Air Intake Quads 1 to 4	~	I01!3	78.0	78.0	78.0	Lw	S3		0	0	0	(none)	1.5	g
Main Mech. Room Exhaust Vent #1		I00!9	95.5	95.5	95.5	Lw	S9		0	0	0	(none)	88	a
Main Mech. Room Exhaust Vent #2		I00!10	96.3	96.3	96.3	Lw	S10		0	0	0	(none)	88	a
Main Mech. Room Exhaust Vent #3		I00!11	96.3	96.3	96.3	Lw	S10		0	0	0	(none)	88	a
Main Mech. Room Exhaust Vent #4		I00!12	96.3	96.3	96.3	Lw	S10		0	0	0	(none)	88	a
Main Mech. Room Exhaust Vent #5		I00!13	97.0	97.0	97.0	Lw	S13		0	0	0	(none)	88	a
General Exhaust Fan		I00!14	92.0	92.0	92.0	Lw	S14		0	0	0	(none)	1.5	g
Sanitary Exhaust fan		I00!15	79.0	79.0	79.0	Lw	S15		0	0	0	(none)	1.5	g
Old Bldg, AHU-1		I00!16	91.0	91.0	91.0	Lw	S16		0	0	0	(none)	1.5	g
Washroom Exhaust, Maternity		I00!25	80.3	80.3	80.3	Lw	S25		0	0	0	(none)	1.5	g
Penthouse Exhaust, Maternity		I00!26	79.0	79.0	79.0	Lw	S26		0	0	0	(none)	1.5	g
Scavenging System exh. vent #1, maternity		I00!28	79.3	79.3	79.3	Lw	S28_29		0	0	0	(none)	1.5	g
Scavenging System exh. vent #2, maternity		I00!29	79.3	79.3	79.3	Lw	S28_29		0	0	0	(none)	1.5	g
Exh. Fan 1-12, Maternity	~	I01!30	74.3	74.3	74.3	Lw	S30		0	0	0	(none)	1.5	g
Exh. Fan 1-11, Maternity	~	I01!33	75.1	75.1	75.1	Lw	S33		0	0	0	(none)	1.5	g



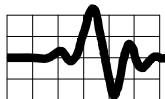
Penthouse Air Intake, Maternity	~	I01I34	75.0	75.0	75.0	Lw	S34	0	0	0	(none)	1.5	g
Exh. Fan 1-10, Maternity		I00I35	84.0	84.0	84.0	Lw	S35	0	0	0	(none)	1.5	g
HVAC Exhaust, Maternity		I00I36	81.1	78.1	78.1	Lw	S36	0	-3	-3	(none)	1.5	g
HVAC Intake, Maternity		I00I37	84.6	81.6	81.6	Lw	S37	0	-3	-3	(none)	1.5	g
CT Scan, 3 ton refrigeration unit	~	I01I38	80.5	77.5	77.5	Lw	S38	0	-3	-3	(none)	1.5	g
Schreiber Pro Med AC Chiller	~	I01I39	86.5	83.5	83.5	Lw	S39	0	-3	-3	(none)	1.5	g
Larkin Air-collod Condenser	~	I01I40	89.0	86.0	86.0	Lw	S40	0	-3	-3	(none)	1.5	g
Air Cooled Condenser, 4 fans		I00I41	93.2	90.2	90.2	Lw	S41	0	-3	-3	(none)	1.5	g
Quarantine Area Exhaust		I00I42	91.7	91.7	91.7	Lw	S42	0	0	0	(none)	1.5	g
Galley Exhaust (level 2)		I00I43	83.0	83.0	83.0	Lw	S43	0	0	0	(none)	1.5	g
Chiller Room Exhaust Fan		I00I46	91.9	91.9	91.9	Lw	S46	0	0	0	(none)	1.5	g
Chiller room air intake louvre	~	I01I47	96.3	96.3	96.3	Lw	S47	0	0	0	(none)	3	r
Cooling Tower 1		I00I48	99.7	96.7	93.7	Lw	CT_2009	0	-3	-6	(none)	2.5	g
Cooling Tower 2		I00I49	99.7	96.7	93.7	Lw	CT_2009	0	-3	-6	(none)	2.5	g
Cooling Tower 3		I00I120	99.7	96.7	93.7	Lw	CT_2009	0	-3	-6	(none)	2.5	g
AHU unit #8 Intake	~	I01I60	80.5	80.5	80.5	Lw	S61	0	0	0	(none)	1.5	g
AHU unit #8 Exhaust	~	I01I61	80.5	80.5	80.5	Lw	S61	0	0	0	(none)	1.5	g
Air Cooled Condensers (2 fans)	~	I01I64	93.0	90.0	90.0	Lw	S64	0	-3	-3	(none)	1	r
Elec. Room Exh. Fan #1	~	I01I70	84.0	84.0	84.0	Lw	S70_71	0	0	0	(none)	1.5	g
Elec. Room Exh. Fan #2	~	I01I71	84.0	84.0	84.0	Lw	S70_71	0	0	0	(none)	1.5	g
Washroom Exhaust	~	I01I72	88.9	88.9	88.9	Lw	S72	0	0	0	(none)	1.5	g
Autopsy Exhaust Vent	~	I01I73	89.6	89.6	89.6	Lw	S73	0	0	0	(none)	1.5	g
Medical Vacuum Exhaust Stack		I00I74	97.0	97.0	97.0	Lw	S74	0	0	0	(none)	1.5	g
Cogeneration Exhaust Fan #3	~	I01I75	90.0	90.0	90.0	Lw	S75	0	0	0	(none)	1.5	g



Carpentry Exhaust Vent	~	I01!80	90.8	90.8	90.8	Lw	S80		0	0	0	(none)	1.5	g
Exhaust stack for 2 steam	~	I01!81	83.3	83.3	83.3	Lw	S81		0	0	0	Chimney (VDI	90.1	a
boilers												3733)		
Hot Water Boiler #1	~	I01!92	80.3	80.3	80.3	Lw	S92		0	0	0	(none)	1.5	g
Exhaust Stack												Chimney (VDI		
Co-gen without Steam	~	I01!93A	89.4	89.4	89.4	Lw	S93A		0	0	0	3733)	90.1	a
Generators														
Hot Water Boiler #2	~	I01!94	93.5	93.5	93.5	Lw	S94		0	0	0	(none)	1.5	g
Exhaust Stack														
AHU units 4 - 7 Intake,	~	I01!95	90.2	90.2	90.2	Lw	S96		0	0	0	(none)	91.3	a
Part 2														
AHU units 4 - 7 exhaust,		I00!96	90.2	90.2	90.2	Lw	S96		0	0	0	(none)	1.5	g
Part 2														
Isolation Room exhaust,	~	I01!97	85.3	85.3	85.3	Lw	S97		0	0	0	(none)	1.5	g
Part 2														
Isolation Rm. Exh. Vent		I00!98	85.4	85.4	85.4	Lw	S98_99		0	0	0	(none)	1.5	g
(level3), Part 2														
Isolation Rm. Exh. Vent	~	I01!99	85.4	85.4	85.4	Lw	S98_99		0	0	0	(none)	1.5	g
(level3), Part 2														
Isolation Exhaust, Level 4,	~	I01!100	87.5	87.5	87.5	Lw	S100		0	0	0	(none)	1.5	g
Part 2														
Isolation Exhaust, Level 4,	~	I01!101	88.5	88.5	88.5	Lw	S101		0	0	0	(none)	1.5	g
Part 2														
Galley Exhaust, Level 4,	~	I01!102	86.0	86.0	86.0	Lw	S102		0	0	0	(none)	1.5	g
Part 2														
Sanitary Exhaust, Level 3,		I00!103	91.0	91.0	91.0	Lw	S103		0	0	0	(none)	1.5	g
Part 2														
Sanitary Exhaust, Level 4,	~	I01!104	91.0	91.0	91.0	Lw	S104	91	0	0	0	(none)	1.5	g
Part 2														
Sanitary Exhaust, Level 4,		I00!105	91.0	91.0	91.0	Lw	S105	91	0	0	0	(none)	1.5	g
Part 2														
Paper Shredding Truck,		I00!111	103.5	0.0	0.0	Lw	S111		-3	-106.5	106.5	(none)	2.5	r
1/2 hour per week														
Truck in front of loading		I00!112	95.5	0.0	0.0	Lw	S112		-9	-104.5	104.5	(none)	3	r
dock														
Gas meter	~	I01!113	72.3	72.3	72.3	Lw	S113		0	0	0	(none)	1.5	r
												Chimney (VDI		
Gen 1 Engine Exhaust		I00!125	92.0	92.0	92.0	Lw	GEN_EXH		0	0	0	3733)	103.1	a



Gen 2 Engine Exhaust	!00!126	92.0	92.0	92.0	Lw	GEN_EXH	0	0	0	Chimney (VDI 3733)	103.1	a
Gen 3 Engine Exhaust	!00!127	92.0	92.0	92.0	Lw	GEN_EXH	0	0	0	Chimney (VDI 3733)	103.1	a
Cancer AHU-1 Intake	~ !01!130	81.3	81.3	81.3	Lw	C_AHU1_In	0	0	0	(none)	79	a
Cancer AHU-2 Intake	~ !01!131	79.7	79.7	79.7	Lw	C_AHU2_In	0	0	0	(none)	83	a
Cancer AHU-3 Intake	~ !01!132	86.5	86.5	86.5	Lw	C_AHU3_In	0	0	0	(none)	87	a
Cancer AHU-4 Intake	~ !01!133	81.2	81.2	81.2	Lw	C_AHU4_In	0	0	0	(none)	91	a
Cancer AHU-5 Intake	~ !01!134	79.1	79.1	79.1	Lw	C_AHU5_In	0	0	0	(none)	79	a
Cancer Exhaust Fan 5	~ !01!139	71.3	71.3	71.3	Lw	C_EF5	0	0	0	(none)	0.6	g
Cancer Exhaust Fan 6A	~ !01!140	83.9	83.9	83.9	Lw	C_EF6AB	0	0	0	(none)	0.6	g
Cancer Exhaust Fan 6B	~ !01!141	83.9	83.9	83.9	Lw	C_EF6AB	0	0	0	(none)	0.6	g
Cancer Exhaust Fan 7A	~ !01!142	88.2	88.2	88.2	Lw	C_EF7AB	0	0	0	(none)	0.6	g
Cancer Exhaust Fan 7B	~ !01!143	88.2	88.2	88.2	Lw	C_EF7AB	0	0	0	(none)	0.6	g
Hot Water Boiler #3 Exhaust Stack	~ !01!152	80.3	80.3	80.3	Lw	S92	0	0	0	(none)	1.5	g
HW Boiler 4 Exhaust Part 3	~ !01!154	79.3	79.3	79.3	Lw	S154_156	0	0	0	(none)	3	g
HW Boiler 5 Exhaust Part 3	~ !01!155	79.3	79.3	79.3	Lw	S154_156	0	0	0	(none)	3	g
HW Boiler 6 Exhaust Part 3	~ !01!156	79.3	79.3	79.3	Lw	S154_156	0	0	0	(none)	3	g
Part 3 Air Intake (West) - Part 1 (Western Louvre)	!00!159.1	86.1	83.1	80.1	Lw	S159.1	0	-3	-6	(none)	92.5	a
Part 3 Air Intake (West) - Part 2 (Eastern Louvre)	!00!159.2	86.1	83.1	80.1	Lw	S159.1	0	-3	-6	(none)	92.5	a
Part 3 Air Intake (East)	!00!160	85.2	82.2	79.2	Lw	S160	0	-3	-6	(none)	92.5	a
Steam Boiler 5 Exhaust Part 3	~ !01!162	83.3	83.3	83.3	Lw	S81	0	0	0	(none)	3	g
Steam Boiler 6 Exhaust Part 3	~ !01!163	83.3	83.3	83.3	Lw	S81	0	0	0	(none)	3	g
Steam Boiler 7 Exhaust Part 3	~ !01!164	83.3	83.3	83.3	Lw	S81	0	0	0	(none)	3	g
Steam Boiler 8 Exhaust Part 3	~ !01!165	83.3	83.3	83.3	Lw	S81	0	0	0	(none)	3	g



Part 3 Air Exhaust (West)	~	!00!170	93.8	90.8	87.8	Lw	S170	0	-3	-6	(none)	92.5	a
Part 3 Air Exhaust (East)	~	!00!171	93.2	90.2	87.2	Lw	S171	0	-3	-6	(none)	92.5	a
Intake OR Addition Mech Room	~	!01!180	94.1	94.1	94.1	Lw	AHU11out	3	3	3	(none)	92	a
Exhaust OR Addition Mech Room	~	!01!181	89.8	89.8	89.8	Lw	AHU11out	3	3	3	(none)	92	a
AHU-13 MRI (Intake & Exhaust)	~	!01!182	84.8	84.8	84.8	Lw	AHU13in++AHU13out	0	0	0	(none)	1.5	g
AHU-12 intake	~	!00!183	94.7	94.7	94.7	Lw	AHU12in	0	0	0	(none)	1.5	g
AHU-14 (Intake & Exhaust)	~	!00!184	90.0	90.0	90.0	Lw	AHU14in++AHU14out	0	0	0	(none)	1.5	g
Transformer #1 5000KVA	~	!01!190	84.5	84.5	84.5	Lw	S190	0	0	0	(none)	80	a
Transformer #2 5000KVA	~	!01!191	84.5	84.5	84.5	Lw	S190	0	0	0	(none)	80	a
Cancer Return Fan 1	~	!01!201	91.3	91.3	91.3	Lw	C_RF1_Out	0	0	0	(none)	79	a
AHU 1 Exhaust	~	!01!201	83.2	83.2	83.2	Lw	C_AHU1_Out	0	0	0	(none)	79	a
AHU 2 Exhaust	~	!01!202	81.6	81.6	81.6	Lw	C_AHU2_Out	0	0	0	(none)	83	a
Cancer Return Fan 2	~	!01!202	80.5	80.5	80.5	Lw	C_RF2_Out	0	0	0	(none)	83	a
AHU 3 Exhaust	~	!01!203	87.4	87.4	87.4	Lw	C_AHU3_Out	0	0	0	(none)	87	a
Cancer Return Fan 3	~	!01!203	78.2	78.2	78.2	Lw	C_RF3_Out	0	0	0	(none)	87	a
AHU 4 Exhaust	~	!01!204	83.1	83.1	83.1	Lw	C_AHU4_Out	0	0	0	(none)	91	a
Cancer Return Fan 4	~	!01!204	78.5	78.5	78.5	Lw	C_RF4_Out	0	0	0	(none)	91	a

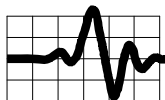


Table A1.5 Vertical Area Sources
(Representing the three air intakes and the three air exhausts in the new generator building)

Name	ID	Result. PWL			Result. PWL"			Value	Attenuation	K0 (dB)
		Day (dBA)	Evening (dBA)	Night (dBA)	Day (dBA)	Evening (dBA)	Night (dBA)			
Gen Air Intake 1	!00!128	96	96	96	86	86	86	GEN_RAD	10*Log10(6)+GEN_AIR_IN_SIL- 10*Log10(3)	3
Gen Air Intake 2	!00!128	96	96	96	86	86	86	GEN_RAD	10*Log10(6)+GEN_AIR_IN_SIL- 10*Log10(3)	3
Gen Air Intake 3	!00!128	96	96	96	86	86	86	GEN_RAD	10*Log10(6)+GEN_AIR_IN_SIL- 10*Log10(3)	3
Gen Air Exhaust 1	!00!129	94	94	94	85	85	85	GEN_RAD	10*Log10(6)+GEN_AIR_EX_SIL- 10*Log10(3)	3
Gen Air Exhaust 2	!00!129	94.4	94.4	94.4	85.2	85.2	85.2	GEN_RAD	10*Log10(6)+GEN_AIR_EX_SIL- 10*Log10(3)	3
Gen Air Exhaust 3	!00!129	94.4	94.4	94.4	85.2	85.2	85.2	GEN_RAD	10*Log10(6)+GEN_AIR_EX_SIL- 10*Log10(3)	3

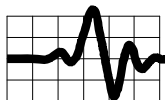


Table A1.6 Barrier

Name	ID	x (m)	y (m)	z (m)	Ground (m)
Transformer Yard Barrier	Tfmr_Barrier	8903.8	21790.1	81.5	78.13
		8891.4	21784.8	81.5	78.56
		8898.4	21767.8	81.5	76.95

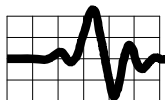
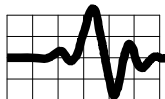


Table A1.7A Point of Reception Noise Impact Table, dBA, By Source – Day (POR's 1 – 12)

	POR Name ----->	26 Sioux Crescent	Part 2, Level 4, North, Patient Room	Old Building, Level 4, North, Patient Room	Residence NCC Land	20 Sioux Crescent	42 Sioux Crescent	2 Shadow Court	Cancer Level 1 - day use only	Cancer Level 2 - day use only
Source Name	POR No. ->	1	2	3	4	5	6	7	11	12
Total Significant Sources	!00*	43.5	59.8	52.0	43.5	43.8	40.7	38.5	64.9	68.1
Main Mech. Room Exhaust Vent #1	!00!9	23.5	38.4	45.5	18.0	28.4	11.0	12.6	22.3	26.9
Main Mech. Room Exhaust Vent #2	!00!10	22.8	40.3	35.1	18.3	22.9	11.1	11.6	32.7	30.1
Main Mech. Room Exhaust Vent #3	!00!11	23.5	40.3	36.8	20.5	23.6	11.0	12.2	23.5	26.7
Main Mech. Room Exhaust Vent #4	!00!12	23.9	40.0	39.0	18.1	24.5	10.9	12.2	21.3	26.5
Main Mech. Room Exhaust Vent #5	!00!13	24.4	40.0	42.5	18.6	25.3	11.6	13.0	23.7	27.1
General Exhaust Fan	!00!14	9.7	18.9	43.9	8.5	7.1	18.0	24.8	12.9	15.9
Sanitary Exhaust fan	!00!15	3.1	5.4	25.8	1.6	-0.4	10.4	10.1	0.8	3.5
Old Bldg, AHU-1	!00!16	14.6	17.3	38.9	7.7	9.9	23.1	23.3	11.7	14.5
Washroom Exhaust, Maternity	!00!25	-5.6	3.6	19.1	15.1	-5.9	-5.2	-2.5	-0.2	0.5
Penthouse Exhaust, Maternity	!00!26	-5.2	3.0	17.9	18.0	-5.4	-4.2	-1.8	-0.8	0.3
Scavenging System exh. vent #1, maternity	!00!28	-4.8	3.6	18.5	18.5	-4.9	-3.7	-1.5	-0.5	0.6
Scavenging System exh. vent #2, maternity	!00!29	-5.9	3.4	18.9	14.3	-6.1	-5.2	-2.8	-0.8	0.1
Exh. Fan 1-10, Maternity	!00!35	-1.4	5.4	18.7	20.0	-1.6	0.4	10.8	3.0	4.1
HVAC Exhaust, Maternity	!00!36	2.4	1.0	12.0	14.9	1.3	4.1	9.6	0.2	2.0
HVAC Intake, Maternity	!00!37	7.2	5.1	15.9	18.5	6.7	10.5	16.0	4.9	7.0
Air Cooled Condenser, 4 fans	!00!41	15.3	45.0	36.2	28.0	15.6	13.6	15.6	32.7	36.9
Quarantine Area Exhaust	!00!42	8.2	30.5	22.9	15.8	7.9	7.2	8.8	28.1	32.6
Galley Exhaust (level 2)	!00!43	1.2	22.0	13.0	5.8	0.3	0.9	3.0	18.1	23.8
Chiller Room Exhaust Fan	!00!46	31.8	42.4	23.9	27.7	32.1	25.3	18.2	46.5	48.2



Cooling Tower 1	!00!48	34.9	46.1	27.8	33.9	35.4	33.5	28.4	62.8	64.1
Cooling Tower 2	!00!49	34.7	45.9	27.6	32.1	35.2	32.7	27.1	58.1	63.0
Cooling Tower 3	!00!120	34.6	45.8	27.9	30.7	35.1	31.5	23.7	56.3	61.8
Medical Vacuum Exhaust Stack	!00!74	35.7	49.1	30.1	32.9	35.8	29.8	23.1	46.9	47.6
AHU units 4 - 7 exhaust, Part 2	!00!96	27.0	24.0	28.2	18.4	25.0	29.4	30.1	16.9	27.0
Isolation Rm. Exh. Vent (level3), Part 2	!00!98	26.2	51.9	22.7	17.9	25.9	21.2	16.1	22.5	35.7
Sanitary Exhaust, Level 3, Part 2	!00!103	32.6	52.8	27.8	25.6	32.2	29.8	29.3	24.3	39.3
Sanitary Exhaust, Level 4, Part 2	!00!105	31.7	28.0	31.9	21.1	30.6	30.5	30.8	14.8	28.2
Paper Shredding Truck, 1/2 hour per week	!00!111	19.4	41.1	28.3	27.7	19.6	17.0	16.8	38.5	52.9
Truck in front of loading dock	!00!112	14.5	26.8	21.1	27.5	17.4	7.4	7.5	25.0	37.0
Gen 1 Engine Exhaust	!00!125	26.9	36.8	30.0	20.7	24.7	26.6	24.9	35.8	29.9
Gen 2 Engine Exhaust	!00!126	28.0	36.1	30.0	22.6	26.7	25.8	25.0	37.9	31.6
Gen 3 Engine Exhaust	!00!127	29.8	36.1	30.0	22.6	26.7	25.9	25.0	37.5	31.7
Part 3 Air Intake (West) - Part 1 (Western Louvre)	!00!159.1	7.9	9.4	38.8	9.0	4.6	17.8	21.8	10.1	11.2
Part 3 Air Intake (West) - Part 2 (Eastern Louvre)	!00!159.2	8.6	10.2	40.2	8.8	5.0	17.1	22.1	10.7	11.8
Part 3 Air Intake (East)	!00!160	8.0	11.8	41.5	5.9	4.8	15.0	17.9	12.2	13.8
Part 3 Air Exhaust (West)	!00!170	23.6	27.0	27.3	35.8	29.5	10.7	11.8	30.4	38.7
Part 3 Air Exhaust (East)	!00!171	24.1	29.2	26.8	29.0	29.8	10.1	11.1	31.8	40.0
AHU-12 intake	!00!183	13.5	54.4	37.6	29.6	16.9	9.8	10.7	35.1	38.9
AHU-14 (Intake & Exhaust)	!00!184	9.7	24.9	31.8	8.9	8.9	11.2	22.0	21.5	19.9
Gen Air Intake 1	!00!128	-3.0	10.2	10.4	31.7	0.3	-3.8	-4.6	14.4	14.3
Gen Air Intake 2	!00!128	-3.0	11.1	10.8	32.3	-0.3	-5.6	-4.5	14.2	14.6
Gen Air Intake 3	!00!128	-3.0	11.8	11.1	32.4	-0.9	-5.7	-5.2	14.5	15.1
Gen Air Exhaust 1	!00!129	2.7	32.7	10.6	16.6	5.2	4.7	-3.6	36.3	19.0
Gen Air Exhaust 2	!00!129	-0.8	32.9	10.9	14.8	4.1	7.1	-4.0	25.1	16.6
Gen Air Exhaust 3	!00!129	-1.5	28.3	11.2	14.2	3.1	6.9	-4.1	21.5	17.7

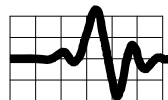
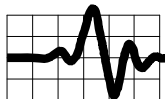


Table A1.7B Point of Reception Noise Impact Table, dBA, By Source – Day (POR's 13 - 43)

	POR Name ----->	Part 2, Level 4 , West A, Patient Rooms	Part 2, Level 4 , West B, Patient Rooms	Part 3 Receptor, 3rd Floor, North , East Side	Part 3 Receptor, 3rd Floor, North, West Side	Part 3 Receptor, 3rd Floor, South, East End	Part 3 Receptor, 3rd Floor, South, West End	Old Building, Level 4, East, Patient Room	Patient Room, Old Part West, A	Patient Room, Old Part West, B
Source Name	POR No. ->	21	22	31	32	33	34	41	42	43
Total Significant Sources	!00*	66.1	59.6	65.8	66.2	63.4	58.6	59.8	57.9	56.2
Main Mech. Room Exhaust Vent #1	!00!9	46.4	29.5	26.9	23.7	57.7	33.8	35.1	27.2	25.0
Main Mech. Room Exhaust Vent #2	!00!10	52.8	41.6	24.0	21.5	42.5	32.7	30.7	23.2	21.8
Main Mech. Room Exhaust Vent #3	!00!11	51.0	36.1	24.4	21.8	47.1	33.1	31.0	24.2	22.7
Main Mech. Room Exhaust Vent #4	!00!12	49.4	33.3	25.1	22.4	55.7	33.6	32.2	25.4	23.7
Main Mech. Room Exhaust Vent #5	!00!13	48.7	31.8	26.5	23.8	58.3	34.5	34.2	27.3	25.4
General Exhaust Fan	!00!14	24.0	42.8	20.1	18.4	32.3	21.8	54.4	24.1	22.5
Sanitary Exhaust fan	!00!15	15.1	30.0	5.7	4.1	19.6	13.4	49.2	10.9	9.7
Old Bldg, AHU-1	!00!16	26.2	42.6	17.7	15.9	28.4	24.0	57.2	21.9	20.7
Washroom Exhaust, Maternity	!00!25	5.3	5.9	6.6	8.0	10.6	22.4	13.1	54.3	45.3
Penthouse Exhaust, Maternity	!00!26	5.4	6.2	5.3	6.8	10.7	22.5	12.7	48.4	42.9
Scavenging System exh. vent #1, maternity	!00!28	5.9	6.6	5.7	7.3	11.3	23.2	13.0	48.0	42.3
Scavenging System exh. vent #2, maternity	!00!29	5.1	5.6	5.8	7.3	10.5	22.2	12.5	51.1	42.5
Exh. Fan 1-10, Maternity	!00!35	8.3	9.1	8.3	9.7	13.9	24.3	13.9	47.1	54.4
HVAC Exhaust, Maternity	!00!36	9.2	14.6	3.7	4.9	11.2	18.7	10.7	37.7	42.6
HVAC Intake, Maternity	!00!37	14.4	19.3	7.5	8.8	16.3	23.2	14.7	40.5	44.8
Air Cooled Condenser, 4 fans	!00!41	62.2	45.8	25.2	21.9	30.8	22.2	32.0	18.6	17.2
Quarantine Area Exhaust	!00!42	53.7	56.7	17.0	14.7	28.7	23.7	42.5	14.7	14.0
Galley Exhaust (level 2)	!00!43	43.3	50.2	8.6	6.4	22.0	14.2	34.2	7.3	6.2
Chiller Room Exhaust Fan	!00!46	45.1	36.0	39.7	36.7	19.8	14.9	22.3	12.4	11.7



Cooling Tower 1	!00!48	44.9	33.7	46.0	43.7	25.0	21.5	27.8	19.1	18.4
Cooling Tower 2	!00!49	44.8	33.4	46.4	44.1	25.3	21.7	28.0	19.2	18.6
Cooling Tower 3	!00!120	39.6	34.3	46.8	44.5	26.5	22.0	28.2	19.4	18.7
Medical Vacuum Exhaust Stack	!00!74	51.4	42.1	44.7	41.5	26.2	21.0	28.8	18.2	17.5
AHU units 4 - 7 exhaust, Part 2	!00!96	34.2	39.0	15.8	14.3	19.6	17.5	32.2	16.8	16.8
Isolation Rm. Exh. Vent (level3), Part 2	!00!98	27.8	18.6	23.3	19.9	13.6	6.5	15.8	5.0	4.5
Sanitary Exhaust, Level 3, Part 2	!00!103	29.7	23.0	26.2	22.9	15.0	11.1	19.3	12.6	11.4
Sanitary Exhaust, Level 4, Part 2	!00!105	30.4	37.7	17.3	16.3	21.1	21.2	35.9	17.5	17.4
Paper Shredding Truck, 1/2 hour per week	!00!111	41.5	39.2	49.0	46.9	30.4	26.0	26.6	23.8	23.0
Truck in front of loading dock	!00!112	26.3	22.7	30.4	22.1	27.7	19.8	21.5	18.7	17.8
Gen 1 Engine Exhaust	!00!125	36.2	32.9	40.1	40.3	22.6	22.8	33.1	17.2	20.1
Gen 2 Engine Exhaust	!00!126	35.4	32.8	40.1	40.3	22.7	22.8	33.1	16.9	19.7
Gen 3 Engine Exhaust	!00!127	35.5	32.8	40.1	40.3	22.7	22.8	33.1	16.8	19.5
Part 3 Air Intake (West) - Part 1 (Western Louvre)	!00!159.1	29.1	25.3	19.4	23.1	40.2	57.7	36.0	36.1	36.1
Part 3 Air Intake (West) - Part 2 (Eastern Louvre)	!00!159.2	29.5	26.1	20.2	21.6	42.5	50.6	37.8	31.9	28.5
Part 3 Air Intake (East)	!00!160	29.1	26.1	20.2	15.9	56.5	39.3	30.8	18.3	17.7
Part 3 Air Exhaust (West)	!00!170	24.4	19.7	52.6	65.8	24.8	31.5	23.4	25.2	23.9
Part 3 Air Exhaust (East)	!00!171	26.3	20.7	65.2	52.7	28.0	26.4	23.6	19.4	17.8
AHU-12 intake	!00!183	61.2	41.5	27.4	23.6	25.9	17.0	26.5	15.5	15.0
AHU-14 (Intake & Exhaust)	!00!184	45.0	52.4	13.9	12.1	17.9	16.8	43.3	14.5	14.1
Gen Air Intake 1	!00!128	9.9	7.3	22.7	40.8	12.4	13.6	7.5	10.0	9.1
Gen Air Intake 2	!00!128	10.9	7.4	25.1	41.3	12.7	14.0	8.2	10.3	9.4
Gen Air Intake 3	!00!128	11.8	7.3	26.5	41.9	13.0	14.4	8.5	10.6	9.7
Gen Air Exhaust 1	!00!129	31.3	12.9	39.5	24.8	12.5	11.9	7.8	7.5	6.2
Gen Air Exhaust 2	!00!129	22.7	11.7	40.1	25.7	12.9	12.3	8.1	7.8	6.5
Gen Air Exhaust 3	!00!129	18.6	10.8	40.6	27.3	13.3	12.7	9.0	8.1	6.8

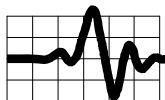
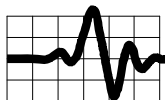
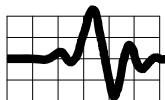


Table A1.7C Point of Reception Noise Impact Table, dBA, By Source – Day (POR's 44 - 51)

	POR Name ----->	Patient Room, Old Part West, C	Operating Rooms, no windows
Source Name	POR No. ->	44	51
Total Significant Sources	!00*	49.7	64.7
Main Mech. Room Exhaust Vent #1	!00!9	24.3	31.7
Main Mech. Room Exhaust Vent #2	!00!10	21.4	32.7
Main Mech. Room Exhaust Vent #3	!00!11	22.3	33.2
Main Mech. Room Exhaust Vent #4	!00!12	23.3	33.3
Main Mech. Room Exhaust Vent #5	!00!13	24.9	33.5
General Exhaust Fan	!00!14	21.9	24.2
Sanitary Exhaust fan	!00!15	9.5	9.7
Old Bldg, AHU-1	!00!16	20.4	22.0
Washroom Exhaust, Maternity	!00!25	26.5	4.0
Penthouse Exhaust, Maternity	!00!26	25.5	2.5
Scavenging System exh. vent #1, maternity	!00!28	24.9	2.9
Scavenging System exh. vent #2, maternity	!00!29	24.4	3.1
Exh. Fan 1-10, Maternity	!00!35	40.5	6.4
HVAC Exhaust, Maternity	!00!36	44.9	2.7
HVAC Intake, Maternity	!00!37	46.7	6.5
Air Cooled Condenser, 4 fans	!00!41	16.9	33.1
Quarantine Area Exhaust	!00!42	13.8	23.4
Galley Exhaust (level 2)	!00!43	6.0	15.2
Chiller Room Exhaust Fan	!00!46	11.6	44.5
Cooling Tower 1	!00!48	18.3	50.4



Cooling Tower 2	!00!49	18.4	50.7
Cooling Tower 3	!00!120	18.5	50.9
Medical Vacuum Exhaust Stack	!00!74	17.3	51.5
AHU units 4 - 7 exhaust, Part 2	!00!96	28.4	19.9
Isolation Rm. Exh. Vent (level3), Part 2	!00!98	4.4	37.4
Sanitary Exhaust, Level 3, Part 2	!00!103	11.1	36.7
Sanitary Exhaust, Level 4, Part 2	!00!105	17.4	21.7
Paper Shredding Truck, 1/2 hour per week	!00!111	22.8	58.7
Truck in front of loading dock	!00!112	17.6	62.1
Gen 1 Engine Exhaust	!00!125	18.7	37.7
Gen 2 Engine Exhaust	!00!126	18.7	37.8
Gen 3 Engine Exhaust	!00!127	18.7	37.8
Part 3 Air Intake (West) - Part 1 (Western Louvre)	!00!159.1	23.0	13.9
Part 3 Air Intake (West) - Part 2 (Eastern Louvre)	!00!159.2	22.2	15.3
Part 3 Air Intake (East)	!00!160	17.0	19.7
Part 3 Air Exhaust (West)	!00!170	20.1	28.0
Part 3 Air Exhaust (East)	!00!171	17.2	31.5
AHU-12 intake	!00!183	14.9	38.4
AHU-14 (Intake & Exhaust)	!00!184	14.1	19.3
Gen Air Intake 1	!00!128	7.8	18.2
Gen Air Intake 2	!00!128	8.1	18.7
Gen Air Intake 3	!00!128	8.4	18.7
Gen Air Exhaust 1	!00!129	5.9	36.3
Gen Air Exhaust 2	!00!129	6.1	36.7
Gen Air Exhaust 3	!00!129	6.3	37.0



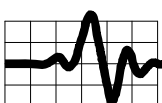
APPENDIX 2

Noise Data

(For sources analysed by HWA,
for other data see 2006 WESA Noise Report⁴)

Contents:

Source	Description	Comments
41	Air Cooled Condenser (4 fan)	Source measured by HW, 11 August 2010 & Instrument Calibration Certificates
48, 49, 120	Cooling Towers	BAC 3552C, Manufacturer`s Data
94	Hot Water Boiler #2	Estimated using referenced generic procedure.
81,162,163, 164 & 165	Steam Boilers 1&2, 5, 6, 7 & 8	Estimated using referenced generic procedure.
114, 180 & 181	AHU`s – 10 & 11, in OR Addition Penthouse	See Appendix 3, Drawing 9915-49-M-700, AHU Schedule
125, 126, 127, 128, 129	New 750 kW Generators	Engine Exhausts: Manufacturer`s data Air Intakes and Exhaust: Estimated using referenced generic procedure. Silencer data.
159.1, 159.2, 160, 170, 171	Air Intake and Exhaust Louvres, Part 3	See Appendix 3, Drawing 9915-49-M-700, AHU Schedule Silencer calculations
130 – 134, 201 - 204	Cancer AHU`s and Return fans	Estimates based on fan data
139 - 143	Cancer Exhaust Fans 5, 6A, 6B, 7A & 7B	Manufacturer`s data Insignificant, data available on request.
152	Cancer Hot Water Boiler #3	Manufacturer`s data Insignificant, data available on request.
154 – 156 & 161	Part 3 Hot Water Boilers	Estimated using referenced generic procedure.
190 & 191	5000 kVA Transformers	Estimated using referenced generic procedure.



Noise Source Analysis, S41 Dry Cooler

Equipment details: S41 Dry cooler, AHU Cooled Condenser (4 fan)

Client: Queensway Carleton Hospital

Location: Roof of old part

Date of Measurements: 11 August 2009

Location	Distance m	File	Elapsed Time hh:mm:ss	Octave Bands, LZEQ											Comments	Calc A dBA
				16 Hz dB	31.5 Hz dB	63 Hz dB	125 Hz dB	250 Hz dB	500 Hz dB	1 kHz dB	2 kHz dB	4 kHz dB	8 kHz dB	16 kHz dB		
6 m, at fan height dB Average Measured Lp: 6 m, at fan h	6	F-001	00:00:31	66.8	67.0	74.0	77.2	72.2	67.3	59.6	54.5	48.1	40.0	29.7	68.2	
	6	F-002	00:00:31	66.5	67.1	74.0	77.2	69.9	66.8	59.9	54.4	47.5	39.7	29.3	67.5	
	6			66.6	67.0	74.0	77.2	71.2	67.0	59.8	54.4	47.8	39.9	29.5	67.8	
	6	BG Corrected		64.6	65.0	72.6	76.3	69.6	66.4	58.2	53.4	45.8	37.9	28.2	66.7	Worst Case
6 m, fan height + 2m 6 m, fan height + 2m	6.3	F-003	00:00:22	66.1	65.8	73.0	73.5	68.9	65.7	63.0	57.6	49.6	41.0	28.4	67.7	
	6.3	BG Corrected		64.1	63.8	71.0	71.5	66.9	64.8	62.4	57.1	48.2	39.6	26.4	66.5	
Background	45	F-004	00:00:31	65.0	68.0	68.4	70.0	66.0	58.7	54.6	47.6	43.7	35.5	23.7	61.4	Worst Case
Sound Power, Lw*				90.5	90.9	98.4	102.1	95.5	92.2	84.0	79.3	71.6	63.7	54.0	92.5	93.2
Sound Power, 2006 Report						100	100	98	96	92	89	87	79		99	98.0
A-weightings				-56.7	-39.4	-26	-16	-9	-3	0	1	1	-1	-7		

* $L_w = L_p + 20 \cdot \log_{10}(d) + 11$ - reflection factor

Reflection factor:

direct path 6 m -15.56

reflected path 14 m -22.92

Correction 0.73

CERTIFICATE OF CALIBRATION

Sound Level Meter Acoustic Calibration

Certificate Number 1-161363316-102 Page 1 of 2

2250/4189 Lin Rev 2.07

Calibration of:

Brüel & Kjær Sound Level Meter Type 2250 Serial Number 2645066

Brüel & Kjær Microphone Type 4189 Serial Number 2638609

Customer:

Hugh Williamson Associates Inc.

205 Bolton Street

Ottawa, ON K1N 1K7

Procedure:

3630 7763 Version 3.0.2.0 - DB: 3.01

Calibrated By:

John Avitabile

Results:

For Calibration Results, see page(s) 2

The acoustic calibration of the listed sound level meter and microphone was accomplished using a test system which conforms with the requirements of ANSI/NCSL Z540-1, ISO/IEC 17025, and ISO 10012-1. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. For "as received" and/or "final" data, see the attached page(s). The sound level meter and microphone listed, has been calibrated using standards with values traceable to the National Institute of Standards and Technology (NIST), and the Danish Primary Laboratory of Acoustics (DPLA). Reported values of the expanded uncertainties are expressed at approximately 95% confidence level using a coverage factor of $k=2$. Items marked with an asterisk (*) are not covered by the current A2LA accreditation. This certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Brüel and Kjær Calibration Laboratory-Norcross, Georgia. The results of this calibration apply to the acoustic calibration of the sound level meter and microphone identified by the serial number combination identified above.

Calibration Date: 15 Dec 2008

Certificate Issued: 16 Dec 2008 **Quality Representative:** 

*The Brüel and Kjær North
American Service Center is
Certified to ISO 9001:2000
KEMA® Certificate Number
710009-001*

Brüel and Kjær Calibration Laboratory
2815 Colonnades Court Building A
Norcross, Georgia 30071-1588
Telephone 800/332-2040
FAX 770/447-4033



Calibration Certificate # 1568.01

CERTIFICATE OF CALIBRATION

2250/4189 Lin Rev 2.07

Certificate Number 1-161363316-102

Page 2 of 2

"As received = Final Data"

Calibration Details:

Sound Level Meter Model Number 2250 Serial Number 2645066

Microphone Model Number 4189 Serial Number 2638609

The sound level meter under test was calibrated acoustically while operating in the "Lin" weighting mode. The acoustical response of the microphone and sound level meter was tested with the multifunction calibrator in the "pressure" mode. Uncertainty of the calibration is based on a sound level meter with a digital type scale with a resolution of 0.1dB.

Frequency in Hertz	Free Field Correction in dB	Expected Level and Acceptance Criteria for Type 1 SLM in dB μ V	Actual Reading in dB μ V	Uncertainty $k=2$ in dB
1,000	0.1	94.1	94.0	0.2
31.5	0.0	94.0 $\pm$ 1.5	94.1	0.2
63.0	0.0	94.0 $\pm$ 1.5	94.0	0.2
125	0.0	94.0 $\pm$ 1.0	94.0	0.2
250	0.0	94.0 $\pm$ 0.9	94.0	0.2
500	0.0	93.9 $\pm$ 0.8	94.0	0.2
2,000	0.3	94.0 $\pm$ 0.8	93.9	0.3
4,000	0.9	93.1 $\pm$ 0.8	93.2	0.4
8,000	2.8	91.0 +1.4/-2.8	90.9	0.5
12,500	5.4	87.8 +2.8/-5.8	88.3	0.6

Calibration Conditions:

Preconditioning: 24 Hours at 23 $\pm$ 3 °C

Environmental conditions: Air Temperature 23 °C
Air pressure 991 mbar
Relative Humidity 32 %

Calibration Instrumentation:

Model Number	Serial Number	Trace Number	Calibration Due	Calibration Interval
Brüel & Kjær 4226	2433680	1-118858601-701	04 Feb 2009	12 mo

Remarks:

Brüel & Kjær

CERTIFICATE OF CALIBRATION

MEASUREMENT STANDARD

This calibration is performed by comparison with a Measurement Standard Pistonphone:

Type 4220 Serial Number 1048235
Calibrated by JAS Due Date 02-Apr-10
Cal Interval 24 mo Trace Number 1-129404471-501

Type HP5315A Serial Number 2536A13949
Calibrated by COM Due Date 14-Aug-09
Cal Interval 12 mo Trace Number 248554

EXPANDED UNCERTAINTY

Reported values represent expanded uncertainties expressed at approximately 95% confidence level using a coverage factor of $k=2$

Parameter	Expanded Uncertainty
Acoustic output level	0.12 dB
Output Frequency	100 ppm

Calibrator Type 4231
Serial Number 2122785
Submitted by Hugh Williamson Associates Inc.
205 Bolton Street
Ottawa, ON K1N 1K7
Asset Number

As Received Data			
With 1.333 cm ³ Effective Load Volume			
Nominal	Actual	Nominal	Actual
in dB re 20 µPa		in Hertz	
94.0 ± 0.2	94.1	1000 ± 1	1000
114.0 ± 0.2	114.1		
Final Data			
With 1.333 cm ³ Effective Load Volume			
Nominal	Actual	Nominal	Actual
in dB re 20 µPa		in Hertz	
94.0 ± 0.2	94.0	1000 ± 1	1000
114.0 ± 0.2	114.0		

Total Harmonic Distortion*: Less than 1 %

This acoustic calibrator has been calibrated using standards with values traceable to the National Institute of Standards and Technology.

The calibration of this acoustic calibrator was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1.

This certificate shall not be reproduced, except in full, without the written approval of the Brüel and Kjær Calibration Laboratory-Norcross, GA.

The results of this calibration apply to the acoustic calibrator type and serial number identified above.

Items marked with an asterisk () are not covered by the current A2LA accreditation.

Calibration Performed By

Jim Rice

Technician

31-Dec-08

Date Certificate Issued

Approved By

Quality Representative

The Brüel and Kjær North American Service Center is also Certified to ISO 9001:2000
KEMA ® Certificate Number 710009-001



Calibration Certificate # 1568.01

CONDITIONS OF TEST

Procedure Number	4231	9.05
Ambient Pressure	989	mbar
Temperature	23	°C
Relative Humidity	29	%
Date of Calibration	15-Dec-08	

Brüel and Kjær Calibration Laboratory
2815 Colonnades Court Building A
Norcross, Georgia 30071-1588
Telephone 800/332-2040
FAX 770/447-4033

Baltimore Aircoil Company
Cooling Tower Selection Program
Series 3000

Version: 7.1.6 NA
Product data correct as of: July 22, 2009

Project Name:
Selection Name:
Project State/Province: Ontario
Project Country: Canada
Date: August 28, 2009

Model: 3552C **Intake Option: None**
Number of Units: 1 **Internal Option: None**
No. of Fans/Unit: 1 **Discharge Option: None**
Fan Type: Standard

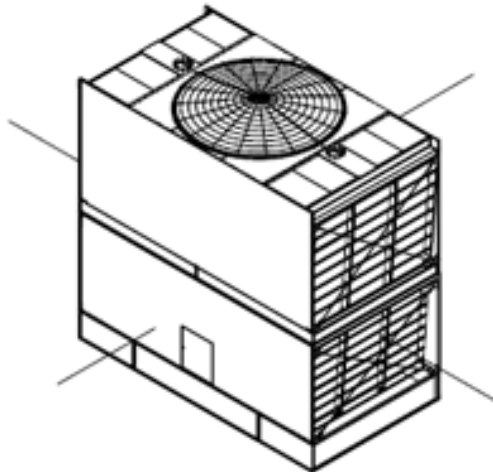
Total Standard Fan Power per Unit: 30.00 HP
Fan Motor Alternative: Full Speed

Octave band and A-weighted sound pressure levels (Lp) are expressed in decibels (dB) reference 0.0002 microbar. Sound power levels (Lw) are expressed in decibels (dB) reference one picowatt. Octave band 1 has a center frequency of 63 Hertz.

Top Lp Sound Pressure (dB)		
Octave Band	Distance	
	5 ft	50 ft
1	87	75
2	87	76
3	86	75
4	82	69
5	80	65
6	74	60
7	69	56
8	68	52
A-wgtd	85	72

Air Inlet Lp Sound Pressure (dB)		
Octave Band	Distance	
	5 ft	50 ft
1	82	69
2	84	68
3	83	70
4	76	66
5	70	61
6	64	53
7	58	47
8	55	43
A-wgtd	78	67

End Lp Sound Pressure (dB)		
Octave Band	Distance	
	5 ft	50 ft
1	80	73
2	80	67
3	78	69
4	71	63
5	66	58
6	58	50
7	51	44
8	49	40
A-wgtd	74	65



End Lp Sound Pressure (dB)		
Octave Band	Distance	
	5 ft	50 ft
1	80	73
2	80	67
3	78	69
4	71	63
5	66	58
6	58	50
7	51	44
8	49	40
A-wgtd	74	65

Air Inlet Lp Sound Pressure (dB)		
Octave Band	Distance	
	5 ft	50 ft
1	82	69
2	84	68
3	83	70
4	76	66
5	70	61
6	64	53
7	58	47
8	55	43
A-wgtd	78	67

Sound Power (dB)		
Octave Band	Center Frequency (Hertz)	Lw
1	63	104
2	125	103
3	250	103
4	500	98
5	1000	93
6	2000	87
7	4000	82
8	8000	78

Estimate of Noise for Source S-94, QCH Hot Water Boiler #2

Boiler: Cleaver Brooks Model CB-700X-600, Serial # 58785, manufactured 1975, 24,838,200 BTU/hr

Fan data (from manufacturer): motor 20 HP, static pressure 14.2 ins H₂O, fan RPM 3600, centrifugal, 9 blades, backward curved

Exhaust: 2 round elbows, stack height 12.8 m (42'), stack diameter 0.9 m (36")

Fan noise calculation:

Reference: R. D. Bruce & C. T. Moritz, 'Sound Power Level Predictions for Industrial Machinery', Encyclopedia of Acoustics, 1997

Formula: $L_w = \text{discharge sound power} = 10 + 10 \cdot \log Q + 20 \cdot \log (\Delta P) - \text{Correction (Table 1)} + 5 \text{ dB at BPF and } 2 \cdot \text{BPF, see reference.}$

assumes an induced draft fan with airfoil or backward curved blades

Inputs:

Air Flow	3178	cfm	90	m ³ /min (Q)
Internal Static Pressure	14.2	ins. H ₂ O	3537	Pa (Delta P)
Fan Speed	3600	RPM		
No. Blades	9			

Calculations:

Blade Passing Freq	540	Hz	(fan RPM * no. blades)/60
Second Harmonic	1080	Hz	2*(fan RPM * no. blades)/60

Item	Ocatve Band									A
	31.5	63	125	250	500	1000	2000	4000	8000	
10 + 10*Log Q + 20*Log (Delta P)	101	101	101	101	101	101	101	101	101	
minus Correction (Table 1 reference)	11	9	7	8	9	9	13	17	24	
+5 in BPF band					5	5				
L_w (re 10⁻¹² W) fan discharge power	90	92	94	93	97	97	88	84	77	99.0

A-weighting factors	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1
---------------------	-------	-------	-------	------	------	-----	-----	-----	------

Sound power at stack outlet:

Item	Ocatve Band									A
	31.5	63	125	250	500	1000	2000	4000	8000	
fan discharge L _w	90	92	94	93	97	97	88	84	77	99.0
Attenuation: 2 round elbows		2	4	6	6	6	6	6	6	
Attenuation: end reflection loss		6	3	1	0	0	0	0	0	
Resultant L_w at stack outlet		84	87	86	91	91	82	78	71	93.0

Estimate of Noise for Source S-81, QCH Steam Boilers #1 & 2

(Also used for Steam Boilers B-5, 6, 7 & 8, Sources S-162, 163, 164 & 165), July 2010

Boiler: Cleaver Brooks Series 700, Model M5P-6000LV, Serial # S-17177M5 & 17178M5, 6,000,000 BTU/hr

Fan data (from manufacturer): motor 5 HP, static pressure 5.2 ins H₂O, fan RPM 3600, centrifugal, 9 blades, backward curved

Exhaust: 2 round elbows, stack height 9.75 m (32'), stack diameter 0.6 m (24")

Fan noise calculation:

Reference: R. D. Bruce & C. T. Moritz, 'Sound Power Level Predictions for Industrial Machinery', Encyclopedia of Acoustics, 1997

Formula: $L_w = \text{discharge sound power} = 10 + 10 \cdot \log Q + 20 \cdot \log (\Delta P) - \text{Correction (Table 1)} + 5 \text{ dB at BPF and } 2 \cdot \text{BPF, see reference.}$

assumes an induced draft fan with airfoil or backward curved blades

Inputs:

Air Flow	2480	cfm	70	m ³ /min (Q)
Internal Static Pressure	5.2	ins. H ₂ O	1295	Pa (Delta P)
Fan Speed	3600	RPM		
No. Blades	9			

Calculations:

Blade Passing Freq	540	Hz	(fan RPM * no. blades)/60
Second Harmonic	1080	Hz	2*(fan RPM * no. blades)/60

Item	Ocatve Band									A
	31.5	63	125	250	500	1000	2000	4000	8000	
10 + 10*Log Q + 20*Log (Delta P)	91	91	91	91	91	91	91	91	91	
minus Correction (Table 1 reference)	11	9	7	8	9	9	13	17	24	
+5 in BPF band					5	5				
L_w (re 10⁻¹² W) fan discharge power	80	82	84	83	87	87	78	74	67	89.2

A-weighting factors	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	
---------------------	-------	-------	-------	------	------	-----	-----	-----	------	--

Sound power at stack outlet:

Item	Ocatve Band									A
	31.5	63	125	250	500	1000	2000	4000	8000	
fan discharge L _w	80	82	84	83	87	87	78	74	67	89.2
Attenuation: 2 round elbows		0	2	4	6	6	6	6	6	
Attenuation: end reflection loss		9	5	2	1	0	0	0	0	
Resultant L_w at stack outlet		73	77	77	80	81	72	68	61	85.4

Estimated Noise from New Generator Engine Exhausts, S-125, 126 & 127

Generator Sound Data from Gal Power (MTU)

Client: QCH

Project: Analysis of new generators: MTU 12V 2000 G82, 835 kW, 1800 rpm

Analysis of converted data

	x	31.5	63	125	250	500	1000	2000	4000	8000	A
Engine radiated at 1 m *	1.0		83.1	85.8	88.8	90.6	96.5	96.2	97.1	94.8	102.9
Engine radiated sound power*			100.1	102.8	105.8	107.6	113.5	113.2	114.1	111.8	119.9
Exhaust Lp at 1 m **	1.0		103.4	111.5	119.3	118.7	117.1	112.5	106.9	99.5	121.1
Exhaust Sound Power**			114.4	122.5	130.3	129.7	128.1	123.5	117.9	110.5	132.1
Silex JDDPR-12-SI, Hospital Plus		-15.0	-20.0	-45.0	-45.0	-40.0	-39.0	-41.0	-42.0	-42.0	
Muffled Exhaust, Lw			94.4	77.5	85.3	89.7	89.1	82.5	75.9	68.5	92.0
A-weightings		-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	
Silex JDDS-12-SI, Hospital		-15.0	-20.0	-50.0	-50.0	-39.0	-26.0	-25.0	-26.0	-27.0	
Silex JDDPR-12-SI, Hospital Plus		-15.0	-20.0	-45.0	-45.0	-40.0	-39.0	-41.0	-42.0	-42.0	

* data interpreted as Lp at 1 m from surface, hence approx 2 m from centre of unit, hence correction = $11 + 20 \log(2) = 17$

** data states Lp at 1 m, correction = 11

Comment: data similar to generic calculations.

Silencer Selection

Call Silex for immediate assistance in selecting the appropriate silencer that best suits your application's acoustical and backpressure requirements or consult the silencer selection guide in our catalogue. You can also use Silex's exclusive Silencer Sizing and Selection Program "Silex Digital Engineer" found on the Company's secure website at www.silex.com.

Application & Performance

The Hospital Plus Grade series are combination silencers with superior acoustical performance. More effective at higher frequency than JDDS Series. The silencer is designed to perform well at both high and low frequency. All of the silencers are manufactured from light to heavy gauge steel and finished with high temperature paint. A drain is included as a standard component on the silencer.

Dimensions

Model	A	B	C	D	F	G	H	Wgt.
JDDPR-1.5	1.5	9 (229)	30 (762)	36 (914)	3.5 (89)	7.5 (191)	33 (838)	48 (22)
JDDPR-2	2	10 (254)	34 (864)	40 (1016)	4.5 (114)	8.0 (203)	37 (940)	62 (28)
JDDPR-2.5	2.5	12 (305)	40 (1016)	46 (1168)	5.5 (140)	9.0 (229)	43 (1092)	87 (40)
JDDPR-3	3	14 (356)	44 (1118)	50 (1270)	6.0 (152)	10.0 (254)	47 (1194)	114 (52)
JDDPR-3.5	3.5	16 (406)	48 (1219)	54 (1372)	7.0 (178)	11.0 (279)	51 (1295)	140 (64)
JDDPR-4	4	18 (457)	54 (1372)	62 (1575)	7.0 (178)	13.0 (330)	58 (1473)	179 (81)
JDDPR-5	5	22 (559)	67 (1702)	75 (1905)	9.0 (229)	15.0 (381)	71 (1803)	264 (120)
JDDPR-6	6	26 (660)	77 (1956)	85 (2159)	11.0 (279)	17.0 (432)	81 (2057)	440 (200)
JDDPR-8	8	30 (762)	95 (2413)	103 (2616)	12.0 (305)	19.0 (483)	99 (2515)	697 (316)
JDDPR-10	10	36 (914)	110 (2794)	118 (2997)	14.0 (356)	22.0 (559)	114 (2896)	986 (447)
JDDPR-12	12	36 (914)	122 (3099)	130 (3302)	14.0 (356)	22.0 (559)	126 (3200)	1103 (500)
JDDPR-14	14	40 (1016)	135 (3429)	145 (3683)	17.0 (432)	25.0 (635)	140 (3556)	1523 (691)
JDDPR-16	16	45 (1143)	146 (3708)	156 (3962)	19.0 (483)	27.5 (699)	151 (3835)	2064 (936)
JDDPR-18	18	50 (1270)	161 (4089)	171 (4343)	21.0 (533)	30.0 (762)	166 (4216)	2887 (1310)
JDDPR-20	20	54 (1372)	175 (4445)	185 (4699)	22.0 (559)	32.0 (813)	180 (4572)	3292 (1493)
JDDPR-22	22	60 (1524)	189 (4801)	199 (5055)	24.0 (610)	35.0 (889)	194 (4928)	4035 (1830)
JDDPR-24	24	64 (1626)	202 (5131)	212 (5385)	26.0 (660)	37.0 (940)	207 (5258)	4593 (2083)
JDDPR-26	26	68 (1727)	225 (5715)	235 (5969)	27.0 (686)	39.0 (991)	230 (5842)	5467 (2480)
JDDPR-28	28	72 (1829)	258 (6553)	268 (6807)	29.0 (737)	41.0 (1041)	263 (6680)	6442 (2922)
JDDPR-30	30	78 (1981)	268 (6807)	278 (7061)	32.0 (813)	44.0 (1118)	273 (6934)	8941 (4056)

Exposed Insulation Inside

Available in sizes up to 60" inlet

Options

- Aluminized steel, 304, 316 or 316L stainless steel, Corten Steel
- Dual inlet or Custom inlet/outlet configurations
- Thermal insulation blankets to suit all configurations
- Mounting brackets, gussets and lifting lugs

Metric dimensions rounded to nearest mm.

Dimensions and weights are nominal and may vary slightly in production models.

Silex Innovations Inc.
Phone 905 612 4000
Fax 905 612 8999
www.silex.com

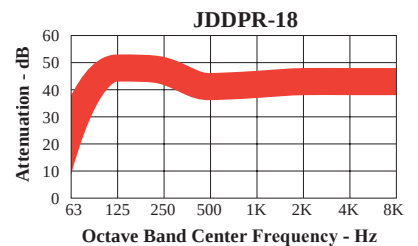
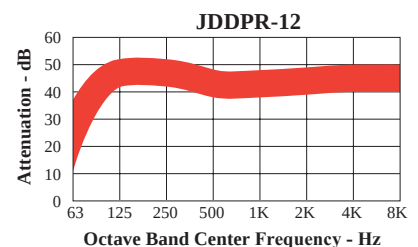
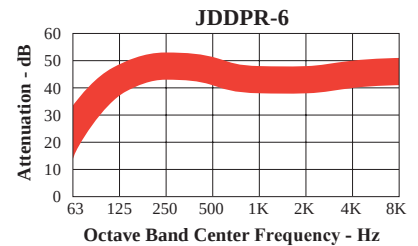
The inlet and outlet on silencers up to 3½" are Sch. 40 NPT pipe. On silencers 4" and larger the inlet and discharge are flanged, manufactured from minimum ½" thick plate and drilled to ANSI class 150.

JDDPR Series

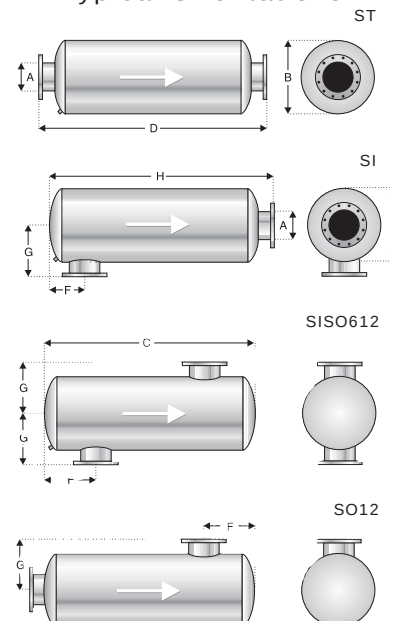
35 - 50 dBA

Hospital Plus Grade

Typical Attenuation Curve



Typical Orientations



Genset surface noise analysis
bandwidth 1/3 octave

TURBOCHARGER: 2 x KKK K36 4667 OAKB/27.22

INTAKE AIR OPENING: Paper filters without housing (Donaldson: 0180941002)

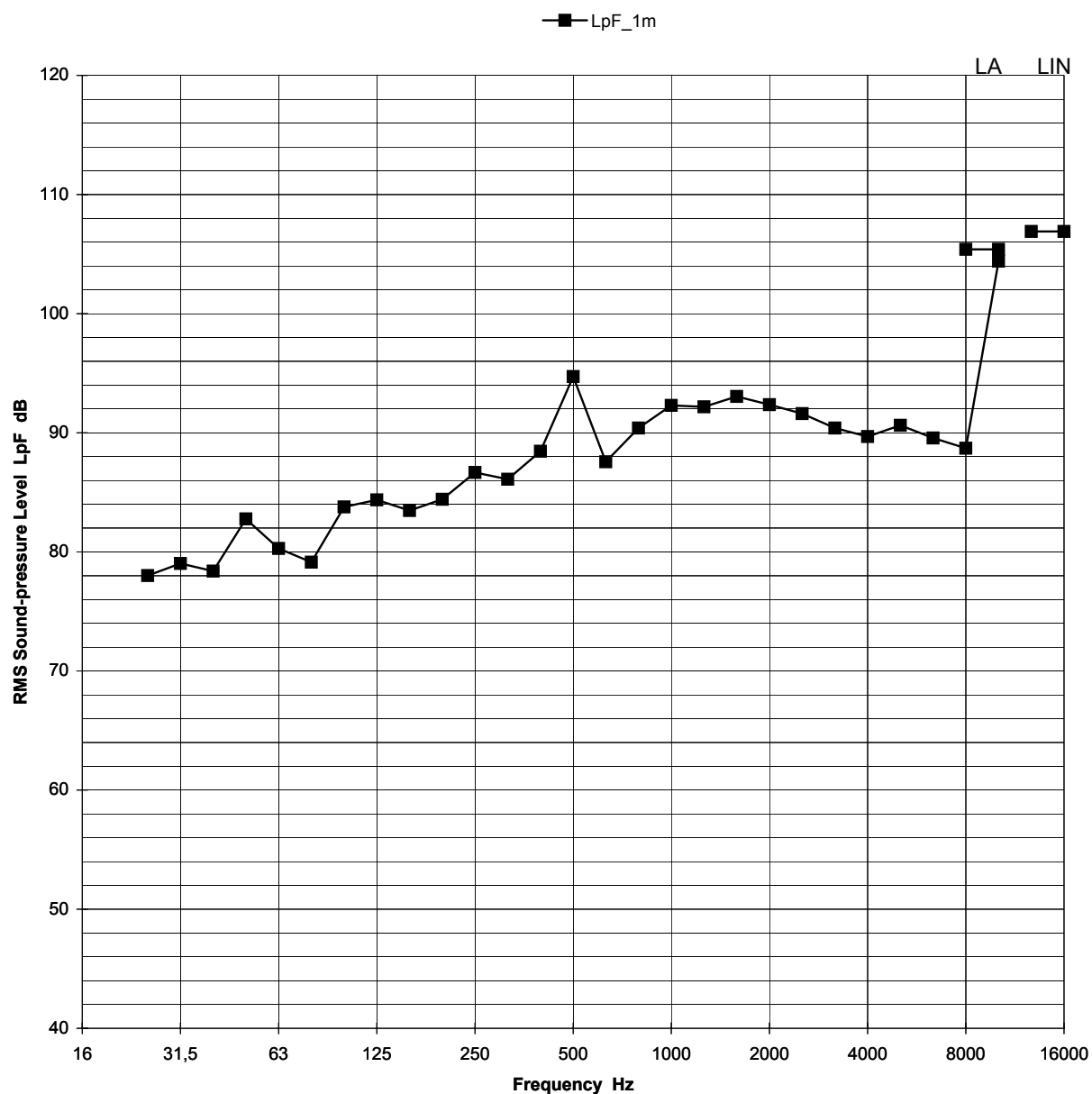
MEASURING DISTANCE: 1 m

MEASURING SURFACE DIMENSION: 18.9 dB

REFERENCE: 2 x 10 EE -5 Pa

FILENAME PC: ...\\akustik\\spektren\\mesdat\\c_br2000\\luftsp\\c02_0010.12V

Energy mean free-field levels of the airborne noise which is emitted by the genset surface incl. intake air noise (with filters), fan cooler noise (BEARWARD) and alternator noise (A. van KAICK).
Measured at MTU test cell No. 125 as per DIN 45 635 Part 43 and ISO 8528 Part 10.



Undampened exhaust gas noise analysis
bandwidth 1/3 octave

TURBOCHARGER: 2 x KKK K36 4667 OAKB/27.22

MEASURING DISTANCE: 1 m

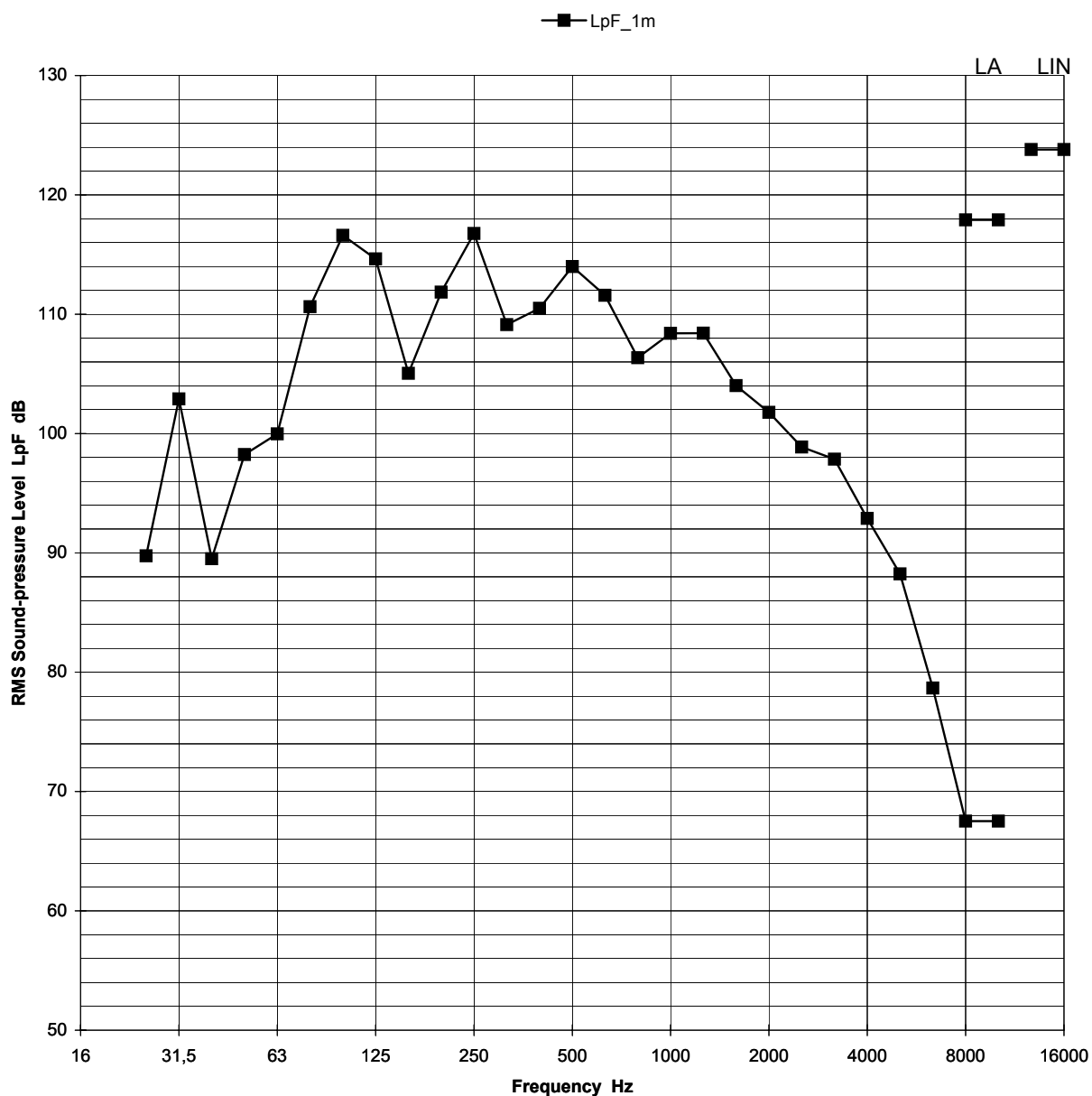
MEASURING SURFACE DIMENSION: 12.6 dB

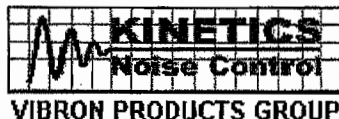
REFERENCE: 2 x 10⁻⁵ Pa

FILENAME VAX: ET_DISK:[MOOM.ABGASP]

FILENAME PC: ...\\akustik\\spektren\\mesdat\\c_br2000\\abgas\\c02_0001.12V

Energy mean free-field levels of the undampened exhaust gas noise as per DIN 45 635 Part 11 and ISO 6798.
Measured at MTU test cell No. 125. Outlet: Horizontal straight pipe. Outlet diameter of exhaust gas pipe: DN400.
Pipe design for measurements: DN400, straight pipe: 11.4m, bends: 2 x 90° and 2 x 45° (mitred).





PROJECT DETAILS

Go to page 13

Project Number:	2071863ALT8
Project Name:	QCH Cancer Centre
Customer:	Modern Niagara
Project Date:	April/19/08
Revision No:	2
Revision Date:	April 23 2008

SILENCER DIMENSIONS (mm)

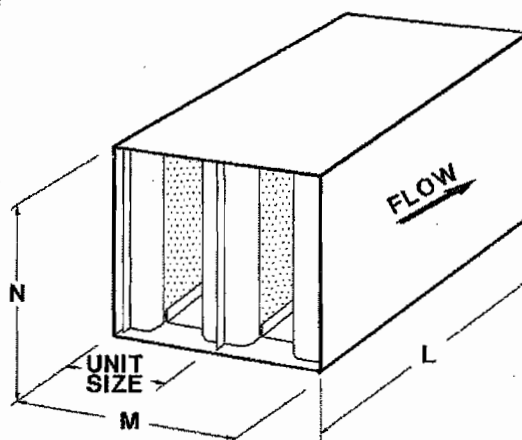
Tag:	Gen Intake SL1,2,3
Qty:	3
System:	Generator
Width:	3000
Height:	2800
Length:	2440
Model:	500VRS-F/3-2440x3000x2800
Weight (kg):	1361
VRS Type:	3
Unit Size:	500

Face Velocity (m/s):	-3
Flow Volume (l/s):	21860
Pressure drop (Pa):	10

SILENCER MODULE DIMENSIONS (mm)

Qty of Pieces:	9
M:	1000
N:	933
L:	2440
Weight each (kg):	151

Dynamic Insertion Loss		Airflow Generated Noise	
Hz	dB	Hz	dB
63:	8	63:	0
125:	17	125:	0
250:	28	250:	0
500:	47	500:	0
1000:	50	1000:	0
2000:	35	2000:	0
4000:	20	4000:	0
8000:	15	8000:	0



- Silencer dimensions to be confirmed by customer prior to fabrication.
- The installed silencer pressure drop may be higher due to system effects caused by the location of duct elements upstream and downstream of the silencer.
- Tolerances are ± 3 mm on all silencer units. If silencers are banked or paired the compounded tolerance needs to be allotted by the contractor.
- Silencer acoustic and aerodynamic performance data are in accordance with ASTM E 477-O6a.
- Flame spread/smoke developed indexes in accordance with ASTM C 1071-05
- Tested data tolerances are in accordance with AMCA 1011-03.

SILENCER CONSTRUCTION OPTIONS

Casing Thickness:	22 gauge
Perforated Lining Thickness:	24 gauge
Material:	Galvanized steel
Acoustic Media:	Fiberglass (standard)
Media Covering:	None
Inlet connection:	1 in slip connection (standard)
Outlet connection:	1 in slip connection (standard)

Notes:



PROJECT DETAILS

Project Number:	2071863ALT8
Project Name:	QCH Cancer Centre
Customer:	Modern Niagara
Project Date:	April 23, 2008
Revision No:	0
Revision Date:	

SILENCER DIMENSIONS (mm)

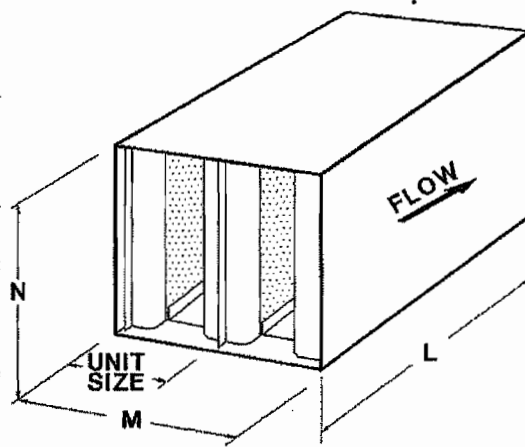
Tag:	GEN Exhaust SL-4,5,6
Qty:	3
System:	Generator
Width:	3000
Height:	2800
Length:	2440
Model:	500VRS-F/2.5-2440x3000x2800
Weight (kg):	1361
VRS Type:	2.5
Unit Size:	500

Face Velocity (m/s):	3
Flow Volume (l/s):	21860
Pressure drop (Pa):	12

SILENCER MODULE DIMENSIONS (mm)

Qty of Pieces:	9
M:	1000
N:	933
L:	2440
Weight each (kg):	151

Dynamic Insertion Loss		Airflow Generated Noise	
Hz	dB	Hz	dB
63:	8	63:	53
125:	17	125:	48
250:	31	250:	41
500:	49	500:	39
1000:	50	1000:	40
2000:	43	2000:	41
4000:	21	4000:	39
8000:	16	8000:	37



- Silencer dimensions to be confirmed by customer prior to fabrication.
- The installed silencer pressure drop may be higher due to system effects caused by the location of duct elements upstream and downstream of the silencer.
- Tolerances are ± 3 mm on all silencer units. If silencers are banked or paired the compounded tolerance needs to be allotted by the contractor.
- Silencer acoustic and aerodynamic performance data are in accordance with ASTM E 477-06a.
- Flame spread/smoke developed indexes in accordance with ASTM C 1071-05
- Tested data tolerances are in accordance with AMCA 1011-03.

SILENCER CONSTRUCTION OPTIONS

Casing Thickness:	22 gauge
Perforated Lining Thickness:	24 gauge
Material:	Galvanized steel
Acoustic Media:	Fiberglass (standard)
Media Covering:	None
Inlet connection:	1 in slip connection (standard)
Outlet connection:	1 in slip connection (standard)

Notes:

QCH Part 3 HVAC Sound Data, West Intake Louvre, Sources 159.1 & 159.2

Client: QCH
 Building: Part 3 & Other Renovations
 Location: Part 3 Level 4 (unless stated otherwise)
 Data Source: VRM Drawings - Part 3 Drawing 9915-49-M-540, 700, 701, 702
 Date: June 2010

Source	Octave band sound power, Lw, dB, un-weighted								A
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Intake Louvre Part 1, Western, Source 159.1									
AHU-15, Intake Silencer: none	84	86	93	90	77	73	68	64	89.3
Resultant	84	86	93	90	77	73	68	64	89.3
SF-1A, supply fan Silencer: none	80	79	74	74	73	66	58	52	76.4
Resultant	80	79	74	74	73	66	58	52	76.4
AHU-16, Intake Silencer: none	83	83	93	95	86	82	77	68	93.9
Resultant	83	83	93	95	86	82	77	68	93.9
AHU-17, Intake Half of AHU-17 to WI-1	85 3	84 3	94 3	90 3	86 3	79 3	77 3	70 3	91.5
Resultant	82	81	91	87	83	76	74	67	88.5
Inside total	88.5	89.0	97.2	96.7	88.2	83.5	79.1	71.5	96.1
Louver silencer, SRD - 1'	3	8	6	11	13	15	15	11	
Resultant, Western Part, 159.1	85.5	81.0	91.2	85.7	75.2	68.5	64.1	60.5	86.1
Intake Louvre Part 2, Eastern, Source 159.2									
AHU-17, Intake Half of AHU-17 to WI-1	85 3	84 3	94 3	90 3	86 3	79 3	77 3	70 3	91.5
Resultant	82	81	91	87	83	76	74	67	88.5
SF-1B, supply fan Silencer: none	80	79	74	74	73	66	58	52	76.4
Resultant	80	79	74	74	73	66	58	52	76.4
AHU-18, Intake Silencer: none	89	90	99	101	92	87	81	73	99.8
Resultant	89	90	99	101	92	87	81	73	99.8
Total	90.2	90.8	99.7	101.2	92.6	87.4	81.8	74.0	100.1
Louver silencer, SRD - 1'	3	8	6	11	13	15	15	11	
Resultant, Eastern Part, 159.2	87.2	82.8	93.7	90.2	79.6	72.4	66.8	63.0	89.8
A-weighting factors	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	

End reflection losses ignored, make only minor difference at low frequencies

QCH Part 3 HVAC Sound Data, East Intake Louvre , Source 160

Client: QCH

Cadna-A Model: Source 160

Building: Part 3 & Other Renovations

Location: Part 3 Level 4 (unless stated otherwise)

Data Source: VRM Drawings - Part 3 Drawing 9915-49-M-540, 700, 701, 702

Date: June 2010

Source	Octave band sound power, Lw, dB, un-weighted								A
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
East Intake Louvre									
AHU-19, Intake	83	83	93	95	86	82	77	68	97.9
No data, used AHU-16 data									
Resultant	83	83	93	95	86	82	77	68	97.9
SF-1C, supply fan	80	79	74	74	73	66	58	52	84.1
Silencer: none									
Resultant	80	79	74	74	73	66	58	52	84.1
AHU-20, Intake	82	84	91	90	76	72	67	63	94.4
Silencer: none									
Resultant	82	84	91	90	76	72	67	63	94.4
SF-2, supply fan	81	91	93	91	87	85	83	71	97.5
SLS-2X: 48 X 40-RFL-HV-F4 X 36	3	4	8	13	14	11	9	5	
Resultant	78	87	85	78	73	74	74	66	90.1
Inside, East Intake Louvre	87.2	90.1	95.6	96.3	86.8	83.1	79.1	70.9	100.1
Louver silencer, SRD - 1'	3	8	6	11	13	15	15	11	
Resultant, East Exhaust Louvre	84.2	82.1	89.6	85.3	73.8	68.1	64.1	59.9	92.3
A-weighting factors	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	

Elbow attenuations calculated using ASHRAE Handbook HVAC Applications , 2007.

End reflection losses ignored, make only minor difference at low frequencies

QCH Part 3 HVAC Sound Data, West Exhaust Louvre, Source 170

Client: QCH

Cadna-A Model: Source 170

Building: Part 3 & Other Renovations

Location: Part 3 Level 4 (unless stated otherwise)

Data Source: VRM Drawings - Part 3 Drawing 9915-49-M-540, 700, 701, 702

Date: June 2010

Source	Octave band sound power, Lw, dB, un-weighted								A
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
West Exhaust Louvre									
AHU-15, Return	100	97	100	91	89	85	81	75	95.5
RF-15, exhaust	100	101	90	85	84	79	73	69	90.0
SLS-15X: 84 X 36-RFL-HV-F5 X 36	1	3	7	11	14	14	10	4	
Unlined 84" elbow, turning vanes	4	6	4	4	4	4	4	4	
Resultant	98	93	89	77	72	68	68	68	84.0
AHU-20, Return	97	94	96	88	86	82	78	72	92.1
RF-20, exhaust	96	95	85	81	80	76	71	67	85.6
SLS-20X: 60 X 26-RFL-HV-F6 X 36	1	3	6	11	14	16	11	4	
Resultant	99	95	90	78	73	67	68	69	84.8
AHU-16, Return	81	87	95	92	83	79	71	62	91.8
SLS-16X: 40 X 20-RFL-HV-F6 X 36	1	3	6	11	14	16	11	4	
Resultant	80	84	89	81	69	63	60	58	82.8
EF-4A, exhaust	78	91	87	86	83	81	74	66	88.4
Silencer: none									
Resultant	78	91	87	86	83	81	74	66	88.4
EF-1, exhaust	78	85	78	81	70	65	64	61	79.8
Silencer: none									
Resultant	78	85	78	81	70	65	64	61	79.8
EF-3, exhaust	86	86	87	77	73	72	70	64	82.0
Silencer: none									
Resultant	86	86	87	77	73	72	70	64	82.0
AHU-17, Return	80	87	92	87	77	77	68	61	87.8
Silencer: none									
Resultant	80	87	92	87	77	77	68	61	87.8
EF-29	92	81	72	78	76	72	64	68	80.3
Silencer: none									
Resultant	92	81	72	78	76	72	64	68	80.3
Total, West Exhaust Louvre	102.0	99.0	97.3	91.4	85.6	83.5	77.7	74.8	93.8
A-weighting factors	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	

Elbow attenuations calculated using ASHRAE Handbook HVAC Applications , 2007.

End reflection losses ignored, make only minor difference at low frequencies

QCH Part 3 HVAC Sound Data, East Exhaust Louvre, Source 171

Client: QCH

Cadna-A Model: Source 171

Building: Part 3 & Other Renovations

Location: Part 3 Level 4 (unless stated otherwise)

Data Source: VRM Drawings - Part 3 Drawing 9915-49-M-540, 700, 701, 702

Date: June 2010

Source	Octave band sound power, Lw, dB, un-weighted								A
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
East Exhaust Louvre									
AHU-18, Return fans	89	94	101	97	87	83	77	71	97.0
SLS-18X: 100 X 32-RFL-HV-F6 X 36	1	3	6	11	14	16	11	4	
Generated Noise	65	64	61	59	58	59	54	47	
Resultant	88	91	95	86	73	68	66	67	88.4
RF-19, exhaust	100	92	95	89	87	84	77	70	92.5
2 26" square elbows with vanes	0	2	8	12	8	8	8	8	
Resultant	100	90	87	77	79	76	69	62	84.5
EF-2, exhaust	95	93	89	82	80	75	69	65	86.0
2 square 34" elbows	2	10	16	8	6	6	6	6	
Resultant	93	83	73	74	74	69	63	59	78.0
EF-4B, exhaust	78	91	87	86	83	81	74	66	88.4
Silencer: none									
Resultant	78	91	87	86	83	81	74	66	88.4
EF-23, exhaust	77	79	78	78	67	58	53	51	76.7
Silencer: none									
Resultant	77	79	78	78	67	58	53	51	76.7
EF-30, exhaust	84	85	77	74	64	59	57	56	75.0
Silencer: none									
Resultant	84	85	77	74	64	59	57	56	75.0
EF-21, exhaust	78	85	83	81	80	75	70	64	84.0
2 radiused 36" elbows	2	4	6	6	6	6	6	6	
Resultant	76	81	77	75	74	69	64	58	78.1
EF-5, exhaust electrical	81	91	93	91	87	85	83	71	93.2
1 square 60" lined elbow	6	11	10	10	10	10	10	10	
Resultant	75	80	83	81	77	75	73	61	83.2
Total, East Exhaust Louvre	101.2	96.4	96.6	90.5	86.1	83.4	78.0	71.4	93.2
A-weighting factors	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	

Elbow attenuations calculated using ASHRAE Handbook HVAC Applications , 2007.

End reflection losses ignored, make only minor difference at low frequencies

QCH Cancer AHU & RF Sound Data, Sources 130, 131, 132, 133, 134 & 201, 201 203, 204

Client: QCH

Building: Cancer

Location: West end Mechanical rooms

Basis of calculations:

1. 2003 ASHRAE Applications Handbook, Chapter 47, Sound and Vibration Control

Note: This is raw fan data, to account for the attenuation of coils, linings, bends etc in the air handling units,
10 dB has been subtracted for Cadna-A modelling.

Supplier Data

Name	Type	Weight	Octave band, Hz								A	Lin	Source
		31.5	63	125	250	500	1000	2000	4000	8000			
Fan AHU-1-S/A													SD 015730-1, Twin City
AHU-1, fan in	Lw		93	102	96	86	81	77	72	69	91.3		SD 015730-1, Twin City
AHU 1, fan out	Lw		96	99	95	91	87	83	77	72	93.2		SD 015730-1, Twin City
Fan AHU-5-E/A													SD 015730-1, Twin City
AHU-2, fan in	Lw		89	90	91	88	82	79	75	70	89.1		SD 015730-1, Twin City
AHU 2, fan out	Lw		100	96	93	83	82	78	74	68	88.9		SD 015730-1, Twin City
Fan RF-1													SD 015820-1, Cook QMX
In sound power	Lw		84	89	93	89	88	88	87	75	94.5		SD 015820-1, Cook QMX
Out sound power	Lw		90	92	98	96	93	90	88	76	98.4		SD 015820-1, Cook QMX
Fan RF-2													SD 015820-1, Cook SQI-B
In sound power	Lw		87	90	83	81	78	72	65	58	83.1		SD 015820-1, Cook SQI-B
Out sound power	Lw												SD 015820-1, Cook SQI-B
Fan RF-3													SD 015820-1, Cook SQI-B
In sound power	Lw		84	88	79	78	75	68	62	56	80.0		SD 015820-1, Cook SQI-B
Out sound power	Lw												SD 015820-1, Cook SQI-B
Fan RF-4													SD 015820-1, Cook SQI-B
In sound power	Lw		85	89	80	79	76	70	63	57	81.1		SD 015820-1, Cook SQI-B
Out sound power	Lw												SD 015820-1, Cook SQI-B
A-weighting factors		-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1			

Estimate of Noise for Source S-154, 155 & 156, QCH Hot Water Boilers B-4, 5 & 6, Part 3

Date: 5 July 2010

Boiler: Cleaver Brooks Model FLX 500, 5,000,000 BTU/hr

Fan data (from Schedule 9915-49-M-701): motor 2 HP; Assume: 1000 cfm, staic pressure 5.2 ins H₂O, fan RPM 3600, centrifugal, 9 blades, backward curve

Exhaust: 2 round elbows, stack height 2.4 m (8'), stack diameter 0.45 m (18")

Fan noise calculation:

Reference: R. D. Bruce & C. T. Moritz, 'Sound Power Level Predictions for Industrial Machinery', Encyclopedia of Acoustics, 1997

Formula: $L_w = \text{discharge sound power} = 10 + 10 \cdot \log Q + 20 \cdot \log (\Delta P) - \text{Correction (Table 1)} + 5 \text{ dB at BPF and } 2 \cdot \text{BPF, see reference.}$

assumes an induced draft fan with airfoil or backward curved blades

Inputs:

Air Flow	1000	cfm	28	m ³ /min (Q)
Internal Static Pressure	5.2	ins. H ₂ O	1295	Pa (Delta P)
Fan Speed	3600	RPM		
No. Blades	9			

Calculations:

Blade Passing Freq	540	Hz	(fan RPM * no. blades)/60
Second Harmonic	1080	Hz	2*(fan RPM * no. blades)/60

Item	Ocatve Band									A
	31.5	63	125	250	500	1000	2000	4000	8000	
10 + 10*Log Q + 20*Log (Delta P)	87	87	87	87	87	87	87	87	87	
minus Correction (Table 1 reference)	11	9	7	8	9	9	13	17	24	
+5 in BPF band					5	5				
L_w (re 10⁻¹² W) fan discharge power	76	78	80	79	83	83	74	70	63	85.3

A-weighting factors	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	
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Sound power at stack outlet:

Item	Ocatve Band									A
	31.5	63	125	250	500	1000	2000	4000	8000	
fan discharge L _w	76	78	80	79	83	83	74	70	63	85.3
Attenuation: 2 round elbows (ASHRAE)		0	2	4	6	6	6	6	6	
Attenuation: end reflection loss (ASHRAE)		10	6	2	1	0	0	0	0	
Resultant L_w at stack outlet		68	72	73	76	77	68	64	57	81.3

Octave Sound Level Estimates for Transformers, Sources 190 & 191

Reference: R. D. Bruce & C. T. Moritz, 'Sound Power Level Predictions for Industrial Machinery', Encyclopedia of Acoustics, ed. Crocker, 1997

Recommendation: R. D. Stevens & C. Hung, 'Towards a Realistic Estimate of Octave Band Sound Levels for Electric Transformers', Canadian Acoustics, Vol. 38, No. 1

Project **Queensway Carleton Hospital**

Transformer: **Northern Transformer, 4000/FUT 5000 KVA oil Filled, ref. Shop Drawing 16320-1, 26 May 2008**

Formulae:

$$L_w = N_r + 10 \cdot \log S + C$$

$$N_r = \text{NEMA Sound Rating} = 55 + 12 \cdot \log_{10}(\text{MVA}) \leftarrow \text{standard transformer} = 63.4$$

$$N_r = \text{NEMA Sound Rating} = 45 + 12 \cdot \log_{10}(\text{MVA}) \leftarrow \text{quieted transformer} = 53.4$$

$$\text{Approximation for } 10 \log_{10}(S) = 14 + 2.5 \cdot \log_{10}(\text{MVA}) = 15.7$$

Lw = sound power
MVA = 5 = transformer power rating

Notes:

NEMA = National Electric Manufacturers Association

S = Area of four transformer side walls, excluding the top and bottom

C = frequency adjustment

		Octave bands									
		31.5	63	125	250	500	1000	2000	4000	8000	A
Frequency Adjustment - C		-3	3	5	0	0	-6	-11	-16	-23	0.4
A-weightings		-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	
Estimated Sound Levels for Standard Transformers											
Sound Power, L _w	1	76.1	82.1	84.1	79.1	79.1	73.1	68.1	63.1	56.1	79.5
L _p at 1 m	1	65.1	71.1	73.1	68.1	68.1	62.1	57.1	52.1	45.1	68.5
L _p at x m	50	31.2	37.2	39.2	34.2	34.2	28.2	23.2	18.2	11.2	34.5
Estimated Sound Levels for Quieted Transformers											
Sound Power, L _w	1	66.1	72.1	74.1	69.1	69.1	63.1	58.1	53.1	46.1	69.5
L _p at 1 m	1	55.1	61.1	63.1	58.1	58.1	52.1	47.1	42.1	35.1	58.5
L _p at x m	50	21.2	27.2	29.2	24.2	24.2	18.2	13.2	8.2	1.2	24.5

. 2010

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APPENDIX 3

Outdoor to Indoor Sound Level Estimates

Contents:

Table A3.1 Predicted Indoor Sound Levels at POR's

Table A3.2 Sample Calculations

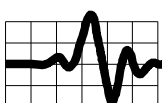


Table A3.1: Predicted Indoor Sound Levels at Points of Reception

See Table A3.2 for sample calculations of indoor sound level predictions

Day is worst case

POR ID	Description	Period	Noise Level	Octave Frequency Band - A-weighted										A
				31.5	63	125	250	500	1000	2000	4000	8000	16000	
2	Part 2, Patient Room, Level 4, North Side	Day	External (from CadnaA) Indoor		12.0	36.8	46.2	52.0	54.3	55.4	50.3	43.0	31.7	59.8
						9.5	22.3	18.7	13.5	16.2	3.9			25.1
3	Old Building, Patient Room Level 4, North Side	Day	External (from CadnaA) Indoor		33.9	39.6	46.8	47.8	44.5	39.3	29.0	16.2		52.0
						12.3	22.9	14.5	3.7	0.1	-17.4			23.9
11	Cancer, Treatment Room Level 1 - day use only	Day	External (from CadnaA) Indoor		42.2	52.7	59.5	59.1	58.9	54.9	49.9	42.9		64.9
						25.4	35.6	25.8	18.1	15.7	3.5			36.5
12	Cancer, Treatment Room Level 2 - day use only	Day	External (from CadnaA) Indoor		46.3	53.9	62.7	63.4	61.7	57.0	51.2	43.4		68.1
						26.6	38.8	30.1	20.9	17.8	4.8			39.7
13	Cancer, Treatment Room Level 3 - day use only	Day	External (from CadnaA) Indoor		46.3	54.7	63.0	63.6	62.2	58.3	52.2	43.7		68.5
						30.4	42.1	33.3	24.4	22.1	8.8			40.0
14	Cancer, Treatment Room Level 4 - day use only	Day	External (from CadnaA) Indoor		45.7	54.2	62.4	63.0	61.5	57.6	51.5	42.9		67.9
						26.9	38.5	29.7	20.7	18.4	5.1			39.4
21	Part 2, Patient Rooms, Level 4, West Side, North		External (from CadnaA) Indoor		45.2	55.4	58.5	61.3	60.7	56.0	48.5	39.2		66.1
						28.1	34.6	28.0	19.9	16.8	2.1			36.4
22	Part 2, Patient Rooms, Level 4, West Side, South	Day	External (from CadnaA) Indoor		35.9	44.4	50.8	53.8	55.2	52.3	44.2	33.6		59.6
						17.1	26.9	20.5	14.4	13.1	-2.2			28.5
31	Part 3, Patient Room, 3rd Floor, North Side, East	Day	External (from CadnaA) Indoor		50.3	52.8	60.4	59.9	58.8	57.1	51.9	42.8		65.8
						25.5	36.5	26.6	18.0	17.9	5.5			37.3
32	Part 3, Patient Room, 3rd Floor, North Side, West	Day	External (from CadnaA) Indoor		51.0	55.0	61.0	60.6	58.3	57.1	51.9	45.6		66.3
						27.7	37.1	27.3	17.5	17.9	5.5			38.1
33	Part 3, Patient Room, 3rd Floor, South Side, East	Day	External (from CadnaA) Indoor		39.3	47.7	57.8	59.5	55.7	53.5	42.7	31.2		63.4
						20.4	33.9	26.2	14.9	14.3	-3.7			34.8
34	Part 3, Patient Room, 3rd Floor, South Side, West	Day	External (from CadnaA) Indoor		35.7	38.5	55.1	55.0	47.7	42.2	37.3	30.8		58.6
						11.2	31.2	21.7	6.9	3.0	-9.1			31.7
41	Old Building, Patient Room Level 4, East	Day	External (from CadnaA) Indoor		35.6	45.5	50.1	55.0	55.2	51.9	42.3	30.7		59.8
						18.2	26.2	21.7	14.4	12.7	-4.1			28.3
42	Old Building, Patient Room Level 4, West Side, North	Day	External (from CadnaA) Indoor		34.8	42.0	50.8	51.4	53.3	49.9	43.1	33.2		57.9
						14.7	26.9	18.1	12.5	10.7	-3.3			27.9
43	Old Building, Patient Room Level 4, West Side, South	Day	External (from CadnaA) Indoor		36.5	42.5	47.2	49.6	50.1	49.8	46.7	38.7		56.2
						15.2	23.3	16.3	9.3	10.6	0.3			25.0
44	Old Building, Patient Room Level 4, South Side	Day	External (from CadnaA) Indoor		32.0	36.5	42.1	44.3	43.7	41.8	37.5	28.1		49.7
						9.2	18.2	11.0	2.9	2.6	-8.9			19.8
51	Operating Rooms, no windows, Level 3	Day	External (from CadnaA) Indoor		39.9	47.9	55.1	58.1	59.7	58.7	53.0	41.2		64.7
						12.3	23.0	17.4	9.1	0.3	-7.3	-18.3		24.5

Table Table A3.2: Sample Calculations of Interior Sound Levels due to External Noise

Client: Queensway Carleton Hospital

Project: Noise Study for C of A, 2010

Assumption: considers worst case

Base Relationship: $L_2 = L_1 - TL + 10 \cdot \log(S/A)$

Room Absorption from: $RT = 0.161 \cdot Vol/A$

		STC	Description	Octave Frequency Band										A
				31.5	63	125	250	500	1000	2000	4000	8000	16000	
Case 1: POR 13 Day	Large reverberant room, e.g. a ward, RT = 1 seconds, glass external wall, window area 50% of external wall Vol = 72 S = 9 A = 11.59 L1 TL 10*Log(S/A) L2	window area (50%) STC 35	Internal room dimensions: External wall dimensions: Reverberation Time: External Sound Level - A-weighted 6GI_12AIR_6GL (Source Viracon) Room & external wall correction Internal sound level	L = 6.0 L = 6.0 RT = 1.0	W = 4.0	H = 3.0 H = 3.0								
Case 2: POR 33 Day	Small room, e.g. a private room, RT = 1 seconds, glass external wall, window area 50% of external wall Vol = 42 S = 5.25 A = 6.76 L1 TL 10*Log(S/A) L2	window area (50%) STC 35	Internal room dimensions: External wall dimensions: Reverberation Time: External Sound Level 6GI_12AIR_6GL (Source Viracon) Room & external wall correction Internal sound level	L = 3.5 L = 3.5 RT = 1.0	W = 4.0	H = 3.0 H = 3.0								
Case 3: POR 51 Day	Operating Room, RT = 2 seconds, no windows, external wall brick veneer Vol = 75 S = 15 A = 6.04 L1 TL 10*Log(S/A) L2	100% of ext. wall STC 53	Internal room dimensions: External wall dimensions: Reverberation Time: External Sound Level Brick veneer (Source: National Research Council) Room & external wall correction Internal sound level	L = 5.0 L = 5.0 RT = 2.0	W = 5.0	H = 3.0 H = 3.0								
			A-weightings	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	-6.6	