



Airflow Testing Report

Prepared for

Portland Public Schools

August 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
Faubion PK-8
3039 NE Portland Blvd, Portland, OR 97211**

Job Number: 2021-0297

Project Completion Date: 08/25/21

Revision Date:

-

Revision Number:

-



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Neudorfer Engineers, Inc.

Consulting Engineers Seattle, Washington - Portland, Oregon



www.NeudorferEngineers.com

**Portland Public Schools Airflow Testing
Faubion PK-8**

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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
Faubion PK-8

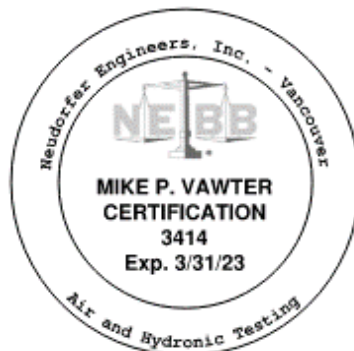
NEI Job#: 2021-0297

Mechanical Engineer: NA

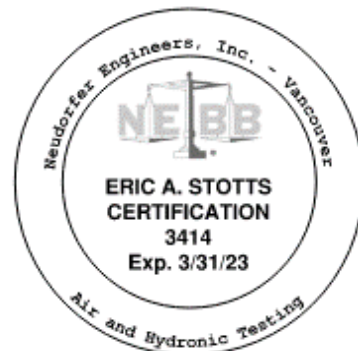
Architect: NA

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**

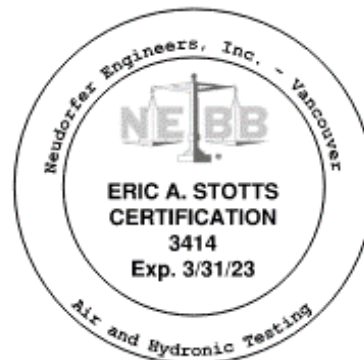
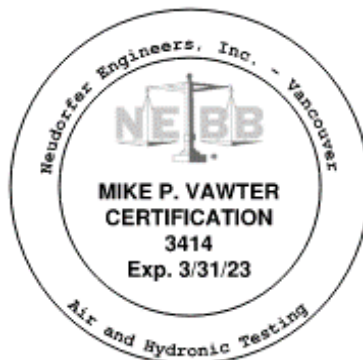
Expiration Date: **March 31, 2023**

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



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TERMS AND ABBREVIATIONS

Project: Portland Public Schools Airflow Testing

AC or ACU Air Conditioner or Air Conditioning Unit	HEPA High Efficiency Particulate Arrestance
AH or AHU Air Handler or Air Handling Unit	HP Horsepower
AVG Average	HVAC Heating Ventilation and Air Conditioning
BHP Brake Horsepower	HWS Heating Water Supply
CAV Constant Air Volume	HWR Heating Water Return
CBV Calibrated Balancing Valve (Circuit Setter)	HX Heat Exchanger
CC Cooling Coil	HZ Hertz, cycle per second
CD Ceiling Diffuser	in. inches
CFM Cubic Feet per Minute	in.w.g. inches of water gauge
CH Chiller	Kfactor Correction factor to the free area need to calculate CFM.
CHWS Chilled Water Supply	KW Kilowatts
CHWR Chilled Water Return	LAT Leaving Air Temperature
CP Circulating Pump	LWG Low Wall Grille
CR Ceiling Register	LWR Low Wall Register
CRAC Computer Room Air Conditioner	LWT Leaving Water Temperature
CRU Computer Room Unit	MAU Make-up Air Hanging Unit
CT Cooling Tower	MBH 1,000 BTUH
CU Condenser Unit	N/A Not Applicable
CUH Cabinet Unit Heater	OSA Outside Air
CWS Condenser Water Supply	OBD Opposed Blade Damper
CWR Condenser Water Return	ΔP Pressure Drop.
DAT Discharge Air Temperature	PH Phase
DB Dyr Bulb	PSI Pounds per Square Inch
DD Direct Drive	RA Return Air
DDC Direct Digital Controls: EMS Control System for the HVAC	RAD Radiator
Des. Design	RAT Return Air Temperature
Dia. Diameter	RF Return Fan
Disch. Discharge	RH Relative Humidity
EA Exhaust Air	RHC Reheat Coil
EAT Entering Air Temperature	RPM Revolutions per Minute
Economizer Controls and components that allow an air handler to logically utilize outdoor air for cooling as opposed to the use of mechanical cooling.	RTU Roof Top Unit
EF Exhaust Fan	SA Supply Air
EG Exhaust Grille	SAT Supply Air Temperature
EMCS Energy Management Control System	S.F. Service Factor
ERU Energy Recovery Unit	SF Supply Fan
E.S.P. External Static Pressure	SFD Smoke/Fire Damper
HRC Heat Recovery Coil	SP Static Pressure
EWT Entering Water Temperature	sq.ft. square feet
FCU Fan Coil Unit	Suct. Suction
FD Fire Damper	SWG Sidewall Grille
FLA Full Load Amperage: Maximum amperage a motor can draw.	SWR Sidewall Register
Flow Hood Instrument that captures air and converts the reading to CFM.	TAB Test; Adjust; and Balance
FHT Fume Hood Test	TSP Total Static Pressure: Difference between the entering and leaving static pressure of a fan.
FPB Fan Powered Box	UH Unit Heater
FPM Feet per Minute	VAV Variable Air Volume; box that contains a motorized damper that modulates airflow.
FR Field Report	VD Volume Damper
FT Foot, Feet	VFD Variable Frequency Drive
FTU Fan Terminal Unit	Velgrid Instrument that reads used to read velocity in feet per minute.
GPM Gallons per Minute	VVT Variable Volume Terminal
HC Heating Coil	WC Water Column
TDH Pressure Difference across the entering and leaving side of a pump.	W.G. Water Gauge
	WB Wet Bulb

INSTRUMENT CALIBRATIONS

Portland Public Schools Airflow Testing

Instrument Type	Air Data Meter with Flowhood	Instrument Serial #	M00475
Instrument Manufacturer	Shortridge	Calibration Date	11/4/2020
Instrument Model Number	ADM 870	Calibration Due	11/4/2021
Instrument Type	Differential Pressure Water Meter	Instrument Serial #	W14090
Instrument Manufacturer	Shortridge	Calibration Date	10/16/2020
Instrument Model Number	HDM-250	Calibration Due	10/16/2021
Instrument Type	Psychrometer	Instrument Serial #	8084305
Instrument Manufacturer	Extech	Calibration Date	10/13/2020
Instrument Model Number	RH390	Calibration Due	10/13/2021
Instrument Type	Tachometer	Instrument Serial #	B185B5022P
Instrument Manufacturer	Nidec	Calibration Date	10/11/2020
Instrument Model Number	MT-200	Calibration Due	10/11/2021
Instrument Type	Amp Probe	Instrument Serial #	33380179WS
Instrument Manufacturer	Fluke	Calibration Date	10/9/2020
Instrument Model Number	323 Clamp Meter	Calibration Due	10/9/2021
Instrument Type	Digital Thermometer	Instrument Serial #	45400509WS
Instrument Manufacturer	Fluke	Calibration Date	10/9/2020
Instrument Model Number	52 II	Calibration Due	10/9/2021
Instrument Type	Manometer	Instrument Serial #	M00475
Instrument Manufacturer	Shortridge	Calibration Date	11/4/2020
Instrument Model Number	ADM 870	Calibration Due	11/4/2021
Instrument Type	Thermal Anemometer	Instrument Serial #	AVM440742003
Instrument Manufacturer	Alnor Instruments	Calibration Date	11/9/2020
Instrument Model Number	AVM 440	Calibration Due	11/9/2021
Instrument Type	Ultrasonic Flow Meter	Instrument Serial #	N5K1435T
Instrument Manufacturer	Fuji	Calibration Date	10/14/2020
Instrument Model Number	Portaflow-C	Calibration Due	10/14/2021



PROJECT	Portland Public Schools Airflow Testing
LOCATION	Faubion PK-8; 3039 NE Portland Blvd, Portland, OR 97211

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: Faubion PK-8; 3039 NE Portland Blvd, Portland, OR 97211
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																
183B	AHU-4	AHU	11.8	10.9	129	9.0	1,158	60	38	63%	3.1	2.0	1	15.9	2.4	
183D	AHU-4	AHU	10.3	11.8	121	9.0	1,092	65	41	63%	3.6	2.2	1	17.0	2.7	
183F	AHU-4	AHU	11.8	11.0	130	8.8	1,145	220	139	63%	11.5	7.3	1	22.5	8.9	
183G	AHU-4	AHU	10.1	12.7	128	8.9	1,139	210	132	63%	11.1	7.0	1	22.2	8.5	
183H	AHU-4	AHU	12.7	10.6	134	8.9	1,195	200	126	63%	10.0	6.3	1	20.8	7.7	
183J	AHU-4	AHU	12.7	9.5	120	9.0	1,083	210	132	63%	11.6	7.3	1	23.4	9.0	
183K	AHU-4	AHU	9.6	12.8	122	9.0	1,099	115	72	63%	6.3	4.0	1	19.0	4.8	
183L	AHU-4	AHU	9.5	12.7	120	9.0	1,083	345	217	63%	19.1	12.0	1	29.1	14.7	
183M	AHU-4	AHU	11.8	11.0	129	9.0	1,163	375	236	63%	19.3	12.2	1	28.3	14.9	
183P	AHU-4	AHU	10.4	11.8	123	9.0	1,104	55	35	63%	3.0	1.9	1	16.4	2.3	
183Q	AHU-4	AHU	10.2	11.8	120	9.0	1,080	55	35	63%	3.1	1.9	1	16.8	2.4	
183R	AHU-4	AHU	10.2	1.8	18	8.9	158	75	47	63%	28.4	17.9	1	120.4	21.9	
192	AHU-4	AHU	-	-	-	-	6,464	260	164	63%	2.4	1.5	1	4.3	1.9	Room area was adjusted.
192A	AHU-4	AHU	16.6	7.8	128	8.1	1,038	50	32	63%	2.9	1.8	1	17.3	2.2	
Rm 188	AHU-4	AHU	23.6	28.0	661	9.6	6,344	445	280	63%	4.2	2.7	1	5.7	3.2	
Rm 186	AHU-4	AHU	24.4	28.2	688	9.9	6,824	440	277	63%	3.9	2.4	1	5.3	3.0	
Rm 184	AHU-4	AHU	21.6	28.1	606	10.0	6,060	380	239	63%	3.8	2.4	1	5.5	2.9	
Rm 181	AHU-4	AHU	29.8	24.4	726	10.8	7,810	780	491	63%	6.0	3.8	1	6.6	4.6	
173	AHU-1	AHU	5.3	9.7	51	8.5	432	30	28	93%	4.2	3.9	1	39.5	3.3	
Conf Rm 171	AHU-1	AHU	12.4	16.5	205	9.7	1,982	115	107	93%	3.5	3.2	1	10.6	2.8	
169	AHU-1	AHU	25.4	17.7	449	10.0	4,492	525	488	93%	7.0	6.5	1	9.0	5.6	
167	AHU-1	AHU	31.0	22.1	685	10.2	6,988	470	437	93%	4.0	3.8	1	5.4	3.2	
Conf. Room 161A	AHU-1	AHU	17.5	11.5	201	9.8	1,962	280	280	93%	8.6	8.6	1	14.8	6.8	
163	AHU-1	AHU	13.3	7.7	102	9.8	995	130	121	93%	7.8	7.3	1	21.9	6.2	

Date: 8/9/2021

Readings By: Mayer/Suyematsu



AIRFLOW SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Location: Faubion PK-8; 3039 NE Portland Blvd, Portland, OR 97211
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																
161	AHU-1	AHU	25.3	19.9	503	12.3	6,162	185	172	93%	1.8	1.7	1	4.0	1.4	
156	AHU-1	AHU	30.8	28.0	862	9.8	5,878	150	140	93%	1.5	1.4	1	3.9	1.2	Room area was adjusted.
156C	AHU-4	AHU	13.1	8.0	105	9.8	1,027	100	63	63%	5.8	3.7	1	19.7	4.5	
156D	AHU-4	AHU	13.1	10.3	134	9.8	1,316	100	63	63%	4.6	2.9	1	15.4	3.5	
153	-	-	-	-	-	-	-	-	-	-	0	0	1	-	0.0	Ventilation supplied by adjacent spaces.
151B	-	-	-	-	-	-	-	-	-	-	0	0	1	-	0.0	Ventilation supplied by adjacent spaces.
151	AHU-2	AHU	31.8	48.0	1,526	9.5	14,501	980	764	78%	4.1	3.2	1	4.2	3.2	Note #1
154	AHU-2	AHU	17.9	21.0	376	9.8	3,684	135	105	78%	2.2	1.7	1	6.0	1.7	
Main Office 101	AHU-3	AHU	31.7	21.3	845	12.3	10,394	220	220	100%	1.3	1.3	1	2.5	1.0	Non-rectangular room.
101B	-	-	-	-	-	-	-	-	-	-	0	0	1	-	0.0	Open to Main Office 101.
Conf. Room 101A	AHU-3	AHU	14.0	16.4	230	9.8	2,250	130	130	100%	3.5	3.5	1	9.7	2.8	
101D	AHU-3	AHU	10.7	17.4	186	9.9	1,843	110	110	100%	3.6	3.6	1	11.3	2.9	
103A	AHU-3	AHU	10.9	14.0	152	9.8	1,495	190	190	100%	7.6	7.6	1	16.5	6.1	
103B	AHU-3	AHU	14.0	15.0	210	9.8	2,058	220	220	100%	6.4	6.4	1	12.7	5.1	
103C	AHU-3	AHU	14.0	17.0	238	9.8	2,332	305	305	100%	7.8	7.8	1	13.0	6.3	
103D	AHU-3	AHU	9.3	15.8	146	9.8	1,435	80	80	100%	3.3	3.3	1	13.5	2.7	
103E	AHU-3	AHU	9.3	15.3	141	9.8	1,382	75	75	100%	3.3	3.3	1	13.9	2.6	
103F	AHU-3	AHU	10.0	14.0	140	9.8	1,372	130	130	100%	5.7	5.7	1	15.9	4.5	
104	AHU-3	AHU	14.5	9.0	131	9.8	1,279	75	75	100%	3.5	3.5	1	15.0	2.8	
104A	AHU-3	AHU	9.8	7.0	69	9.8	672	45	45	100%	4.0	4.0	1	26.4	3.2	
104B	AHU-3	AHU	9.8	7.0	69	9.8	672	30	30	100%	2.7	2.7	1	25.3	2.1	
149A	-	-	-	-	-	-	-	-	-	-	0	0	0	N/A	0.0	149A is no longer a separate room from 149.
Conf. Room 148	AHU-2	AHU	8.5	13.8	117	9.8	1,150	95	74	78%	5.0	3.9	1	17.4	3.9	
Rm 149	AHU-2	AHU	30.0	37.3	1,118	9.5	10,616	725	566	78%	4.1	3.2	1	4.7	3.2	Room area was adjusted.

Date: 8/9/2021

Readings By: Mayer/Suyematsu



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First Floor																
Rm 147	AHU-2	AHU	37.8	29.0	1,096	9.5	9,248	595	464	78%	3.9	3.0	1	4.7	3.0	Room area was adjusted.
147A	-	-	-	-	-	-	-	-	-	-	0	0	0	N/A	0.0	147A is no longer a separate room from 147.
Conf. Room 110	AHU-3	AHU	17.0	11.5	196	11.0	2,151	85	85	100%	2.4	2.4	1	9.2	1.9	
145A	-	-	-	-	-	-	-	-	-	-	0	0	0	N/A	0.0	145A is no longer a separate room from 145.
Rm 145	AHU-2	AHU	37.5	29.0	1,088	9.5	9,208	695	542	78%	4.5	3.5	1	5.2	3.5	Room area was adjusted.
Conf. Room 144	AHU-2	AHU	13.6	8.5	116	9.8	1,133	125	98	78%	6.6	5.2	1	18.9	5.2	
Rm 143	AHU-2	AHU	37.8	30.0	1,134	9.5	9,625	425	332	78%	2.6	2.1	1	3.7	2.1	Room area was adjusted.
143A	-	-	-	-	-	-	-	-	-	-	0	0	0	N/A	0.0	143A is no longer a separate room from 143.
Rm 141	AHU-2	AHU	41.3	30.0	1,238	9.5	10,460	305	238	78%	1.7	1.4	1	2.9	1.4	Room area was adjusted.
141A	-	-	-	-	-	-	-	-	-	-	0	0	0	N/A	0.0	141A is no longer a separate room from 141.
118A	AHU-3	AHU	9.8	6.8	67	9.8	653	25	25	100%	2.3	2.3	1	25.7	1.8	
118B	AHU-3	AHU	9.8	6.8	67	9.8	653	20	20	100%	1.8	1.8	1	25.4	1.5	
Conf. Rm 118	AHU-3	AHU	14.5	9.0	131	9.8	1,279	55	55	100%	2.6	2.6	1	14.3	2.1	
112	AHU-3	AHU	31.3	20.0	625	11.0	6,875	245	245	100%	2.1	2.1	1	4.0	1.7	
Rm 115	AHU-3	AHU	32.0	38.0	1,216	11.0	13,240	400	400	100%	1.8	1.8	1	2.6	1.5	Room area was adjusted.
115A	-	-	-	-	-	-	-	-	-	-	-	-	0	N/A		115A is no longer a separate room from 115.
Rm 117	AHU-3	AHU	32.0	38.0	1,216	11.0	12,023	455	455	100%	2.3	2.3	1	3.1	1.8	Room area was adjusted.
117A	-	-	-	-	-	-	-	-	-	-	0	0	0	N/A	0.0	117A is no longer a separate room from 117
Rm 119	AHU-3	AHU	32.0	38.0	1,216	11.0	12,023	355	355	100%	1.8	1.8	1	2.7	1.4	Room area was adjusted.
119A	-	-	-	-	-	-	-	-	-	-	0	0	0	N/A	0.0	119A is no longer a separate room from 119
120	AHU-3	AHU	15.5	22.5	349	9.8	3,418	140	140	100%	2.5	2.5	1	6.5	2.0	
127	AHU-9	FCU	15.5	52.4	812	14.5	13,733	410	193	47%	1.8	0.8	1	2.5	1.4	Room area was adjusted.
132	AHU-9	AHU	10.4	14.6	152	9.8	1,488	90	42	47%	3.6	1.7	1	13.2	2.7	
122B	AHU-6	AHU	13.0	21.8	283	9.5	2,692	90	90	100%	2.0	2.0	1	7.4	1.6	

Date: 8/9/2021

Readings By: Mayer/Suyematsu



AIRFLOW SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Location: Faubion PK-8; 3039 NE Portland Blvd, Portland, OR 97211
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																
Gym 121	AHU-5	AHU	98.3	65.0	6,386	29.8	189,991	7,625	2,890	38%	2.4	0.9	1	1.9	1.8	
121B	AHU-6	AHU	12.5	19.0	238	9.8	2,328	255	255	100%	6.6	6.6	1	12.0	5.3	
121C	AHU-6	AHU	9.6	13.5	130	9.8	1,264	105	105	100%	5.0	5.0	1	16.3	4.0	
121D	AHU-6	AHU	12.5	19.0	238	9.8	2,328	245	245	100%	6.3	6.3	1	11.8	5.1	
121F	AHU-6	AHU	20.5	26.8	548	21.3	285	260	260	100%	54.7	54.7	1	98.5	43.8	
Rm 122	AHU-7	AHU	30.3	44.3	1,339	18.0	24,094	2,245	180	8%	5.6	0.4	1	4.7	4.1	
Cafeteria 123	AHU-8	AHU	85.0	39.0	3,315	23.0	74,345	6,165	1,425	23%	5.0	1.2	1	3.9	3.7	Room area was adjusted.
124	AHU-9	AHU	37.5	22.1	829	11.0	9,116	885	381	43%	5.8	2.5	1	6.1	4.4	
125	AHU-9 + KES-1	AHU + MAU	52.8	17.3	910	9.8	8,035	1,815	1,670	92%	13.6	12.5	1	12.7	10.8	Room area was adjusted.
123A	-	-	8.4	13.5	113	9.9	8,035	-	-	-	0	0	0	N/A	0.0	This is an exit interstitial.
Second Floor																
261	AHU-4	AHU	23.1	19.9	460	9.9	4,551	690	435	63%	9.1	5.7	1	10.4	7.0	
263	AHU-4	AHU	23.8	17.0	405	9.8	3,965	660	416	63%	10.0	6.3	1	11.6	7.7	
Conf. Room 250A	AHU-4	AHU	15.3	13.3	10	9.9	98	90	57	63%	55.1	34.7	1	201.6	42.4	
Conf. Room 250C	AHU-4	AHU	9.4	7.3	10	9.9	98	150	95	63%	91.8	57.9	1	229.9	70.7	
250D	AHU-4	AHU	9.3	15.5	144	9.9	1,427	165	104	63%	6.9	4.4	1	16.3	5.3	
250E	AHU-4	AHU	9.3	15.4	143	9.9	1,418	175	110	63%	7.4	4.7	1	16.7	5.7	
250F	AHU-4	AHU	9.3	15.4	143	9.9	1,418	235	148	63%	9.9	6.3	1	18.7	7.7	
250G	AHU-4	AHU	9.4	15.6	147	9.9	1,452	230	145	63%	9.5	6.0	1	18.1	7.3	
250H	AHU-4	AHU	28.4	9.9	281	9.9	2,783	400	252	63%	8.6	5.4	1	12.2	6.6	
250J	AHU-4	AHU	14.8	8.6	127	9.8	1,247	160	101	63%	7.7	4.8	1	18.4	5.9	
Conf. Room 250K	AHU-4	AHU	18.7	15.4	288	9.9	2,851	615	387	63%	12.9	8.2	1	15.4	10.0	
250L	AHU-4	AHU	15.4	9.4	145	9.9	1,433	135	85	63%	5.7	3.6	1	15.2	4.4	
250M	AHU-4	AHU	15.4	9.3	143	9.9	1,418	375	236	63%	15.9	10.0	1	23.2	12.2	

Date: 8/9/2021

Readings By: Mayer/Suyematsu



AIRFLOW SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Location: Faubion PK-8; 3039 NE Portland Blvd, Portland, OR 97211
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	
Second Floor																
250N	AHU-4	AHU	36.4	31.9	1,161	10.2	11,844	455	287	63%	2.3	1.5	1	3.1	1.8	
250N1	AHU-4	AHU	9.2	8.4	77	9.8	757	120	76	63%	9.5	6.0	1	27.9	7.3	
250N2	AHU-4	AHU	9.8	9.2	90	9.9	893	90	57	63%	6.0	3.8	1	22.1	4.7	
Conf. Room 241	AHU-4	AHU	29.8	18.4	548	9.8	5,374	550	347	63%	6.1	3.9	1	7.6	4.7	
240	AHU-4	AHU	25.7	18.5	475	9.9	4,707	460	290	63%	5.9	3.7	1	7.8	4.5	
233A	AHU-1	AHU	10.9	8.7	95	9.9	939	30	28	93%	1.9	1.8	1	18.1	1.5	
Rm 201	AHU-1	AHU	32.9	32.0	1,053	14.3	15,055	990	921	93%	3.9	3.7	1	4.2	3.1	
Rm 203	AHU-1	AHU	36.2	34.2	1,238	14.4	17,828	1,065	990	93%	3.6	3.3	1	3.7	2.8	
Rm 205	AHU-1	AHU	34.1	32.7	1,115	14.2	15,834	405	377	93%	1.5	1.4	1	2.2	1.2	
207A	AHU-1	AHU	13.4	8.0	107	10.0	1,072	40	37	93%	2.2	2.1	1	16.3	1.8	
207B	AHU-1	AHU	14.5	11.4	165	9.8	1,620	240	223	93%	8.9	8.3	1	16.7	7.1	
Library 207	AHU-1	AHU	70.7	36.1	2,552	24.3	62,020	610	567	93%	0.6	0.5	1	0.7	0.5	
230	AHU-3	AHU	14.5	11.1	161	9.8	1,577	75	75	100%	2.9	2.9	1	12.2	2.3	
230A	AHU-3	AHU	9.3	6.9	64	9.8	629	40	40	100%	3.8	3.8	1	27.9	3.1	
230B	AHU-3	AHU	9.3	6.9	64	9.8	629	35	35	100%	3.3	3.3	1	27.5	2.7	
Rm 209	AHU-3	AHU	34.4	29.4	1,011	9.8	9,911	360	360	100%	2.2	2.2	1	3.3	1.7	
Rm 211	AHU-3	AHU	31.9	30.0	957	9.8	9,379	430	430	100%	2.8	2.8	1	3.9	2.2	
Rm 213	AHU-3	AHU	34.5	29.0	1,001	9.8	9,805	620	620	100%	3.8	3.8	1	4.6	3.0	
Rm 215	AHU-3	AHU	34.4	28.9	994	9.8	9,743	585	585	100%	3.6	3.6	1	4.5	2.9	
Rm 217	AHU-3	AHU	32.0	29.9	957	9.8	9,377	595	595	100%	3.8	3.8	1	4.7	3.0	
Rm 219	AHU-3	AHU	34.5	28.0	966	9.8	9,467	460	460	100%	2.9	2.9	1	4.0	2.3	
Rm 221	AHU-2	AHU	33.1	29.9	990	9.9	9,798	400	312	78%	2.4	1.9	1	3.5	1.9	
Rm 222	FC-1	FCU	31.4	26.1	820	9.2	7,540	320	30	9%	2.5	0.2	1	3.9	1.9	
Rm 223	AHU-2	AHU	30.8	30.0	924	9.8	9,055	390	304	78%	2.6	2.0	1	3.7	2.0	

Date: 8/9/2021

Readings By: Mayer/Suyematsu



AIRFLOW SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Location: Faubion PK-8; 3039 NE Portland Blvd, Portland, OR 97211
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	
Second Floor																
Rm 225	AHU-2	AHU	32.5	28.9	939	9.8	9,205	390	304	78%	2.5	2.0	1	3.7	2.0	
Rm 227	AHU-2	AHU	34.6	27.0	934	9.9	9,249	320	250	78%	2.1	1.6	1	3.3	1.6	
Rm 229	AHU-2	AHU	31.9	29.9	954	9.9	9,443	450	351	78%	2.9	2.2	1	3.9	2.2	
Rm 231	AHU-2	AHU	33.2	29.2	969	9.9	9,597	395	308	78%	2.5	1.9	1	3.6	1.9	
220	AHU-3	AHU	20.0	10.5	210	9.9	2,079	130	130	100%	3.8	3.8	1	10.5	3.0	
Rm 233	AHU-1	AHU	31.9	28.5	909	9.9	9,001	365	339	93%	2.4	2.3	1	3.7	1.9	This office is not shown on the floor plan.
240A	AHU-4	AHU	7.8	6.7	52	9.9	517	50	32	63%	5.8	3.7	1	34.6	4.5	This office is not shown on the floor plan.
242	AHU-4	AHU	25.7	19.3	496	9.9	4,910	360	227	63%	4.4	2.8	1	6.6	3.4	This office is not shown on the floor plan.
224	AHU-3	AHU	14.3	11.5	164	9.9	1,628	115	115	100%	4.2	4.2	1	13.0	3.4	
224A	AHU-3	AHU	10.0	6.8	68	9.9	673	55	55	100%	4.9	4.9	1	27.1	3.9	
224B	AHU-3	AHU	10.0	6.8	68	9.8	666	55	55	100%	5.0	5.0	1	27.4	4.0	
Third Floor																
301A	AHU-1	AHU	20.6	10.6	218	10.2	2,227	155	144	93%	4.2	3.9	0	N/A	3.3	
Rm 301	AHU-1	AHU	36.8	33.1	1,218	15.7	19,124	1,250	1,163	93%	3.9	3.6	1	3.9	3.1	
Rm 303	AHU-1	AHU	66.7	36.3	2,421	15.9	38,497	325	302	93%	0.5	0.5	1	0.8	0.4	
305	AHU-1	AHU	25.7	25.7	660	10.2	6,737	260	242	93%	2.3	2.2	1	4.2	1.8	
333	AHU-1	AHU	36.4	31.9	752	10.2	7,670	365	339	93%	2.9	2.7	1	4.3	2.3	Non-rectangular room.
333B	AHU-1	AHU	8.8	7.4	65	10.3	671	125	116	93%	11.2	10.4	1	32.1	8.9	
308	-	-	12.5	10.1	126	16.9	2,134	-	-	-	0	0	0	N/A	0.0	This is a custodian closet.
330	AHU-3	AHU	14.4	11.0	158	10.3	1,632	75	75	100%	2.8	2.8	1	11.8	2.2	
330A	AHU-3	AHU	9.5	6.9	66	10.2	669	50	50	100%	4.5	4.5	1	26.9	3.6	
330B	AHU-3	AHU	9.2	6.9	63	10.3	654	50	50	100%	4.6	4.6	1	27.5	3.7	
Rm 309	AHU-3	AHU	34.5	29.3	1,011	10.3	10,412	655	655	100%	3.8	3.8	1	4.5	3.0	
Rm 311	AHU-3	AHU	31.9	30.0	957	10.2	9,761	750	750	100%	4.6	4.6	1	5.3	3.7	

Date: 8/9/2021

Readings By: Mayer/Suyematsu



Project:	Portland Public Schools Airflow Testing
Location:	Faubion PK-8; 3039 NE Portland Blvd, Portland, OR 97211
Filter Status:	Upgraded

Date: 8/9/2021 Readings By: Mayer/Suyematsu

Project:

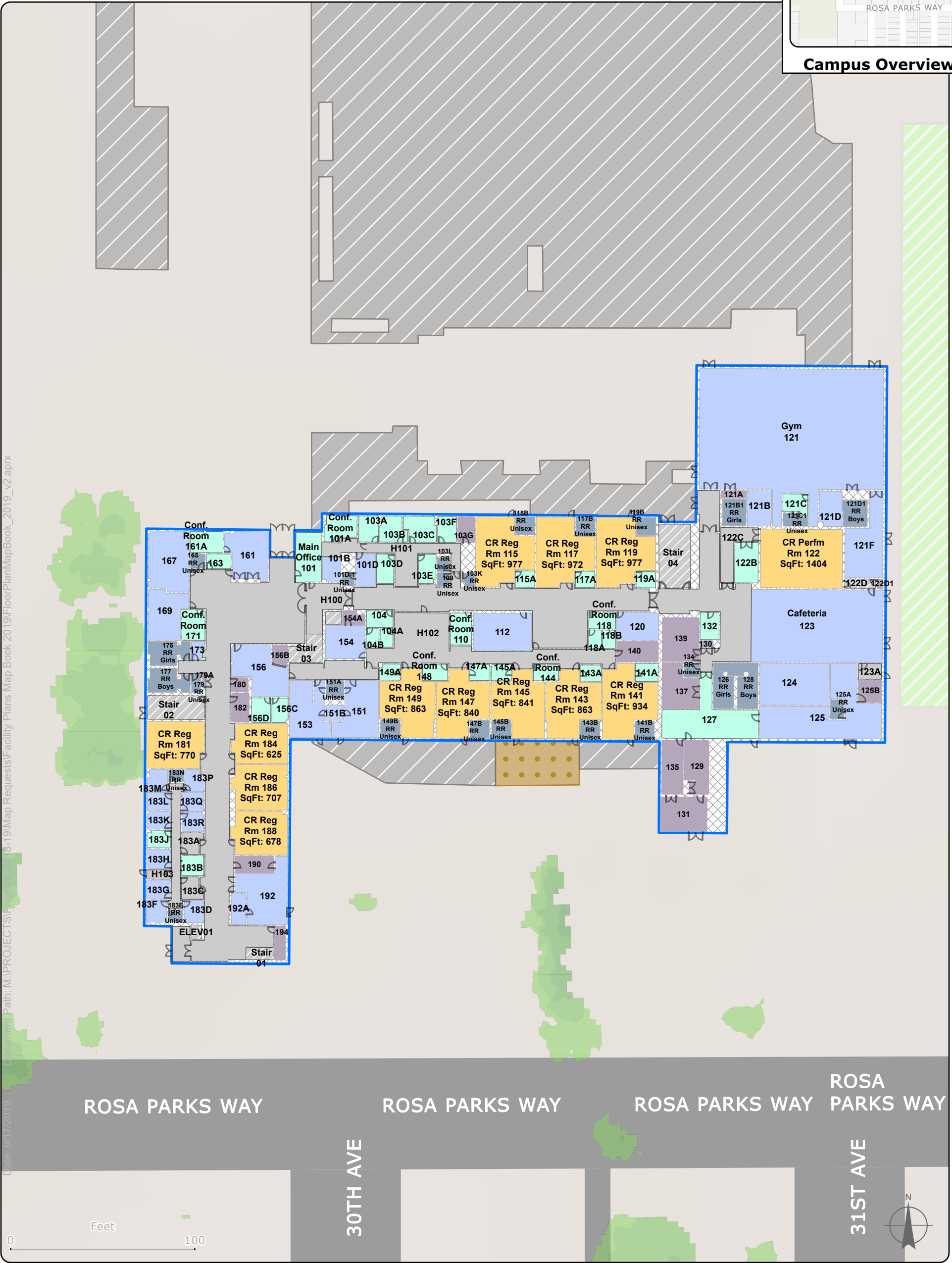
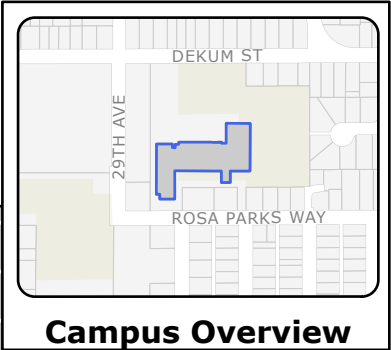
Portland Public Schools Airflow Testing

Location:

Faubion Pk-8; 3039 NE Portland Blvd, Portland, OR 97211

NOTE #	NOTE DESCRIPTION
1	Rooms 151, 151B and 153 were combined into one room.

FAUBION: First 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

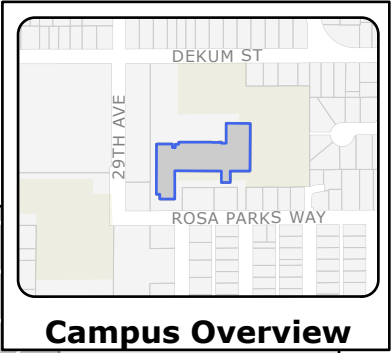
Classrooms: 13

Office Spaces: 36

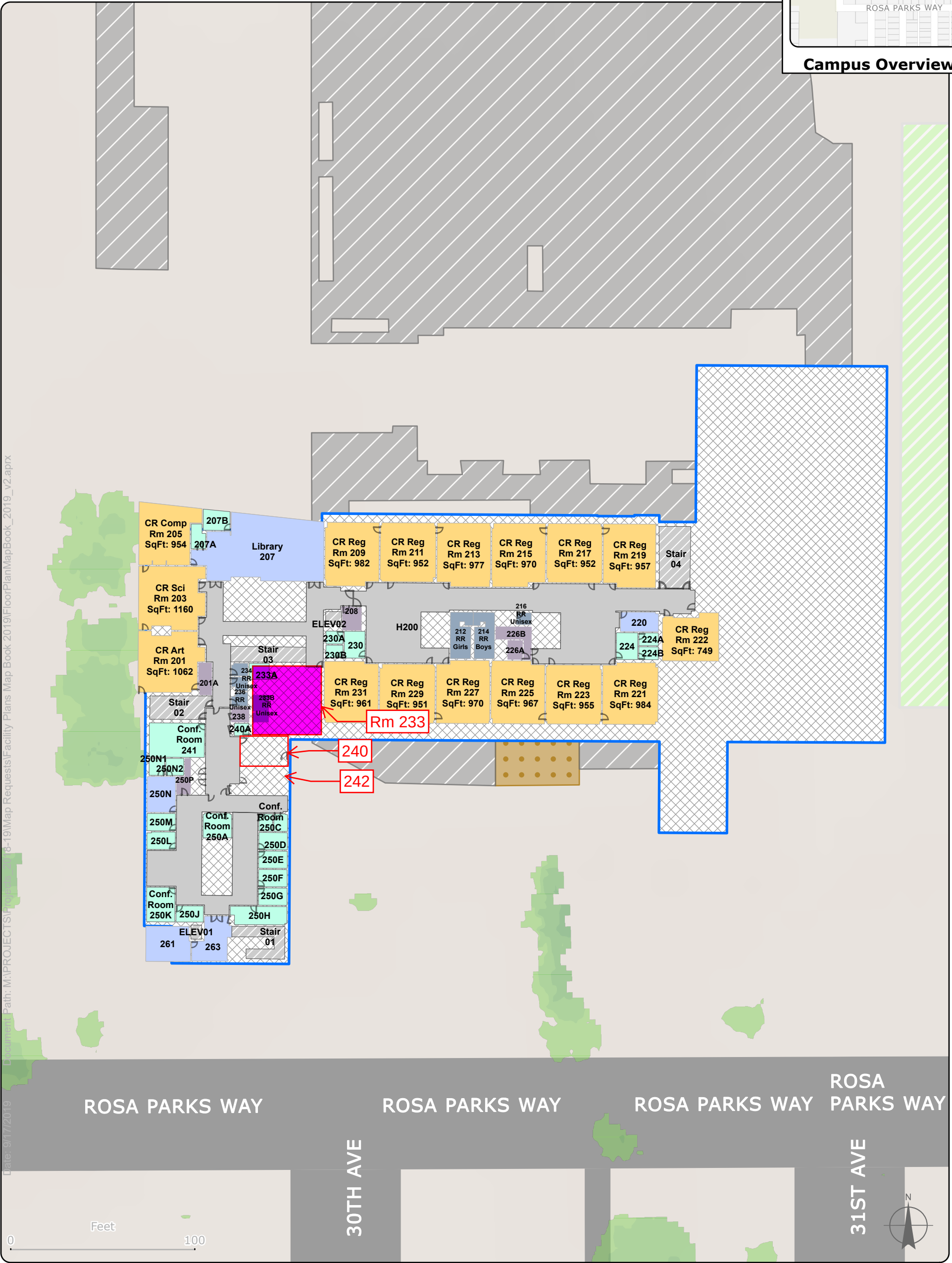
Special Purpose: 32

Storage: 12

FAUBION: Second Floor



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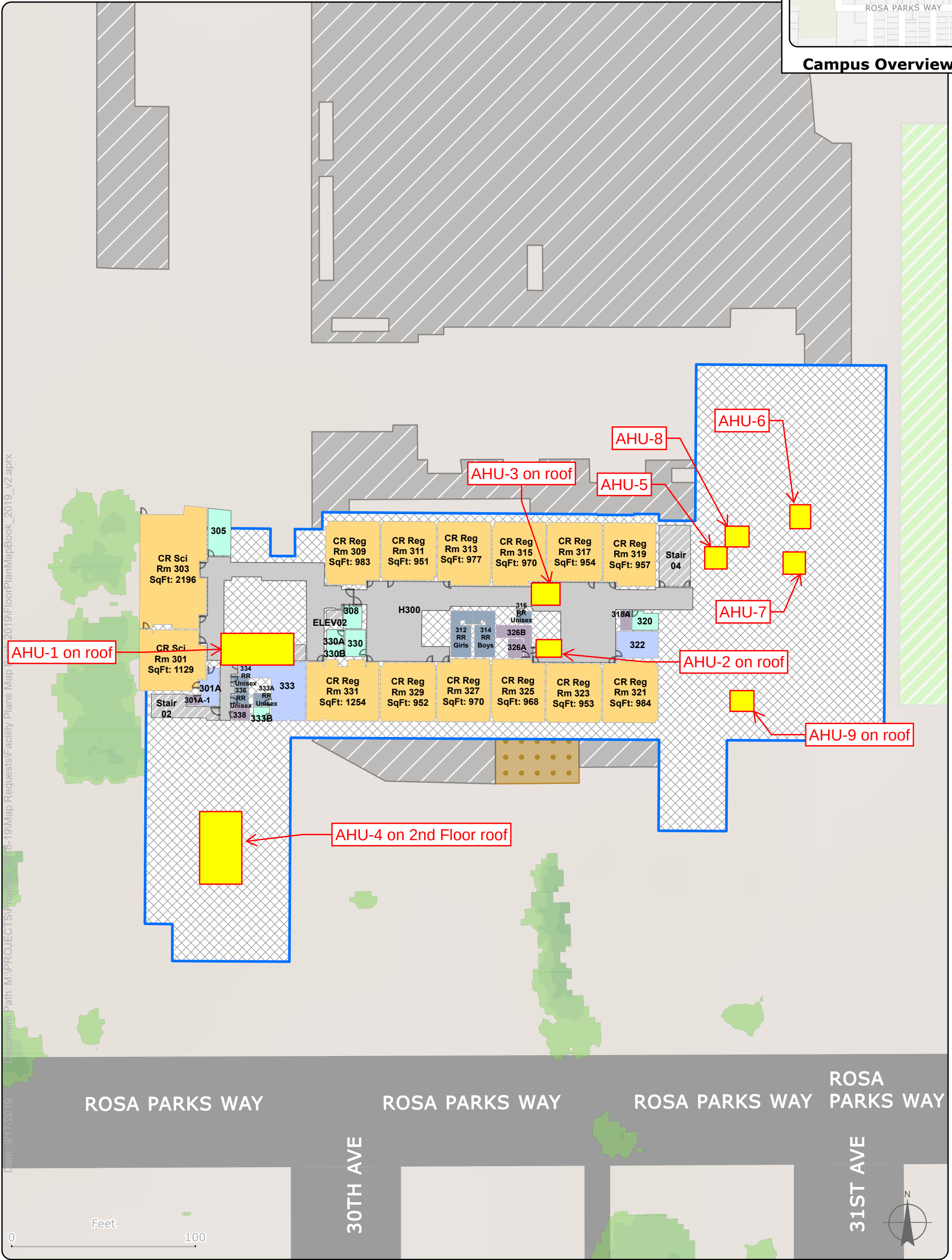
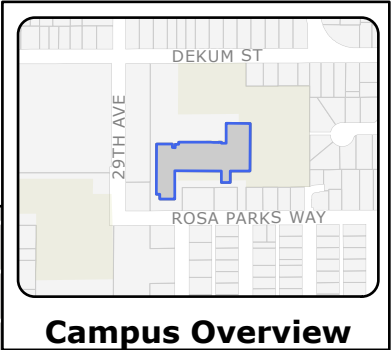


Space Use		School Grounds	
	Classroom		Campus Footprints
	Office		Athletic Field
	Rest Room		Playground: Paved
	Special Purpose		Playground: Unpaved
	Corridor		Streets
	Other		Doors
	Stairs/Elevator		

Total Number Of Rooms By Classification

Classrooms: 16	Special Purpose: 5
Office Spaces: 24	Storage: 3

FAUBION: Third Floor



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: 14	Special Purpose: 3
Office Spaces: 7	Storage: 2