



Airflow Testing Report

Prepared for

Portland Public Schools

November 2021





9700 SW Capitol Hwy, Suite 110
Portland, OR 97219
ameresco.com

PROJECT OVERVIEW

As part of the continuing process to ensure a safe return to in-person learning, Portland Public Schools has contracted with Ameresco to test the airflow and ventilation of all educational and office spaces in each school. The data is reviewed by both Ameresco and PPS personnel to identify any potential shortcomings in the airflow from the HVAC systems. To accomplish this task, Ameresco has partnered with a local NEBB certified Test-Adjust-Balance (TAB) firm, Neudorfer Engineers, who will measure the airflow to each zone with calibrated measurement equipment in accordance with current testing standards and procedures. As part of this effort, HVAC professionals will review the operation of the HVAC equipment serving every educational and office space in each school.

Ameresco is pleased to have partnered with PPS over the last decade as the district's Energy Services Company (ESCO) on six energy efficiency construction projects, four service projects, and numerous energy audits. Our partnership has resulted in reducing over 3,000 tons of CO₂ and other GHG emissions and over \$1,000,000 in utility cost savings per year. Ameresco appreciates this opportunity to play a small role in the safe reopening of schools.

About Ameresco, Inc.

Founded in 2000, Ameresco, Inc. (NYSE:AMRC) is a leading cleantech integrator and renewable energy asset developer, owner and operator. Our comprehensive portfolio includes energy efficiency, infrastructure upgrades, asset sustainability and renewable energy solutions delivered to clients throughout North America and the United Kingdom. Ameresco's sustainability services in support of clients' pursuit of Net Zero include upgrades to a facility's energy infrastructure and the development, construction, and operation of distributed energy resources. Ameresco has successfully completed energy saving, environmentally responsible projects with Federal, state and local governments, healthcare and educational institutions, housing authorities, and commercial and industrial customers. With its corporate headquarters in Framingham, MA, Ameresco has more than 1,000 employees providing local expertise in the United States, Canada, and the United Kingdom. For more information, visit www.ameresco.com.

Explanation of ASHRAE Total Effective Air Changes per Hour (ACH_e) Calculation

ASHRAE has been updating their Building Readiness document to reflect the most current understanding in the engineering community for how to operate and maintain buildings during the pandemic. Their update on 4/27/2021 provided an explanation of the impact air filters and air cleaning devices have on the air in buildings. They provided the methodology, formulas, and an Excel-based tool for determining the equivalent outside air a space is receiving by having a mix of outside air, filtered recirculated air, and additional air filtration or cleaning devices in the room. Here is the explanation from ASHRAE:

Epidemic Conditions in Place



Equivalent Outdoor Air:

The equivalent outdoor air calculation indicates that the outdoor air can be calculated by using the combination of the actual outdoor air, impact of filtration or air cleaning technologies on recirculated air, and the impact of air cleaning technologies in the space.

This is using the principal of filters in series and the effectiveness at reducing particles. For items in series, the initial item would see the recirculated airflow to clean. The second item in the series would see the “cleaned” air from Item 1 and so the impact of Item 1 must be accounted for in Item 2.

As part of the airflow testing project that Portland Public Schools has partnered with Ameresco to complete, we are including the calculation of the Total Effective Air Changes per Hour (ACH_e) to show the impact of the air filtration that is active in nearly all spaces in the PPS schools. The formula for doing so is:

$$ACH_e = (ACH_{oa} + ACH_f) * E_z + ACH_{ir}$$

where:

- ACH_{oa} = air changes per hour of outside air = outside airflow in cubic feet per minute * 60 minutes per hour / room volume in cubic feet
- ACH_f = air changes per hour of clean air from filtered recirculated air with filters of the specified MERV rating as determined by ASHRAE
- E_z = Zone Air Distribution Effectiveness = how effective the HVAC system is at circulating and mixing the air to distribute the clean air throughout the room
- ACH_{ir} = the air changes per hour of clean air from portable air filters in the room = number of filters * CADR * 60 minutes per hour / room volume in cubic feet
 - CADR = Clear Air Delivery Rate = the CFM of clean air as specified by the manufacturer of the air filter

In order to include these calculations in the airflow testing reports, Ameresco and PPS have made the following assumptions as not all the variables are known:

1. PPS is in process of upgrading the air filters in their HVAC systems to MERV 13 and plans to be complete with that project for the start of the '21-'22 school year. In this report and for the sake of the ACH_e calculation, we are using the filters that are in place at the time of the measurements, so some of them are still MERV 8.
2. ASHRAE has guidelines for what should be used for the Zone Air Distribution Effectiveness (E_z) based on the HVAC system configuration, but they do not provide a value for every HVAC system and room configuration. For the majority of PPS rooms, an E_z of 0.8 – 1.0 would be most appropriate, so we have made the conservative assumption of using 0.8 for every space as that yields the lower ACH_e.
3. The CADR for a given air filter is from manufacturer ratings and is based on certain conditions (fan speed, particulate size, filter cleanliness, etc.) that change with operating conditions.



NEUDORFER ENGINEERS INC.

**TEST REPORT TYPE:
SURVEY REPORT**

Portland Public Schools Airflow Testing Tubman MS

Job Number: 2021-0297

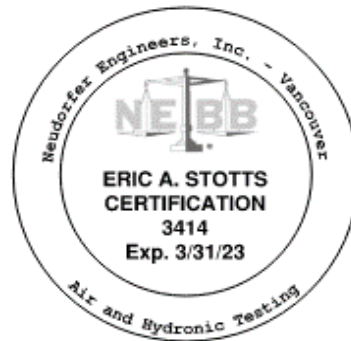
Project Completion Date: November 2021

Revision Date:

-

Revision Number:

-



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Neudorfer Engineers, Inc.

Consulting Engineers Seattle, Washington - Portland, Oregon



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**Portland Public Schools Airflow Testing
Tubman MS**

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Neudorfer Engineers, Inc.

Consulting Engineers Seattle, Washington - Portland, Oregon



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REPORT TITLE

CERTIFIED TEST: SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Tubman MS

NEI Job#: 2021-0297

Mechanical Engineer: NA

Architect: NA

HVAC Contractor: NA

TAB Firm: Neudorfer Engineers Inc
Test Engineer: Zach Mayer



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CERTIFICATION

Portland Public Schools Airflow Testing

The data presented in this report is a record of system measurements and final adjustments that have been obtained in accordance with the current edition of the NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems. Any variances from design quantities, which exceed NEBB tolerances, are noted in the Test-Adjust-Balance Report Project Summary.

Significant / Noteworthy Remarks are noted on the General Remarks and General Field Notes pages. Other remarks are noted on individual test sheets.

Noted deficiencies are not the TAB firms responsibility to repair. Prior to issuance of this report, Deficiency Reports are forwarded to our contracted agent.

Warranty is limited to one year from date of this report. Within that time, any discrepancies, ambiguities, or omissions found in this report will be retested, adjusted, or balanced as needed. A written notification will be required.

Submitted and Certified by:

NEBB TAB Firm: **Neudorfer Engineers Inc**

Certification No: **3414**

Expiration Date: **March 31, 2023**

Certification Date: **March 31, 2021**

(Date completed) **Signed and Sealed by:**

NEBB Supervisor: **Mike Vawter P.E.**

NEBB Supervisor: **Eric Stotts**





Neudorfer Engineers, Inc.

Consulting Engineers Seattle, Washington - Portland, Oregon



www.NeudorferEngineers.com

TERMS AND ABBREVIATIONS

Project: **Portland Public Schools Airflow Testing**

AC or ACU Air Conditioner or Air Conditioning Unit

AH or AHU Air Handler or Air Handling Unit

ACH Air Changes per Hour

AVG Average

BHP Brake Horsepower

CAV Constant Air Volume

CBV Calibrated Balancing Valve
(Circuit Setter)

CC Cooling Coil

CD Ceiling Diffuser

CFM Cubic Feet per Minute

CH Chiller

CHWS Chilled Water Supply

CHWR Chilled Water Return

CP Circulating Pump

CR Ceiling Register

CRAC Computer Room Air Conditioner

CRU Computer Room Unit

CT Cooling Tower

CU Condenser Unit

CUH Cabinet Unit Heater

CWS Condenser Water Supply

CWR Condenser Water Return

DAT Discharge Air Temperature

DB Dry Bulb

DD Direct Drive

DDC Direct Digital Controls: EMS Control
System for the HVAC

Des. Design

Dia. Diameter

Disch. Discharge

EA Exhaust Air

EAT Entering Air Temperature

Economizer Controls and components that allow an
air handler to logically utilize outdoor air
for cooling as opposed to the use of
mechanical cooling.

EF Exhaust Fan

EG Exhaust Grille

EMCS Energy Management Control System

ERU Energy Recovery Unit

E.S.P. External Static Pressure

HRC Heat Recovery Coil

EWT Entering Water Temperature

FCU Fan Coil Unit

FD Fire Damper

FSD Fire Smoke Damper

FLA Full Load Amperage: Maximum
amperage a motor can draw.

Flow Hood Instrument that captures air and
converts the reading to CFM.

FHT Fume Hood Test

FPB Fan Powered Box

FPM Feet per Minute

FR Field Report

FT Foot, Feet

FTU Fan Terminal Unit

GPM Gallons per Minute

HC Heating Coil

TDH Pressure Difference across the entering
and leaving side of a pump.

HEPA High Efficiency Particulate Absorbing

HP Horsepower

HVAC Heating Ventilation and Air Conditioning

HWS Heating Water Supply

HWR Heating Water Return

HX Heat Exchanger

HZ Hertz, cycle per second

in. inches

in.w.g. inches of water gauge

Kfactor Correction factor to the free area need to
calculate CFM.

KW Kilowatts

LAT Leaving Air Temperature

LBWG Low Wall Grille

LWR Low Wall Register

LWT Leaving Water Temperature

MAU Make-up Air Handling Unit

MBH 1,000 BTUH

N/A Not Applicable

OSA Outside Air

OBD Opposed Blade Damper

ΔP Pressure Drop.

PH Phase

PSI Pounds per Square Inch

RA Return Air

RAT Return Air Temperature

RF Return Fan

RH Relative Humidity

RHC Reheat Coil

RPM Revolutions per Minute

RTU Roof Top Unit

SA Supply Air

SAT Supply Air Temperature

S.F. Service Factor

SF Supply Fan

SFD Smoke/Fire Damper

SP Static Pressure

sq.ft. square feet

Suct. Suction

SWG Sidewall Grille

SWR Sidewall Register

TAB Test; Adjust; and Balance

TSP Total Static Pressure: Difference
between the entering and leaving
static pressure of a fan.

UH Unit Heater

VAV Variable Air Volume; box that
contains a motorized damper that
modulates airflow.

VD Volume Damper

VFD Variable Frequency Drive

Velgrid Instrument that reads used to read
velocity in feet per minute.

VVT Variable Volume Terminal

WC Water Column

W.G. Water Gauge

WB Wet Bulb

INSTRUMENT CALIBRATIONS

Portland Public Schools Airflow Testing

Tubman MS

Instrument Type	Air Data Meter with Flowhood	Instrument Serial #	M97410
Instrument Manufacturer	Shortridge	Calibration Date	10/4/2021
Instrument Model Number	ADM 860	Calibration Due	10/4/2022
Instrument Type	Differential Pressure Water Meter	Instrument Serial #	W12178
Instrument Manufacturer	Shortridge	Calibration Date	10/4/2021
Instrument Model Number	HDM-250	Calibration Due	10/4/2022
Instrument Type	Psychrometer	Instrument Serial #	181128924
Instrument Manufacturer	Extech	Calibration Date	10/1/2021
Instrument Model Number	RH390	Calibration Due	10/1/2022
Instrument Type	Tachometer	Instrument Serial #	B185B5022P
Instrument Manufacturer	Nidec	Calibration Date	10/1/2021
Instrument Model Number	MT-200	Calibration Due	10/1/2022
Instrument Type	Amp Probe	Instrument Serial #	33380179WS
Instrument Manufacturer	Fluke	Calibration Date	10/1/2021
Instrument Model Number	323 Clamp Meter	Calibration Due	10/1/2022
Instrument Type	Digital Thermometer	Instrument Serial #	45400509WS
Instrument Manufacturer	Fluke	Calibration Date	10/1/2021
Instrument Model Number	52 II	Calibration Due	10/1/2022
Instrument Type	Manometer	Instrument Serial #	M97410
Instrument Manufacturer	Shortridge	Calibration Date	10/4/2021
Instrument Model Number	ADM 860	Calibration Due	10/4/2022
Instrument Type	Thermal Anemometer	Instrument Serial #	AVM440808002
Instrument Manufacturer	Alnor Instruments	Calibration Date	9/22/2021
Instrument Model Number	AVM 440	Calibration Due	9/22/2022
Instrument Type	Ultrasonic Flow Meter	Instrument Serial #	N1F1823T
Instrument Manufacturer	Fuji	Calibration Date	9/20/2021
Instrument Model Number	Portaflow-C	Calibration Due	9/20/2022



PROJECT	Portland Public Schools Airflow Testing
LOCATION	Tubman MS; 2231 N Flint Ave, Portland, OR 97227

REPORT SUMMARY

This project has been surveyed per plans and specifications using the National Environmental Balancing Bureau (NEBB) standards and procedures.

The scope of work for this project was to assess the current airflows for each classroom, office, and special purpose space. Air changes per hour were calculated along with the % of OSA for the spaces and any deficiencies found for each piece of equipment has been noted in the following report.

All ventilation equipment was commanded to run by the BMS system. Ventilation units were measured with a flowhood on the supply outlets. Outside air was recorded with a flowhood on the OSA louvre where accessible. AK factors were calculated from flowhood readings. The remaining OSA values were recorded with a velgrid. AHU supply air was recorded by a summation of the outlets as recorded by flowhood or velgrid when appropriate. Outside air was recorded with a velgrid or airfoil and calculated by the free area method.

The measured airflows in this report represent the performance of the equipment at the time of measurement, which vary over time based on operating conditions. There are factors outside the control of Neudorfer that impact airflow, and variance in those factors is expected and normal. One significant factor is the MERV rating and condition of the air filters on the equipment. During the summer of 2021, PPS began upgrading the filters on all their fan systems to MERV 13. Those upgraded filters are more effective at capturing particles but also impact the amount of airflow from the equipment. These filter changes were occurring while the airflow measurement project was happening, so some schools had the new filters, and some had the old filters at the time of measurement. On the data page included this report, there is a line stating whether or not the upgraded filters were in place at the time of measurement.



AIRFLOW SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Location: Tubman MS; 2231 N Flint Ave, Portland, OR 97227
Filter Status: Upgraded

Room	Equipment Info		Room Dimensions					Airflow Measurements			Calculated ACH					Notes
	Served By	Equipment Type	Room Length	Room Width	Room Area	Room Height	Room Volume	Total CFM Supply	OA CFM Supply	OA %	Air Changes per Hour (supply)	Air Changes per Hour (OA)	# of Portable Filters	Total Effective Air Changes per Hour (ACH_e) with Portable Filter	Total Effective Air Changes per Hour (ACH_e) without Portable Filter	
First Floor																
170A	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0	N/A	0.0	This is storage.
164B	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0	N/A	0.0	This is a water closet.
164A	AHU-1	AHU	24.0	26.2	629	11.5	7,231	465	149	32%	3.9	1.2	1	5.0	2.9	Non-rectangular room.
166A	AHU-1	AHU	8.8	18.9	166	9.0	1,497	280	90	32%	11.2	3.6	1	18.8	8.4	
168	AHU-1	AHU	7.1	12.6	89	8.8	787	100	32	32%	7.6	2.4	1	25.5	5.7	
Gym 160	AHU-1	AHU	54.0	90.0	4,860	22.7	110,322	7,860	2,515	32%	4.3	1.4	2	3.5	3.2	
162A	AHU-1	AHU	24.0	20.1	482	11.5	5,548	130	42	32%	1.4	0.4	1	3.9	1.0	
Main Office 157	AHU-1	AHU	12.5	66.1	826	16.0	9,530	260	83	32%	1.6	0.5	1	2.9	1.2	Non-rectangular room.
155	AHU-1	AHU	7.8	10.9	85	8.0	680	25	8	32%	2.2	0.7	1	24.6	1.6	
157A	AHU-1	AHU	13.3	24.6	174	12.6	2,195	100	32	32%	2.7	0.9	1	9.1	2.0	Non-rectangular room.
153	AHU-1	AHU	9.2	12.6	116	9.0	1,043	130	42	32%	7.5	2.4	1	20.5	5.6	
167	AHU-1	AHU	7.4	11.9	88	7.5	660	60	19	32%	5.5	1.7	1	27.7	4.1	
165	AHU-1	AHU	7.8	11.9	93	7.5	696	55	18	32%	4.7	1.5	1	25.9	3.5	
Conf. Room 163	AHU-1	AHU	7.8	11.9	93	7.5	696	70	22	32%	6.0	1.9	1	26.9	4.5	
161	AHU-1	AHU	10.1	17.4	176	7.5	1,318	50	16	32%	2.3	0.7	1	13.5	1.7	
100F	AHU-1	AHU	6.1	20.5	125	8.5	1,063	65	21	32%	3.7	1.2	1	17.4	2.7	
Rm 159D	AHU-1	AHU	19.9	43.8	872	11.4	8,337	65	21	32%	0.5	0.1	1	2.2	0.3	Non-rectangular room.
100E	AHU-1	AHU	9.3	19.8	184	11.6	2,136	40	13	32%	1.1	0.4	1	8.1	0.8	
100A	AHU-1	AHU	23.8	29.4	700	15.3	10,706	75	24	32%	0.4	0.1	1	1.8	0.3	Sloped ceiling.
Conf. Room 101A	AHU-1	AHU	11.8	12.2	144	9.0	1,296	80	26	32%	3.7	1.2	1	14.8	2.8	
101	AHU-1	AHU	11.2	39.3	407	12.9	5,252	60	19	32%	0.7	0.2	1	3.5	0.5	Non-rectangular room.
Library 100	AHU-1	AHU	49.5	53.2	2,633	15.8	36,996	140	45	32%	0.2	0.1	1	0.6	0.2	Split level ceiling.
151	AHU-1	AHU	20.0	26.1	486	12.4	6,026	505	162	32%	5.0	1.6	1	6.3	3.7	Non-rectangular room.
103	AHU-1	AHU	9.7	13.4	130	8.9	1,157	240	77	32%	12.4	4.0	1	22.8	9.3	

Date: 11/8/2021

Readings By: Mayer



AIRFLOW SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Location: Tubman MS; 2231 N Flint Ave, Portland, OR 97227
Filter Status: Upgraded

Room	Equipment Info		Room Dimensions					Airflow Measurements			Calculated ACH					Notes
	Served By	Equipment Type	Room Length	Room Width	Room Area	Room Height	Room Volume	Total CFM Supply	OA CFM Supply	OA %	Air Changes per Hour (supply)	Air Changes per Hour (OA)	# of Portable Filters	Total Effective Air Changes per Hour (ACH _e) with Portable Filter	Total Effective Air Changes per Hour (ACH _e) without Portable Filter	
First Floor																
105A	AHU-1	AHU	11.6	13.9	161	9.8	1,580	30	10	32%	1.1	0.4	1	10.7	0.8	
Rm 105	AHU-1	AHU	30.3	35.0	937	11.0	10,302	525	168	32%	3.1	1.0	1	3.8	2.3	Non-rectangular room.
111	AHU-1	AHU	14.0	25.0	350	11.0	3,850	460	147	32%	7.2	2.3	1	9.4	5.3	
114	AHU-1	AHU	13.4	18.8	252	9.3	2,343	160	51	32%	4.1	1.3	1	9.7	3.1	Sloped ceiling.
Rm 118	AHU-1	AHU	28.9	30.5	881	10.8	9,520	620	198	32%	3.9	1.3	1	4.6	2.9	
Rm 120	AHU-1	AHU	28.9	30.5	881	10.8	9,520	695	222	32%	4.4	1.4	1	4.9	3.3	
Rm 113	AHU-1	AHU	28.9	30.5	881	12.0	10,577	770	246	32%	4.4	1.4	1	4.7	3.3	
Rm 115	AHU-1	AHU	28.9	30.5	881	12.0	10,577	580	186	32%	3.3	1.1	1	3.9	2.5	
Rm 122	AHU-1	AHU	28.9	30.5	881	12.0	10,577	660	211	32%	3.7	1.2	1	4.3	2.8	
Rm 124B	AHU-1	AHU	8.3	17.2	143	8.9	1,271	25	8	32%	1.2	0.4	1	13.2	0.9	
Rm 124	AHU-1	AHU	28.9	30.0	867	12.0	10,404	510	163	32%	2.9	0.9	1	3.7	2.2	
Rm 117	AHU-1	AHU	28.5	30.5	869	12.1	10,518	645	206	32%	3.7	1.2	1	4.2	2.7	
Rm 119	AHU-1	AHU	28.5	30.5	869	12.1	10,518	740	237	32%	4.2	1.4	1	4.6	3.1	
Cafeteria 131	AHU-1	AHU	64.4	179.5	11,560	37.1	319,957	5,885	1,883	32%	1.1	0.4	2	0.9	0.8	Non-rectangular room.
129	AHU-1	AHU	23.8	57.2	1,189	12.9	15,343	365	117	32%	1.4	0.5	1	2.1	1.1	Non-rectangular room.
Rm 130	AHU-1	AHU	24.7	39.3	875	17.5	15,307	515	165	32%	2.0	0.6	1	2.5	1.5	Non-rectangular room.
Rm 132	AHU-1	AHU	39.2	40.6	1,169	17.7	20,683	765	245	32%	2.2	0.7	1	2.4	1.7	Non-rectangular room.
132A	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	N/A	N/A	This room does not exist.
123	AHU-1	AHU	24.0	52.0	1,248	10.0	5,956	325	104	32%	3.3	1.0	1	5.1	2.4	Non-rectangular room.
123A	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0	N/A	0.0	This is the walk-in cooler.
123B	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0	N/A	0.0	This is the walk-in cooler.
135	AHU-1	AHU	7.4	18.2	135	12.9	1,737	80	26	32%	2.8	0.9	1	11.0	2.1	
133	AHU-1	AHU	7.4	18.2	135	12.9	1,737	75	24	32%	2.6	0.8	1	10.9	1.9	
148	AHU-1	AHU	13.4	21.1	242	9.0	2,176	540	173	32%	14.9	4.8	1	18.3	11.1	

Date: 11/8/2021

Readings By: Mayer



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First Floor																
Rm 146	AHU-1	AHU	32.9	40.3	1,043	11.8	12,307	425	136	32%	2.1	0.7	1	2.8	1.5	Non-rectangular room.
185	AHU-1	AHU	14.1	14.1	199	1103.0	219,287	120	38	32%	0.0	0.0	1	0.1	0.0	
180	AHU-1	AHU	45.0	59.0	2,810	11.1	31,191	1,720	550	32%	3.3	1.1	2	3.5	2.5	Non-rectangular room.
181	AHU-1	AHU	10.6	12.5	133	11.3	1,497	40	13	32%	1.6	0.5	1	11.6	1.2	
182	AHU-1	AHU	12.6	19.8	249	11.2	2,794	85	27	32%	1.8	0.6	1	6.9	1.4	
Second Floor																
Rm 221	AHU-1	AHU	29.3	33.3	976	10.0	9,757	540	173	32%	3.3	1.1	1	4.1	2.5	
Rm 223	AHU-1	AHU	29.8	34.0	1,013	10.0	10,132	540	173	32%	3.2	1.0	1	3.9	2.4	
Rm 227	AHU-1	AHU	23.1	23.8	540	9.9	5,344	510	163	32%	5.7	1.8	1	7.2	4.3	
Rm 228	AHU-1	AHU	21.9	35.0	707	9.8	6,924	560	179	32%	4.9	1.6	1	5.9	3.6	Non-rectangular room.
Rm 201	AHU-1	AHU	28.7	30.0	861	11.0	9,471	950	304	32%	6.0	1.9	1	6.1	4.5	
Rm 203	AHU-1	AHU	28.7	30.0	861	11.0	9,471	860	275	32%	5.4	1.7	1	5.7	4.1	
Rm 200	AHU-1	AHU	28.7	30.0	861	11.0	9,471	590	189	32%	3.7	1.2	1	4.4	2.8	
Rm 202	AHU-1	AHU	28.7	30.0	861	11.0	9,471	690	221	32%	4.4	1.4	1	4.9	3.3	
Rm 205	AHU-1	AHU	28.7	30.0	861	11.0	9,471	720	230	32%	4.6	1.5	1	5.0	3.4	
Rm 207	AHU-1	AHU	28.7	30.0	861	11.0	9,471	930	298	32%	5.9	1.9	1	6.0	4.4	
Rm 204	AHU-1	AHU	28.7	30.0	861	11.0	9,471	745	238	32%	4.7	1.5	1	5.2	3.5	
Rm 206	AHU-1	AHU	28.7	30.0	861	11.0	9,471	880	282	32%	5.6	1.8	1	5.8	4.2	
Rm 209	AHU-1	AHU	28.7	30.0	861	11.0	9,471	1,020	326	32%	6.5	2.1	1	6.5	4.8	
Rm 211	AHU-1	AHU	28.7	30.0	861	11.0	9,471	795	254	32%	5.0	1.6	1	5.4	3.8	
Rm 214	AHU-1	AHU	24.4	36.3	886	10.0	8,857	1,060	339	32%	7.2	2.3	1	7.1	5.4	
215A	AHU-1	AHU	7.6	31.6	240	10.0	2,402	160	51	32%	4.0	1.3	1	9.5	3.0	
Rm 215	AHU-1	AHU	37.8	40.6	1,034	9.9	10,233	870	278	32%	5.1	1.6	1	5.3	3.8	Non-rectangular room.
Rm 216	AHU-1	AHU	21.2	31.8	674	10.5	7,079	200	64	32%	1.7	0.5	1	3.5	1.3	

Date: 11/8/2021

Readings By: Mayer

Project:	Portland Public Schools Airflow Testing
Location:	Tubman MS; 2231 N Flint Ave, Portland, OR 97227
Filter Status:	Upgraded

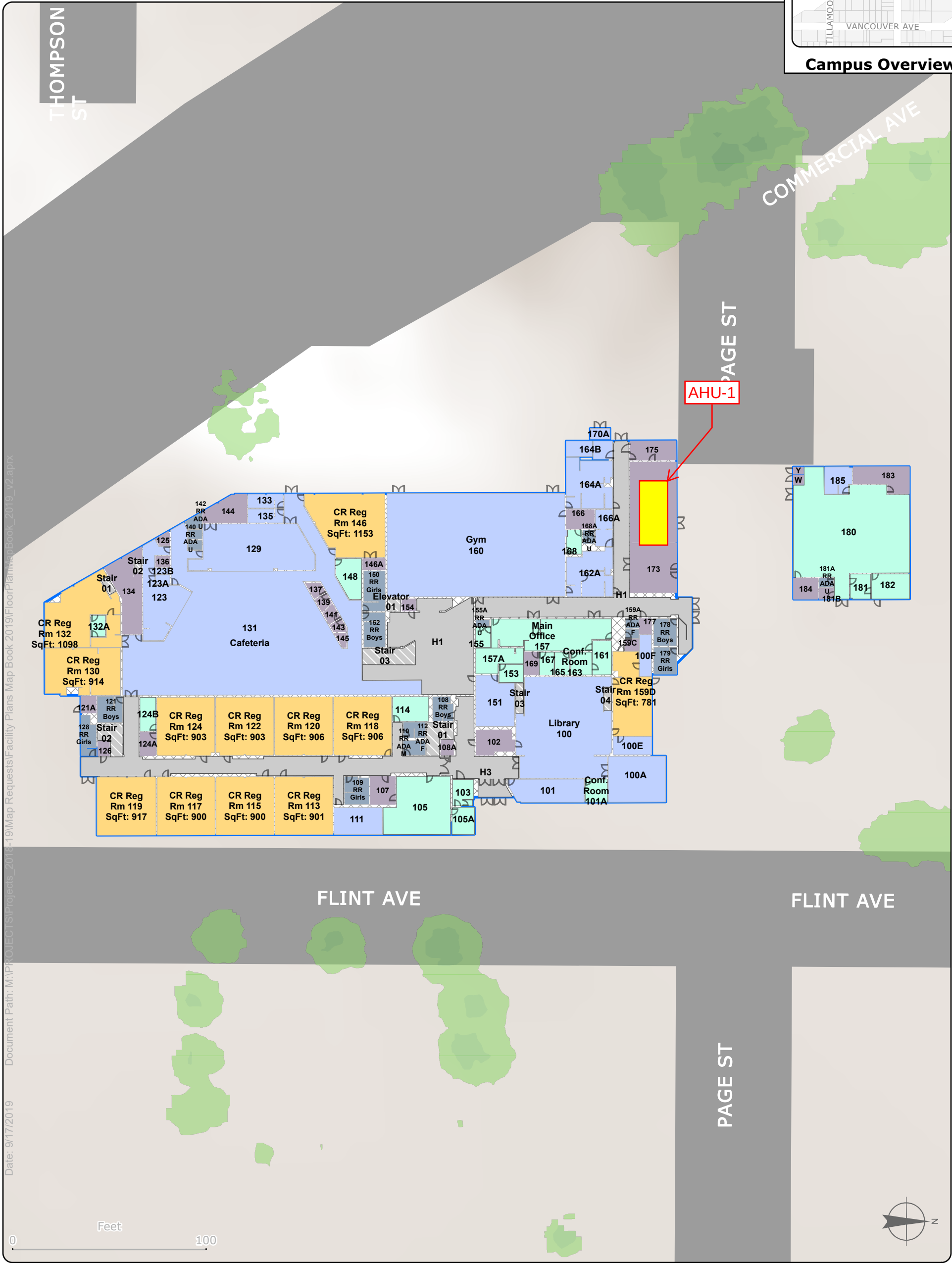
[illegible]

Date: 11/8/2021

Project: Portland Public Schools Airflow Testing

Location: Tubman MS; 2231 N Flint Ave, Portland, OR 97227

NOTE #	NOTE DESCRIPTION

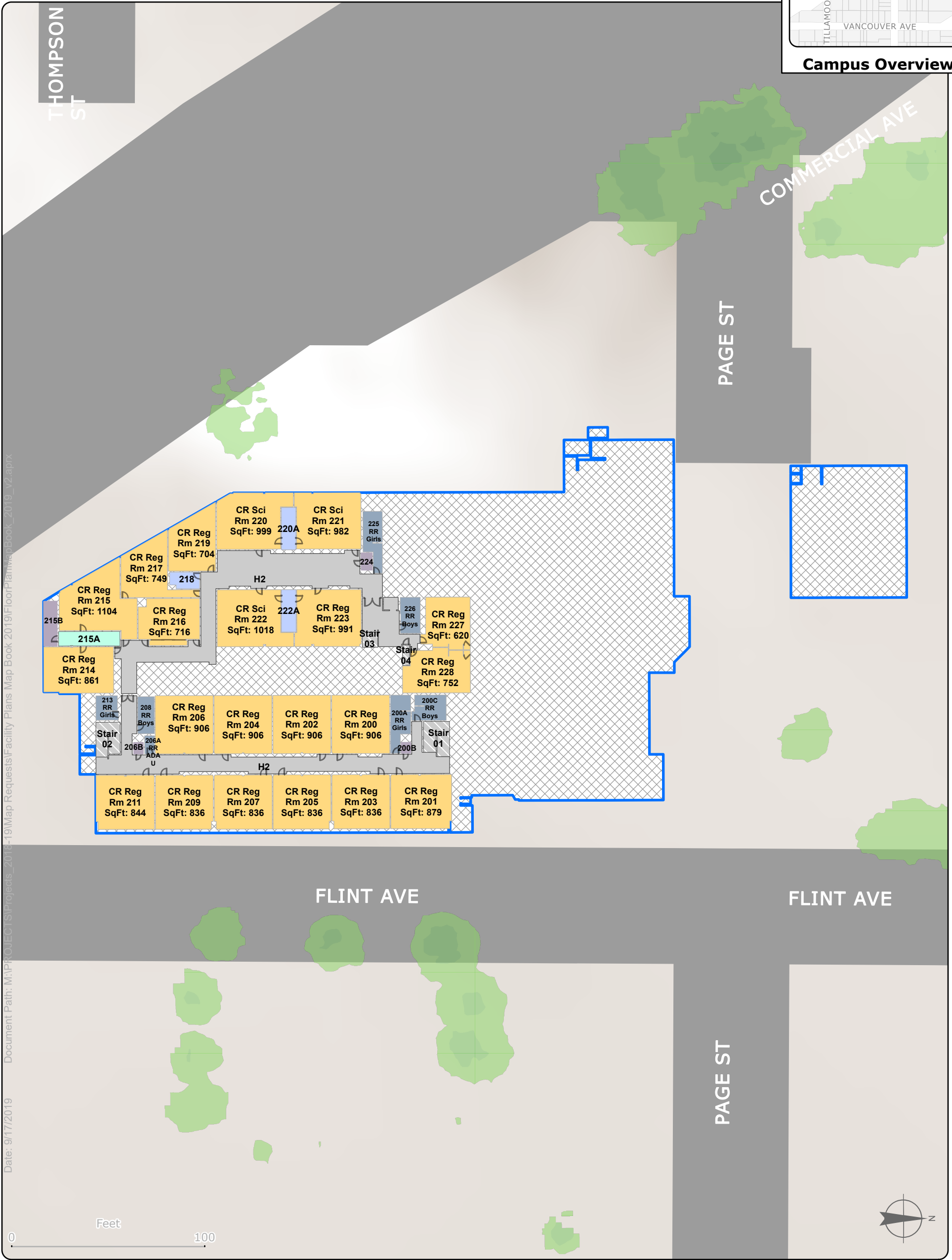
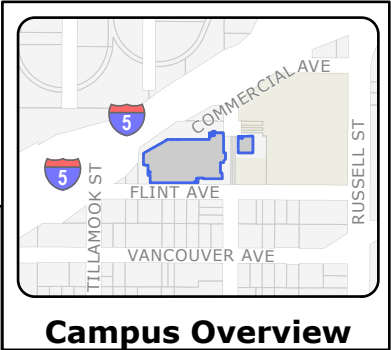


Space Use	School Grounds
 Classroom	 Campus Footprints
 Office	 Athletic Field
 Rest Room	 Playground: Paved
 Special Purpose	 Playground: Unpaved
 Corridor	 Streets
 Other	 Doors
 Stairs/Elevator	

Total Number Of Rooms By Classification

Classrooms: 12	Special Purpose: 21
Office Spaces: 20	Storage: 24

TUBMAN: Second Floor



Space Use

- Classroom
- Office
- Rest Room
- Special Purpose
- Corridor
- Other
- Stairs/Elevator

School Grounds

- Campus Footprints
- Athletic Field
- Playground: Paved
- Playground: Unpaved
- Streets
- Doors

Total Number Of Rooms By Classification

Classrooms: 21

Office Spaces: 1

Special Purpose: 3

Storage: 4