U.S. Department of Housing and Urban Development
451 Seventh Street, SW
Washington, DC 20410
www.hud.gov
espanol.hud.gov

Environmental Assessment Determinations and Compliance Findings for HUD-assisted Projects 24 CFR Part 58

Project Information

Project Name: 1-27-JASPER-ST---SENIOR-HOUSING

HEROS Number: 900000010174692

Project Location: 1 Jasper St, Paterson, NJ 07522

Additional Location Information:
AKA 1-27 JASPER ST. PATERSON, NJ

Description of the Proposed Project [24 CFR 50.12 & 58.32; 40 CFR 1508.25]:
The project sponsor is seeking HOME funding from the U.S. Department of Housing and Urban Development to construct a new multifamily residential complex. The scope of work would consist of redevelopment of a vacant lot (approximately 1.78 acres in size), located at 1-27 Jasper St. Paterson, NJ, adjacent to Hinchliffe stadium with a six-story mixed-use multi-family building. The project will consist of 75 units, age-restricted to households ages 55 years old and up, on the second through the sixth floor. The first floor of the building will include a childcare facility of approximately 5,800 sq. ft. The six-story building will contain 75 units, comprised of 5 studio units, 55 one-bedroom units, and 15 two-bedroom units. In addition, a new four-story accessory parking garage consisting of approximately 315 parking spaces is proposed, located in the rear of the proposed six-story building. Unit amenities include stainless steel ENERGY STAR appliances; high-efficiency individual heating and cooling; contemporary, open floor plans, and healthy, low- or no-VOC finishes. The project has a ground floor amenity space that opens out onto a landscaped courtyard located between Hinchliffe Stadium and the building. Residents have access to garage parking on the ground floor as well as the freestanding parking garage connected to the building. Residents will also enjoy proximity to neighborhood goods, services, transportation, and recreation, especially the Great Falls National Historical Park. The total project cost is $28,001,498. The funding will consist of both public ($13,518,664) and private ($14,482,834) funding. The completion of the project will take approximately 18 months.

Funding Information

Grant Number	HUD Program	Program Name
.	Community Planning and Development (CPD)	HOME Program
.	Housing: Multifamily FHA	Section 202. Supportive Housing for the Elderly

Estimated Total HUD Funded Amount: $9,125,477.00

Estimated Total Project Cost [24 CFR 58.2 (a) (5)]: $28,001,498.00

Mitigation Measures and Conditions [CFR 1505.2(c)]:

Summarized below are all mitigation measures adopted by the Responsible Entity to reduce, avoid or eliminate adverse environmental impacts and to avoid non-compliance or non-conformance with the above-listed authorities and factors. These measures/conditions must be incorporated into project contracts, development agreements and other relevant documents. The staff responsible for implementing and monitoring mitigation measures should be clearly identified in the mitigation plan.

Law, Authority, or Factor	Mitigation Measure or Condition
Contamination and Toxic Substances	The only REC/area of concern that was mentioned was the presence of historic fill material. According to historical records and a review of Sanborn maps, a reservoir known as the Middle Reservoir occupied the Property from at least 1915 through the mid-1950s. The presence of the Middle Reservoir in itself is not an environmental concern; however, the water body was drained and filled to grade as indicated in the aerial photographs. Fill material was imported to fill the reservoir and raise the Property to grade. Historic fill generally constitutes a concern when it contains industrial waste, construction and demolition debris, coal ash, dredge spoils, or other potentially contaminated anthropogenic materials. The quality of the fill material used to fill the reservoir is unknown at this time and therefore historic fill material is considered a REC/AOC. No evaluation is required under NJDEP regulations at this time. However, should a triggering event occur at the Property such as a release to subsurface or construction/activities occur which involve the disturbance and/or disposal of the site soils, appropriate site investigation sampling may be necessary to determine the quality of the soil. The soil sampling test results came back with no detection. Radon According to the EPA, the radon zone level for the area is Zone 2, which has a predicted average indoor screening level between 2 pCi/L and 4 pCi/L, equal to or below the action level of 4 pCi/L set forth by the US EPA. While the subject property currently consists of vacant land, it is AEI's understanding that the subject property is planned for redevelopment with

	a multifamily residential building in connection with HUD HOME financing. As such, in accordance with the HUD MAP Guide, new construction should follow the ANSI/AARST CC-1000 (2018) Soil Gas System in New Construction of Buildings and post construction testing must be performed after construction is complete. Asbestos and Lead-based Paint The subject property is currently vacant land. EWMA's site reconnaissance noted the only structure on site was a plastic shed. Consequently, no building components likely to contain lead-based paints or suspect asbestos-containing materials were noted on site. With implementation of the recommended mitigation, the project will be in compliance with contamination and toxic substances requirements.
Conformance with Plans / Compatible Land Use and Zoning / Scale and Urban Design	None
Soil Suitability / Slope/ Erosion / Drainage and Storm Water Runoff	None
Hazards and Nuisances including Site Safety and Site-Generated Noise	None
Energy Consumption/Energy Efficiency	None
Employment and Income Patterns	N/A
Demographic Character Changes / Displacement	N/A
Educational and Cultural Facilities (Access and Capacity)	N/A
Commercial Facilities (Access and Proximity)	N/A
Health Care / Social Services (Access and Capacity)	N/A
Solid Waste Disposal and Recycling (Feasibility and Capacity)	N/A
Waste Water and Sanitary Sewers (Feasibility and Capacity)	N/A
Water Supply (Feasibility and Capacity)	N/A
Public Safety - Police, Fire and Emergency Medical	N/A
Parks, Open Space and Recreation (Access and Capacity)	N/A
Transportation and Accessibility (Access and Capacity)	N/A
Unique Natural Features /Water Resources	N/A
Vegetation / Wildlife (Introduction, Modification, Removal, Disruption, etc.)	N/A
Other Factors	N/A

Permits, reviews, and approvals	The project was presented before the City of Paterson Zoning Board of Adjustments for the following variances: use, "C" and "D" variances to permit the Housing Component in the Public Use District Zone of the First Ward Redevelopment Plan, which were approved as per the Resolution.
Endangered Species Endangered Species Act of 1973, particularly section 7; 50 CFR Part 402	According to April 2020 FWS data, there are documented bat maternity occurrences in the City of Paterson. Based on the FWS New Jersey Field Office Project Screening Chart for the Indiana bat, the recommended seasonal restriction on tree clearing in municipalities with maternity occurrence is April 1 to September 30. Tree clearing activities for the proposed project should not exceed an area of 5 acres and should not occur between April 1 and September 30. Based on these assumptions, No Adverse Effect to the Indiana Bat is anticipated. If tree clearing is proposed during the restricted season, project information must be submitted to the FWS New Jersey Field Office.

Project Mitigation Plan

In accordance with the HUD MAP Guide, new construction should follow the ANSI/AARST CC-1000 (2018) Soil Gas System in New Construction of Buildings and post construction testing must be performed after construction is complete. The post-construction testing of radon is planned to be performed by AT Cameron, PG in Fall 2022.

Radon Testing Proposal mitigation.pdf

Determination:

☒	Finding of No Significant Impact [24 CFR 58.40(g)(1); 40 CFR 1508.13] The project will not result in a significant impact on the quality of human environment
☐	Finding of Significant Impact

Preparer Signature: Diana Vazquez **Date:** 9/8/21

Name / Title/ Organization: DIANA VAZQUEZ / / PATERSON

Certifying Officer Signature: [signature] **Date:** 9/8/2021

Name/ Title: Barbara A. Blake-McKenna, CD Director

This original, signed document and related supporting material must be retained on file by the Responsible Entity in an Environment Review Record (ERR) for the activity / project (ref: 24 CFR Part 58.38) and in accordance with recordkeeping requirements for the HUD program(s).

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Project Information

Project Name: 1-27-JASPER-ST---SENIOR-HOUSING

HEROS Number: 900000010174692

Responsible Entity (RE): PATERSON, CITY HALL PATERSON NJ, 07505

RE Preparer: DIANA VAZQUEZ

State / Local Identifier:

Certifying Officer: ANDRE SAYEGH, MAYOR

Grant Recipient (if different than Responsible Entity): HINCHLIFFE HOUSING URBAN RENEWAL ASSOCIATES LP

Point of Contact: JOSEPH PORTELLI

Consultant (if applicable): AEI CONSULTANTS-NEPA COMPLIANCE SPECIALIST

Point of Contact: SHARON WRIGHT

Project Location: 1 Jasper St, Paterson, NJ 07522

Additional Location Information:
AKA 1-27 JASPER ST. PATERSON, NJ

Direct Comments to:

Description of the Proposed Project [24 CFR 50.12 & 58.32; 40 CFR 1508.25]:
The project sponsor is seeking HOME funding from the U.S. Department of Housing and Urban Development to construct a new multifamily residential complex. The scope of work would consist of redevelopment of a vacant lot (approximately 1.78 acres in size), located at 1-27 Jasper St. Paterson, NJ, adjacent to Hinchliffe stadium with a six-story mixed-use multi-family building. The project will consist of 75 units, age-restricted to households ages 55 years old and up, on the second through the sixth floor. The first floor of the building will include a childcare facility of approximately 5,800 sq. ft. The six-story building will contain 75 units, comprised of 5 studio units, 55 one-bedroom units, and 15 two-bedroom units. In addition, a new four-story accessory parking garage consisting of approximately 315 parking spaces is proposed, located in the rear of the proposed six-story building. Unit amenities include stainless steel ENERGY STAR appliances; high-efficiency individual heating and cooling; contemporary, open floor plans, and healthy, low- or no-VOC finishes. The project has a ground floor amenity space that opens out onto a landscaped courtyard located between Hinchliffe Stadium and the building. Residents have access to garage parking on the ground floor as well as the freestanding parking garage connected to the building. Residents will also enjoy proximity to neighborhood goods, services, transportation, and recreation, especially the Great Falls National Historical Park. The total project cost is $28,001,498. The funding will consist of both public ($13,518,664) and private ($14,482,834) funding. The completion of the project will take approximately 18 months.

Statement of Purpose and Need for the Proposal [40 CFR 1508.9(b)]:
The project is located in census tract 2642 in the 1st Ward Redevelopment Area in Paterson. The median household income in the project's census tract is $20,964, 53% of the area median income (AMI) for Paterson (median income of $39,282) and 35% of the area median income for Passaic County (median income of $60,293). Over 40% of households in the census tract are living below poverty and 23.4% of Paterson households are below the poverty line. The unemployment rate 4.9% in the specific census tract, 2.8% in Paterson, 3.7% in Passaic County. The housing component will bring much needed age-restricted housing to the area along with a new childcare facility. The stadium component will revitalize a historic structure in the City of Paterson and will once again be a high-quality recreational and community space for City residents.

Existing Conditions and Trends [24 CFR 58.40(a)]:
The property is within a mixed commercial and residential area in the southeastern portion of the City of Paterson, Passaic County, New Jersey. The property is zoned "B-2" for neighborhood business use and is known as Lot 7 and a portion of Lot 23, City of Paterson, NJ. The property is located to the northeast side of Hinchliffe Stadium, and south of the intersection of Maple Street in the City of Paterson, Passaic County, New Jersey. The property is undeveloped, is generally rectangular in shape, and is in close proximity to the Paterson Great Falls National Historic Park. The site sits at an elevation of approximately 80 feet above mean sea level, and is generally level. A chain link fence surrounds the northern, eastern and western portions of the property. The Property was used by the public as the Paterson Public Community "Elysian Fields" Garden. Except for small wooden garden frames used by the Paterson Public

Community "Elysian Fields" Garden group, there are no permanent structures on site. In addition, a plastic 100 square foot storage shed is located on the property and is currently empty. The remainder of the property consists of undeveloped wooded and grassy areas.

Maps, photographs, and other documentation of project location and description:
DSC01003.JPG

Determination:

✓	Finding of No Significant Impact [24 CFR 58.40(g)(1); 40 CFR 1508.13] The project will not result in a significant impact on the quality of human environment
	Finding of Significant Impact

Approval Documents:

7015.15 certified by Certifying Officer on:

7015.16 certified by Authorizing Officer on:

Funding Information

Grant / Project Identification Number	HUD Program	Program Name
.	Community Planning and Development (CPD)	HOME Program
.	Housing: Multifamily FHA	Section 202. Supportive Housing for the Elderly

Estimated Total HUD Funded, Assisted or Insured Amount: $9,125,477.00

This project anticipates the use of funds or assistance from another federal agency in addition to HUD in the form of:

Estimated Total Project Cost [24 CFR 58.2 (a) $28,001,498.00

(5)]:

Compliance with 24 CFR §50.4, §58.5 and §58.6 Laws and Authorities

Compliance Factors: Statutes, Executive Orders, and Regulations listed at 24 CFR §50.4, §58.5, and §58.6	Are formal compliance steps or mitigation required?	Compliance determination (See Appendix A for source determinations)
STATUTES, EXECUTIVE ORDERS, AND REGULATIONS LISTED AT 24 CFR §50.4 & § 58.6		
Airport Hazards Clear Zones and Accident Potential Zones; 24 CFR Part 51 Subpart D	☐ Yes ☑ No	The project site is not within 15,000 feet of a military airport or 2,500 feet of a civilian airport. The project is in compliance with Airport Hazards requirements. (REFER TO NEPASSIST MAPS.)
Coastal Barrier Resources Act Coastal Barrier Resources Act, as amended by the Coastal Barrier Improvement Act of 1990 [16 USC 3501]	☐ Yes ☑ No	This project is not located in a CBRS Unit. Therefore, this project has no potential to impact a CBRS Unit and is in compliance with the Coastal Barrier Resources Act. (REFER TO CBRS MAPS.)
Flood Insurance Flood Disaster Protection Act of 1973 and National Flood Insurance Reform Act of 1994 [42 USC 4001-4128 and 42 USC 5154a]	☐ Yes ☑ No	The structure or insurable property is not located in a FEMA-designated Special Flood Hazard Area. While flood insurance may not be mandatory in this instance, HUD recommends that all insurable structures maintain flood insurance under the National Flood Insurance Program (NFIP). The project is in compliance with flood insurance requirements. Based on a review of FEMA Flood Insurance Rate Map (FIRM) Community Panel Number 34031C0216G, dated April 17, 2020, the subject property is located in Zone X (unshaded), areas of minimal flood hazard outside of the 100- and 500-year floodplains. No preliminary or pending FIRM panels were identified for the project area. Additionally, the subject property is located in the City of Paterson, Community #340404, which is a participating community in the National Flood Insurance Program (NFIP). (REFER TO FIRM MAP

		34031C0216G EFF. 4/17/2020)
STATUTES, EXECUTIVE ORDERS, AND REGULATIONS LISTED AT 24 CFR §50.4 & § 58.5		
Air Quality Clean Air Act, as amended, particularly section 176(c) & (d); 40 CFR Parts 6, 51, 93	☐ Yes ☑ No	The project's county or air quality management district is in non-attainment status for the following: Carbon monoxide, Ozone. This project does not exceed de minimis emissions levels or the screening level established by the state or air quality management district for the pollutant(s) identified above. The project is in compliance with the Clean Air Act. In a letter dated June 2, 2021, the New Jersey Department of Environmental Protection (NJDEP) determined that the anticipated emissions of the proposed project would not exceed general conformity de minimis or threshold emission levels for criteria pollutants and would therefore be in conformance with the New Jersey State Implementation Plan. Based on the above information, the project is in compliance with the Clean Air Act.
Coastal Zone Management Act Coastal Zone Management Act, sections 307(c) & (d)	☐ Yes ☑ No	This project is not located in or does not affect a Coastal Zone as defined in the state Coastal Management Plan. The project is in compliance with the Coastal Zone Management Act. (REFER TO CAFRA MAP NJ)
Contamination and Toxic Substances 24 CFR 50.3(i) & 58.5(i)(2)]	☑ Yes ☐ No	Site contamination was evaluated as follows: ASTM Phase I ESA. On-site or nearby toxic, hazardous, or radioactive substances were found that could affect the health and safety of project occupants or conflict with the intended use of the property. The adverse environmental impacts can be mitigated. With mitigation, identified in the mitigation section of this review, the project will be in compliance with contamination and toxic substances requirements.
Endangered Species Act Endangered Species Act of 1973, particularly section 7; 50 CFR Part	☐ Yes ☑ No	This project May Affect, but is Not Likely to Adversely Affect, listed species, and informal consultation was conducted.

402		This project is in compliance with the Endangered Species Act without mitigation. (REFER TO IPAC REPORT AND PROJECT SCREENING CHARTS)
Explosive and Flammable Hazards Above-Ground Tanks)[24 CFR Part 51 Subpart C	☐ Yes ☑ No	There are no current or planned stationary aboveground storage containers of concern within 1 mile of the project site. The project is in compliance with explosive and flammable hazard requirements. (REFER TO NEPASSIST MAP.)
Farmlands Protection Farmland Protection Policy Act of 1981, particularly sections 1504(b) and 1541; 7 CFR Part 658	☐ Yes ☑ No	The project includes activities that could convert agricultural land to a non-agricultural use, but "prime farmland","unique farmland", or "farmland of statewide or local importance" regulated under the Farmland Protection Policy Act does not occur on the project site. The project is in compliance with the Farmland Protection Policy Act. (REFER TO WEBSOIL SURVEY REPORT)
Floodplain Management Executive Order 11988, particularly section 2(a); 24 CFR Part 55	☐ Yes ☑ No	This project does not occur in a floodplain. The project is in compliance with Executive Order 11988. (REFER TO FIRM MAP 34031C0216C EFF. 4/17/2020)
Historic Preservation National Historic Preservation Act of 1966, particularly sections 106 and 110; 36 CFR Part 800	☐ Yes ☑ No	Based on Section 106 consultation, there are No Historic Properties Affected because the project will have no effect on the historic properties that are present. The project is in compliance with Section 106. (REFER TO SHPO AND THPO CORRESPONDENCE) Ms. Thivierge (SHPO) also noted that their office is aware that the National Park Service (NPS) Historic Landmarks Program had expressed interest in reviewing the project and should also be consulted. As such, AEI sent a Section 106 consultation package to Mr. Dennis Montagna of the NPS for review and comment on July 28, 2021. As of the date of this report, AEI has not received a response. It is AEI's understanding

		that a different NPS contact previously reviewed the project in 2019 and had no concerns. Therefore, it is not anticipated that the NPS would object to the proposed project.
Noise Abatement and Control Noise Control Act of 1972, as amended by the Quiet Communities Act of 1978; 24 CFR Part 51 Subpart B	☐ Yes ☑ No	A Noise Assessment was conducted. The noise level was acceptable: 65.0 db. See noise analysis. The project is in compliance with HUD's Noise regulation. (REFER TO NEPASSIT MAPS - NOISE GENERATOR MAPS AND ESSEX COUNTY AIRPORT NOISE CONTOUR MAP.)
Sole Source Aquifers Safe Drinking Water Act of 1974, as amended, particularly section 1424(e); 40 CFR Part 149	☐ Yes ☑ No	The project is not located on a sole source aquifer area. The project is in compliance with Sole Source Aquifer requirements. (REFER TO MAP)
Wetlands Protection Executive Order 11990, particularly sections 2 and 5	☐ Yes ☑ No	The project will not impact on- or off-site wetlands. The project is in compliance with Executive Order 11990. (REFER TO MAP)
Wild and Scenic Rivers Act Wild and Scenic Rivers Act of 1968, particularly section 7(b) and (c)	☐ Yes ☑ No	This project is not within proximity of a NWSRS river. The project is in compliance with the Wild and Scenic Rivers Act. (REFER TO THE MAPS AND WILD AND SCENIC RIVER STUDIES)
HUD HOUSING ENVIRONMENTAL STANDARDS		
ENVIRONMENTAL JUSTICE		
Environmental Justice Executive Order 12898	☐ Yes ☑ No	No adverse environmental impacts were identified in the project's total environmental review. The project is in compliance with Executive Order 12898. According to the EPA, 40.62% of the subject property population resides below the poverty line and 100% of the population is described as people of color. Based on the information gathered from the regulatory database report and other information sources reviewed during the course of EWMA's Phase I ESA, as well as the additional soil sampling and migration to ground water pathway investigations, there are no compounds that would pose a concern

		in terms of soil or groundwater impact. Therefore, the future residents of the subject property would not suffer from disproportionately adverse environmental effects relative to the community-at-large. The project is in compliance with Executive Order 12898.

Environmental Assessment Factors [24 CFR 58.40; Ref. 40 CFR 1508.8 &1508.27]

Impact Codes: An impact code from the following list has been used to make the determination of impact for each factor.

(1) Minor beneficial impact
(2) No impact anticipated
(3) Minor Adverse Impact – May require mitigation
(4) Significant or potentially significant impact requiring avoidance or modification which may require an Environmental Impact Statement.

Environmental Assessment Factor	Impact Code	Impact Evaluation	Mitigation
LAND DEVELOPMENT			
Conformance with Plans / Compatible Land Use and Zoning / Scale and Urban Design	2	The project location, which is currently vacant land, is in the Public Use District Zone and the National Gateway District Zone of the First Ward Redevelopment Plan and was previously zoned as a B-2 (Business Use). The project was presented before the City of Paterson Zoning Board of Adjustments for the following variances: use, "C" and "D" variances to permit the Housing Component in the Public Use District Zone of the First Ward Redevelopment Plan, which were approved as per the Resolution. In addition, the proposed project was found appropriate for the neighborhood. Documentation: Zoning Board of Adjustments Resolution	None
Soil Suitability / Slope/ Erosion / Drainage and Storm Water Runoff	2	The project site is flat, therefore there are not any slopes. There is no visible evidence of soil problems in the neighborhood of the site. The site geology was described as Piedmont Physiographic Province, siltstone and shale. The soil is	None

Environmental Assessment Factor	Impact Code	Impact Evaluation	Mitigation
LAND DEVELOPMENT			
		described as well-drained within the Holyoke-rock outcrop complex. NJDEP's GeoWeb mapping program also designates the surficial geology of the area as Rahway Till, composed of clayey silt to sandy silt with some to many pebbles and cobbles deposited from glacial ice during the late Wisconsin glaciations. Bedrock geology is classified as fine to mid-grained Orange Mountain Basalt. A soil/borings test was performed and no indication of marginal or unsatisfactory soil conditions were found. A stormwater infiltration basin underneath the access drive is proposed to handle the increased runoff generated by the proposed development. Documentation: Phase 1 ESA; April 2020 geotechnical investigation report by Whitestone Associates; January 2021 fill investigation by A.T. Cameron; Zoning Board of Adjustments Resolution	
Hazards and Nuisances including Site Safety and Site-Generated Noise	2	The proposed project will not be affected by any natural or man-made hazards. The proposed project will also not be affected by any nuisances nor will it be a noise-generating facility. The project is compatible with surrounding land uses.	None
Energy Consumption/Energy Efficiency	2	The developer intends for the project design to take full advantage of the potential energy saving measures with the ENERGYSTAR Multi-Family New Construction participation, as well as conform with HUD Minimum Property Standards and other applicable energy saving codes. The project site is also in close proximity to shopping, services, and employment locations, which are all accessible via the NJ Transit system in Paterson. Documentation: MaGrann Associates Builder's Upgrade Letter	None
SOCIOECONOMIC			
Employment and Income	1	For this project, there will be no impact on	N/A

Environmental Assessment Factor	Impact Code	Impact Evaluation	Mitigation
LAND DEVELOPMENT			
Patterns		employment and income patterns in the City of Paterson or the surrounding areas. The project construction activities may have short-term benefits to local employment or income from construction workers in the City. However, these project related impacts are considered minor and short-term and in the long-run the project will not employ any additional workers or change any income patterns for the local community.	
Demographic Character Changes / Displacement	1	The proposed project will be targeted toward age-restricted to households aged 55 years old and up with incomes at or below 60% area median income. In addition, there will be no alterations or displacements to the demographic characteristics of the community, residential, commercial or industrial uses, nor any community facilities or institution, since the project site is currently a vacant lot.	N/A
COMMUNITY FACILITIES AND SERVICES			
Educational and Cultural Facilities (Access and Capacity)	1	Because this project is targeted toward seniors, the access and capacity to get to these facilities will not be an issue. The Passaic County Community College, about 1 mile from the site, if the seniors are interested in taking educational/cultural classes in their leisure time.	N/A
Commercial Facilities (Access and Proximity)	2	The senior housing project will be in proximity to walkable locations to restaurants, groceries, open space, pharmacies, and banking services, for example: * C&C Grocery & Deli (0.3 mile away) * Union Ave Supermarket (0.5 mile away) * McDermott Pharmacy (0.5 mile away) * Cortese Pharmacy (0.8 mile away) Resource: Google Maps	N/A
Health Care / Social Services (Access and Capacity)	2	The nearest full-service hospital, St. Joseph's University Medical Hospital is 2 miles away. The nearest ambulance	N/A

Environmental Assessment Factor	Impact Code	Impact Evaluation	Mitigation
LAND DEVELOPMENT			
		service located approximately 7 minutes away. Nearest police station located approximately 5 minutes away. Primary care doctors located within neighborhood. The City of Paterson is the seat of Passaic County and hosts many government social service agencies. Social services will also be provided on-site. Resource: Google Maps; Documentation: Social services agreement with Life Management, Inc.	
Solid Waste Disposal and Recycling (Feasibility and Capacity)	2	There is an existing or planned solid waste disposal system adequately service the proposed project which will not overload the design capacity of these facilities. The project will include a trash chute and room with private, third-party hauling.	N/A
Waste Water and Sanitary Sewers (Feasibility and Capacity)	2	The existing or planned waste water and storm water systems of the city will adequately service the proposed development. The project will not overload the design capacity nor adversely affect proximity to these facilities. Source: Passaic Valley Sewer Commission will serve letter	N/A
Water Supply (Feasibility and Capacity)	2	The City of Paterson water utility or on-site water supply system is adequate to serve the proposed project. An approved water main extension permit has been accepted by NJDEP. Documentation: NJDEP water main extension permit	N/A
Public Safety - Police, Fire and Emergency Medical	2	The nearest police station as well as the fire station is 1 mile from the project site. The nearest full-service hospital, St. Joseph's University Medical Hospital is 2 miles away. Resource: Google Maps	N/A
Parks, Open Space and Recreation (Access and Capacity)	2	There are three parks located within the neighborhood: - Paterson Great Falls National Historic Park (0.6 mile from site) - Grace Buckley Park (1 mile from site) - West Side Park (0.8 mile from site) Resource: Google Maps	N/A
Transportation and	2	Project parking ratio exceeds 1:1, which is	N/A

Environmental Assessment Factor	Impact Code	Impact Evaluation	Mitigation
LAND DEVELOPMENT			
Accessibility (Access and Capacity)		more than adequate for senior housing. Overflow parking available in adjacent parking garage. Walking distance to Totowa Avenue and Broadway bus stops. Documentation: Project Plans; Resource: Google Maps	
NATURAL FEATURES			
Unique Natural Features /Water Resources	2	The project site is located in the general vicinity of the Paterson Great Falls. No impact or relationship other than general proximity. Groundwater will not be used as water supply. There are no visual or other indications of water quality problem on or near the site. The development will be using public infrastructure for water and sewer.	N/A
Vegetation / Wildlife (Introduction, Modification, Removal, Disruption, etc.)	2	The project site is currently a flat, vacant lot with grass covering. The remainder of the property consists of undeveloped wooded and grassy areas. The project will not damage or destroy trees without replacement, will not threaten the survival of existing vegetation, particularly changes in the native plant community habitats, and will not create conditions favorable to nuisance species. Documentation: Phase 1 ESA	N/A
Other Factors	2	None	N/A

Supporting documentation

Development Agreement (Execution) signed.pdf
Hinchliffe Residential - Executed Upgrade Letter - MAGRANN ASSOCIATES.pdf
1605002_WCP200004_DEP approved permit.pdf
SOIL TESTING REPORT.pdf
2020-04-09 Geotech Report - WHITESTONE ASSOCIATES.PDF
Phase I Environmental Site Assessment(1).pdf
8-13-20 ZONING RESOLUTION 1-27 JASPER ST.pdf

Additional Studies Performed:

* April 2020 Geotechnical Report, prepared by Whitestone Associates, Inc. * January 2021 Limited Environmental Investigation of Soils Letter Report, prepared by A.T.

DEVELOPMENT AGREEMENT

This AGREEMENT is made and entered into as of the 27th day of August, 2020, BETWEEN LIFE MANAGEMENT, INC., a Non-Profit Corporation, AND, Hinchliffe Housing Urban Renewal Associates, L.P., a New Jersey Limited Partnership (the "Owner").

WHEREAS, the parties have agreed to enter into this arrangement for the development and operation of a 75-unit age-restricted affordable housing project (hereafter referred to as "Hinchliffe Residential" or the "Project") with a location at 1-27 Jasper Street in the City of Paterson, New Jersey.

NOW THEREFORE, the parties agree as follows:

1. RPM Development, L.L.C. ("RPM") and BAW Development, L.L.C. (the "Developers") will provide development services to the Project. An affiliate of RPM will serve as General Contractor of Hinchliffe Residential. The Developers and RPM as General Contractor will receive compensation in accordance with the New Jersey Housing and Mortgage Finance Agency's guidelines.

2. Life Management, Inc. has designed and will administer a Social Service Plan for the Project attached hereto as Exhibit A. Life Management, Inc. will receive compensation pursuant to the Social Service Plan.

3. Life Management, Inc., or an affiliate will serve as a Special Limited Partner holding a minority interest of 0.01% substantially in accordance with the organizational chart attached hereto as Exhibit B.

HINCHLIFFE HOUSING URBAN RENEWAL ASSOCIATES, L.P.

BY: RPM Partners LIX, L.L.C., General Partner

BY: _____
EDWARD G. MARTOGLIO
SOLE MEMBER

LIFE MANAGEMENT, INC.

BY: Barbara A. Havlik Digitally signed by Barbara A. Havlik Date: 2020.08.28 15:15:22 -04'00'
BARBARA A. HAVLIK
EXECUTIVE DIRECTOR

EXHIBIT A
Social Service Plan

Life Management, Inc. at a cost of $16,000 per year (with a maximum of a 3% increase per year), will provide to Hinchliffe Senior residents, the following, but not limited to:

On-Site Social Services 6-8 hours per week

- one-on-one assistance
- computer lab/ technical support
- information and referrals
- scheduling of educational forums, classes, recreation and entertainment

Health and Fitness Classes once per week

- yoga
- balance and coordination
- Zumba
- IntenSati
- meditation
- other

Recreation, Arts and Crafts, Musical entertainment once per month (min.)

(Volunteers, students, scouts, church groups and others from the community will be invited to entertain, and work with, and practice their trade with the residents. Community service hours will be provided to local high school students and college students will also be invited to do internships at Hinchliffe. *The intergenerational aspect of having students involved will be therapeutic to residents, as well as to the students.)

- holiday parties
- paint and sip
- bingo
- jewelry making
- holiday crafts
- manicure
- reiki
- singing and dance performances
- other

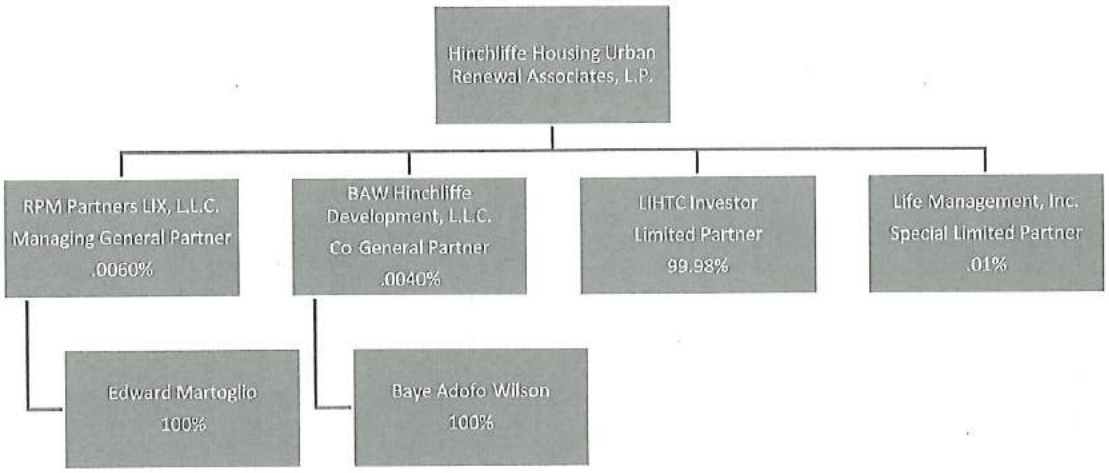
Hinchliffe Senior Housing will offer a complete calendar of activities including, but not limited to: recreation and fitness, educational programs with regard to a broad variety of topics, arts and crafts, computer and technical support labs, health and wellness classes and screenings. Residents will be informed about programs and entitlements offered by the Paterson Health Department and Passaic County and local Divisions of Senior Services. Residents will be encouraged to apply for programs and entitlements in order that they can utilize their limited funds most appropriately and maximize their quality of life while making their home at Hinchliffe Senior Housing. Senior residents can avail themselves of activities and other opportunities offered to older adults throughout the County, such as: group excursions, cultural events, entertainment programs, farmer's markets, health screenings, nutrition sites, home health aides, energy assistance, income tax assistance, free transportation, lectures and entitlement programs for which they may qualify. Our Resident Services Coordinator (RSC), who will be onsite 6-8 hours per week, will schedule workshops and activities, publicize them, as well as work with residents on a one-on-one basis as needed. A priority of Life Management will be to bring programs onsite that the seniors desire. The RSC will help connect residents to programs and assist them with applications, as well as encourage them to attend programs offered a Hinchliffe, including but not limited to:

- Weekly Exercise Program (Strength and Balance, Zumba, Yoga)
- Monthly Educational Programs
- Arts and Crafts
- Weekly Computer and Educational Lab

- Bingo and Game Nights
- Movie Nights
- Music and other entertainment
- Holiday Parties and Special Events

In addition to our scheduled events, residents will enjoy the community room where they can play games, utilize the computers in the computer lab, celebrate special events with their friends and family, watch movies and just sit and read and relax outside their apartment. Residents will be able to enjoy the historical surroundings of their building as the stadium will host games and school programs throughout the year.

EXHIBIT B
Organizational Chart


Hinchliffe Housing Urban Renewal Associates, L.P.
RPM Partners LIX, L.L.C.
Managing General Partner
.0060%
BAW Hinchliffe Development, L.L.C.
Co General Partner
.0040%
LIHTC Investor
Limited Partner
99.98%
Life Management, Inc.
Special Limited Partner
.01%
Edward Martoglio
100%
Baye Adofo Wilson
100%

MaGrann ASSOCIATES

Making Buildings Better

June 23, 2020
RPM Development Group
Amber Delaney
77 Park Street
Montclair, NJ 07042

Re: ENERGY STAR Multifamily New Construction Participation
Hinchliffe Stadium Residential, Paterson, New Jersey

Dear Amber,

Thank you for choosing to participate in the Energy Star Multifamily New Construction Program with MaGrann Associates as your partner. Per your request, we have reviewed Hinchliffe Stadium Residential and performed an analysis to help you determine the best path to meet Program Requirements, based on the information that you have provided us. Please note that the results of this analysis represent a road map to successful completion of this project and Energy Star Multifamily New Construction certification.

In order for this project to qualify for Energy Star Multifamily New Construction Version 1.1 certification, there are a number of technical requirements that must be met as well as several procedural steps to complete as outlined here:

- Technical requirements, which are detailed in the attached *Technical Requirements Checklist*, fall under two categories. Mandatory items that must be completed regardless of the level of performance that is being sought. Performance based items are less rigid, but are crucial to achieving the minimum performance standards of the program. It is possible to trade-off performance items, but important to understand that not all options will provide the same level of performance.

- Procedural steps, many of which are also mandatory, are spelled out in the attached *Procedures Checklist*. Completing each of these steps on a timely basis will keep the project on track for certification and eligible for incentives.

The dwelling units in this project are projected to achieve Energy Star Multifamily New Construction Version 1.1 certification, provided they are constructed in accordance with the mandatory and performance based items of the *Technical Requirements Checklist*, as verified during mandatory pre-drywall and final field verifications.

Please refer to the attached *Technical Requirements Checklist* and review mandatory and performance based elements of the project that MaGrann has selected as a cost- and resource-effective way to achieve

program compliance. You may wish to review these items with your design and construction teams. If you agree with our approach, sign and return a copy of this checklist to my attention. If you would prefer to investigate other approaches, please contact me at the number or email address listed below my signature. Because changes in project details often have unintended consequences, please notify me if, at any time during the project, any of the items in the *Technical Requirements Checklist* change. Project certification may be impacted.

Please also review the *Procedures Checklist*. I will be happy to answer any questions and address any concerns that you may have regarding this.

Thank you for choosing to build energy-efficient dwelling units through the Energy Star Multifamily New Construction Program. We look forward to working with you on this project.

Sincerely,

Brian Stanfill

Encl.: *Technical Requirements Checklist*
Procedures Checklist
ENERGY STAR Multifamily New Construction Checklists

June 23, 2020
RPM Development Group
Hinchliffe Stadium Residential
Paterson, NJ
Number of Units: 75

TECHNICAL REQUIREMENTS CHECKLIST

The following items represent the energy related features that will contribute to the project's achievement of Energy Star Multifamily New Construction Version 1.1 Certification. Mandatory items are required for all dwelling units and common areas as specified. Failure to comply with these requirements will jeopardize program participation. Performance based items are an integral component of achieving the energy savings necessary for program certification. Changes in these items will impact energy savings and may jeopardize program participation.

Please note that this analysis was performed using the **ERI** Path for compliance.

Mandatory Items

- ☐ Design all systems in accordance with the HVAC Design Report and submit one completed report which includes system designs for all unique unit plans and common spaces to my attention prior to the Site Orientation meeting (see attached);
- ☐ Comply with all applicable items from the Rater Design Review Checklist (see attached);
- ☐ Comply with all applicable items from the Rater Field Checklist (see attached);
- ☐ Complete all applicable items from the HVAC Functional Testing Checklist (see attached);
- ☐ Comply with all applicable items from the Water Management System Requirements (see attached);
- ☐ Install all insulation to meet RESNET Grade I installation quality.
- ☐ Provide whole house ventilation and bathroom and kitchen exhaust in accordance with ASHRAE 62.2-2010 or 2013;
- ☐ Provide ventilation air for common spaces in accordance with ASHRAE 62.1-2010 or 2013 without exceeding 2013 rates by more than 50%.
- ☐ All exterior walls must have a minimum of R-5 continuous rigid insulation, insulated siding or combination of the two
- ☐ Install an HVAC filter of MERV 6 or greater for all forced air HVAC systems;
- ☐ Install minimum R-5 thermal break at the edge of the slab on grade floor that extends to the top of the slab edge
- ☐ Common Space Heating and Cooling Equipment must meet efficiency levels specified in Exhibit X (see attached)

- ☐ All common spaces (including parking garages), except the building lobby and where automatic shutoff would endanger the safety of occupants, must have occupancy sensors or automatic bi-level lighting controls (ERI Path only)

- ☐ Total specified lighting power for the combined common spaces must not exceed 0.7 Watts per square feet OR not exceed the values below by space type. Parking Garages must not exceed 0.24 Watts per square feet.

Space by Space Lighting Allowances for Common Areas	
Space Type	Maximum Watts/Square Feet
Stairs	0.6
Corridors	0.5
Electrical/Mechanical	1.5
Offices	1.1
Laundry Rooms	1.3
Lounge/Recreation Rooms	1.2
Community Rooms	1.2
Trash Rooms	0.8
Storage Rooms	0.8
Tenant Storage Rooms	0.3
Elevator (Interior)	1.3
Fitness Room	0.9
Garage	0.24
Lobby	1.3
Multipurpose Room	1.3
Restrooms	0.9

- ☐ Exterior Lighting fixtures, including parking lot fixtures, must include automatic switching on timers or photocells controls except fixtures intended for 24 hour operation, required for security, or located on dwelling unit balconies.

- ☐ 100% of exterior (excluding landscape or parking lot light fixtures) and common space fixtures must utilized LED or fluorescent lamps OR 90% of exterior and common space fixtures must be ENERGY STAR certified

- ☐ Common area refrigerators, dishwashers, clothes washers, clothes dryers, and ceiling fans must be ENERGY STAR certified. Common area bathroom faucets and aerators must be WaterSense certified. Where and appliance type is not eligible for ENERGY STAR certification (e.g. commercial dryer) the appliance is exempt from this requirement. Likewise where a bathroom faucet or aerator is not eligible for WaterSense certification (e.g. public use lavatory faucets) the fixture is exempt from this requirement.

- ☐ Common Space insulation:
  - Insulated per "All Other" column of 2012 IECC Commercial Tables C402.1.2 or C402.2, OR
  - Provide a whole building COMCheck showing compliance with 2012 IECC UA tradeoff.

☐ Common Spaces must meet the following requirements for windows and doors:

ERI Path

Fixed Window U-Factor	0.36
Operable Windows U-Factor	0.43
SHGC	0.40
Opaque Door U-Factor	0.17
≤ 1/2 lite Door U-Factor / SHGC	0.25 / 0.25
≥ 1/2 lite Door U-Factor / SHGC	0.3 / 0.40

Performance Based Items

☐ Achieve an air infiltration rate of no more than 0.30 CFM50 per square foot of enclosure area as measured with a blower door for each unit;

☐ Slab-on-grade	Minimum R-5 thermal break on slab edge per mandatory requirement listed above & R-10 under insulation extending 2' underneath the slab
☐ Above grade Wood 2x6 walls	R-19 batt insulation with R-5 continuous insulation
☐ Above grade metal 2x6 walls	R-19 batt insulation with R-5 continuous insulation
☐ CMU Walls	R-5 continuous insulation
☐ Rim Joist	R-19 batt insulation with R-5 continuous insulation
☐ Floor above Parking	R-30 insulation installed in direct contact with concrete floor
☐ Windows	U-value = 0.28 (or lower), SHGC = 0.32 (or lower)
☐ Ceiling/Roofdeck	Entire Truss space filled with cellulose insulation and 2" rigid insulation on top of roofdeck
☐ Heating/Cooling	3.3 COP / 12 EER through the wall VRF PTHP units
☐ Water heater	Central, Gas, 97% thermal efficiency
☐ Showerheads	Water-Sense Labeled
☐ Bathroom Faucets	Water-Sense Labeled
☐ Dishwasher	ENERGY STAR Labeled
☐ Refrigerator	ENERGY STAR Labeled
☐ Clothes Washers	ENERGY STAR Labeled

☐	Lighting	100% LED lighting
☐	Continuous Ventilation	ENERGY STAR labeled bath fan, controlled to meet ASHRAE 62.2-2007 whole building ventilation rates
☐	Local Bathroom Ventilation	Bathroom exhaust fan, 3.0 Sones or less – must meet measured 50 CFM or greater
☐	Kitchen Ventilation	100 CFM vented range hood

June 23, 2020
RPM Development Group
Hinchliffe Stadium Residential

PROCEDURES CHECKLIST

Mandatory Items

- ☐ If you have not already done so, please complete an Energy Star Partnership Agreement. This can be done online at:

  https://www.energystar.gov/partner_resources/join_energy_star/new_home_construction

- ☐ In order for the project to be eligible for the ENERGY STAR Multifamily New Construction V1.1 label, select an HVAC Contractor that is credentialed by an EPA approved third party organization. Information is available on the EPA ENERGY STAR website at:

  https://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_hvac_contractors

  For non-residential style systems a certified commissioning agent or a representative of the original equipment manufacturer must complete the HVAC functional testing checklist. (see attached)

- ☐ Submit an HVAC Design Report for the project prior to the site orientation meeting (see attached);

- ☐ Schedule meeting(s) and field verifications: Contact scheduling@magrann.com or call 856-813-8793 at least three (3) business days in advance to ensure availability to schedule the following

  - o Site Orientation Meeting – scheduled as soon as all trades are under contract, this MaGrann led meeting that along with the participation of all involved parties will familiarize you and your subcontractors with the *Technical Requirements Checklist and* ENERGY STAR Multifamily New Construction Checklists.
  - o Slab insulation verification - for all slab-on-grade construction.
  - o Frame-walk - schedule after framing has begun to review air sealing details.
  - o Pre-drywall verification – schedule once the dwelling units and common areas are insulated and rough mechanicals are installed but before drywall insulation.
  - o Final field verification – schedule once the dwelling units and common areas are complete and prior to final cleaning.

Recommended Procedures

- ☐ Your availability (or that of your representative) on-site at both the Pre-Drywall Verification and at the Final Verification appointments will enhance communication and minimize project delays.

- ☐ We understand that construction schedules may change. Please keep us informed as these changes occur so that we can proactively determine how to meet your scheduling needs for our verification services. For ease of notification, feel free to email your construction schedule to scheduling@magrann.com.

June 23, 2020
RPM Development Group
Hinchliffe Stadium Residential

CLIENT ACKNOWLEDGMENT

By signing below I acknowledge that I have received and reviewed the technical and procedural requirements of the Energy Star Multifamily New Construction Version 1.1 Program.

I understand that to achieve Energy Star Multifamily New Construction Version 1.1 certification, the project MUST comply with all mandatory items and meet the performance levels of the performance based items. I understand that all installations MUST be verified by pre-drywall and final field verifications.

Builder Signature: _____ Date: 6/23/2020

Please return a signed copy of this page to scheduling@magrann.com

National HVAC Design Report [1]
ENERGY STAR Multifamily New Construction Version 1 / 1.1

HVAC Designer Responsibilities:

- Complete one National HVAC Design Report for each building / project, which includes system design for all unique unit plans and common spaces. [1]
- Obtain efficiency features (e.g., window performance, insulation levels, and infiltration rate) from the builder, architect, or Rater.
- Provide the completed National HVAC Design Report to the Rater and the person / company completing the National HVAC Functional Testing Checklist.

1. Design Overview

1.1 Designer name: _____ Designer company: _____ Date: _____

1.2 Select which party you are providing these design services to: ☐ Builder / Developer ☐ FT Agent ☐ MEP / Credentialed HVAC contractor

1.3 Name of company you are providing these design services to (if different than Item 1.1): _____

1.4 Project address: _____ City: _____ State: _____ Zip code: _____

2a. Dwelling Unit & Common Space Mechanical Ventilation Design [2,3]						**Designer Verified**
Airflow:						
2.1 Dwelling unit ventilation airflow design rate & run-time meet the requirements of Section 4 of ASHRAE 62.2 [4]-☐ 2010 ☐ 2013						☐
2.2 Common space outdoor airflow design rate meet the requirements of Section 6 of ASHRAE 62.1 [5]-☐ 2010 ☐ 2013, without exceeding 2013 rates by more than 50%						☐
2.3 Access points to measure airflow rate are provided and accessible by the Rater						☐
List unique unit plan for which 62.2 ventilation rates were calculated in the spaces to the right: [6]						
2.4 # of bedrooms:						
2.5 Square footage:						
2.6 Ventilation airflow rate required by ASHRAE 62.2:						
2.7 Ventilation airflow rate designed:						
2.7.1 If applicable, run-time per cycle (minutes):						
2.7.2 If applicable, cycle time (minutes):						
List common space for which 62.1 ventilation rates were calculated in the spaces to the right: [6]						
2.8 Ventilation airflow rate required by ASHRAE 62.1:						
2.9 Ventilation airflow rate designed:						
System Type & Controls:						
List Ventilation System ID in the spaces to the right: [6]						
2.10 Specified system type: (e.g., supply, exhaust, balanced, ERV, HRV)						
2.11 Specified system type: (e.g., in-unit, central)						
2.12 Manufacturer:						
2.13 Model Number:						
2.14 Area / space(s) that system serves: (e.g., Unit A kitchens, corridor, community room)						
2.15 Specified control location: (e.g., Master bath, utility):						
2.16 Specified controls allow the systems to operate automatically, without occupant intervention. In a multi-family dwelling unit, the override control is not required to be readily accessible to the occupant. However, in such cases, EPA recommends but does not require that the control be readily accessible to others (e.g., building maintenance staff) in lieu of the occupant						☐
2.17 No outdoor air intakes designed to connect to the return side of the dwelling unit HVAC system, unless specified controls operate intermittently and automatically based on a timer and restrict intake when not in use (e.g., motorized damper) [7]						☐
Sound:						
2.18 If located in the dwelling unit, the fan of the specified system is rated ≤ 3 sones if intermittent and ≤ 2 sones if continuous, or exempted [8]						☐
Efficiency:						
2.19 If system utilizes the dwelling unit HVAC fan, then the specified fan type in Item 4.12 is ECM / ICM, or the specified controls will reduce the standalone ventilation run-time by accounting for hours when the HVAC system is heating or cooling						☐
2.20 If in-unit bathroom fans or in-line fans are specified as part of the dwelling unit mechanical ventilation system, then they are ENERGY STAR certified [9]						☐
2.21 If central exhaust fans, ≤ 1 HP, are specified as part of the dwelling unit mechanical ventilation system, then they are direct-drive, ECM, with variable speed controllers. If > 1 HP, they are specified with NEMA Premium™ Motors						☐

National HVAC Design Report [1]
ENERGY STAR Multifamily New Construction Version 1 / 1.1

Air Inlet Locations: (Complete this section if system has specified air inlet location(s); otherwise check "N/A") [10]	☐ N/A
2.22 Inlet(s) pull ventilation air directly from outdoors and not from attic, crawlspace, garage, or adjacent dwelling unit	☐
2.23 Inlet(s) are ≥ 2 ft. above grade or roof deck; ≥ 10 ft. of stretched-string distance from known contamination sources (e.g., stack, vent, exhaust, vehicles) not exiting the roof, and ≥ 3 ft. from dryer exhausts and sources exiting the roof	☐
2b. Dwelling Unit Local Mechanical Exhaust Design – System(s) are designed that mechanically exhaust air from each dwelling unit kitchen and bathroom directly to the outdoors or to ventilation risers and meet the continuous and/or intermittent rates [11]	☐

Location		Continuous Rate	Intermittent Rate[13]	Exhaust Fan Type
Kitchen	Airflow	≥ 5 ACH, based on kitchen volume[13, 14, 15]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [13, 14, 15, 16]	☐ Continuous ☐ Intermittent ☐ In-unit fan ☐ Central / shared fan
	Sound	Recommended if in-unit: ≤ 1 sone	Recommended if in-unit: ≤ 3 sones	
Bathroom	Airflow	≥ 20 CFM	≥ 50 CFM	☐ Continuous ☐ Intermittent ☐ In-unit fan ☐ Central / shared fan
	Sound	Required if in-unit: ≤ 2 sones	Recommended if in-unit: ≤ 3 sones	

2c. Common Space Minimum Exhaust Rates – System(s) are designed that mechanically exhaust air from each common space, as required by ASHRAE 62.1-2010 or 2013 ☐

Location	ASHRAE 62.1 Rate	Design Rate	Location	ASHRAE 62.1 Rate	Design Rate
Janitor Room	1 cfm/ft²		Common space kitchen [17]	50 cfm / 100 cfm	
Trash / Recycling Room	1 cfm/ft²		Common space bathroom [18]	50 cfm per toilet / urinal	
Parking Garage	0.05 cfm/ft², standby 0.75 cfm/ft², full-on		☐ Garage exhaust fan controls include CO and NO2 sensors		

3. Heating & Cooling Loads

Dwelling Unit Heating & Cooling Loads (only required for ducted split AC, unitary AC, ASHP, WSHP, GSHP, and furnaces) [19] ☐ N/A

3.1 Loads calculated using: ☐ Unabridged ACCA Manual J v8 ☐ 2013 / 2017 ASHRAE Fundamentals ☐ Other per AHJ [20]
Townhouses only: Loads must be calculated room-by-room.

3.2 Check one box only to indicate whether the Dwelling Unit Loads is unit-specific or represents the design of more than one unit: [21]
☐ Unit-specific design ☐ Group design [22] ____ total groups for this project, representing ____ units
☐ Worst-case design (If the top floor unit with the greatest CFA and window area results in total heat gain <18 kBtuh, it may represent all other units if cooling system selected for all is single-speed & <20 kBtuh or two-speed / variable-speed & <25 kBtuh

3.3 Indoor design temperatures used in loads are 70°F for heating and 75°F for cooling ☐

3.4 Outdoor design temperatures used in loads: (See Footnote 23 and energystar.gov/hvacdesigntemps) [23]
County & State selected: _____ Cooling season: _____°F Heating season: _____°F

List the unit plan for which Loads were calculated: [6]								
3.5 Location of Unit: top, mid, bottom, corner, interior								
3.6 Number of occupants used in loads: [21, 24]								
3.7 Total occupant gains (Btuh): [21]								
3.8 Conditioned floor area used in loads: [21]								
3.9 Window area used in loads: [21]								
3.10 Predominant window SHGC used in loads: [21, 25]								
3.11 Infiltration (ACH / ACH50 / CFM) used in loads: [26]								
3.12 Mechanical ventilation (CFM) used in loads: [21]								
3.13 Non-occupant Internal gains (appliance, equipment and lighting) used in loads (Btuh): [21]								
3.14 Sensible Heat Gain At Design Conditions (kBtuh): [21]								
3.15 Latent Heat Gain At Design Conditions (kBtuh):								
3.16 Total Heat Gain at Design Conditions (kBtuh): [21]								
3.17 Total Heat Loss at Design Conditions (kBtuh):								

3.18 Common Space Heating & Cooling Loads [6]

Common Space Name: _____ Design Conditions: Total Heat Gain: _____(kBtuh) Total Heat Loss: _____(kBtuh)
Common Space Name: _____ Design Conditions: Total Heat Gain: _____(kBtuh) Total Heat Loss: _____(kBtuh)
Common Space Name: _____ Design Conditions: Total Heat Gain: _____(kBtuh) Total Heat Loss: _____(kBtuh)

National HVAC Design Report [1]
ENERGY STAR Multifamily New Construction Version 1 / 1.1

3.19 Building Heating & Cooling Loads [6] (only required when shared systems such as central boilers or chillers are specified) ☐ N/A							
System Name: _____ Design Conditions: Total Heat Gain: _____(kBtuh) Total Heat Loss: _____(kBtuh)							
System Name: _____ Design Conditions: Total Heat Gain: _____(kBtuh) Total Heat Loss: _____(kBtuh)							
4. Heating & Cooling Equipment Selection							
4.1 Equipment selected per ACCA Manual S (see Footnote 27) [27]							☐
4.2 Prescriptive Path: Equipment serving dwelling units and common spaces meet the efficiency levels specified in the Exhibit X of the National Rater Field Checklist. Electric resistance heating is not specified in dwelling units						☐	☐ N/A
4.3 ERI Path: Equipment serving common spaces but not serving dwelling units meet the efficiency levels specified in the Exhibit X of the National Rater Field Checklist. Also see Exhibit X for restrictions on electric resistance						☐	☐ N/A
Cooling Equipment [6] (Complete all applicable items; otherwise check "N/A") ☐ N/A							
List Cooling Equipment ID in the spaces to the right:							
4.4 Equipment type: (e.g., PTAC / AC, Chiller / CT, PTHP / WLHP / GSHP / ASHP / VRF)							
4.5 Area / Space(s) that system serves:							
4.6 Chiller / condenser / outdoor unit manufacturer:							
4.7 Chiller / condenser / outdoor unit model #:							
4.8 Evaporator / indoor unit manufacturer:							
4.9 Evaporator / indoor unit model #:							
4.10 AHRI reference #: [28]							
4.11 AHRI listed efficiency:							
4.12 Evaporator fan type: PSC, ECM / ICM Other:							
4.13 Compressor speed: Single, Two, Variable							
4.14 Turn down ratio (for variable speed equipment):							
4.15 Latent capacity at design conditions (kBtuh): [29]							
4.16 Sensible capacity at design conditions (kBtuh): [29]							
4.17 Total capacity at design conditions (kBtuh): [29]							
4.18 Cooling sizing % = Total capacity (Item 4.17) divided by Total Heat Gain of space(s) in Item 4.5:							
4.19 Meets cooling sizing limit: (see below for A, B, C, D or N/A) [19]							
4.20 If "B", list Load sensible heat ratio = Max. sensible heat gain (Item 3.14) / Max. total heat gain (Item 3.16): [30]							
4.21 If "B", calculate HDD / CDD ratio: [30]							

Equipment Type & Climate Condition	Compressor Type (Per Item 4.13)		
	Single-Speed	Two-Speed	Variable-Speed
A: For Cooling-Only Equipment or For Cooling Mode of Heat Pump in Condition A Climate [30]	Recommended: 90 – 115% Allowed: 90 – 130%	Recommended: 90 – 120% Allowed: 90 – 140%	Recommended: 90 – 130% Allowed: 90 – 160%
B: For Cooling Mode of Heat Pump in Condition B Climate [30]	90% - 100%, plus 15 kBtuh	90% - 100%, plus 15 kBtuh	90% - 100%, plus 15 kBtuh
C: For low-load spaces (≤15 kBtuh) [31]	≤ 20 kBtuh		
D: For low-load spaces (≤18 kBtuh) [31]		≤ 25 kBtuh	≤ 25 kBtuh

National HVAC Design Report [1]
ENERGY STAR Multifamily New Construction Version 1 / 1.1

Heating Equipment [6] (Complete all applicable items; otherwise check "N/A")							☐ N/A
List Heating Equipment ID in the spaces to the right:							
4.22 Electric equipment type: PTHP, WLHP, GSHP, ASHP, VRF, Boiler, Furnace, Electric Resistance							
4.23 Gas Equipment type: HW PTAC / fan coil, Gas-Fired PTAC, Boiler, Furnace							
4.24 Area / Space(s) that system serves:							
4.25 Manufacturer & model:							
4.26 Listed efficiency:							
4.27 Equipment output capacity:							
4.28 Air-source heat pump output capacity (17°F):							
4.29 Type of Venting: Natural Draft, Mechanically Drafted, Direct Vent [32]							
4.30 Furnace heating sizing % = Total capacity (Item 4.27) divided by Total Heat Loss of space(s) in Item 4.24:							
4.31 Meets furnace sizing limit: (see below for A, B, C, or N/A)							

A: For low-load spaces (≤ 10 kBtuh), furnace output capacity is ≤ 40 kBtuh	
B: When Used for Heating Only	C: When Paired With Cooling
100 – 400%	Recommended: 100 – 140% Allowed: 100 – 400%

Equipment Controls	
4.32 All equipment controls below have been included where applicable in the HVAC Design	☐
4.33 All heating and cooling systems serving a dwelling unit shall have thermostatic controls within the dwelling unit which are not located on exterior walls	
4.33.1 Prescriptive Path: Dwelling unit thermostats are programmable	☐
4.34 Stair and elevator shaft vents shall be equipped with motorized dampers that are capable of being automatically closed during normal building operation and are interlocked to open as required by fire and smoke detection systems	
4.35 Freeze protection systems, such as heat tracing of piping and heat exchangers, including self-regulating heat tracing, and garage / plenum heaters shall include automatic controls capable of shutting off the systems when pipe wall or garage / plenum temperatures are above 40°F. Where heat tracing is specified for freeze protection, controls must be based on pipe wall temperature and a minimum of R-3 pipe insulation is also required	
4.36 Snow- and ice-melting systems shall include automatic controls capable of shutting off the systems when the pavement temperature is above 50°F and no precipitation is falling, and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F so that the potential for snow or ice accumulation is negligible	

Hydronic Distribution	☐ N/A
4.37 All hydronic distribution requirements below have been included where applicable in the HVAC Design	☐
4.38 All terminal heating and cooling distribution equipment must be separated from the riser or distribution loop by a control valve or terminal distribution pump, so that heated or cooled fluid is not delivered to the dwelling unit distribution equipment when there is no call from the thermostat	
4.39 Terminal units must be equipped with pressure independent balancing valves or pressure independent control valves	
4.40 Piping of a heating or cooling system (e.g., steam, hot or chilled water, brine, refrigerant) shall be thermally insulated in accordance with ASHRAE 90.1-2007, Table 6.8.3. Construction documents must account for piping total thickness including required insulation when passing through planks or any other penetrations and shall specify that the piping must be inspected before access is covered up: Heating System: Pipe size:____ inches Insulation thickness:___ inches Pipe size:____ inches Insulation thickness:___ inches Cooling System: Pipe size:____ inches Insulation thickness:___ inches Pipe size:____ inches Insulation thickness:___ inches	
4.41 For circulating pumps serving hydronic heating or cooling systems with three-phase motors, 1 horse-power or larger, motors shall meet or exceed efficiency standards for NEMA Premium™ motors. If 5 horse-power or larger, must also be specified with variable frequency drives	

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5. Dwelling Unit Duct Design (Complete if heating or cooling equipment will be installed with ducts; otherwise check "N/A") ☐ N/A

5.1 Duct system designed for the equipment selected in Section 4, per ☐ ACCA Manual D ☐ Other: _____ ☐

5.2 Room-by-room design airflows documented below (which should sum to the mode with the higher Design HVAC fan airflow) [6, 33, 34]

Name of the unit plan:	Name of the unit plan:
Design HVAC fan airflow: [35] Cooling mode _____ CFM Heating mode _____ CFM	Design HVAC fan airflow: [35] Cooling mode _____ CFM Heating mode _____ CFM
Design HVAC fan speed setting (e.g., low, medium, high): [36] Cooling mode _____ Heating mode _____	Design HVAC fan speed setting (e.g., low, medium, high): [36] Cooling mode _____ Heating mode _____
Design total external static pressure (corresponding to the mode with the higher airflow above): [37] _____ IWC	Design total external static pressure (corresponding to the mode with the higher airflow above): [37] _____ IWC

	Room Name	Design Airflow (CFM)		Room Name	Design Airflow (CFM)
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
	Total for all rooms			Total for all rooms	

6. Duct Quality Installation - *Applies to Heating, Cooling, Ventilation, Exhaust, & Pressure Balancing Ducts, Unless Noted in Footnote*

6.1 All duct quality installation requirements below have been included where applicable in the HVAC Design ☐

6.2 Ductwork specified without kinks, sharp bends, compressions, or excessive coiled flexible ductwork [38]

6.3 All supply and return ducts not in conditioned space, including connections to trunk ducts, are insulated to ≥ R-6 [39]

6.3.1 Prescriptive Path: Dwelling unit ductwork meets the location and insulation requirements specified in the ENERGY STAR MF Reference Design

Dwelling Unit

6.4 At least one MERV 6 or higher filter specified for each ducted mechanical system serving an individual dwelling unit and is in a location that facilitates access and regular service by the occupant or building owner. Filter access panel specified with a gasket or comparable sealing mechanism. All return air and mechanically supplied outdoor air designed to pass through filter prior to conditioning

6.5 Ductwork air-sealing specified such that Rater-measured total duct leakage is ≤ 4 CFM25 per 100 ft² of CFA at rough-in or ≤ 8 CFM25 per 100 ft² at final, or if there are no ducted returns, ≤ 3 CFM25 per 100 ft² of CFA at rough-in or ≤ 6 CFM25 per 100 ft² at final. [40] Additionally, for Townhouses only, Rater-measured duct leakage to outdoors is ≤ 4 CFM25 per 100 ft² of CFA or ≤ 40 CFM25 [41]

6.6 Bedrooms with a design supply airflow ≥ 150 CFM (as reported in Item 5.2) are specified with any combination of transfer grilles, jump ducts, dedicated return ducts, and/or undercut doors to achieve a Rater-measured pressure differential ≥ - 5 Pa and ≤ 5 Pa with respect to the main body of the dwelling unit when all air handlers are operating

Common Space

6.7 Duct design specifies that all supply, return, and exhaust ductwork and all plenums shall be sealed at all transverse joints, longitudinal seams, and duct wall penetrations

6.8 Central exhaust systems (that serve four or more dwelling units): Ductwork air-sealing specified such that measured duct leakage does not exceed 25% of exhaust fan flow at rough-in (e.g., including trunks, branches, and take-offs) or 30% of exhaust fan flow at final (e.g., inclusive of all ductwork between the fan and the grilles) [42]

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Footnotes:

1. This report shall represent system design for all unique unit plans and common spaces. The term 'common space' refers to any spaces on the property that serve a function in support of the residential part of the building that is not part of a dwelling or sleeping unit. This includes spaces used by residents, such as corridors, stairs, lobbies, laundry rooms, exercise rooms, residential recreation rooms, or parking garages used exclusively by residents, building staff, and their guests. This also includes offices used by building management, administration or maintenance and all special use areas located on the property to serve and support the residents such as day-care facilities, gyms, dining halls, etc. This report is designed to meet ASHRAE 62.1-2010 / 2013, ASHRAE 62.2-2010 / 2013, and ANSI / ACCA's 5 QI-2015 protocol, thereby improving the performance of HVAC equipment in new multifamily buildings when compared to multifamily buildings built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems (e.g., those caused by a lack of maintenance or occupant behavior). Therefore, system designs documented through the use of this report are not a guarantee of proper ventilation, indoor air quality, or HVAC performance.
2. The dwelling-unit mechanical ventilation system shall have at least one supply or exhaust fan with associated ducts and controls. Local exhaust fans are allowed to be part of a dwelling-unit mechanical ventilation system. Designers may provide supplemental documentation as needed to document the system design.
3. In "Warm-Humid" climates as defined by 2009 IECC Figure 301.1 (i.e., CZ 1 and portions of CZ 2 and 3A below the white line), it is recommended, but not required, that equipment be specified with sufficient latent capacity to maintain indoor relative humidity at ≤ 60%.
4. Airflow design rates and run-times shall be determined using ASHRAE 62.2-2010 or later. Designers are permitted, but not required, to use published addenda and/or the 2013 version of the standard to assess compliance.
5. Airflow design rates shall be determined using ASHRAE 62.1-2010 or later. Designers are permitted, but not required, to use published addenda and/or the 2013 version of the standard to assess compliance.
6. If the tables provided cannot accommodate all the unit plans, spaces, or systems in the project, use the tables in Appendix A to supplement the Design Report.
7. In addition, consult manufacturer requirements to ensure return air temperature requirements are met.
8. Dwelling-unit mechanical ventilation fans shall be rated for sound at no less than the airflow rate in Item 2.7. Fans exempted from this requirement include HVAC air handler fans, remote-mounted fans, and intermittent fans rated ≥ 400 CFM. To be considered for this exemption, a remote-mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways and there shall be ≥ 4 ft. ductwork between the fan and intake grill. Per ASHRAE 62.2-2010, habitable spaces are intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms.
9. Bathroom fans with a rated flow rate ≥ 500 CFM are exempted from the requirement to be ENERGY STAR certified.
10. EPA requires rodent / insect screens with < 0.5 inch mesh to be installed at ventilation air inlets. Without proper maintenance, ventilation air inlet screens often become filled with debris. Therefore, EPA recommends, but does not require, that these ventilation air inlets be located so as to facilitate access and regular service by the building maintenance staff.
11. Continuous bathroom local mechanical exhaust fans shall be rated for sound at no less than the design airflow rate. Intermittent bathroom and both intermittent and continuous kitchen local mechanical exhaust fans are recommended, but not required, to be rated for sound at no less than the design airflow rate. Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope (e.g., bath exhaust fans, range hoods, clothes dryers). Per ASHRAE 62.2-2010, a bathroom is any room containing a bathtub, shower, spa, or similar source of moisture.
12. An intermittent mechanical exhaust system, where provided, shall be designed to operate as needed by the occupant. Control devices shall not impede occupant control in intermittent systems.
13. Kitchen volume shall be determined by drawing the smallest possible rectangle on the floor plan that encompasses all cabinets, pantries, islands, peninsulas, ranges / ovens, and the kitchen exhaust fan, and multiplying by the average ceiling height for this area. In addition, the continuous kitchen exhaust rate shall be ≥ 25 CFM, per 2009 IRC Table M1507.3, regardless of the rate calculated using the kitchen volume. Cabinet volume shall be included in the kitchen volume.
14. While not required, the prescriptive duct sizing requirements in Table 5.3 of ASHRAE 62.2-2010 are recommended to be used for kitchen exhaust fans based upon the rated airflow of the fan at 0.25 IWC.
15. As an alternative, dwelling units are permitted to use a continuous kitchen exhaust rate of 25 CFM per 2009 IRC Table M1507.3, if they are either a) PHIUS+ or PHI certified, or b) provide both dwelling unit ventilation and local mechanical kitchen exhaust using a balanced system, and have a Rater-verified whole-building infiltration rate ≤ 0.05 CFM50 per ft² of Enclosure Area, and a Rater-verified dwelling unit compartmentalization rate ≤ 0.30 CFM50 per ft² of Enclosure Area if multiple dwelling units are present in the building. 'Enclosure Area' is defined as the area of the surfaces that bound the volume being pressurized / depressurized during the test.
16. All intermittent kitchen exhaust fans must be capable of exhausting at least 100 CFM. In addition, if the fan is not part of a vented range hood or appliance-range hood combination (i.e., if the fan is not integrated with the range), then it must also be capable of exhausting ≥ 5 ACH, based on the kitchen volume.
17. For continuous system operation, the lower rate may be used. Otherwise, use the higher rate. Commercial kitchens shall be designed to provide a minimum continuous rate of 0.70 cfm/ft².
18. As an alternative, for a toilet room intended to be occupied by one person at a time, a minimum continuous rate of 25 cfm is permitted.
19. This section / item applies to split air conditioners, unitary air conditioners, air-source heat pumps, and water-source (i.e., geothermal) heat pumps up to 65 kBtuh with forced-air distribution systems and to furnaces up to 225 kBtuh with forced-air distribution system serving individual dwelling units. Forced-air distribution systems are those that supply air through ductwork exceeding 0 ft. in length. This section / item therefore does not apply to non-ducted systems, such as non-ducted mini-splits, multi-splits, PTHP's, or PTAC's.

20. Select "2013 / 2017 ASHRAE Fundamentals" if using Chapter 17 of the 2013 or 2017 ASHRAE Handbook of Fundamentals. Select "Other per AHJ" if the Authority Having Jurisdiction where the unit will be certified mandates the use of a load calculation methodology other than Unabridged ACCA Manual J v8 or 2013 ASHRAE Fundamentals.

21. Check the box for "unit-specific design" if the design was created for the specific plan configuration (i.e., elevation, option, orientation, and county) of the unit to be certified. Check the box for "group design" if designs were created for unit plans that are repeated throughout the project / building with potentially different configurations (i.e., different elevations and/or orientations). Check the box for "worst-case design" if loads for the unit with the largest heat gain in the project / building are less than 18 kBtuh and are being used to represent all other units. Only one box may be checked. Regardless of the box checked, the system design as documented on this HVAC Design Report must fall within the following tolerances for the unit to be certified:

    - Item 3.4: The outdoor design temperature used in loads are within the limits defined at energystar.gov/hvacdesigntemps.
    - Item 3.6: The number of occupants used in loads is within ± 2 of the dwelling unit to be certified.
    - Item 3.7: Total occupant gains used in loads shall not exceed 645 Btuh per occupant.
    - Item 3.8: The conditioned floor area used in loads is between 100 ft² smaller and 300 ft² larger than the dwelling unit to be certified.
    - Item 3.9: The window area used in loads is between 15 ft² smaller and 60 ft² larger than the dwelling unit to be certified, or for dwelling units with > 500 ft² of window area, between 3% smaller and 12% larger.
    - Item 3.10: The predominant window SHGC is within 0.1 of the predominant value in the dwelling unit to be certified.
    - Item 3.12: The mechanical ventilation rate used in loads is the same as the value in Section 2a for the given unit plan.
    - Item 3.13: The sum of the internal gains associated with lighting and appliances used in loads shall not exceed 3,600 Btuh.
    - Items 3.14 & 3.16: The sensible & total heat gain are documented for the orientation of the dwelling unit to be certified.
    - Item 4.18: The cooling sizing % is within the cooling sizing limit selected.

    Provide the National HVAC Design Report to the party you are providing these design services to (i.e., a builder / developer, Functional Testing Agent (FT Agent), and/or MEP / credentialed HVAC contractor) and to the Rater. The report is only required to be provided once per project / building. As long as a report has been provided that falls within these tolerances for the units to be certified, no additional work is required. However, if no report falls within these tolerances or if any aspect of the system design changes, then an additional report will need to be generated prior to certification.

    Visit energystar.gov/hvacdesign for a tool to assist with group designs and for more information.

22. For each unique unit floorplan, determine the orientation with the largest and smallest Total Heat Gain. Orientation represents the direction that the front door of the dwelling unit is facing. The designer is only required to document the loads for the orientation(s) that the dwelling unit might be built in. For example, if a unit plan will only be built in a specific orientation (e.g., facing South), then the designer only needs to document the loads for this one orientation. Verify that the difference in Total Heat Gain between the orientation with the largest and smallest value is ≤ 6 kBtuh. If not, then treat that orientation as a unique unit plan.

23. Visit energystar.gov/hvacdesigntemps for the maximum cooling season design temperature and minimum heating season design temperature permitted for ENERGY STAR. For "County & State, or US Territory, selected", select the County and State or US Territory (i.e., Guam, Northern Mariana Islands, Puerto Rico, or US Virgin Islands), where the unit is to be certified. The same design report is permitted to be used in other counties, as long as the design temperature limits in those other counties meet or exceed the cooling and heating season temperature limits for the county selected. For example, if Fauquier County, VA, is used for the load calculations, with a 1% cooling temperature limit of 93°F, then the same report could be used in Fairfax County (which has a higher limit of 94°F) but not in Arlington County (which has a lower limit of 92°F). If a jurisdiction-specified design temperature is used that exceeds the limit in the ENERGY STAR Certified Homes Design Temperature Limit Reference Guide, designers must submit a Design Temperature Exception Request. Visit energystar.gov/hvacdesigntemps for a copy of this form.

24. To determine the number of occupants among all HVAC systems in the dwelling unit, calculate the number of bedrooms, as defined below, and add one. This number of occupants must be within ± 2 of the dwelling unit to be certified.

    A bedroom is defined by ANSI / RESNET / ICC Standard 301-2014 as a room or space 70 ft² or greater size, with egress window and closet, used or intended to be used for sleeping. A "den", "library", or "home office" with a closet, egress window, and 70 ft² or greater size or other similar rooms shall count as a bedroom, but living rooms and foyers shall not.

    An egress window, as defined in 2009 IRC section R310, shall refer to any operable window that provides for a means of escape and access for rescue in the event of an emergency. The egress window definition has been summarized for convenience. The egress window shall:

    - have a sill height of not more than 44 inches above the floor; AND
    - have a minimum net clear opening of 5.7 ft²; AND
    - have a minimum net clear opening height of 24 in.; AND
    - have a minimum net clear opening width of 20 in.; AND
    - be operational from the inside of the room without the use of keys, tools or special knowledge.

25. "Predominant" is defined as the SHGC value used in the greatest amount of window area in the dwelling unit.

26. Infiltration rate shall use "Tight" values for the cooling season infiltration rate and "Tight" values for the heating season infiltration rate, as defined by Table 5A or 5B of ACCA Manual J, Eighth Edition, Version Two. Alternatively, infiltration rate shall not exceed 0.24 air changes per hour.

27. Equipment shall be selected using the maximum total heat gain and the total heat loss in Section 3 per ACCA Manual S, Second Edition, except that cooling ranges above ACCA Manual S limits are temporarily allowed, per Item 4.19.

28. If an AHRI Reference # is not available, OEM-provided documentation shall be attached with the rated efficiency of the specific combination of indoor and outdoor components of the air conditioner or heat pump, along with confirmation that the two components are designed to be used together.
29. Capacity will be listed as the capacity at design conditions, from OEM expanded performance data, and shall include the capacity of all systems providing space cooling to the dwelling unit.
30. Per ACCA Manual S, Second Edition, if the load sensible heat ratio is ≥ 95% and the HDD / CDD ratio is ≥ 2.0, then the Climate is Condition B, otherwise it is Condition A.
31. As an alternative for low-load dwelling units, a system match-up including a single-speed compressor with a total capacity ≤ 20 kBtuh is permitted to be used in spaces with a total cooling load ≤ 15 kBtuh. A system match-up including a two-speed or variable-speed compressor with a total capacity ≤ 25 kBtuh is permitted to be used in spaces with a total cooling load ≤ 18 kBtuh.
32. Per the 2009 International Mechanical Code, a direct-vent furnace or boiler is one that is constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outside atmosphere; a mechanical draft system is a venting system designed to remove flue or vent gases by mechanical means consisting of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure; and a natural draft system is a venting system designed to remove flue or vent gases under non-positive static vent pressure entirely by natural draft. Naturally drafted equipment is only allowed if located in a space outside the pressure boundary, where the envelope assemblies separating it from conditioned space are insulated and air-sealed.
33. Designers may provide supplemental documentation with room-by-room and total design airflows in lieu of completing Item 5.5. Sample supplemental documentation can be found at energystar.gov/newhomeshvacdesign.
34. Orientation-specific room-by-room design airflows are recommended, but not required, to distribute airflow proportional to load, thereby improving comfort and efficiency.
35. Design HVAC fan airflow is the design airflow for the blower in CFM, as determined using the manufacturer's expanded performance data.
36. Design HVAC fan speed setting is the fan speed setting on the control board (e.g., low, medium, high) that corresponds with the Design HVAC fan airflow.
37. Design total external static pressure is the pressure corresponding to the Design HVAC fan airflow, inclusive of external components (e.g., evaporator coil, whole-house humidifier, or ≥ MERV 6 filter).
38. Kinks are to be avoided and are caused when ducts are bent across sharp corners such as framing members. Sharp bends are to be avoided and occur when the radius of the turn in the duct is less than one duct diameter. Compression is to be avoided and occurs when flexible ducts in unconditioned space are installed in cavities smaller than the outer duct diameter and ducts in conditioned space are installed in cavities smaller than inner duct diameter. Ducts shall not include coils or loops except to the extent needed for acoustical control.
39. Item 6.3 does not apply to ducts that are a part of local mechanical exhaust or exhaust-only dwelling-unit ventilation systems. EPA recommends, but does not require, that all metal ductwork not encompassed by Section 6 (e.g., exhaust ducts, duct boots, ducts in conditioned space) also be insulated and that insulation be sealed to duct boots to prevent condensation.
40. Item 6.5 only applies to heating, cooling, and balanced ventilation ducts that only serve one dwelling unit. Duct leakage testing is not required if the ducts and air handler are in conditioned space and the total supply duct length of the system, including all supply trunks and branches, is ≤ 10 ft. For balanced ventilation ducts that are not connected to space heating or cooling systems, a Rater is permitted to visually verify, in lieu of duct leakage testing, that all seams and connections are sealed with mastic or metal tape and all duct boots are sealed to floor, wall, or ceiling using caulk, foam, or mastic tape.
41. Duct leakage shall be determined and documented by a Rater in accordance with ANSI / RESNET / ICC Std. 380. Leakage limits shall be assessed on a per-system, rather than per-dwelling unit, basis. For a duct system with one or two returns, the total Rater-measured duct leakage is permitted to be the greater of ≤ 4 CFM25 per 100 ft² of CFA or ≤ 40 CFM25 at 'rough-in' or the greater of ≤ 8 CFM25 per 100 ft² of CFA or ≤ 8 CFM25 at 'final'. For a duct system with three or more returns, the total Rater-measured duct leakage is permitted to be the greater of ≤ 6 CFM25 per 100 ft² of CFA or ≤ 60 CFM25 at 'rough-in' or the greater of ≤ 12 CFM25 per 100 ft² of CFA or ≤ 120 CFM25 at 'final'. For a duct system without any ducted returns, the total Rater-measured duct leakage is permitted to be the greater of ≤ 3 CFM25 per 100 ft² of CFA or ≤ 30 CFM25 at 'rough-in' or the greater of ≤ 6 CFM25 per 100 ft² of CFA or ≤ 60 CFM25 at 'final' and, the Rater-measured pressure difference between the space containing the air handler and the conditioned space, with the air handler running at high speed, is ≤ 5 Pa. For systems > 1 ton, increase by 1 Pa per half ton.
42. Exhaust fan flow shall be the lesser of the rated fan flow and at rough-in, 133% of the sum of the design airflow of the dwelling units that are exhausted by that central fan or at final, 143% of the sum of the design airflow of the dwelling units that are exhausted by that central fan.

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Appendix A – Supplementary tables for Section 2 and 3

2a. Dwelling Unit & Common Space Mechanical Ventilation Design [2,3]						
List unique unit plan for which 62.2 ventilation rates were calculated in the spaces to the right:						
2.4 # of bedrooms:						
2.5 Square footage:						
2.6 Ventilation airflow rate required by ASHRAE 62.2:						
2.7 Ventilation airflow rate designed:						
2.7.1 If applicable, run-time per cycle (minutes):						
2.7.2 If applicable, cycle time (minutes):						

List common space for which 62.1 ventilation rates were calculated in the spaces to the right:						
2.8 Ventilation airflow rate required by ASHRAE 62.1:						
2.9 Ventilation airflow rate designed:						

System Type & Controls						
List Ventilation System ID in the spaces to the right:						
2.10 Specified system type: (e.g., supply, exhaust, balanced, ERV, HRV)						
2.11 Specified system type: (e.g., in-unit, central)						
2.12 Manufacturer:						
2.13 Model Number:						
2.14 Area / space(s) that system serves: (e.g., Unit A kitchens, corridor, community room)						
2.15 Specified control location: (e.g., Master bath, utility)						

3. Heating & Cooling Loads								
Dwelling Unit Heating & Cooling Loads (only required for ducted split AC, unitary AC, ASHP, WSHP, GSHP, and furnaces) [19] ☐ N/A								
List the unit plan for which Loads were calculated:								
3.5 Location of Unit: top, mid, bottom, corner, interior								
3.6 Number of occupants used in loads: [21,24]								
3.7 Total occupant gains (Btuh): [21]								
3.8 Conditioned floor area used in loads: [21]								
3.9 Window area used in loads: [21]								
3.10 Predominant window SHGC used in loads: [21,25]								
3.11 Infiltration (ACH / ACH50) used in loads: [26]								
3.12 Mechanical ventilation (CFM) used in loads:								
3.13 Non-occupant internal gains (appliance, equipment and lighting) used in loads (Btuh): [21]								
3.14 Sensible Heat Gain At Design Conditions (kBtuh): [21]								
3.15 Latent Heat Gain At Design Conditions (kBtuh):								
3.16 Total Heat Gain at Design Conditions (kBtuh): [21]								
3.17 Total Heat Loss at Design Conditions (kBtuh):								

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Appendix A – Supplementary tables for Section 3

3.18 Common Space Heating & Cooling Loads			
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
Common Space Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)

Building Heating & Cooling Loads (only required when shared systems such as central boilers or chillers are specified)		
System Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
System Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
System Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)
System Name: _____	Design Conditions: Total Heat Gain: _____(kBtuh)	Total Heat Loss: _____(kBtuh)

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Appendix A – Supplementary tables for Section 4

4. Heating & Cooling Equipment Selection							
Cooling Equipment (Complete all applicable items; otherwise check "N/A")							☐ N/A
List Cooling Equipment ID in the spaces to the right:							
4.4 Equipment type: (PTAC / AC, Chiller / CT, PTHP / WLHP / GSHP / ASHP / VRF)							
4.5 Area / Space(s) that system serves:							
4.6 Chiller / condenser / outdoor unit manufacturer:							
4.7 Chiller / condenser / outdoor unit model #:							
4.8 Evaporator / indoor unit manufacturer:							
4.9 Evaporator / indoor unit model #:							
4.10 AHRI reference #: [28]							
4.11 AHRI listed efficiency:							
4.12 Evaporator fan type: PSC, ECM / ICM Other:							
4.13 Compressor speed: Single, Two, Variable							
4.14 Turn down ratio (for variable speed equipment):							
4.15 Latent capacity at design conditions (kBtuh): [29]							
4.16 Sensible capacity at design conditions (kBtuh): [29]							
4.17 Total capacity at design conditions (kBtuh): [29]							
4.18 Cooling sizing % = Total capacity (Item 4.17) divided by Total Heat Gain of space(s) in Item 4.5:							
4.19 Meets cooling sizing limit: (A, B, C, D or N/A) [19]							
4.20 If "B", list Load sensible heat ratio = Max. sensible heat gain (Item 3.14) / Max. total heat gain (Item 3.16): [30]							
4.21 If "B", calculate HDD / CDD ratio: [30]							

Equipment Type & Climate Condition	Compressor Type (Per Item 4.13)		
	Single-Speed	Two-Speed	Variable-Speed
A: For Cooling-Only Equipment or For Cooling Mode of Heat Pump in Condition A Climate [30]	Recommended: 90 – 115% Allowed: 90 – 130%	Recommended: 90 – 120% Allowed: 90 – 140%	Recommended: 90 – 130% Allowed: 90 – 160%
B: For Cooling Mode of Heat Pump in Condition B Climate [30]	90% - 100%, plus 15 kBtuh	90% - 100%, plus 15 kBtuh	90% - 100%, plus 15 kBtuh
C: For low-load spaces (≤15 kBtuh) [31]	≤ 20 kBtuh		
D: For low-load spaces (≤18 kBtuh) [31]		≤ 25 kBtuh	≤ 25 kBtuh

Heating Equipment (Complete all applicable items; otherwise check "N/A")							☐ N/A
List Heating Equipment ID in the spaces to the right:							
4.22 Electric equipment type: PTHP, WLHP, GSHP, ASHP, VRF, Boiler, Furnace, Electric Resistance							
4.23 Gas Equipment type: HW PTAC / fan coil, Gas-Fired PTAC, Boiler, Furnace							
4.24 Area / Space(s) that system serves:							
4.25 Manufacturer & model:							
4.26 Listed efficiency:							
4.27 Equipment output capacity:							
4.28 Air-source heat pump output capacity (17°F):							
4.29 Type of Venting: Natural Draft, Mechanically Drafted, Direct Vent [32]							
4.30 Furnace heating sizing % = Total capacity (Item 4.27) divided by Total Heat Loss of space(s) in Item 4.24:							
4.31 Meets furnace sizing limit: (A, B, C, or N/A)							

A: For low-load spaces (≤ 10 kBtuh), furnace output capacity is ≤ 40 kBtuh	
B: When Used for Heating Only	C: When Paired With Cooling
100 – 400%	Recommended: 100 – 140% Allowed: 100 – 400%

National HVAC Design Report [1]
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Appendix A – Supplementary tables for Section 5

5. Dwelling-Unit Duct Design

5.2 Room-by-room design airflows documented below (which should sum to the mode with the higher Design HVAC fan airflow) [33, 34]

Name of the unit plan:		Name of the unit plan:	
Design HVAC fan airflow: [35] Cooling mode _____ CFM Heating mode _____ CFM		Design HVAC fan airflow: [35] Cooling mode _____ CFM Heating mode _____ CFM	
Design HVAC fan speed setting (e.g., low, medium, high): [36] Cooling mode _____ Heating mode _____		Design HVAC fan speed setting (e.g., low, medium, high): [36] Cooling mode _____ Heating mode _____	
Design total external static pressure (corresponding to the mode with the higher airflow above): [37] _____ IWC		Design total external static pressure (corresponding to the mode with the higher airflow above): [37] _____ IWC	
	Room Name	Design Airflow (CFM)	Room Name	Design Airflow (CFM)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
	Total for all rooms		Total for all rooms	

Name of the unit plan:		Name of the unit plan:	
Design HVAC fan airflow: [35] Cooling mode _____ CFM Heating mode _____ CFM		Design HVAC fan airflow: [35] Cooling mode _____ CFM Heating mode _____ CFM	
Design HVAC fan speed setting (e.g., low, medium, high): [36] Cooling mode _____ Heating mode _____		Design HVAC fan speed setting (e.g., low, medium, high): [36] Cooling mode _____ Heating mode _____	
Design total external static pressure (corresponding to the mode with the higher airflow above): [37] _____ IWC		Design total external static pressure (corresponding to the mode with the higher airflow above): [37] _____ IWC	
	Room Name	Design Airflow (CFM)	Room Name	Design Airflow (CFM)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
	Total for all rooms		Total for all rooms	

National Rater Design Review Checklist [1]
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Project Name: _____ Number of Units: _____ Permit Date: _____

Project Address: _____ City: _____ State: _____

	Must Correct	Rater [3] Verified
1. Partnership Status		
1.1 Rater has verified that builder or developer is an ENERGY STAR partner using energystar.gov/partnerlocator Builder name: _____ Developer name: _____	☐	☐
1.2 ASHRAE Only: Rater has verified that modeler is listed in the online directory using energystar.gov/mfdirectory Modeler name: _____	☐	☐
2. High-Performance Fenestration		
2.1 Dwelling units:		
2.1.1 Prescriptive: Specified fenestration meets or exceeds ENERGY STAR MF Reference Design requirements [4]	☐	☐
2.1.2 ERI and ASHRAE only: Specified fenestration meets or exceeds 2009 IECC residential requirements [4]	☐	☐
2.2 Common space: [2]		
2.2.1 ERI and Prescriptive: Specified fenestration meets or exceeds ENERGY STAR MF Reference Design requirements [4]	☐	☐
2.2.2 ASHRAE only: Specified fenestration meets or exceeds 2009 IECC commercial requirements [4]	☐	☐
3. High-Performance Insulation		
3.1 Dwelling unit:		
3.1.1: Prescriptive: Specified ceiling [5], wall [6], floor, and slab-on-grade insulation levels meet or exceed ENERGY STAR MF Reference Design requirements [7, 8, 9]	☐	☐
3.1.2: ERI and ASHRAE only: Specified ceiling [5], wall [6], floor, and slab-on-grade insulation levels meet or exceed values from the "Group R" column in the 2009 IECC Commercial chapter [7, 8, 9]	☐	☐
3.2 Common space: [2]		
3.2.1 ERI and Prescriptive: Specified ceiling [5], wall [6], floor, and slab-on-grade insulation levels meet or exceed ENERGY STAR MF Reference Design requirements [7, 8, 9]	☐	☐
3.2.2 ASHRAE only: Specified ceiling [5], wall [6], floor, and slab-on-grade insulation levels meet or exceed the values from the "All Other" column in the 2009 IECC Commercial chapter [7, 8, 9]	☐	☐
4. Review of National HVAC Design Report (National HVAC Design Report Item # indicated in parenthesis) [10]		
4.1 National HVAC Design Report collected for records, with no items left blank	☐	☐
4.2 National HVAC Design Report reviewed by Rater for the following parameters (National HVAC Design Report Item # indicated in parenthesis):		
4.2.1 Prescriptive Path: Dwelling Unit Mechanical Ventilation (2.7) is <150% of ASHRAE 62.2-2013 requirements [11]	☐	☐
4.2.2 Cooling season and heating season outdoor design temperatures used in loads (3.4) are within the limits defined at energystar.gov/hvacdesigntemps for the State and County where the building will be built, or the designer has provided an allowance from EPA to use alternative values [12]	☐	☐
4.2.3 Number of occupants used in loads (3.6) is within ± 2 of the dwelling unit to be certified and total occupant gains (3.7) do not exceed 645 Btuh per occupant [13]	☐	☐
4.2.4 Conditioned floor area used in loads (3.8) is between 100 sq. ft. smaller and 300 sq. ft. larger than the dwelling unit to be certified	☐	☐
4.2.5 Window area used in loads (3.9) is between 15 sq. ft. smaller and 60 sq. ft. larger than the dwelling unit to be certified, or for dwelling units to be certified with > 500 sq. ft. of window area, between 3% smaller and 12% larger	☐	☐
4.2.6 Predominant window SHGC used in loads (3.10) is within 0.1 of predominant value in the dwelling unit to be certified [14]	☐	☐
4.2.7 Mechanical ventilation used in loads (3.12) is the same as the ventilation design (2.7) for the given unit plan	☐	☐
4.2.8 Non-occupant internal gains (3.13) are less than 3,600 Btuh	☐	☐
4.2.9 Sensible & total heat gain are documented (3.14, 3.16) for the orientation of the dwelling unit to be certified [15]	☐	☐
4.2.10 Cooling sizing % (4.18) is within the cooling sizing limit (4.19) selected by the HVAC designer	☐	☐

Rater Name: _____ Date of Review: _____

Rater Signature: _____ Rater Company Name: _____

National Rater Design Review Checklist [1]
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5. Additional Construction Document Review – Recommended, not required	
5.1 Air Sealing: Review construction documents to verify that air-sealing details at assemblies adjacent to exterior and unconditioned spaces are represented which, at a minimum, demonstrate compliance with checklist items in Section 4 of the National Rater Field Checklist (noted with an asterisk below). Items 5.1.9 and 5.1.10 are not verified by the Rater in the field, but are recommended.	
5.1.1 Ducts, flues, shafts, plumbing, piping, wiring, exhaust fans, & other penetrations to unconditioned space sealed, with blocking / flashing as needed*	☐
5.1.2 Recessed lighting fixtures adjacent to unconditioned space ICAT labeled and gasketed. Also, if in insulated ceiling without attic above, exterior surface of fixture insulated to ≥ R-10 in CZ 4-8*	☐
5.1.3 Continuous top plate or blocking is at top of walls adjoining unconditioned space including at balloon-framed parapets, and sealed*	☐
5.1.4 Drywall sealed to top plate at all unconditioned attic / wall interfaces using caulk, foam, drywall adhesive (but not other construction adhesives), or equivalent material. Either apply sealant directly between drywall and top plate or to the seam between the two from the attic above*	☐
5.1.5 Rough opening around windows & exterior doors sealed*[16]	☐
5.1.6 Assemblies that separate attached garages from occupiable space sealed and, also, an air barrier installed, sealed, and aligned with these assemblies*	☐
5.1.7 Attic access panels, roof hatches and drop-down stairs are gasketed (i.e., not caulked) or equipped with durable covers that are gasketed*[17]	☐
5.1.8 Doors adjacent to unconditioned space (e.g., attics, garages, basements), ambient conditions, or a unit entrance to a corridor / stairwell, made substantially air-tight with doorsweep and weatherstripping or equivalent gasket*	☐
5.1.9 Above-grade sill plates adjacent to conditioned space sealed to foundation or sub-floor. Gasket also placed beneath above-grade sill plate if resting atop concrete / masonry & adjacent to conditioned space [18, 19]	☐
5.1.10 The gap between the common wall (e.g., the drywall shaft wall) and the structural framing between units sealed at all exterior boundaries	☐
5.2 Dwelling Unit Compartmentalization	
5.2.1 Review construction documents to verify that air-sealing details [20] are represented such that air exchange between the dwelling unit and outside as well as the dwelling unit and other adjacent spaces is minimized and designed to achieve compartmentalization less than or equal to 0.30 CFM50 per square feet of dwelling unit enclosure area, following procedures in ANSI / RESNET / ICC Std. 380	☐
5.2.2 Seal all spaces 5.1.1-5.1.10 on adiabatic unit enclosure assemblies	☐
5.3 Prescriptive Path: Verify that Window-to-wall ratio ≤ 30% [21]	☐
5.4 Verify that fully-aligned air barrier details are in compliance with checklist items in Section 2 of the National Rater Field Checklist	☐
5.5 Verify that thermal bridging details are in compliance with checklist items in Section 3 of the National Rater Field Checklist	☐
5.6 Verify that HVAC details are in compliance with checklist items in Sections 5 - 10 of the National Rater Field Checklist	☐
5.6.1 Verify that HVAC design includes access and means to measure the dwelling-unit mechanical ventilation airflow rate	☐
5.6.2 Verify that bedrooms with design airflow ≥ 150 CFM are specified with a combination of transfer grilles, jump ducts dedicated return ducts, and/or undercut doors to achieve a Rater-measured pressure differential ≥ -5 Pa and ≤ +5 Pa with respect to the main body of the dwelling unit when all air handlers are operating	☐
5.6.3 Verify that Functional Testing Agent holds credential required to complete the National HVAC Functional Testing Checklist [22]	☐
5.7 Verify that Domestic Hot Water, Lighting, Appliances, Ceiling Fans, Plumbing Fixtures, and Whole Building Utility Data Acquisition Strategy details are in compliance with checklist items in Sections 11 – 14 of the National Rater Field Checklist	☐

National Rater Design Review Checklist Footnotes
ENERGY STAR Multifamily New Construction Version 1 / 1.1

Footnotes:

1. This Checklist applies to all dwelling units, sleeping units, most common spaces [2] on the property, and parking lots. This Checklist does not apply to commercial or retail spaces. This Checklist does not apply to common spaces that are located in buildings on the property without any dwelling or sleeping units. The term 'sleeping unit' refers to a room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Where the term 'dwelling unit' is used in this Checklist, the requirement is also required of 'sleeping' units. The term 'building' refers to a structure utilized or intended for supporting or sheltering occupancy for a residential purpose; a structure with no dwelling or sleeping units connected to a structure with dwelling or sleeping units by less than 10% of its exterior wall area is not to be included in the 'building'.
2. The term 'common space' refers to any spaces on the property that serve a function in support of the residential part of the building that is not part of a dwelling or sleeping unit. This includes spaces used by residents, such as corridors, stairs, lobbies, laundry rooms, exercise rooms, residential recreation rooms, or parking garages used exclusively by residents, building staff, and their guests. This also includes offices used by building management, administration or maintenance and all special use areas located on the property to serve and support the residents such as day-care facilities, gyms, dining halls, etc.
3. The term 'Rater' refers to the person completing the third-party inspections required for certification. This person shall: a) be a Certified Rater, Approved Inspector, or an equivalent designation as determined by a "Multifamily Oversight Organization" and, b) have attended and successfully completed an EPA-recognized training class. See energystar.gov/mftraining.
4. All windows, doors and skylights must meet or exceed the U-factor and SHGC requirements specified in the table below. If no NFRC rating is noted on the window or in product literature (e.g., for site-built fenestration), select the U-factor and SHGC value from Tables 4 and 10, respectively, in 2013 ASHRAE Handbook of Fundamentals, Chapter 15. Select the highest U-factor and SHGC value among the values listed for the known window characteristics (e.g., frame type, number of panes, glass color, and presence of low-e coating). Note that the U-factor requirement applies to all fenestration while the SHGC only applies to the glazed portion.

	Dwelling unit doors and windows that are not classified "Class AW"*	Dwelling unit windows that are classified as "Class AW"*	Common Space†
ERI	2009 IECC Table 402.1.1	2009 IECC Table 502.3	ENERGY STAR MF Reference Design – for Class AW
ASHRAE	2009 IECC Table 402.1.1	2009 IECC Table 502.3	2009 IECC Table 502.3
Prescriptive	ENERGY STAR MF Reference Design	ENERGY STAR MF Reference Design – for Class AW	ENERGY STAR MF Reference Design – for Class AW

* Classified as "Class AW" under the North American Fenestration Standard (AAMA / WDMA / CSA 101 / I.S.2 / A440).
† Opaque doors in common spaces in CZ1-6 shall not exceed U-0.70, and in CZ 7-8, shall not exceed U-0.5.

The following exemptions apply:

i. An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements;
ii. An area-weighted average of fenestration products ≥ 50% glazed shall be permitted to satisfy the SHGC requirements; and
iii. 5% of all combined fenestration area (glazed and opaque) shall be exempt from the U-factor and SHGC requirements, and shall be excluded from area-weighted averages calculated using i) and ii), above.

In PHIUS+ or PHI certified buildings, where triple-glazed window assemblies with thermal breaks / spacers between the panes are used, such windows meet the intent of Items 2.1 and 2.2 and shall be excluded when assessing compliance of a) through d), above.

5. Where the term 'ceiling' is used, the component insulation levels for "roofs" shall be used and does not apply to adiabatic ceilings, such as the insulated or uninsulated ceiling between two dwelling units in a multistory building.
6. Items 3.1 and 3.2 are also applicable to walls that are adjacent to other buildings or adjacent to unconditioned spaces within the building. Where the wall assembly includes continuous insulation that is interrupted by fasteners or service openings, an assembly U-factor must be calculated. For the interrupted portions, the continuous insulation cannot contribute to the assembly U-factor and an overall U-factor shall be calculated based on an area weighted ratio. Thermally broken shelf-angles are exempt from de-rating.
7. Specified levels shall meet or exceed the component insulation levels in 2009 IECC Table 502.2(1) or the table specified in the ENERGY STAR Multifamily Reference Design. The following exceptions apply:
   a. For ceilings with attic spaces, R-30 shall satisfy the requirement for R-38 and R-38 shall satisfy the requirement for R-49 wherever the full height of uncompressed insulation at the lower R-value extends over the wall top plate at the eaves. This exemption shall not apply if the alternative calculations in d) are used;
   b. For ceilings without attic spaces, that are not roofs with insulation above deck, R-30 shall satisfy the requirement for any required value above R-30 if the design of the roof / ceiling assembly does not provide sufficient space for the required insulation value. This exemption shall be limited to 20% of the total insulated ceiling area. This exemption shall not apply if the alternative calculations in d) are used;
   c. Common spaces following the ENERGY STAR Multifamily Reference Design should use the "All Other" column and also use the row of the table that best corresponds to the common space features. Unlike Prescriptive Path dwelling units, the common spaces do not need to follow the row corresponding to a wood-framed building.
   d. An alternative equivalent U-factor or total UA calculation may also be used to demonstrate compliance, as follows:

      An assembly with a U-factor equal or less than specified in 2009 IECC Table 502.1.2 complies.

      A total building thermal envelope UA that is less than or equal to the total UA resulting from the U-factors in Table 502.1.2 also complies. The performance of all components (i.e., roofs, walls, floors, slabs-on-grade, and fenestration) can be traded off using the UA approach. Note that Items 1.5, 1.6, and 3.1 through 3.7 of the National Rater Field Checklist shall be met regardless of the UA tradeoffs calculated. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and

shall include the thermal bridging effects of framing materials. The calculation for a steel-frame envelope assembly shall use the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method.

8. Consistent with the 2009 IECC, slab edge insulation is only required for slab-on-grade floors with a floor surface less than 24 inches below grade. Slab-on-grade perimeter insulation shall extend to the top of the slab to provide a complete thermal break. If the top edge of the insulation is installed between the exterior wall and the edge of the interior slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall. Alternatively, the thermal break is permitted to be created using ≥ R-3 rigid insulation on top of an existing slab (e.g., in a building undergoing a gut rehabilitation). In such cases, up to 10% of the slab surface is permitted to not be insulated (e.g., for sleepers, for sill plates). Insulation installed on top of slab shall be covered by a durable floor surface (e.g., hardwood, tile, carpet).
9. Where an insulated wall separates a garage, patio, porch, or other unconditioned space from the conditioned space of the building, slab perimeter insulation shall also be installed at this interface to provide a thermal break between the conditioned and unconditioned slab, if the slab is in contact with the ground at that interface. Where specific details cannot meet this requirement, partners shall provide the detail to EPA to request an exemption prior to the building's certification. EPA will compile exempted details and work with industry to develop feasible details for use in future revisions to the program. A list of currently exempted details is available at: energystar.gov/slabedge.
10. The Rater shall collect one National HVAC Design Report per building / project. Regardless of whether the "unit-specific design", "group design", or "worst-case design" box has been checked in Item 3.2 of the National HVAC Design Report, the system design as documented on the National HVAC Design Report must fall within the tolerances in Item 4.2 for the unit to be certified. The Rater is only responsible for verifying that the designer has not left any items blank on the National HVAC Design Report and for verifying the discrete objective parameters in Item 4.2 of this Checklist, not for verifying the accuracy of every input on the National HVAC Design Report.
11. Raters may use this table to determine the maximum ventilation rate allowed.

	Number of Bedrooms				
Floor area	1	2	3	4	5
<500	45	57	67.5	79.5	90
501-1000	67.5	79.5	90	102	112.5
1001-1500	90	102	112.5	124.5	135
1501-2000	112.5	124.5	135	147	157.5
2001-2500	135	147	157.5	169.5	180
2501-3000	157.5	169.5	180	192	202.5
3001-3500	180	192	202.5	214.5	225
3501-4000	202.5	214.5	225	237	247.5
4001-4500	225	237	247.5	259.5	270
4501-5000	247.5	259.5	270	282	292.5

12. Visit energystar.gov/hvacdesigntemps for the maximum cooling season design temperature and minimum heating season design temperature permitted and the process for a designer to obtain an allowance from EPA. The same design report is permitted to be used in other counties, as long as the design temperature limits in those other counties meet or exceed the cooling and heating season temperature limits for the county selected. For example, if Fauquier County, VA, is used for the load calculations, with a 1% cooling temperature limit of 93 °F, then the same report could be used in Fairfax County (which has a higher limit of 94 °F) but not in Arlington County (which has a lower limit of 92 °F).
13. To determine the number of occupants among all HVAC systems in the dwelling unit, calculate the number of bedrooms, as defined below, and add one. The number of occupants used in loads must be within ± 2 of the dwelling unit to be certified.

    A bedroom is defined by ANSI / RESNET / ICC Standard 301-2014 as a room or space 70 sq. ft. or greater size, with egress window and closet, used or intended to be used for sleeping. A "den", "library", or "home office" with a closet, egress window, and 70 sq. ft. or greater size or other similar rooms shall count as a bedroom, but living rooms and foyers shall not.

    An egress window, as defined in 2009 IRC Section R310, shall refer to any operable window that provides for a means of escape and access for rescue in the event of an emergency. The egress window definition has been summarized for convenience. The egress window shall:

    - have a sill height of not more than 44 inches above the floor; AND
    - have a minimum net clear opening of 5.7 sq. ft.; AND
    - have a minimum net clear opening height of 24 in.; AND
    - have a minimum net clear opening width of 20 in.; AND
    - be operational from the inside of the room without the use of keys, tools or special knowledge.
14. "Predominant" is defined as the SHGC value used in the greatest amount of window area in the dwelling unit.
15. Orientation represents the direction that the front door of the dwelling unit is facing. The designer is only required to document the loads for the orientation(s) that the dwelling unit might be built in. For example, if a unit plan will only be built in a specific orientation (e.g., facing South), then the designer only needs to document the loads for this one orientation.
16. In Climate Zones 1 through 3, a continuous stucco cladding system sealed to windows and doors is permitted to be used in lieu of sealing rough openings with caulk or foam.
17. Examples of durable covers include, but are not limited to, pre-fabricated covers with integral insulation, rigid foam adhered to cover with adhesive, or batt insulation mechanically fastened to the cover (e.g., using bolts, metal wire, or metal strapping).

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18. Existing sill plates (e.g., in a building undergoing a gut rehabilitation) on the interior side of structural masonry or monolithic walls may not be able to complete this item. In addition, other existing sill plates resting atop concrete or masonry and adjacent to conditioned space can in lieu of using a gasket, be sealed with caulk, foam, or equivalent material at both the interior seam between the sill plate and the subfloor and the seam between the top of the sill plate and the sheathing.
19. In Climate Zones 1 through 3, a continuous stucco cladding system adjacent to sill and bottom plates is an alternate option of sealing plates to foundation or sub-floor with caulk, foam, or equivalent material.
20. Recommended air leakage paths to be sealed include, but are not limited to the following:
    a. Plumbing penetrations, including those from water piping, drain waste and vent piping, HVAC piping, and gas line piping.
    b. Electrical penetrations, including those for receptacle outlets, lighting outlets / fixtures, communications wiring, thermostats, and smoke alarms.
    c. HVAC penetrations, including those for fans and for exhaust, supply, transfer, and return air ducts.
    d. Envelope penetrations, including at the intersection of baseboard trim and floor, at the intersection of walls and ceilings, around window trim and dwelling unit doors, including the door latch hole.
21. Window-to-Wall ratio is taken as the sum of all window area divided by the total exterior above-grade wall area. All decorative glass and skylight window area contribute to the total window area to above-grade wall ratio (WWR). Spandrel sections of curtain wall systems contribute to the above-grade wall area.
22. Functional Testing Agents must be a Certified Commissioning Professional (CCP), a Certified Building Commissioning Professional (CBCP), a Building Commissioning Professional (BCxP, formerly the Commissioning Process Management Professional (CPMP)), a NEBB Certified Technician (BSC CxCT) or Certified Professional (BSC CP or CxPP), a representative of the Original Equipment Manufacturer (OEM), or a contractor credentialed by an HVAC Quality Installation Training and Oversight Organization (H-QUITO), if not completing Sections 6 and higher. Functional Testing Agents may not be the installing contractor unless they are a credentialed contractor. An explanation of the credentialing process and links to H-QUITOs, which maintain lists of credentialed contractors, can be found at energystar.gov/credentialedhvac. A directory of other FT Agents can be found at energystar.gov/mfdirectory.

National Rater Field Checklist [1]
ENERGY STAR Multifamily New Construction Version 1 / 1.1

Project Name: _____ Number of Units: _____ Permit Date: _____

Project Address: _____ City: _____ State: _____

Thermal Enclosure System	Must Correct	Builder Verified [3]	Rater Verified [4]	N/A [5]
1. High-Performance Fenestration & Insulation				
1.1 Fenestration meets or exceeds specification in Items 2.1 and 2.2 of the Natl Rater Design Review Checklist	☐	☐	☐	-
1.2 Insulation meets or exceeds specification in Items 3.1 and 3.2 of the Natl Rater Design Review Checklist	☐	☐	☐	-
1.3 All insulation achieves Grade I install. per ANSI / RESNET / ICC Std. 301. Alternatives in Footnote 6. [6,7]	☐	☐	☐	-
1.4 Prescriptive Path: Window-to-wall ratio ≤ 30% [8]	☐	☐	☐	☐
1.5 Heated plenums in unconditioned space or ambient conditions must meet the following requirements: [9]				
1.5.1 Sides of plenum are an air barrier and insulated to ≥ R-3ci in CZ 1-4; ≥ R-5ci in CZ 5-6; ≥ R-7.5ci in CZ 7; ≥ R-9.5ci in CZ 8, AND;	☐	☐	☐	☐
1.5.2 Insulation at top of plenum meets or exceeds the R-value for mass floors from the "All Other" column of Table 502.2(1) of 2009 IECC, AND;	☐	☐	☐	☐
1.5.3 Bottom of plenum must have at least R-13 insulation [10]	☐	☐	☐	☐
1.6 Garages with space heating must meet the following requirements: [9]				
1.6.1 Insulation on above grade walls and walls on the first story below grade ≥ R-5ci in CZ 5-6; ≥ R-7.5ci in CZ 7; ≥ R-9.5ci in CZ 8, AND;	☐	☐	☐	☐
1.6.2 Garage ceiling insulation meets or exceeds the R-value for mass floors from the "All Other" column of Table 502.2(1) of 2009 IECC	☐	☐	☐	☐
2. Fully-Aligned Air Barriers [11] At each insulated location below, a complete air barrier is provided that is fully aligned as follows:				
Ceilings: At interior or exterior horizontal surface of ceiling insulation in Climate Zones 1-3; at interior horizontal surface of ceiling insulation in Climate Zones 4-8. Also, at exterior vertical surface of ceiling insulation in all climate zones (e.g., using a wind baffle that extends to the full height of the insulation in every bay or a tabbed baffle in each bay with a soffit vent that prevents wind washing in adjacent bays). [12]				
2.1 Dropped ceilings / soffits below unconditioned attics, chase / dead space, and all other ceilings	☐	☐	☐	☐
Walls: At exterior vertical surface of wall insulation in all climate zones; also at interior vertical surface of wall insulation in Climate Zones 4-8 [13]				
2.2 Walls behind showers, tubs, staircases, and fireplaces	☐	☐	☐	☐
2.3 Architectural bump-outs, dead space, and all other exterior walls	☐	☐	☐	-
Floors: At exterior vertical surface of floor insulation in all climate zones and, if over unconditioned space, also at interior horizontal surface including supports to ensure alignment. Alternatives in Footnotes 15 & 16. [14, 15, 16]				
2.4 Floors above garages, floors above unconditioned basements or crawlspaces, and cantilevered floors	☐	☐	☐	☐
2.5 All other floors adjoining unconditioned space (e.g., rim / band joists at exterior wall or at porch roof)	☐	☐	☐	☐
3. Reduced Thermal Bridging				
3.1 For insulated ceilings with attic space above (i.e., non-cathedralized), Grade I insulation extends to the inside face of the exterior wall below and is ≥ R-21 in CZ 1-5; ≥ R-30 in CZ 6-8 [17]	☐	☐	☐	☐
3.2 For insulated ceilings with attic space above, attic access panels and drop-down stairs insulated ≥ R-10 or equipped with durable ≥ R-10 cover [18]	☐	☐	☐	☐
3.3 Insulation beneath attic platforms (e.g., HVAC platforms, walkways) ≥ R-21 in CZ 1-5; ≥ R-30 in CZ 6-8	☐	☐	☐	☐
3.4 For slabs on grade in CZ 4-8, 100% of slab edge insulated to ≥ R-5 at the depth specified by Table 502.2(1) of the 2009 IECC and aligned with the thermal boundary of the walls [19, 20]	☐	☐	☐	☐
3.5 For elevated concrete slabs in CZ 4-8 (i.e., podiums and projected balconies, but not intermediate slab floor edges) 100% of the slab edge insulated to ≥ R-5. For podiums, insulation must be installed for the full height of the podium wall. Alternatives in Footnote 21 [21]	☐	☐	☐	☐
3.6 For elevated concrete slabs in CZ 4-8 (i.e., podiums, but not intermediate floor slabs), floor insulation meets the U-factor specified in Table 502.1.2 of the 2009 IECC for Group R when dwelling units are above the slab, and for 'All Other' when common space is above the slab [22]	☐	☐	☐	☐
3.7 At above-grade walls and rim / band joists separating conditioned from unconditioned space, one of the following options used: [23]				
3.7.1 Continuous rigid insulation, insulated siding, or combination of the two is: ≥ R-3 in CZ 1-4; ≥ R-5 in CZ 5-8 [24, 25, 26, 27], OR;	☐	☐	☐	☐
3.7.2 Structural Insulated Panels OR; Insulated Concrete Forms OR; Double-wall framing OR; [24, 28]	☐	☐	☐	☐
3.7.3 Option for CZ 1-3 OR buildings ≤ 3 stories: 'advanced framing' details including all of the items below: [29]				
3.7.3a Corners insulated ≥ R-6 to edge [30], AND;	☐	☐	☐	☐
3.7.3b Headers above windows & doors insulated ≥ R-3 for 2x4 framing or equivalent cavity width, and ≥ R-5 for all other assemblies (e.g., with 2x6 framing) [31], AND;	☐	☐	☐	☐
3.7.3c Interior / exterior wall intersections insulated to same R-value as rest of exterior wall [32]	☐	☐	☐	☐

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4. Air Sealing (Unless otherwise noted below, "sealed" indicates the use of caulk, foam, or equivalent material)	Must Correct	Builder Verified [3]	Rater Verified [4]	N/A [5]
The following items must be verified in dwelling units and common spaces to reduce air leakage to exterior, adjacent buildings, or unconditioned spaces.				
4.1 Ducts, flues, shafts, plumbing, piping, wiring, exhaust fans, & other penetrations to unconditioned space sealed, with blocking / flashing as needed	☐	☐	☐	-
4.2 Recessed lighting fixtures adjacent to unconditioned space ICAT labeled and gasketed. Also, if in insulated ceiling without attic above, exterior surface of fixture insulated to ≥ R-10 in CZ 4-8	☐	☐	☐	☐
4.3 Continuous top plate or blocking is at top of walls adjoining unconditioned space including at balloon-framed parapets, and sealed	☐	☐	☐	☐
4.4 Drywall sealed to top plate at all unconditioned attic / wall interfaces using caulk, foam, drywall adhesive (but not other construction adhesives), or equivalent material. Either apply sealant directly between drywall and top plate or to the seam between the two from the attic above	☐	☐	☐	☐
4.5 Rough opening around windows & exterior doors sealed [33]	☐	☐	☐	-
4.6 Assemblies that separate attached garages from occupiable space sealed and, also, an air barrier installed, sealed, and aligned with these assemblies	☐	☐	☐	☐
4.7 Doors adjacent to unconditioned space (e.g., attics, garages, basements) or ambient conditions made substantially air-tight with doorsweep and weatherstripping or equivalent gasket	☐	☐	☐	☐
4.8 Attic access panels, roof hatches and drop-down stairs are gasketed (i.e., not caulked) or equipped with durable covers that are gasketed [18]	☐	☐	☐	☐
The following items must be additionally verified in dwelling units, to reduce air leakage between conditioned spaces.				
4.9 Doors serving as a unit entrance from a corridor/stairwell made substantially air-tight with doorsweep and weatherstripping or equivalent gasket	☐	☐	☐	☐
4.10 Rater-measured compartmentalization is no greater than 0.30 CFM50 per square feet of dwelling unit enclosure area, following procedures in ANSI / RESNET / ICC Std. 380	☐	-	☐	☐
4.10.1 For dwelling units with forced air distribution systems without ducted returns and located in a closet adjacent to unconditioned space, the Rater-measured pressure difference between the space containing the air handler and the conditioned space during the compartmentalization test is no greater than 5 Pa [34]	☐	-	☐	☐
HVAC System [35]		**Must Correct**	**Rater Verified [4]**	**N/A [5]**
5. Heating & Cooling Equipment				
5.1 HVAC manufacturer & model number on installed equipment matches either of the following (check box): [36] ☐ National HVAC Design Report ☐ Written approval received from designer		☐	☐	☐
5.2 Prescriptive Path: Heating and cooling equipment serving dwelling units and common spaces meet the efficiency levels specified in the Exhibit X. Electric resistance heating is not installed in dwelling units		☐	☐	☐
5.3 ERI Path: Heating and cooling equipment serving common spaces, but <u>not</u> serving dwelling units, meet the efficiency levels specified in the Exhibit X. See Exhibit X for restrictions on electric resistance heating		☐	☐	☐
5.4 External static pressure measured by Rater at contractor-provided test locations and documented below: [37] Return-Side External Static Pressure: _____ IWC Supply-Side External Static Pressure: _____ IWC		☐	☐	☐
5.5 National HVAC Functional Testing Checklist(s) collected prior to certification, with all HVAC systems in the building / project fully documented. Exception: Where credentialed HVAC Contractor(s) are completing the National HVAC Functional Testing Checklist, the checklist is not required to be collected [38]		☐	☐	☐
5.6 Rater has verified that Functional Testing Agent(s) ("FT Agent(s)") hold credentials required to complete the National HVAC Functional Testing Checklist, and are listed on the appropriate online directory [38] Credential: _____ FT Agent Company Name(s): _____		☐	☐	☐

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Equipment Controls	Must Correct	LP Verified [39]	Rater Verified [4]	N/A [5]
5.7 All heating and cooling systems serving a dwelling unit have thermostatic controls within the dwelling unit which are not located on exterior walls	☐	-	☐	☐
5.7.1 Prescriptive Path: Dwelling unit thermostats are programmable	☐	-	☐	☐
5.8 Stair and elevator shaft vents equipped with motorized dampers that are capable of being automatically closed during normal building operation and are interlocked to open as required by fire and smoke detection systems. Dampers are verified to be closed at the time of inspection	☐	☐	☐	☐
5.9 Freeze protection systems, such as heat tracing of piping and heat exchangers, including self-regulating heat tracing, and garage / plenum heaters include automatic controls that are verified to shut off the systems when pipe wall or garage / plenum temperatures are above 40°F	☐	☐	☐	☐
5.9.1 Where heat tracing is specified for freeze-protection, controls must be based on pipe wall temperature and a minimum of R-3 pipe insulation is also required	☐	☐	☐	☐
5.10 Snow- and ice-melting systems include automatic controls that are verified to shut off the systems when the pavement temperature is above 50°F and no precipitation is falling, and an automatic or manual control is installed that is verified to shut off system when the outdoor temperature is above 40°F, so that the potential for snow or ice accumulation is negligible	☐	☐	☐	☐
Hydronic Distribution				
5.11 For hydronic distribution systems, all terminal heating and cooling distribution equipment are separated from the riser or distribution loop by a control valve or terminal distribution pump, so that heated or cooled fluid is not delivered to the dwelling unit distribution equipment when there is no call from the thermostat	☐	☐	☐	☐
5.12 Terminal units in hydronic distribution systems are equipped with pressure independent balancing valves or pressure independent control valves	☐	☐	☐	☐
5.13 Piping of a heating or cooling system is insulated in accordance with Item 4.40 on the National HVAC Design Report, including where passing through planks or any other penetrations	☐	☐	☐	☐
5.14 For circulating pumps serving hydronic heating or cooling systems with three-phase motors, 1 horse-power or larger, motors meet or exceed efficiency standards for NEMA Premium™ motors. If 5 horse-power or larger, also specified with variable frequency drives	☐	☐	☐	☐
6. Duct Quality Installation - *Applies to Heating, Cooling, Ventilation, Exhaust, & Pressure Balancing Ducts, Unless Noted in Footnote*	**Must Correct**		**Rater Verified [4]**	**N/A [5]**
6.1 Ductwork installed without kinks, sharp bends, compressions, or excessive coiled flexible ductwork [40]	☐		☐	☐
6.2 Bedrooms with a design supply airflow ≥ 150 CFM (per Item 5.2 on the National HVAC Design Report) pressure-balanced (e.g., using transfer grilles, jump ducts, dedicated return ducts, undercut doors) to achieve a Rater-measured pressure differential ≥ -5 Pa and ≤ +5 Pa with respect to the main body of the dwelling unit when all air handlers are operating. See Footnote 41 for test configuration [41]	☐		☐	☐
6.3 All supply and return ducts in unconditioned space, including connections to trunk ducts, are insulated to ≥ R-6 [42]	☐		☐	☐
6.3.1 Prescriptive Path: Dwelling unit ductwork meets the location and insulation requirements specified in the ENERGY STAR Multifamily Reference Design	☐		☐	☐
6.4 Rater-measured total duct leakage in dwelling units meets one of the following two options: [43]				
6.4.1 Rough-in: Tested per allowances below, with air handler & all ducts, building cavities used as ducts, & duct boots installed. In addition, all duct boots sealed to finished surface, Rater-verified at final [44] No ducted returns [34]: The greater of ≤ 3 CFM25 per 100 sq. ft. of CFA or ≤ 30 CFM. Additionally, the Rater-measured pressure difference between the space containing the air handler and the conditioned space, with the air handler running at high speed, is ≤ 5 Pa. For systems > 1 ton, increase by 1 Pa per half ton One or two ducted returns [34]: The greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM Three or more ducted returns [34]: The greater of ≤ 6 CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM	☐		☐	☐
6.4.2 Final: Tested per allowances below, with the air handler & all ducts, building cavities used as ducts, duct boots, & register grilles atop the finished surface (e.g., drywall, floor) installed [45] No ducted returns [34]: The greater of ≤ 6 CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM. Additionally, the Rater-measured pressure difference between the space containing the air handler and the conditioned space, with the air handler running at high speed, is ≤ 5 Pa. For systems > 1 ton, increase by 1 Pa per half ton One or two ducted returns [34]: The greater of ≤ 8 CFM25 per 100 sq. ft. of CFA or ≤ 80 CFM Three or more ducted returns [34]: The greater of ≤ 12 CFM25 per 100 sq. ft. of CFA or ≤ 120 CFM	☐		☐	☐
6.5 Townhouses only: Rater-measured duct leakage to outdoors the greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25 [43, 46]	☐		☐	☐
6.6 Common Space: Supply, return, and exhaust ductwork and all plenums are sealed at all transverse joints, longitudinal seams, and duct wall penetrations with mastic or mastic tape	☐		☐	☐
6.7 Central exhaust systems that serve four or more dwelling units tested for duct leakage, where the leakage at rough-in (e.g., including trunks, branches, and take-offs) does not exceed 25% of exhaust fan flow or 30% of exhaust fan flow at final (e.g., inclusive of all ductwork between the fan and the grilles) [47]	☐		☐	☐

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7. Dwelling-Unit & Common Space Mechanical Ventilation System (National HVAC Design Report Item # indicated in parenthesis)	Must Correct	Rater Verified [4]	N/A [5]
7.1 Ventilation manufacturer & model number on installed equipment matches either of the following (check box): [36] ☐ National HVAC Design Report ☐ Written approval received from designer	☐	☐	-
7.2 Rater-measured ventilation rate is within either ± 15 CFM or ±15% of dwelling unit design values (2.7) [48]	☐	☐	-
7.3 Measured ventilation rate is within either ± 15 CFM or ±15% of common space design values (2.9) [49]	☐	☐	-
7.4 No outdoor air intakes connected to return side of the dwelling unit HVAC system, unless controls are installed to operate intermittently & automatically based on a timer and to restrict intake when not in use (e.g., motorized damper)	☐	☐	-
7.5 If located in the dwelling unit, system fan rated ≤ 3 sones if intermittent, ≤ 2 sones if continuous, or exempted [50]	☐	☐	-
7.6 If system utilizes the dwelling unit HVAC fan, then the specified fan type is ECM / ICM (4.12), or the controls will reduce the standalone ventilation run-time by accounting for hours when the HVAC system is heating or cooling	☐	☐	☐
7.7 In-unit bathroom fans or in-line fans are ENERGY STAR certified if used as part of the dwelling-unit mechanical ventilation system [51]	☐	☐	☐
7.8 If central exhaust fans, ≤ 1 HP, are specified as part of the dwelling-unit mechanical ventilation system, then they are direct-drive, ECM, with variable speed controllers. If > 1 HP, they are specified with NEMA™ Premium Motors	☐	☐	☐
7.9 Air inlet locations (Complete if ventilation air inlet locations were specified (2.22, 2.23); otherwise check "N/A"): [52, 53]	-	-	☐
7.9.1 Inlet(s) pull ventilation air directly from outdoors and not from attic, crawlspace, garage, or adjacent dwelling unit	☐	☐	-
7.9.2 Inlet(s) are ≥ 2 ft. above grade or roof deck; ≥ 10 ft. of stretched-string distance from known contamination sources (e.g., stack, vent, exhaust, vehicles) not exiting the roof, and ≥ 3 ft. distance from dryer exhausts and sources exiting the roof	☐	☐	-

8. Local Mechanical Exhaust (National HVAC Design Report Item # indicated in parenthesis)

Dwelling Unit Mechanical exhaust - In each dwelling unit kitchen and bathroom, a system is installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow and manufacturer-rated sound level standards: [46, 54]

Location		Continuous Rate	Intermittent Rate [55]	Must Correct	Rater Verified [4]	N/A [5]
8.1 Kitchen	Airflow	≥ 5 ACH, based on kitchen volume [56, 57]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [56, 57, 58]	☐	☐	-
	Sound	Recommended: ≤ 1 sone	Recommended: ≤ 3 sones			
8.2 Bathroom	Airflow	≥ 20 CFM	≥ 50 CFM	☐	☐	-
	Sound	Required: ≤ 2 sones	Recommended: ≤ 3 sones			

Common Space [2] Mechanical Exhaust			
8.3 Measured ventilation rate is within either ± 15 CFM or ±15% of design values (2c) [48]	☐	☐	☐
8.4 Parking garage exhaust ventilation system is equipped with controls that sense CO and NO2	☐	☐	☐
9. Filtration			
9.1 At least one MERV 6 or higher filter installed in each dwelling unit ducted mechanical system serving an individual dwelling unit in a location that facilitates access and regular service by the occupant or building owner [60]	☐	☐	☐
9.1.1 Filter access panel includes gasket or comparable sealing mechanism and fits snugly against the exposed edge of filter when closed to prevent bypass [61]	☐	☐	☐
9.1.2 All return air and mechanically supplied outdoor air passes through filter prior to conditioning	☐	☐	☐
10. Combustion Appliances			
10.1 Furnaces, boilers, and water heaters located within the building's pressure boundary are mechanically drafted or direct-vented. If mechanically drafted, the minimum volume of combustion air required for safe operation by the manufacturer and/or code shall be met or exceeded and make-up air sources must be mechanically closed when the combustion appliance is not in operation. Alternatives in Footnote 63 [61, 62, 63]	☐	☐	☐
10.2 Fireplaces located within the building's pressure boundary are direct-vented [61, 62]	☐	☐	☐
10.3 No unvented combustion appliances other than cooking ranges or ovens are located inside the building's pressure boundary. For cooking ranges and ovens, local mechanical exhaust per Checklist Item 8.1 requirements must be met [61]	☐	☐	☐

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Other	Must Correct	LP Verified [39]	Rater Verified [4]	N/A [5]
11. Domestic Hot Water				
11.1 Prescriptive Path: Hot water equipment rated in EF or UEF meet the efficiency levels specified in the ENERGY STAR Multifamily Reference Design. Boilers providing hot water are ≥85% Et [64]	☐	-	☐	☐
11.2 ERI: Hot water equipment rated in EF or UEF serving common spaces but not dwelling units nor shared laundry meet the efficiency levels specified in the ENERGY STAR Multifamily Reference Design. Boilers providing hot water are ≥85% Et [64]	☐	-	☐	☐
11.3 For in-unit storage water heaters, AHRI Certificate confirms the presence of a heat trap	☐	-	☐	☐
11.4 DHW piping is insulated with a minimum of R-3 [65]	☐	☐	☐	-
11.5 Rater-measured delivery temperatures at faucets and showerheads do not exceed 125°F [66]	☐	-	☐	-
12. Lighting				
12.1 Common Space [2] Lighting Controls:				
12.1.1 ERI and Prescriptive Path: All common spaces [2] (including parking garages), except the building lobby and where automatic shutoff would endanger the safety of occupants, have occupancy sensors or automatic bi-level lighting controls installed and operation has been verified	☐	☐	☐	☐
12.1.2 ASHRAE path only: All common spaces [2] (including parking garages), except the building lobby, corridors, and stairwells and where automatic shutoff would endanger the safety of occupants, have occupancy sensors or automatic bi-level lighting controls installed and operation has been verified	☐	☐	☐	☐
12.2 Common Space [2] Lighting Power Density Maximum (except parking garages): [67]				
12.2.1 ERI and Prescriptive Path: Total specified lighting power for the combined common spaces [2] must not exceed ASHRAE 90.1-2007 allowances for those combined spaces, using the Space-by-Space or Building Area Method. See Footnote 68 for allowances [68]	☐	☐	☐	☐
12.2.2 ASHRAE path only: Total specified lighting power for the combined common spaces [2] must not exceed ASHRAE 90.1-2007 allowances for those combined spaces, using the Space-by-Space or Building Area Method, by more than 20%. See Footnote 68 for allowances [68]	☐	☐	☐	☐
12.3 Parking garages: Lighting power density does not exceed 0.24 W/ft²	☐	☐	☐	☐
12.4 Exterior lighting controls: Fixtures, including parking lot fixtures, must include automatic switching on timers or photocell controls except fixtures intended for 24-hour operation, required for security, or located on dwelling unit balconies	☐	☐	☐	☐
12.5 ERI Path: All exterior and common space lighting fixtures meet the efficiency requirements in the ENERGY STAR Multifamily Reference Design, except fixtures located on dwelling unit balconies [69, 70]	☐	-	☐	☐
12.6 Prescriptive Path: All lighting fixtures (i.e., dwelling units, common spaces, and exterior) meet the efficiency requirements in the ENERGY STAR Multifamily Reference Design [69, 70]	☐	-	☐	☐
12.7 Prescriptive Path: Dwelling unit overall in-unit lighting power density ≤ 0.75 W/ft². When calculating overall lighting power density, use 1.1 W/ft² where lighting is not installed [67]	☐	-	☐	☐
13. Appliances, Ceiling Fans, and Plumbing Fixtures		**Must Correct**	**Rater Verified [4]**	**N/A [5]**
13.1 Prescriptive Path: Specified appliances, ceiling fans, and plumbing fixtures in dwelling units and common spaces meet the criteria in the ENERGY STAR Multifamily Reference Design [71]		☐	☐	☐
13.2 ERI Path: Specified appliances, ceiling fans, and plumbing fixtures in common spaces, and not included in the ERI model, meet the criteria in the ENERGY STAR Multifamily Reference Design [71]		☐	☐	☐
13.3 Prescriptive Path: Shower compartments with multiple fixtures cannot be operated simultaneously OR the average flow rate per shower compartment must not exceed 1.75 gallons per minute, as rated at 80 psi		☐	☐	☐
14. Whole Building Energy Consumption Data Acquisition Strategy				
14.1 For buildings 50,000 ft² and larger, a strategy that enables the collection of monthly or annual building-level energy consumption data (electricity, natural gas, chilled water, steam, fuel oil, propane, etc.) has been confirmed [72]		☐	☐	☐

Rater Name: _____ Rater Pre-Drywall Inspection Date(s): _____ Rater Initials: _____

Rater Company Name: _____

Rater Name: _____ Rater Final Inspection Date(s): _____ Rater Initials: _____

Rater Company Name: _____

Builder/Developer Employee: _____ Builder Inspection Date(s): _____ Builder Initials: _____

Builder/Developer Name: _____

Licensed Professional: _____ LP Inspection Date(s): _____ LP Initials: _____

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Footnotes:

1. This Checklist applies to all dwelling units, sleeping units, most common spaces [2] on the property, and parking lots. This Checklist does not apply to commercial or retail spaces. This Checklist does not apply to common spaces [2] that are located in buildings on the property without any dwelling or sleeping units. The term 'sleeping unit' refers to a room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Where the term 'dwelling unit' is used in this Checklist, the requirement is also required of 'sleeping' units. The term 'building' refers to a structure utilized or intended for supporting or sheltering occupancy for a residential purpose; a structure with no dwelling or sleeping units connected to a structure with dwelling or sleeping units by less than 10% of its exterior wall area is not to be included in the 'building'.
2. The term 'common space' refers to any spaces on the property that serve a function in support of the residential part of the building that is not part of a dwelling or sleeping unit. This includes spaces used by residents, such as corridors, stairs, lobbies, laundry rooms, exercise rooms, residential recreation rooms, or parking garages used exclusively by residents, building staff, and their guests. This also includes offices used by building management, administration or maintenance and all special use areas located on the property to serve and support the residents such as day-care facilities, gyms, dining halls, etc.
3. At the discretion of the Rater, the builder or developer may verify up to eight items in Sections 1-4 of this Checklist. For the purpose of this Checklist, "Builder" represents either the builder or the developer. When exercised, the builder's responsibility will be formally acknowledged by the builder, or their designated agent, signing off on the checklist for the item(s) that they verified. However, if a quality assurance review indicates that items have not been successfully completed, the Rater will be responsible for facilitating corrective action.
4. The term 'Rater' refers to the person completing the third-party inspections required for certification. This person shall: a) be a Certified Rater, Approved Inspector, or an equivalent designation as determined by a "Multifamily Oversight Organization" and, b) have attended and successfully completed an EPA-recognized training class. See energystar.gov/mftraining.
5. The column titled "N/A," which denotes items that are "not applicable," should be used when the checklist item is not present in the project or conflicts with local requirements.
6. Two alternatives are provided: a) Grade II cavity insulation is permitted to be used for assemblies that contain a layer of continuous, air impermeable insulation ≥ R-3 in Climate Zones 1 to 4, ≥ R-5 in Climate Zones 5 to 8; b) Grade II batts are permitted to be used in floors if they fill the full width and depth of the floor cavity, even when compression occurs due to excess insulation, as long as the R-value of the batts has been appropriately assessed based on manufacturer guidance and the only defect preventing the insulation from achieving Grade I is the compression caused by the excess insulation.
7. Ensure compliance with this requirement using the version of ANSI / RESNET / ICC Std. 301 utilized by RESNET for HERS ratings.
8. Window-to-Wall ratio is taken as the sum of all window area divided by the total exterior above-grade wall area. All decorative glass and skylight window area contribute to the total window area to above-grade wall ratio (WWR). Spandrel sections of curtain wall systems contribute to the above-grade wall area.
9. Compliance with Items 1.5 and 1.6 is not required for ASHRAE projects, but the energy used by the heating systems must be modeled following the requirements in the Simulation Guidelines, available at energystar.gov/mfguidance.
10. The bottom of the plenum is permitted to be suspended ceiling tiles or other non-air barrier material. If fiberglass insulation is installed, it must be paper-faced.
11. For purposes of this Checklist, an air barrier is defined as any durable solid material that blocks air flow between conditioned space and unconditioned space, including necessary sealing to block excessive air flow at edges and seams and adequate support to resist positive and negative pressures without displacement or damage. EPA recommends, but does not require, rigid air barriers.

    Open-cell or closed-cell foam shall have a finished thickness ≥ 5.5 in. or 1.5 in., respectively, to qualify as an air barrier unless the manufacturer indicates otherwise.

    If flexible air barriers such as house wrap are used, they shall be fully sealed at all seams and edges and supported using fasteners with caps or heads ≥ 1 in. diameter unless otherwise indicated by the manufacturer. Flexible air barriers shall not be made of kraft paper, paper-based products, or other materials that are easily torn. If polyethylene is used, its thickness shall be ≥ 6 mil.
12. All insulated ceiling surfaces, regardless of slope (e.g., cathedral ceilings, tray ceilings, conditioned attic roof decks, flat ceilings, sloped ceilings), must meet the requirements for ceilings, unless the ceiling is adiabatic.
13. All insulated vertical surfaces are considered walls (e.g., above and below grade exterior walls, knee walls) and must meet the air barrier requirements for walls. The following exceptions apply: air barriers recommended, but not required, in adiabatic walls; and, in Climate Zones 4 through 8, an air barrier at the interior vertical surface of insulation is recommended but not required in basement walls or crawlspace walls. For the purpose of these exceptions, a basement or crawlspace is a space for which ≥ 40% of the total gross wall area is below-grade.
14. EPA highly recommends, but does not require, an air barrier at the interior vertical surface of floor insulation in Climate Zones 4-8.
15. Examples of supports necessary for permanent contact include staves for batt insulation or netting for blown-in insulation. Alternatively, supports are not required if batts fill the full depth of the floor cavity, even when compression occurs due to excess insulation, as long as the R-value of the batts has been appropriately assessed based on manufacturer guidance and the only defect preventing the insulation from achieving the required installation grade is the compression caused by the excess insulation.
16. Alternatively, an air barrier is permitted to be installed at the exterior horizontal surface of the floor insulation if the insulation is installed in contact with this air barrier, the exterior vertical surfaces of the floor cavity are also insulated, and air barriers are included at the exterior vertical surfaces of this insulation.
17. The minimum designated R-values must be achieved regardless of the trade-offs determined using an equivalent U-factor or UA alternative calculation.

    Note that if the minimum designated values are used, then higher insulation values may be needed elsewhere to meet Item 1.2. Also, note that these requirements can be met by using any available strategy, such as a raised-heel truss, alternate framing that provides adequate space, and / or high-density insulation.

18. Examples of durable covers include, but are not limited to, pre-fabricated covers with integral insulation, rigid foam adhered to cover with adhesive, or batt insulation mechanically fastened to the cover (e.g., using bolts, metal wire, or metal strapping. Low-slope roof hatch covers to be insulated to R-5 minimum.
19. Consistent with the 2009 IECC, slab edge insulation is only required for slab-on-grade floors with a floor surface less than 24 inches below grade. Slab-on-grade perimeter insulation shall extend to the top of the slab to provide a complete thermal break. If the top edge of the insulation is installed between the exterior wall and the edge of the interior slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall. Alternatively, the thermal break is permitted to be created using ≥ R-3 rigid insulation on top of an existing slab (e.g., in a building undergoing a gut rehabilitation). In such cases, up to 10% of the slab surface is permitted to not be insulated (e.g., for sleepers, for sill plates). Insulation installed on top of slab shall be covered by a durable floor surface (e.g., hardwood, tile, carpet).
20. Where an insulated wall separates a garage, patio, porch, or other unconditioned space from the conditioned space of the building, slab perimeter insulation shall also be installed at this interface to provide a thermal break between the conditioned and unconditioned slab, if the slab is in contact with the ground at that interface. Where specific details cannot meet this requirement, partners shall provide the detail to EPA to request an exemption prior to the building's certification. EPA will compile exempted details and work with industry to develop feasible details for use in future revisions to the program. A list of currently exempted details is available at: energystar.gov/slabedge.
21. For projected balconies, install a minimum of R-5 slab edge insulation to provide a thermal break between conditioned space and the unconditioned projected balcony slab. Alternatively, a UA calculation for the wall assembly that accounts for this uninsulated projected slab must be performed to demonstrate compliance with Item 1.2. For the purpose of this UA calculation, the area of the wall that is uninsulated due to the projected balcony is required to be calculated as 400% of that actual area. For example, for a projected balcony that is 20 feet wide, and has a thickness of 1 foot, the area to be used in the UA calculation is 80 ft^2 instead of 20 ft^2. The distance the balcony projects from the building is not used in this calculation.
22. Whether insulating from above or below the slab, thermal breaks must be accounted for when determining compliance with floor U-factors. Where structural columns cause a discontinuity in the installed floor insulation, the UA calculation for the floor assembly must account for this uninsulated area of the floor. For the purpose of this UA calculation, the area of the floor that is uninsulated due to the structural columns is required to be calculated as 400% of that actual area. For example, for a 4'x4' column, the area to be used in the UA calculation is 64 ft^2 instead of 16 ft^2. The height of the column is not used in this calculation. Alternatively, if the structural column is insulated for a minimum of 4 vertical feet, the modification to the UA calculation is not required, and the U-value of the column insulation shall be associated with the uninsulated area of the floor due to the column.
23. Item 3.7 is applicable to walls that are adjacent to other buildings or adjacent to unconditioned spaces within the building. Mass walls utilized as the thermal mass component of a passive solar design (e.g., a Trombe wall) are exempt from this item. To be eligible for this exemption, the passive solar design shall be comprised of the following five components: an aperture or collector, an absorber, thermal mass, a distribution system, and a control system. For more information, see: energy.gov/sites/prod/files/guide_to_passive_solar_home_design.pdf.

    Mass walls that are not part of a passive solar design (e.g., CMU block or log home enclosure) shall either utilize the strategies outlined in Item 3.7 or the pathway in the assembly with the least thermal resistance, as determined using a method consistent with the 2013 ASHRAE Handbook of Fundamentals, shall provide ≥ 50% of the applicable assembly resistance, defined as the reciprocal of the mass wall equivalent U-factor in the 2009 IECC Table 502.1.2. Documentation identifying the pathway with the least thermal resistance and its resistance value shall be collected by the Rater and any Builder Verified or Rater Verified box under Item 3.7 shall be checked.
24. Up to 10% of the total exterior wall surface area is exempted from the reduced thermal bridging requirements to accommodate intentional designed details (e.g., architectural details such as thermal fins, wing walls, brick returns, stone window sills, metal panels, or masonry fireplaces; structural details, such as fasteners (e.g., shelf angles, metal clips, z-girts, brick ties), projected balconies, and service openings (e.g., PTACs), but not steel columns or wall area occupied by intermediate floors). It shall be apparent to the Rater that the exempted areas are intentional designed details or the exempted area shall be documented in a plan provided by the builder, architect, or engineer. The entire area of the wall area that is bypassed by the fastener must be used in the calculation. The Rater need not evaluate the necessity of the designed detail to certify the project.
25. If used, insulated siding shall be attached directly over a water-resistive barrier and sheathing. In addition, it shall provide the required R-value as demonstrated through either testing in accordance with ASTM C 1363 or by attaining the required R-value at its minimum thickness. Insulated sheathing rated for water protection can be used as a water resistant barrier if all seams are taped and sealed. If non-insulated structural sheathing is used at corners, the advanced framing details listed in Item 3.7.3 shall be met for those wall sections.
26. Steel framing shall meet the reduced thermal bridging requirements by complying with Item 3.7.1 of the Checklist.
27. In a building undergoing a gut rehabilitation, continuous interior insulation may be used in lieu of continuous exterior rigid insulation or insulated siding.
28. Double-wall framing is defined as any framing method that ensures a continuous layer of insulation covering the studs to at least the R-value required in Item 3.7.1 of the Checklist, such as offset double-stud walls, aligned double-stud walls with continuous insulation between the adjacent stud faces, or single-stud walls with 2x2 or 2x3 cross-framing. In all cases, insulation shall fill the entire wall cavity from the interior to exterior sheathing except at windows, doors and other penetrations.
29. Rim / band joists are exempt from this requirement. All 'advanced framing' details shall be met except where the builder, architect, or engineer provides a framing plan that encompasses the details in question, indicating that structural members are required at these locations and including the rationale for these members (e.g., full-depth solid framing is required at wall corners or interior / exterior wall intersections for shear strength, a full-depth solid header is required above a window to transfer load to jacks studs, additional jack studs are required to support transferred loads, additional cripple studs are required to maintain on-center spacing, or stud spacing must be reduced to support multiple stories in a multifamily building). The Rater shall retain a copy of the detail and rationale for their records, but need not evaluate the rationale to certify the building.
30. All exterior corners shall be constructed to allow access for the installation of ≥ R-6 insulation that extends to the exterior wall sheathing. Examples of compliance options include standard-density insulation with alternative framing techniques, such as using three studs per corner, or high-density insulation (e.g., spray foam) with standard framing techniques.
31. Compliance options include continuous rigid insulation sheathing, SIP headers, other prefabricated insulated headers, single-member or two-member headers with insulation either in between or on one side, or an equivalent assembly. R-value requirement refers to manufacturer's nominal insulation value.

32. Insulation shall run behind interior / exterior wall intersections using ladder blocking, full length 2x6 or 1x6 furring behind the first partition stud, drywall clips, or other equivalent alternative.
33. In Climate Zones 1 through 3, a continuous stucco cladding system sealed to windows and doors is permitted to be used in lieu of sealing rough openings with caulk or foam.
34. A 'ducted return' is defined as a continuous duct made of sheet metal, duct board, or flexible duct that connects one or more return grilles to the return-side inlet of the air handler. Any other approach to convey air from return or transfer grille(s) to the air handler, such as the use of building cavities, does not constitute a 'ducted return'.
35. This section of the Checklist is designed to meet the requirements of ASHRAE 62.1-2010 / 2013, ASHRAE 62.2-2010 / 2013, and ANSI / ACCA's 5 QI-2015 protocol, thereby improving the performance of HVAC equipment in new multifamily buildings when compared to multifamily buildings built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems, (e.g., those caused by a lack of maintenance or by occupant behavior). Therefore, this Checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.
36. If installed equipment does not match the National HVAC Design Report, then prior to certification the Rater shall obtain written approval from the designer (e.g., email, updated National HVAC Design Report) confirming that the installed equipment meets the requirements of the National HVAC Design Report. In cases where the condenser unit is installed after the time of inspection by the Rater, the HVAC manufacturer and model numbers on installed equipment can be documented through the use of photographs provided by the Functional Testing Agent after installation is complete.
37. The Rater shall measure and record the external static pressure in the return-side and supply-side of the system using the contractor-provided test locations. However, at this time, the Rater need not assess whether these values are within a specific range to certify the dwelling unit.
38. Functional Testing Agents must be a Certified Commissioning Professional (CCP), a Certified Building Commissioning Professional (CBCP), a Building Commissioning Professional (BCxP, formerly the Commissioning Process Management Professional (CPMP)), a NEBB Certified Technician (BSC CxCT) or Certified Professional (BSC CP or CxPP), a representative of the Original Equipment Manufacturer (OEM), or a contractor credentialed by an HVAC Quality Installation Training and Oversight Organization (H-QUITO), if not completing Sections 6 and higher. Functional Testing Agents may not be the installing contractor unless they are a credentialed contractor. An explanation of the credentialing process and links to H-QUITOs, which maintain lists of credentialed contractors, can be found at energystar.gov/credentialedhvac. A directory of other FT Agents can be found at energystar.gov/mfdirectory.
39. At the discretion of the Rater, a Licensed Professional (LP), (i.e., a Registered Architect or Professional Engineer in good standing and with a current license), may verify any of the items in Sections 5, 11, and 12 of this Checklist, where a checkbox is provided for "LP Verified". When exercised, the LP's responsibility will be formally acknowledged by the LP signing off on the checklist for the item(s) that they verified. However, if a quality assurance review indicates that items have not been successfully completed, the Rater will be responsible for facilitating corrective action.
40. Kinks are to be avoided and are caused when ducts are bent across sharp corners such as framing members. Sharp bends are to be avoided and occur when the radius of the turn in the duct is less than one duct diameter. Compression is to be avoided and occurs when flexible ducts in unconditioned space are installed in cavities smaller than the outer duct diameter and ducts in conditioned space are installed in cavities smaller than inner duct diameter. Ducts shall not include coils or loops except to the extent needed for acoustical control.
41. Item 6.2 does not apply to ventilation ducts, exhaust ducts, or non-ducted systems. For an HVAC system with a multi-speed fan, the highest design fan speed shall be used when verifying this requirement. When verifying this requirement, doors separating bedrooms from the main body of the dwelling unit (e.g., a door between a bedroom and a hallway) shall be closed and doors to rooms that can only be entered from the bedroom (e.g., a closet, a bathroom) shall be open. The Rater-measured pressure shall be rounded to the nearest whole number to assess compliance.
42. Item 6.3 does not apply to ducts that are a part of local mechanical exhaust or exhaust-only dwelling-unit mechanical ventilation systems. EPA recommends, but does not require, that all metal ductwork not encompassed by Section 6 (e.g., exhaust ducts, duct boots, ducts in conditioned space) also be insulated and that insulation be sealed to duct boots to prevent condensation.
43. Item 6.4 and 6.5 only apply to heating, cooling, and balanced ventilation ducts that only serve one dwelling unit. Duct leakage testing is not required if the ducts and air handler are in conditioned space and the total supply duct length of the system, including all supply trunks and branches, is ≤ 10 ft. Duct leakage shall be determined and documented by a Rater using the same version of ANSI / RESNET / ICC Std. 380 that is utilized by RESNET for HERS ratings. Leakage limits shall be assessed on a per-system, rather than per-dwelling unit, basis. For balanced ventilation ducts that are not connected to space heating or cooling systems, a Rater is permitted to visually verify, in lieu of duct leakage testing, that all seams and connections are sealed with mastic or metal tape and all duct boots are sealed to floor, wall, or ceiling using caulk, foam, or mastic tape.
44. Cabinets (e.g., kitchen, bath, multimedia) or ducts that connect duct boots to toe-kick registers are not required to be in place during the 'rough-in' test.
45. Registers atop carpets are permitted to be removed and the face of the duct boot temporarily sealed during testing. In such cases, the Rater shall visually verify that the boot has been durably sealed to the subfloor (e.g., using duct mastic or caulk) to prevent leakage during normal operation.
46. Testing of duct leakage to the outside can be waived if all ducts & air handling equipment are located within the townhouse's air and thermal barriers AND infiltration does not exceed the following: CZ 1-2: 3 ACH50; CZ 3-4: 2.5 ACH50; CZ 5-7: 2 ACH50; CZ 8: 1.5 ACH50. Alternatively, testing of duct leakage to outside can be waived if total duct leakage is ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25, whichever is larger.
47. Exhaust fan flow shall be the lesser of the rated fan flow and at rough-in, 133% of the sum of the design airflow of the dwelling units that are exhausted by that central fan or at final, 143% of the sum of the design airflow of the dwelling units that are exhausted by that central fan. Duct leakage shall be determined using the procedures in the *RESNET Guidelines for Multifamily Energy Ratings*. No less than 50% of the ductwork, based on total linear feet, shall be tested. Where portions of ductwork are tested, rather than entire risers, the percentage of leakage allowed is based upon the design airflow of the dwelling units that are exhausted in that portion. Where failures occur, the percentage

of total linear feet required to be tested increases by 10%. Where aerosol-based sealant is used on some but not all risers, the ductwork selected for testing must be representative of all sealing strategies used.

48. The dwelling-unit ventilation air flow and local exhaust air flows shall be determined and documented by a Rater using the same version of ANSI / RESNET / ICC Std. 380 that is utilized by RESNET for HERS ratings.
49. While common spaces are not under the scope of ANSI / RESNET / ICC Std. 380, the ventilation air flow and exhaust air flows in common spaces shall be measured in accordance with the procedures in ANSI / RESNET / ICC Std. 380. The air flows may be measured by a Rater or a certified air-balancing contractor under the observation of a Rater. Where a system provides supply air that is a mix of return and outdoor air, and not 100% outdoor air, the outdoor air intake airflow shall be measured and compared to the total supply airflow to determine percentage of outdoor air supplied. This percentage shall be applied to airflow measured at supply registers to determine outdoor air provided for comparison to design airflow rates.
50. Dwelling-unit mechanical ventilation fans shall be rated for sound at no less than the airflow rate in Item 2.7 of the National HVAC Design Report. Fans exempted from this requirement include HVAC air handler fans, remote-mounted fans, and intermittent fans rated ≥ 400 CFM. To be considered for this exemption, a remote-mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways and there shall be ≥ 4 ft. ductwork between the fan and intake grill. Per ASHRAE 62.2-2010, habitable spaces are intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms.
51. Bathroom fans with a rated flow rate ≥ 500 CFM are exempted from the requirement to be ENERGY STAR certified.
52. Ventilation air inlets that are only visible via rooftop access are exempted from Item 7.9 and the Rater shall mark "N/A". The outlet and inlet of balanced ventilation systems shall meet these spacing requirements unless manufacturer instructions indicate that a smaller distance may be used. However, if this occurs the manufacturer's instructions shall be collected for documentation purposes.
53. Without proper maintenance, ventilation air inlet screens often become filled with debris. Therefore, EPA recommends, but does not require, that these ventilation air inlets be located so as to facilitate access and regular service by the building owner.
54. Continuous bathroom local mechanical exhaust fans shall be rated for sound at no less than the airflow rate in Item 8.2. Intermittent bathroom and both intermittent and continuous kitchen local mechanical exhaust fans are recommended, but not required, to be rated for sound at no less than the airflow rate in Items 8.1 and 8.2. Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope (e.g., bath exhaust fans, range hoods, clothes dryers). Per ASHRAE 62.2-2010, a bathroom is any room containing a bathtub, shower, spa, or similar source of moisture.
55. An intermittent mechanical exhaust system, where provided, shall be designed to operate as needed by the occupant. Control devices shall not impede occupant control in intermittent systems.
56. Kitchen volume shall be determined by drawing the smallest possible rectangle on the floor plan that encompasses all cabinets, pantries, islands, peninsulas, ranges / ovens, and the kitchen exhaust fan, and multiplying by the average ceiling height for this area. In addition, the continuous kitchen exhaust rate shall be ≥ 25 CFM, per 2009 IRC Table M1507.3, regardless of the rate calculated using the kitchen volume. Cabinet volume shall be included in the kitchen volume.
57. Alternatively, the prescriptive duct sizing requirements in Table 5.3 of ASHRAE 62.2-2010 are permitted to be used for kitchen exhaust fans based upon the rated airflow of the fan at 0.25 IWC. If the rated airflow is unknown, ≥ 6 in. smooth duct shall be used, with a rectangular to round duct transition as needed. Guidance to assist partners with these alternatives is available at energystar.gov/newhomesresources. As an alternative to Item 8.1, dwelling units are permitted to use a continuous kitchen exhaust rate of 25 CFM per 2009 IRC Table M1507.3, if they are either a) PHIUS+ or PHI certified, or b) provide both dwelling-unit ventilation and local mechanical kitchen exhaust using a balanced system, and have a Rater-verified whole-building infiltration rate ≤ 0.05 CFM50 per sq. ft. of Enclosure Area, and a Rater-verified dwelling unit compartmentalization rate ≤ 0.30 CFM50 per sq. ft. of Enclosure Area if multiple dwelling units are present in the building. 'Enclosure Area' is defined as the area of the surfaces that bound the volume being pressurized / depressurized during the test.
58. All intermittent kitchen exhaust fans must be capable of exhausting at least 100 CFM. In addition, if the fan is not part of a vented range hood or appliance-range hood combination (i.e., if the fan is not integrated with the range), then it must also be capable of exhausting ≥ 5 ACH, based on the kitchen volume.
59. Based upon, ASHRAE 62.2-2010, ducted mechanical systems are those that supply air to an occupiable space with a total amount of supply ductwork exceeding 10 ft. in length and through a thermal conditioning component, except for evaporative coolers. Systems that do not meet this definition are exempt from this requirement. While filters are recommended for mini-split systems, HRV's, and ERV's, these systems, ducted or not, typically do not have MERV-rated filters available for use and are, therefore, also exempted under this version of the requirements. HVAC filters located in the attic shall be considered accessible to the occupant or building owner if either 1) drop-down stairs provide access to attic and a permanently installed walkway has been provided between the attic access location and the filter or 2) the filter location enables arm-length access from a portable ladder without the need to step into the attic and the ceiling height where access is provided is ≤ 12 ft.
60. The filter media box (i.e., the component in the HVAC system that houses the filter) may be either site-fabricated by the installer or pre-fabricated by the manufacturer to meet this requirement. These requirements only apply when the filter is installed in a filter media box located in the HVAC system, not when the filter is installed flush with the return grill.
61. The pressure boundary is the primary enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to outside than to conditioned space would be outside the pressure boundary.
62. Per the 2009 International Mechanical Code, a direct-vent appliance is one that is constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outside atmosphere; a mechanical draft system is a venting system designed to remove flue or vent gases by mechanical means consisting of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure; and a natural draft system is a venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.
63. Naturally drafted equipment is only allowed if located in a space outside the pressure boundary, where the envelope assemblies separating it from conditioned space are insulated and air-sealed.

64. Where water heater efficiency is rated in Uniform Energy Factor (UEF) rather than Energy Factor (EF), the EF may be calculated from the Uniform Energy Factor (UEF) using the RESNET EF Calculator 2017. The calculated EF must meet the efficiency levels specified in the ENERGY STAR Multifamily Reference Design.

65. In accordance with Section 7.4.3 of ASHRAE 90.1-2016, the following DHW piping requires insulation:
    a. Recirculating system piping, including the supply and return piping of a circulating tank type water heater.
    b. The first 8 feet of outlet piping of a constant-temperature nonrecirculating storage system.
    c. The first 8 feet of branch piping connecting to recirculated, heat-traced, or impedance heated piping.
    d. The inlet piping between the storage tank and a heat trap in a nonrecirculating storage system.
    e. Piping that is externally heated (such as heat trace or impedance heating.

66. To measure the delivery temperature, turn the hot water at a fixture completely on and place a digital thermometer in the stream of water. Observe the thermometer and when no additional rise in temperature occurs after 10 seconds, confirm this temperature does not exceed 125°F.

67. Senior housing projects can use the space-by-space allowances for 'facilities for the visually impaired' in ASHRAE 90.1-2016 Appendix G Table G3.7 for spaces used primarily by building residents. For example, 1.15 W/SF lighting power allowance may be used for the corridors in the baseline. To qualify for the increased allowance, the project must be designed to comply with the light levels in ANSI / IES RP-28 and must provide housing for seniors and/or people with special visual needs. Prescriptive Path dwelling unit overall in-unit lighting power density is permitted to be ≤ 1.3 W/SF, using 1.65 W/SF where lighting is not installed.

68. Lighting power density values from ASHRAE 90.1-2007 Section 9 for Space-by-Space Method for typical common spaces in multifamily properties are shown in the table below. Projects following the Building Area method, the lighting power density is 0.7 W/ft². For spaces not shown, refer to ASHRAE 90.1-2007 Section 9.

ASHRAE Space Type	Lighting Power Densities (W/ft²)	ASHRAE Space Type	Lighting Power Densities (W/ft²)	ASHRAE Space Type	Lighting Power Densities (W/ft²)
Lobby / Elevator	1.3	Corridor / Transition	0.5	Office	1.1
Active Storage (e.g., trash chute / room, janitor closet)	0.8	Stairs - Active	0.6	Lounge / Recreation / Community Room / Computer Room	1.2
Inactive Storage (e.g., tenant storage)	0.3	Restroom	0.9	Electrical / Mechanical	1.5
Exercise Area / Room	0.9	Laundry Room	1.3	Workshop	1.9

69. This requirement applies to exterior lighting fixtures that are attached to the building, but does not apply to landscape or parking lot lighting fixtures.

70. For Prescriptive Path dwelling units, ENERGY STAR certified fixtures or light bulbs are required; however, the Rater is only responsible for verifying that the installed lighting meets the Tier I or Tier II definition specified in ANSI / RESNET / ICC Std. 301. For locations outside the dwelling unit, as an alternative to ENERGY STAR certified fixtures or light bulbs, lighting that meets the Tier I or Tier II definition specified in ANSI / RESNET / ICC Std.301 is permitted.

71. Where an appliance type is not eligible for ENERGY STAR certification, (e.g., commercial dryers) the appliance is exempt from this requirement. Where a bathroom faucet or aerator is not eligible for WaterSense certification, (e.g., public use lavatory faucets) the fixture is exempt from this requirement.

72. Strategies include: an agreement with the utility companies to provide the aggregated building-level data, in a spreadsheet format or directly through Portfolio Manager; OR evidence that securing signed utility data release forms will be a mandatory component of all lease agreements; OR installation of a building-level energy monitor, data acquisition system, or utility-owned energy meter. If an energy monitor is installed, the builder shall provide the building operator with the manufacturer's documentation and operations manual. EPA recommends, but does not require, that one of these strategies also be implemented in buildings 25,000-49,999 ft².

National Rater Field Checklist Footnotes
ENERGY STAR Multifamily New Construction Version 1 / 1.1

Exhibit X – Prescriptive Minimum Heating and Cooling Equipment Efficiencies

Equipment Type	Minimum Efficiency
Room AC (window, through-wall, ductless mini-splits)	ENERGY STAR certified
Air conditioners, air cooled (<13 KBtu/h)	13 SEER
Air conditioners, air cooled (≥13 and <65 KBtu/h)	See Reference Design
Air conditioners, air cooled (≥65 and <240 KBtu/h)	11.5 EER/12.0 IEER
Air conditioners, air cooled (≥240 and < 760 KBtu/h)	10.0 EER/10.5 IEER
Electric resistance space heating	• Not permitted in any dwelling unit using the Prescriptive Path • Electric resistance heating specified in common spaces has a total heating capacity ≤ 12 kBtu/h (3.5 kW) per enclosed space and has automatic thermostatic controls
Warm-Air Furnace (<225 KBtu/h, common spaces)	78% AFUE or 80% Et
Warm-Air Furnace (<225 KBtu/h, dwelling units)	See Reference Design
Warm-Air Furnace (≥225 KBtu/h)	80% Et (gas) or 81% Et (oil)
Packaged Terminal Air Conditioner (PTAC)	13.8 – (0.300 X Cap/1000) EER
Packaged Terminal Heat Pump (PTHP)	Cooling: 14.0– (0.3 X Cap/1000) EER Heating: 3.7– (0.052 X Cap/1000) COP
Air cooled heat pump (≥13 and <65 KBtu/h)	See Reference Design
Air cooled heat pump (≥65 and <240 KBtu/h)	Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)
Air cooled heat pump (≥240 KBtu/h)	Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)
Water-source heat pump (<135 KBtu/h)	Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)
Boilers, hot water (<300,000 Btu/h)	See Reference Design
Boilers, hot water (≥300,000 Btu/h)	86% E_t (89% E_t if using heat pumps)
VRF Air Conditioners and Heat Pumps	See Tables 6.8.1I and 6.8.1J of ASHRAE 90.1-2010
Air-cooled chillers with or without condenser	10.0 EER / 12.5 IPLV
Water-cooled chiller, positive displacement (<75 tons)	0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)
Water-cooled chiller, positive displacement (75-150 tons)	0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)
Water-cooled chiller, positive displacement (150-300tons)	0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)
Water-cooled chiller, positive displacement (>300 tons)	0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)
Water-cooled, centrifugal (<300 tons)	0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)
Water-cooled, centrifugal (≥300 and <600 tons)	0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)
Water-cooled, centrifugal (≥600 tons)	0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)
Air-cooled absorption single effect chiller	0.6 COP
Water-cooled absorption single effect chiller	0.7 COP
Absorption double effect indirect-fired chiller	1.0 COP (Full load) / 1.05 COP (IPLV)
Absorption double effect direct-fired chiller	1.0 COP (Full load) / 1.00 COP (IPLV)
Open-loop propeller or axial fan cooling towers*	>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)
Closed-loop propeller or axial fan cooling towers*	>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)
Open-loop centrifugal fan cooling towers*	>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)
Closed-loop centrifugal fan cooling towers*	>8 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)

Cap means the rated capacity of the product in Btu/h. If < 7,000 Btu/h, use 7,000; if > 15,000, use 15,000 in calculation.

*Cooling tower fan motors must be equipped with VFD controlled by a temperature sensor on the condenser water supply pipe.

National HVAC Functional Testing Checklist [1]
ENERGY STAR Multifamily New Construction Version 1 / 1.1

HVAC Functional Testing Responsibilities:

- The entity performing Functional Testing Agent ("FT Agent") must either be a Certified Commissioning Professional (CCP), a Certified Building Commissioning Professional (CBCP), a Building Commissioning Professional (BCxP, formerly the Commissioning Process Management Professional (CPMP)), a NEBB Certified Technician (BSC CxCT) or Certified Professional (BSC CP or CxPP), or a representative of the Original Equipment Manufacturer (OEM) to complete this checklist. A contractor credentialed by an HVAC Quality Installation Training and Oversight organization (H-QUITO) is only permitted to complete Sections 1-5 of this checklist. [2]
- Functional Testing checklists must be completed and signed by an FT Agent. An FT Agent is permitted to complete just the specific sections of this checklist that pertain to their area of expertise. However, all applicable sections must be completed by an FT Agent. Multiple FT Agents may be needed for one project.
- Functional Testing checklists must include all HVAC systems in the building / project that serve the dwelling units or common spaces, but may exclude systems solely serving commercial / retail spaces. Multiple checklists will be needed to document all HVAC systems in the building / project. No items on the Functional Testing Checklist are permitted to be verified using a sampling protocol.
- The completed checklists, along with the corresponding National HVAC Design Report, shall be retained by the FT Agent for quality assurance purposes. Furthermore, if the FT Agent is not a credentialed contractor, they shall provide the completed and signed checklists to the builder / developer and the Rater [3] responsible for certifying the units / building, prior to the project's certification. Credentialed contractors shall provide the checklist upon request.

1. Functional Testing Overview

1.1 Company performing Functional Testing _____ FT Agent name _____ Date _____

1.2 If applicable, H-QUITO that your company is credentialed with and ID Number: ☐ ACCA ☐ Advanced Energy ID Number _____

1.3 Builder / developer client name: _____

1.4 Project address: _____ City: _____ State: _____ Zip code: _____

1.5 National HVAC Design Report corresponding to this project has been collected from designer or builder ☐

1.6 Checklist applies to the following equipment: _____

2. Refrigerant Charge - Run system for 15 minutes before testing. If outdoor ambient temperature at the condenser is ≤ 55°F or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle, then the system shall include a TXV, the outdoor temperature shall be recorded in Item 2.1, and the contractor shall check "N/A" in this Section. [4] This section must be completed for split air conditioners, unitary air conditioners, air-source heat pumps, and water-source (i.e., geothermal or water-loop) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts > 0 ft.), whether serving dwelling units or other common spaces in the building. All other permutations of refrigerant-based systems such as ducted or non-ducted mini-split / multi-split systems are exempt from this section. [5]			FT Agent Verified	N/A
2.1 Outdoor ambient temperature at condenser:	_____	°F DB	-	-
2.2 Return-side air temperature inside duct near evaporator, during cooling mode:	_____	°F WB	-	☐
2.3 Liquid line pressure:	_____	psig	-	☐
2.4 Liquid line temperature:	_____	°F DB	-	☐
2.5 Suction line pressure:	_____	psig	-	☐
2.6 Suction line temperature:	_____	°F DB	-	☐
For System with Thermal Expansion Valve (TXV):				
2.7 Condenser saturation temperature:	_____	°F DB (Using Item 2.3)	-	☐
2.8 Subcooling value:	_____	°F DB (Item 2.7 – Item 2.4)	-	☐
2.9 OEM subcooling goal:	_____	°F DB	-	☐
2.10 Subcooling deviation:	_____	°F DB (Item 2.8 – Item 2.9)	-	☐
For System with Fixed Orifice:				
2.11 Evaporator saturation temperature:	_____	°F DB (Using Item 2.5)	-	☐
2.12 Superheat value:	_____	°F DB (Item 2.6 – Item 2.11)	-	☐
2.13 OEM superheat goal:	_____	°F DB (Using superheat tables and Items 2.1 & 2.2)	-	☐
2.14 Superheat deviation:	_____	°F DB (Item 2.12 – Item 2.13)	-	☐
2.15 Item 2.10 is ± 3°F or Item 2.14 is ± 5°F			☐	☐
2.16 An OEM test procedure (e.g., as defined for a ground-source heat pump) has been used in place of the sub-cooling or super-heat process and documentation has been attached that defines this procedure			☐	☐

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3. Indoor HVAC Fan Airflow - This section must be completed for split air conditioners, unitary air conditioners, air-source heat pumps (including multi-splits), and water-source (i.e., geothermal or water-loop) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts) and to furnaces up to 225 kBtuh with forced-air distribution systems (i.e., ducts > 0 ft). whether serving dwelling units or other common spaces in the building. Mini-splits, ducted or non-ducted, are exempt, however multi-split systems such as central VRF systems, where indoor HVAC fans with forced-air distribution are connected to a shared outdoor unit that exceeds 65 kBtuh, are not exempt [5]

3.1 The mode with the higher design HVAC fan airflow used, per Item 5.2 of National HVAC Design Report: ☐ Heating ☐ Cooling	☐	-
3.2 Static pressure test holes have been created, and test hole locations are well-marked and accessible	☐	-
Test hole location for return external static pressure: ☐ Plenum ☐ Cabinet ☐ Transition ☐ Other: _____	-	-
Test hole location for supply external static pressure: ☐ Plenum ☐ Cabinet ☐ Transition ☐ Other: _____	-	-
3.3 Measured return external static pressure (Enter value only, without negative sign): _____ IWC	-	-
3.4 Measured supply external static pressure (Enter value only, without positive sign): _____ IWC	-	-
3.5 Measured total external static pressure = Value-only from Item 3.3 + Value-only from Item 3.4 = _____ IWC	-	-
3.6 Measured (Item 3.5) - Design (Item 5.2 on National HVAC Design Report) total external static pressure = _____ IWC	-	-
3.7 Measured HVAC fan airflow, using Item 3.5 and fan speed setting: _____ CFM	-	-
3.8 Measured HVAC fan airflow (Item 3.7) is ± 15% of design HVAC fan airflow (Item 5.2 on National HVAC Design Report)	☐	-

4. Air Balancing of Supply Registers & Return Grilles (Recommended, but not Required) [6]

4.1 Balancing report attached with room-by-room design airflows from Item 5.2 on National HVAC Design Report, and contractor-measured airflow using ANSI / ACCA 5 QI-2015 protocol	☐	☐
4.2 Room-by-room airflows verified by contractor to be within the greater of ± 20% or 25 CFM of design airflow	☐	☐

5. Functional Testing: Indoor / Terminal Units - This section must be completed for all heating and cooling equipment located within dwelling units or common spaces, including systems identified in Sections 2 and 3, except where specifically noted. Indoor / terminal units include, but are not limited to, mini-splits, multi-splits, PTAC's, PTHP's, W. HP's, fan coils, and hydronic distribution systems [5]

	Rater Verified	FT Agent Verified	N/A
5.1 Installation Checks			
5.1.1 Zone thermostat (or remote zone temperature sensor) in dwelling units installed in design location, within the zone being served, and not on an exterior wall	☐	☐	☐
5.1.2 Where specified by design, external condensate pump installed and condensate drain pan drains to a conspicuous point of disposal in case of blockage	☐	☐	☐
5.2 Functional Testing			
5.2.1 Zone temperature displayed on thermostat or sensor is within 5°F of measured zone temperature	☐	☐	☐
5.2.2 System turns on when there is a call for heat and heating is provided. System turns off when the heating setpoint has been met. For forced air systems: Measured discharge air temperature _____ °F	☐	☐	☐
5.2.3 System turns on when there is a call for cooling and cooling is provided. System turns off when the cooling setpoint has been met. For forced air systems: Measured discharge air temperature _____ °F	☐	☐	☐
5.2.4 Measure and record the inlet and outlet condenser, chilled, or hot-water temperatures at the terminal unit. Cooling mode: Inlet _____ °F Outlet _____ °F Heating mode: Inlet _____ °F Outlet _____ °F	☐	☐	☐
5.2.5 Where OA dampers are installed, the damper closes when there is no call for ventilation or when fan is off	☐	☐	☐
5.2.6 If more than one system provides heating or cooling to the same space, controls prevent simultaneous heating and cooling	☐	☐	☐

6. VRF Outdoor Unit - This section must be completed for all VRF outdoor units serving dwelling units or common spaces

	FT Agent Verified	N/A
6.1 Installation Checks		
6.1.1 Pressure testing on refrigerant piping has been completed for this system (indicate exact test in / test out pressure (psig) / time (hours)): _____/_____/_____	☐	☐
6.1.2 Vacuum testing has been completed (indicate exact test in / test out pressure (psig) / time (hours)): _____/_____/_____	☐	☐
6.1.3 Refrigerant line lengths and height differences have been recorded from as-built shop drawings or field measured, and documentation of the measurement is available, if requested	☐	☐
6.1.4 Indicate required additional charge amount (lbs): _____	☐	☐

National HVAC Functional Testing Checklist [1]
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6.2 Functional Testing		
6.2.1 In cooling mode, the outdoor unit fan is ON and heat is being rejected.[7] Measure and verify that outdoor unit fan discharge air temperature is warmer than the ambient air temperature	☐	☐
6.2.2 In heating mode, the outdoor unit fan is ON and heat is being absorbed.[7] Measure and verify that outdoor unit fan discharge air temperature is colder than the ambient air temperature	☐	☐
6.2.3 Using the central maintenance tool or controller, none of the outdoor units or connected indoor units are showing an alarm	☐	☐
6.2.4 Using the central maintenance tool, the manufacturer's representative confirmed refrigerant charge test per manufacturer's guidelines	☐	☐
7. Central Boilers - This section must be completed for all central boilers serving dwelling units or common spaces	**FT Agent Verified**	**N/A**
7.1 Installation Checks		
7.1.1 Piping pressure testing is completed and all accessible boiler piping, fittings, and accessories are free from leaks. FT agent may conduct the test or witness the test being conducted by the installing contractor	☐	☐
7.1.2 Boiler relief valves and discharge piping do not show signs of weeping or leakage	☐	☐
7.1.3 No signs of blockage, leakage, or deterioration in the fresh air intake or flue gas vent piping	☐	☐
7.1.4 Temperature, pressure gauges, air eliminator, expansion tank, check valves and all other piping components installed as specified by HVAC Designer	☐	☐
7.1.5 Boiler supply / header temperature sensor and, where applicable, outdoor air temperature sensor, are located as specified by HVAC Designer	☐	☐
7.1.6 Indicate boiler header / supply setpoint type: ☐ Fixed ☐ Seasonal ☐ Outdoor temperature reset ☐ Indoor temperature reset ☐ Other: _____	☐	☐
7.1.7 Where outdoor air temperature reset schedule is applicable, indicate reset schedule (e.g., 180°F Supply @ 10°F outdoor, 120°F supply @ 55°F outdoor) _____ @ _____ , _____ @ _____	☐	☐
7.1.8 Where Warm Weather Shut Down (WWSD) is applicable, list temperature (NA if boilers and system pumps also serve DHW)	_____°F	☐
7.2 Functional Testing: Boilers		
7.2.1 Measure the combustion gas efficiency at high fire and low fire for one of the boilers. Note which one and record information _____% ☐ high fire _____% ☐ low fire	☐	☐
7.2.2 Boiler combustion air intake dampers open / close with boiler operation	☐	☐
7.2.3 If each boiler has its own dedicated boiler circulator pump, it operates only when the respective boiler is firing. (Circulator pump may run for a short period of time before or after the boiler fires, as recommended by the equipment manufacturer)	☐	☐
7.2.4 When there is a call for heating, the boiler(s) are enabled according to their design sequence of operation	☐	☐
7.2.5 When multiple boilers are supposed to operate at the same time, they operate according to the Engineer of Record's sequence of operation and the on / off sequencing is observed	☐	☐
7.2.6 Cycle the boilers on and off 3 times. Boiler(s) modulate / step down to the minimum firing rate before shutting off	☐	☐
7.2.7 Boiler(s) do not short cycle (i.e., the minimum on time is 5 minutes and the minimum off time is 5 minutes, or as recommended by the boiler manufacturer to prevent short cycling)	☐	☐
7.2.8 Condensing Boiler: Return temperature enables condensing Design / OEM temp: _____°F Measured temp: _____°F	☐	☐
7.2.9 Boiler supply / header temperature sensor is reading within 3°F of measured boiler supply / header temperature	☐	☐
7.2.10 Boiler minimum flow rate and change in flow rate are maintained within the manufacturer's stated limits throughout the sequence of operation	☐	☐
7.3 Functional Testing: Heating System Pumps		
7.3.1 Where heating system pumps (i.e., the pumps which are responsible for moving the water through the terminal units) are equipped with a VFD which is responding to a pressure sensor within the system or a sensorless pumping system, indicate which one: ☐ VFD+Sensor ☐ Sensorless	☐	☐
7.3.2 If a variable speed pumping system is installed, the VFD increases and decreases pump speed in response to changes in the system	☐	☐
7.3.3 If a variable speed pumping system is installed, system prevents "dead-heading". (May be tested under real or simulated low flow conditions.) Select the method of water flow bypass: ☐Minimum Flow Bypass Valve ☐ 3 way valves on specific terminal units ☐Other: _____	☐	☐
7.3.4 Pumps are off when outside air temperature is above WWSD (N/A if pumps serve DHW as well as heating)	☐	☐

National HVAC Functional Testing Checklist [1]
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8. Cooling Towers - This section must be completed for all cooling towers serving dwelling units or common spaces	FT Agent Verified	N/A
8.1 Installation Checks		
8.1.1 Cooling Tower piping and all components are free from leaks	☐	☐
8.1.2 Temperature gauges, check valves, tower bypass valve and all other piping components installed as specified by HVAC Designer	☐	☐
8.1.3 Condenser Water Supply setpoint type: ☐ Fixed ☐Outdoor temperature reset ☐Seasonal / based on free cooling	☐	☐
8.1.4 All control sensors (condenser water supply temperature, outdoor air humidity, etc.) are located as specified by HVAC Designer	☐	☐
8.2 Functional Testing: Tower Fans		
8.2.1 Tower fan(s) do not short cycle (i.e., the minimum on time is 5 minutes and the minimum off time is 5 minutes, or as recommended by the manufacturer to prevent short cycling)	☐	☐
8.2.2 Cooling Tower fan(s) do not run unless associated cooling tower pump(s) are running	☐	☐
8.2.3 If installed, basin heater is not enabled when the basin water temperature is above the setpoint	☐	☐
8.2.4 Condenser Water Supply Sensor is reading within 3°F of measured temperature	☐	☐
8.3 Functional Testing: Cooling Tower Pumps		
8.3.1 Cycle the cooling tower pumps on and off 3 times. Cooling tower pumps only operate when controls call for operation (N/A if tower pumps are set to run year round)	☐	☐
9. Chillers - This section must be completed for all chillers serving dwelling units or common spaces	**FT Agent Verified**	**N/A**
9.1 Installation Checks		
9.1.1 Chiller piping and all components are free from leaks	☐	☐
9.1.2 If multiple chillers, water flow is balanced across chillers using (indicate which one): ☐ Balancing valves ☐ Reverse return piping ☐ Individual chiller pumps ☐ Other: _____	☐	☐
9.1.3 Temperature, pressure gauges, air eliminator, expansion tank, check valves and all other piping components installed as specified by HVAC Designer	☐	☐
9.1.4 Chilled Water Supply temperature sensor (and outdoor air temperature sensor where applicable) are located as specified by HVAC Designer	☐	☐
9.2 Functional Testing: Chillers		
9.2.1 When there is a call for cooling, chillers are operating and maintaining chilled water setpoint	☐	☐
9.2.2 When multiple chillers are supposed to operate at the same time, they operate according to the Engineer of Record's sequence of operations and the on / off sequencing is observed	☐	☐
9.2.3 Chiller(s) do not short cycle (i.e., the minimum on time is 5 minutes and the minimum off time is 5 minutes, or as recommended by the chiller manufacturer to prevent short cycling)	☐	☐
9.2.4 Chilled Water Supply Sensor is reading within 3°F of measured chiller temperature	☐	☐
9.2.5 Chiller minimum flow rate and change in flow rate are maintained within the manufacturer's stated limits throughout the sequence of operation	☐	☐
9.3 Functional Testing: Chilled Water System Pumps		
9.3.1 Where Chilled Water System pumps (i.e., the pumps which are responsible for moving the chilled water through the terminal units) are equipped with a VFD, which is responding to a pressure sensor within the system or a sensorless VFD system, indicate which one: ☐ VFD+Sensor ☐ Sensorless	☐	☐
9.3.2 If a variable speed pumping system is installed, confirm that the VFD increases and decreases pump speed in response to changes in the system	☐	☐
9.3.3 If a variable speed pumping system is installed, system prevents "dead-heading". (May be tested under real or simulated low flow conditions.) Select the method of water flow bypass: ☐Minimum Flow Bypass Valve ☐ 3 way valves on specific terminal units ☐Other: _____	☐	☐
9.3.4 Pumps are off when cooling is not required (N/A if chilled water is required year round)	☐	☐

FT Agent Name: _____ Date: _____

FT Agent Signature: _____ Company Name: _____

Rater Name (if applicable): _____ Date: _____

Rater Signature: _____ Company Name: _____

National HVAC Functional Testing Checklist [1]
ENERGY STAR Multifamily New Construction Version 1 / 1.1

Footnotes:

1. This Checklist is designed to align with the requirements of ANSI / ACCA's 5 QI-2015 protocol, thereby improving the performance of HVAC equipment in new multifamily buildings when compared to new multifamily buildings built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems (e.g., those caused by a lack of maintenance or occupant behavior). Therefore, this Checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.

   Sections 2, 3, and 4 of this Checklist generally apply to split air conditioners, unitary air conditioners, air-source heat pumps, and water-source (i.e., geothermal) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts) and to furnaces up to 225 kBtuh with forced-air distribution systems (i.e., ducts). See specific sections for exemptions.

   Where the term 'dwelling unit' is used in this Checklist, the requirement is also required of 'sleeping' units. The term 'sleeping unit' refers to a room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both.

   The term 'common space' refers to any spaces on the property that serve a function in support of the residential part of the building that is not part of a dwelling or sleeping unit. This includes spaces used by residents, such as corridors, stairs, lobbies, laundry rooms, exercise rooms, residential recreation rooms, or parking garages used exclusively by residents, building staff, and their guests. This also includes offices used by building management, administration or maintenance and all special use areas located on the property to serve and support the residents such as day-care facilities, gyms, dining halls, etc.

2. An explanation of the credentialing process and links to H-QUITOs, which maintain lists of credentialed contractors, can be found at energystar.gov/credentialedhvac. FT Agents may not be the installing contractor unless they are a credentialed contractor. All FT Agents that are not credentialed contractors must sign up online in EPA's online database as an FT Agent and watch the online FT Agent orientation. See energystar.gov/mftraining.

3. The term 'Rater' refers to the person completing the third-party inspections required for certification. This person shall: a) be a Certified Rater, Approved Inspector, or an equivalent designation as determined by a "Multifamily Oversight Organization" and, b) have attended and successfully completed an EPA-recognized training class. See energystar.gov/mftraining.

4. Either factory-installed or field-installed TXV's may be used. For field-installed TXV's, ensure that sensing bulbs are insulated and tightly clamped to the vapor line with good linear thermal contact at the recommended orientation, usually 4 or 8 o'clock.

5. The term "mini-split" refers to air conditioners and heat pumps that have variable refrigerant flow and distributed refrigerant technology with a single outdoor section serving a single indoor section. The indoor section is typically, but not exclusively, mounted on room walls and/or ceilings and designed to heat or cool air within the conditioned space either directly or through limited duct runs. The term "multi-split" refers to air conditioners and heat pumps that have variable refrigerant flow and distributed refrigerant technology with the capability of serving multiple indoor sections with a single outdoor section. The indoor sections are typically, but not exclusively, mounted on room walls and/or ceilings and designed to heat or cool air within the conditioned space either directly or through a ducted system. A single outdoor section can serve one or more dwelling units. The length of the duct system is not a determinant for meeting either of these definitions.

6. Air balancing of supply registers and return grilles is highly recommended to improve the performance of the HVAC system and comfort of the occupants, but is not required at this time for certification. When air balancing is completed, balancing dampers or proper duct sizing shall be used instead of looped or coiled ductwork to limit flow to diffusers. When balancing dampers are used, they shall be located at the trunk to limit noise unless the trunk will not be accessible when the balancing process is conducted. In such cases, Opposable Blade Dampers (OBD) or dampers located in the duct boot are permitted to be used.

7. When manually testing outdoor unit heating or cooling mode of operation, at least 25% of associated indoor / terminal units connected to the outdoor unit(s) shall be controlled to the same heating or cooling mode being tested. The FT Agent shall increase the number of indoor / terminal units as needed in order to verify the discharge temperature is warmer / colder than ambient.

National Water Management System Requirements [1]
ENERGY STAR Multifamily New Construction, Version 1 / 1.1

Builder / Developer Partner Responsibilities:

- It is the exclusive responsibility of the Partner to ensure that each multifamily building is constructed to meet these requirements.
- While Partners are not required to maintain documentation demonstrating compliance for each multifamily building, Partners are required to develop a process to ensure compliance for each building (e.g., incorporate these requirements into the Scope of Work for relevant sub-contractors, require the site supervisor to inspect each building for these requirements, and/or sub-contract the verification of these requirements to a Rater).
- In the event that the EPA determines that a certified multifamily building was constructed without meeting these requirements, the building may be decertified.

1. Water-Managed Site and Foundation
1.1 Patio slabs, porch slabs, walks, and driveways sloped ≥ 0.25 in. per ft. away from building to edge of surface or 10 ft., whichever is less. [2]
1.2 Back-fill has been tamped and final grade sloped ≥ 0.5 in. per ft. away from building for ≥ 10 ft. Alternatives in Footnote. [2]
1.3 Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either: ≥ 6 mil polyethylene sheeting, lapped 6-12 in., or ≥ 1 in. extruded polystyrene insulation with taped joints. See additional exemptions for garage slabs in Footnote 3. [3, 4, 5, 6]
1.4 Capillary break at all crawlspace floors using ≥ 6 mil polyethylene sheeting, lapped 6-12 in., & installed using one of the following: [4, 5, 6]
1.4.1 Placed beneath a concrete slab; OR,
1.4.2 Lapped up each wall or pier and fastened with furring strips or equivalent; OR,
1.4.3 Secured in the ground at the perimeter using stakes.
1.5 Exterior surface of below-grade walls of basements & unvented crawlspaces finished as follows: a) For poured concrete, masonry, & insulated concrete forms, finish with damp-proofing coating. [7] b) For wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing.
1.6 Class 1 vapor retarder not installed on interior side of air permeable insulation in exterior below-grade walls. [8]
1.7 Sump pump covers mechanically attached with full gasket seal or equivalent.
1.8 Drain tile installed at basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with ≥ 6 in. of ½ to ¾ in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump pump. If drain tile is on interior side of footing, then channel provided through footing to exterior side. [9]
2. Water-Managed Wall Assembly
2.1 Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system. [10]
2.2 Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Item 2.1 and fully sealed at all penetrations. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies. [10, 11]
2.3 Window and door openings fully flashed. [12]
3. Water-Managed Roof Assembly
3.1 Step and kick-out flashing at all roof-wall intersections, extending ≥ 4" on wall surface above roof deck and integrated shingle-style with drainage plane above; boot / collar flashing at all roof penetrations. [13]
3.2 For buildings that don't have a slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that discharges water on sloping final grade ≥ 5 ft. from foundation, or to underground catchment system not connected to the foundation drain system that discharges water ≥ 10 ft. from foundation. Alternatives & exemptions in Footnote. [4, 14, 15]
3.3 Self-adhering polymer-modified bituminous membrane at all valleys & roof deck penetrations. [4, 16]
3.4 In 2009 IECC Climate Zones 5 & higher, self-adhering polymer-modified bituminous membrane over sheathing at eaves from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall. [4, 16]
4. Water-Managed Building Materials
4.1 Wall-to-wall carpet *not* installed within 2.5 ft. of toilets, tubs, and showers.
4.2 Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used. [17]
4.3 In Warm-Humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls. [8]
4.4 Building materials with visible signs of water damage or mold *not* installed or allowed to remain. [18]
4.5 Framing members & insulation products having high moisture content *not* enclosed (e.g., with drywall). [19]
4.6 For each condensate-producing HVAC component, corrosion-resistant drain pan (e.g., galvanized steel, plastic) included that drains to a conspicuous point of disposal in case of blockage. Backflow prevention valve included if connected to a shared drainage system.

National Water Management System Requirements [1]
ENERGY STAR Multifamily New Construction, Version 1 / 1.1

Footnotes:

1. These requirements are designed to improve moisture control in buildings. However, these features alone cannot prevent all moisture problems. For example, leaky pipes or overflowing baths can lead to moisture issues and negatively impact the performance of the building. For the purpose of this document, "Partner" represents either the builder or the developer.
2. Swales or drains designed to carry water from foundation are permitted to be provided as an alternative to the slope requirements for any building, and shall be provided for a building where setbacks limit space to less than 10 ft. Also, tamping of back-fill is not required if either: proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer; OR, the builder / developer has scheduled a site visit to provide in-fill and final grading after settling has occurred (e.g., after the first rainy season).
3. Not required for garage slabs that meet any of the following criteria:
   a) "Open" (i.e., 20% of wall area is openings for natural ventilation); OR
   b) Mechanically ventilated automatically by means of carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors at a standby airflow rate of not less than 0.05 cfm/ft^2 and full-on rate not less than 0.75 cfm/ft^2.
4. Not required in Dry (B) climates as shown in 2009 IECC Figure 301.1 and Table 301.1.
5. Not required for raised pier foundations with no walls. To earn the ENERGY STAR, EPA recommends, but does not require, that radon resistant features be included in buildings built in EPA Radon Zones 1, 2 & 3. For more information, see epa.gov/indoorairplus.
6. For an existing slab (e.g., in a building undergoing a gut rehabilitation), in lieu of a capillary break beneath the slab, a continuous and sealed Class I or Class II Vapor Retarder (per Footnote 8) is permitted to be installed on top of the entire slab. In such cases, up to 10% of the slab surface is permitted to be exempted from this requirement (e.g., for sill plates). In addition, for existing slabs in occupiable space, the Vapor Retarder shall be, or shall be protected by, a durable floor surface. If Class I Vapor Retarders are installed, they shall not be installed on the interior side of air permeable insulation or materials prone to moisture damage.
7. Interior surface of an existing below-grade wall (e.g., in a building undergoing a gut rehab.) listed in Item 1.5a is permitted to be finished by:
   - Installing a continuous and sealed drainage plane, capillary break, Class I Vapor Retarder (per Footnote 8) and air barrier that terminates into a foundation drainage system as specified in Item 1.8; OR
   - If a drain tile is not required as specified in Footnote 9, adhering a capillary break and Class I Vapor Retarder (per Footnote 8) directly to the wall with the edges taped / sealed to make it continuous.

   Note that no alternative compliance option is provided for existing below-grade wood-framed walls in Item 1.5b.
8. The 2009 IRC defines Class I vapor retarders as a material or assembly with a rating of ≤ 0.1 perm, using the desiccant method with Proc. A of ASTM E 96. The following materials are typically ≤ 0.1 perm and shall not be used on the interior side of air permeable insulation in above-grade exterior walls in warm-humid climates or below-grade exterior walls in any climate: rubber membranes, polyethylene film, glass, aluminum foil, sheet metal, and foil-faced insulating / non-insulating sheathings. These materials can be used on the interior side of walls if air permeable insulation is not present (e.g., foil-faced rigid foam board adjacent to a below-grade concrete foundation wall is permitted).

   Note that this list is not comprehensive and other materials with a perm rating ≤ 0.1 also shall not be used. Also, if mfr. spec.'s for a product indicate a perm rating ≥ 0.1, then it may be used, even if it is in this list. Also note that open-cell and closed-cell foam generally have ratings above this limit and may be used unless mfr. spec.'s indicate a perm rating ≤ 0.1. Several exemptions to these requirements apply:
   - Class I vapor retarders, such as ceramic tile, may be used at shower and tub walls;
   - Class I vapor retarders, such as mirrors, may be used if mounted with clips or other spacers that allow air to circulate behind them.
9. Alternatively, either a drain tile that is pre-wrapped with a fabric filter or a Composite Foundation Drainage System (CFDS) that has been evaluated by ICC-ES per AC 243 are permitted to be used. Note that the CFDS must include a soil strip drain or another ICC-ES evaluated perimeter drainage system to be eligible for use. In an existing building (e.g., in a building undergoing a gut rehab.) a drain tile installed only on the interior side of the footing without a channel is permitted. Additionally, a drain tile is not required when a certified hydrologist, soil scientist, or engineer has determined that a crawlspace foundation, or an existing basement foundation (e.g., in a building undergoing a gut rehab.), is installed in Group I Soils (i.e., well-drained ground or sand-gravel mixtures), as defined by 2009 IRC Table R405.1.
10. These items not required for existing structural masonry walls (e.g., in a building undergoing a gut rehabilitation). Note this exemption does not extend to existing wall assemblies with masonry veneers.
11. Any of the following systems may be used: a monolithic weather-resistant barrier (i.e., house wrap) shingled at horizontal joints and sealed or taped at all joints; weather resistant sheathings (e.g., faced rigid insulation) fully taped at all "butt" joints; lapped shingle-style building paper or felts; or other water-resistive barrier recognized by ICC-ES or other accredited agency.
12. Apply pan flashing over the rough sill framing, inclusive of the corners of the sill framing; side flashing that extends over pan flashing; and top flashing that extends over side flashing or equivalent details for structural masonry walls or structural concrete walls.
13. Intersecting wall siding shall terminate 1 in. above the roof or higher, per manufacturer's recommendations. Continuous flashing shall be installed in place of step flashing for metal and rubber membrane roofs.
14. The assessment of whether the soil is expansive or collapsible shall be completed by a certified hydrologist, soil scientist, or engineer.
15. Any of the following are permitted to be used as alternatives to Item 3.2: a) a roof design that deposits rainwater to a grade-level rock bed with a waterproof liner and a lateral drain pipe that meets discharge requirements per Item 3.2; b) a rainwater harvesting system that drains overflow to meet discharge requirements per Item 3.2; or c) a continuous rubber membrane (e.g., EPDM) that is aligned with the foundation wall from final grade to ≥ 8 in. below grade and then slopes ≥ 0.5 in. per ft. away from the building for at least 5 ft., with Group I Soils (as defined in Footnote 9) covering the membrane to within 3 in. of final grade.
16. As an alternative, any applicable option in 2009 IRC Section R905.2.8.2 is permitted to be used to meet Item 3.3 and any option in 2009 IRC Section R905.2.7.1 is permitted to be used to meet Item 3.4. EPA recommends, but does not require, that products meet ASTM D1970. In addition, any option in 2009 IRC Section R905.13 is permitted to be used to meet either Item 3.3 or 3.4.

17. In addition to cement board, materials that have been evaluated by ICC-ES per AC 115 may also be used to meet this requirement. Monolithic tub and shower enclosures (e.g., fiberglass with no seams) are exempt from this backing material requirement unless required by the manufacturer. Paper-faced backerboard may only be used behind monolithic enclosures or waterproof membranes that have been evaluated by ICC-ES per AC 115, and then only if it meets ASTM mold-resistant standards ASTM D3273 or ASTM D6329.
18. If mold is present, effort should be made to remove all visible signs of mold (e.g., by damp wipe with water and detergent). If removal methods are not effective, then the material shall be replaced. However, stains that remain after damp wipe are acceptable. Lumber with "sap stain fungi" is exempt from this item as long as the lumber is structurally intact.
19. For wet-applied insulation, follow manufacturer's drying recommendations. EPA recommends that lumber moisture content be ≤ 18%.

State of New Jersey

PHILIP D. MURPHY
GOVERNOR

SHEILA Y. OLIVER
LT. GOVERNOR

DEPARTMENT OF ENVIRONMENTAL PROTECTION

CATHERINE R. McCABE
COMMISSIONER

Mail Code 401-04Q
Division of Water Supply & Geoscience
Water System Operations Element
Bureau of Water System Engineering
401 E. State Street - P.O. Box 420
Trenton, New Jersey 08625-0420
Tel #: (609) 292-2957 - Fax #: (609) 633-1495
https://www.nj.gov/dep/watersupply/

December 23, 2020

Passaic Valley Water Commission
1525 Main Avenue
Clifton, NJ 07011

Dear Water Purveyor:

Enclosed is a simplified water main extension permit dated December 23, 2020 issued to you pursuant to the New Jersey Safe Drinking Water Act, N.J.S.A. 58:12A, and in consideration of your application dated September 1, 2020 and signed by James Duprey, Business Administrator.

Your permit is for:

- Construction of 700 L.F. of 8-inch diameter DIP water main to serve Hinchliffe Stadium Neighborhood, a proposed 6-story building with 75 apartment units and daycare facility, a proposed restaurant and exhibition space, and restoration of Hinchliffe Stadium; located in Paterson (Liberty St between Maple St and Jasper St, Block # 801, Lot # 6, 7, 23), County of Passaic, New Jersey; and

- The distribution of water for potable purposes from said works.

Your attention is directed to both the **specific and general** conditions of the aforementioned permit. Enclosed with this permit is the Placed into Service Certification (PSC). The PSC **must** be submitted as required by the Submittal Action Requirements in the attached permit conditions. If the facility is not completed within the specified time allotment, an "Extension of Time" shall be requested at least ninety (90) days prior to the permit expiration date to allow for review and approval. No extension of time will be granted to an expired permit. Should you have any questions about this permit, please contact Kelly Hullen at (609) 292-2957. When contacting the Department regarding this permit, please reference the Permit No. and PWSID No. provided herein.

Sincerely,

Ramesh Patel, Environmental Engineer 4
Bureau of Water System Engineering

PWSID NO.: NJ1605002
WCP200004
Enclosures

cc: Kevin Shelly, P.E., Shore Point Engineering
Mayor and Council of Paterson City
Kelly Hullen, BWSE

NJEMS\sd_const_pemit_simple_01/30/19

A. T. Cameron, PG

273 Thompson Ave., Middletown, NJ 07748
732-787-0440 Fax 732-787-3859

January 5, 2021

Joseph Portelli
RPM Development Group
77 Park Street
Montclair, NJ 07042

Re: Hinchliffe Stadium Proposed Renovation of the Vacant Stadium and Development of an Apartment Building and Parking Garage
Maple and Jasper Streets,
Paterson, NJ

Dear Mr. Portelli:

A.T. Cameron PG has conducted a limited environmental investigation of soils located at the subject property referenced above. The location of this Site is shown on the Attached Figure 1. The investigation was conducted in two areas of the Site. The first was at vacant land located adjacent and to and between the Hinchliffe Stadium and Jasper Street. This area was investigated by the installation of 13 borings with the collection of one soil sample from each boring. This is the area of a proposed six-story apartment building and four-story parking garage. The second area is located on the eastern end of the Stadium Field. Six test pits were investigated with one soil sample being collected from each test pit. The locations and the excavation of each test pit was by Pike Construction the designated site contractor.

Soil Boring Investigation

A total of 13 soil borings were installed in the open field located adjacent to the Stadium and between the Stadium and Jasper Street. Soil borings and samples were collected on July 24, 2020. Samples were submitted to Water Works Laboratory, but several samples were forwarded to Test America for analysis. The locations of soil borings are shown on the attached Figure 2.

Each of the borings were installed by a well driller from GeoPro Environment utilizing a Geoprobe unit with five (5) foot by two (2) inch macro samplers. Each of the borings were installed to a depth of 10 feet below ground surface (bgs). The borings were continuously field screened. Observations consisted of visually inspecting the soils, examining the soils for odors, staining, free product, and screening the soil for organic vapors. Organic vapor screening utilized a Mini Rea 3000 photoionization type meter (PID).

Previous work conducted in this area of the Site included at Phase I/Preliminary Assessment conducted by EWMA and a Geotechnical Investigation conducted by

Whitestone Associates. Historically, part of this area had a water reservoir present that supplied drinking water to the City of Patterson. The reservoir when no longer needed was filled in.

The previous work identified subsurface conditions described as follows. At the surface 6 inches of topsoil and vegetation was noted. Underlying the surface cover fill material was encountered and ranged in depth from approximately 2 feet to 13 feet bgs. The fill material consisted of silty sand with some debris including brick, concrete, coal, ash, etc. Beneath the fill material glacial deposits were encountered. The glacial deposits having varying proportions of sand, poorly graded sand with silt, and poorly graded sand with gravel to depths up to 28 feet bgs. The current investigation is in general agreement with the previous findings.

Two series of borings were installed. The F-series (7 borings) borings were installed adjacent to the Stadium in the area where previous investigation work identified fill. And the H-series borings (6 borings) in the area where glacial deposits were identified at the surface. Each boring was continuously field screened. One sample was collected from each boring in the six-inch interval with the highest field screening result. If no indication of contamination was identified the sample was collected from the 2 to 2.5 foot bgs interval. Each of the soil samples were analyzed for Target Compound List/Target Analyte List compounds, EPH, RCRA Characteristics and hexavalent chromium.

A soil boring log was prepared for each boring. Boring Logs are annexed as part of Attachment A. The F-series borings encountered fill in each boring that ranged from 2.5 feet to 6 feet in thickness. The H-series borings were installed to the northeast of the F-series boring or closer to Jasper Street. No indication of fill was present in borings H-1, H-2, or H-3. Fill was present in borings H-4 (3 feet), H-5 (3 feet) and H-6 (2.5 feet).

Field screening results were negative in each of the F-series and H-series borings. No PID readings were observed in any of the borings. As such each of the soil samples collected for laboratory testing were collected in the 2 to 2.5 foot bgs interval.

Analytical results from each boring sample were below the most restrictive cleanup standards with the following exceptions.

> Volatile Organic Compounds: None detected above most restrictive cleanup standard. Methylene chloride was detected a low level in some F-series samples. This compound was most likely introduced at the laboratory.
>
> Semi-volatile Organic compounds: Benzo(a)pyrene detected above the default impact to groundwater soil cleanup standard (IGWSCS) in borings F-1 (result 0.21 mg/kg, IGWSCS 0.2 mg/kg), F-6 (result 0.34 mg/kg, IGWSCS 0.2 mg/kg) F-7 (result 0.24 mg/kg, IGWSCS 0.2 mg/kg) and H-1 result 0.35 mg/kg, IGWSCS 0.2 mg/kg). No compounds detected above the direct residential or non-residential standards.

Metals: Mercury was detected above the IGWSCS in boring samples F-1 (0.19 mg/kg, IGWSCS 0.1 mg/kg), F-2 (0.14 mg/kg, IGWSCS 0.1 mg/kg), F-3 (0.16 mg/kg, IGWSCS 0.1 mg/kg), and F-6 (0.13 mg/kg, IGWSCS 0.1 mg/kg). Lead was detected above the IGWSCS in boring samples F-1 (217 mg/kg, IGWSCS 90 mg/kg) and F-6 (310 mg/kg, IGWSCS 90 mg/kg). Aluminum and Manganese were detected above their respective IGWSCS in several samples. However, the ground water quality standard for aluminum and manganese are secondary. That is, they are not based on health considerations', but primarily on aesthetic considerations such as taste, odor, and appearance. Both are naturally occurring in the soil in New Jersey with concentrations commonly above the impact to ground water standard. A review of the research paper Ambient Levels of Metals in NJ Soils by Paul F. Sanders, NJDEP Research Project, 2003 shows aluminum and manganese to be present at levels well above the DIGWRS from urban soil within the Piedmont Physiographic Provence. Therefore, NJDEP has determined that the impact to ground water pathway does not need to be addressed for these metals unless there is a reason to believe that their presence is due to a discharge. As there is no evidence that these exceedances are the result of a discharge at the Site, evaluation of the impact to ground water pathway is not required for these compounds. No metals were detected above the residential or non-residential direct contact standards.

Pesticides and Herbicides: One pesticide was detected above the IGWSCS, Chlordane in boring sample F-7 (0.13 mg/kg, IGWSCS 0.05 mg/kg). No pesticides or herbicides were detected above the residential or non-residential direct contact standards.

Summary results for each of the samples for F-Series boring samples is annexed as Attachment B and the laboratory report is annexed as Attachment C. Summary results for each of the samples for H Series boring samples is annexed as Attachment D and the laboratory report is annexed as Attachment E.

Test Pit Environmental Soil Investigation

A total of 6 test pits were installed within part of the Stadium playing field/track area by Pike Construction. The locations of each test pits were selected by Pike. Test pits were approximately 4 feet bgs and the width was that of a backhoe bucket. Test pits were installed, and samples were collected from each of the test pits on October 27, 2020.

Test Pits 1, 2, 3 and 4 were located within the playing field/track of the stadium. At each of these test pits asphalt was located at the surface with a gravel base and geotextile fabric below the base. The fabric was located from 1 to 2 feet bgs. Soil observed at test pits 1 and 2 below the fabric was a brown silty sand with some debris including ash. This material was similar in appearance to the fill observed in borings. Test pits 3, 4, 5 and 6 had a gray silty/clayey sand, poorly sorted with clay to boulder sized material present.

Some debris was present including brick, concrete, coal, and metal. The test pits were all fill material. Test Pits 5 and 6 were outside of the playing field/track area and did not have asphalt at the surface or the geotextile. Photograph of the test pits are annexed as Attachment H.

One sample was collected from each test pit in the six-inch interval with the highest field screening result. If no indication of contamination was identified the sample was collected from the 2 to 2.5 foot bgs interval. Since field screen was also negative in each of the test pits soil samples were collected from the 2 to 2.5 foot bgs interval. Each of the samples were analyzed for Target Compound List/Target Analyte List compounds, EPH, RCRA Characteristics and hexavalent chromium. Samples were submitted to Test America for analysis. The locations of test pits are shown on the attached Figure 2.

Analytical results from each test pit sample were below the most restrictive cleanup standards with the following exceptions.

Volatile Organic Compounds: None detected above most restrictive cleanup standard.

Semi-volatile Organic compounds: Benzo(a)pyrene detected above the default impact to groundwater soil cleanup standard (IGWSCS) in Test Pit 3 (sample C-3) (result 0.72 mg/kg, IGWSCS 0.2 mg/kg) and Test Pit 5 (sample C-5) (result 0.41 mg/kg, IGWSCS 0.2 mg/kg). No other compounds were detected above the direct contact residential or non-residential standards.

Metals: Mercury was detected above the IGWSCS in Test Pit 3 (sample C-3) (0.11 mg/kg, IGWSCS 0.1 mg/kg), Test Pit 4 (sample C-4) (0.14 mg/kg, IGWSCS 0.1 mg/kg) and Test Pit 5 (sample C-5) (0.11 mg/kg, IGWSCS 0.1 mg/kg). Lead was detected above the IGWSCS in Test Pit 5 (sample C-5) (145 mg/kg, IGWSCS 90 mg/kg). Aluminum and Manganese were detected above their respective IGWSCS in several samples. However, the ground water quality standard for aluminum and manganese are secondary. That is, they are not based on health considerations', but primarily on aesthetic considerations such as taste, odor, and appearance. Both are naturally occurring in the soil in New Jersey with concentrations commonly above the impact to ground water standard. A review of the research paper Ambient Levels of Metals in NJ Soils by Paul F. Sanders, NJDEP Research Project, 2003 shows aluminum and manganese to be present at levels well above the DIGWRS from urban soil within the Piedmont Physiographic Provence. Therefore, NJDEP has determined that the impact to ground water pathway does not need to be addressed for these metals unless there is a reason to believe that their presence is due to a discharge. As there is no evidence that these exceedances are the result of a discharge at the Site, evaluation of the impact to ground water pathway is not required for these compounds.

Pesticides and Herbicides: Two pesticides were detected above the most restrictive cleanup standards. Chlordane was detected in Test Pit 3 (sample C-3) and Test Pit 4 (sample C-4) above the IGWSCS with results 0.11 mg/kg and 0.55 respectively (IGWSCS 0.05 mg/kg). Chlordane also exceeded the residential direct contact standard of 0.2 mg/k in Test Pit 4 (sample C-4). Dieldrin was detected above the IGWSCS in Test Pit 3 (sample C-3) (0.0.014 mg/kg, IGWSCS 0.003 mg/kg) and Test Pit 4 (sample C-4) (result 0.036 mg/kg IGWSCS 0.03 mg/kg).

Summary tables for each of the samples for the test pit samples are annexed as Attachment F and the laboratory report is annexed as Attachment G.

Conclusions

One compound, chlordane exceeded its residential direct contact cleanup standard. Test Pit 4 sample C-4 exceeded the standard for Chlordane with a result of 0.55 mg/kg and standard of 0.2 mg/kg. Chlordane was present in boring samples as well suggesting that it may not be localized at Test Pit 4.

Several compounds exceeded the default impact to ground water cleanup standard including benzo(a)pyrene, lead, mercury, aluminum, manganese, chlordane, and dieldrin. Further investigation of the impact to ground water pathway is suggested for those compounds that exceed the IGWSCS. Although aluminum and manganese were detected above their respective IGWSCS no further assessment is required as noted above.

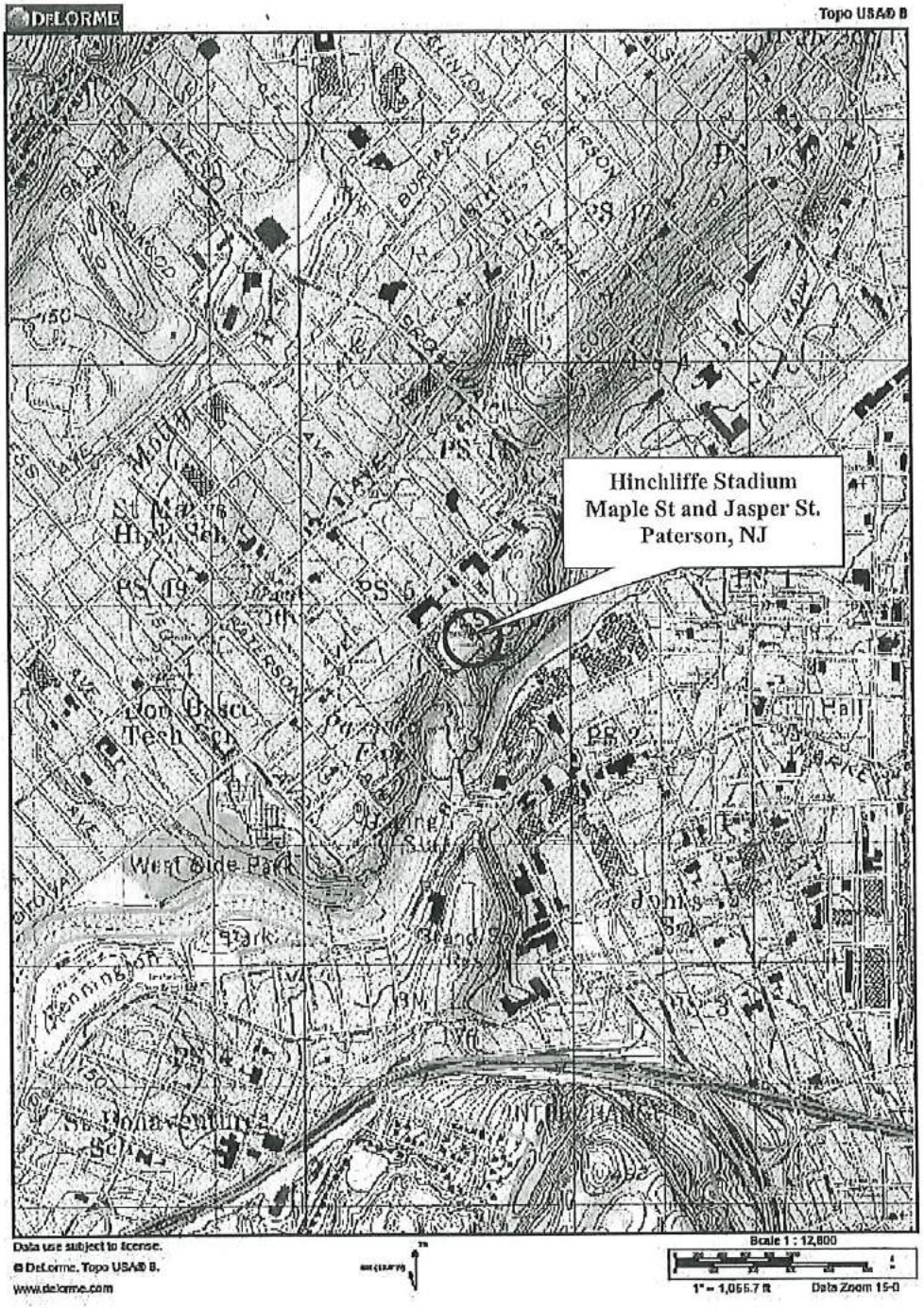
Should you have questions please contact the undersigned.

Regards,

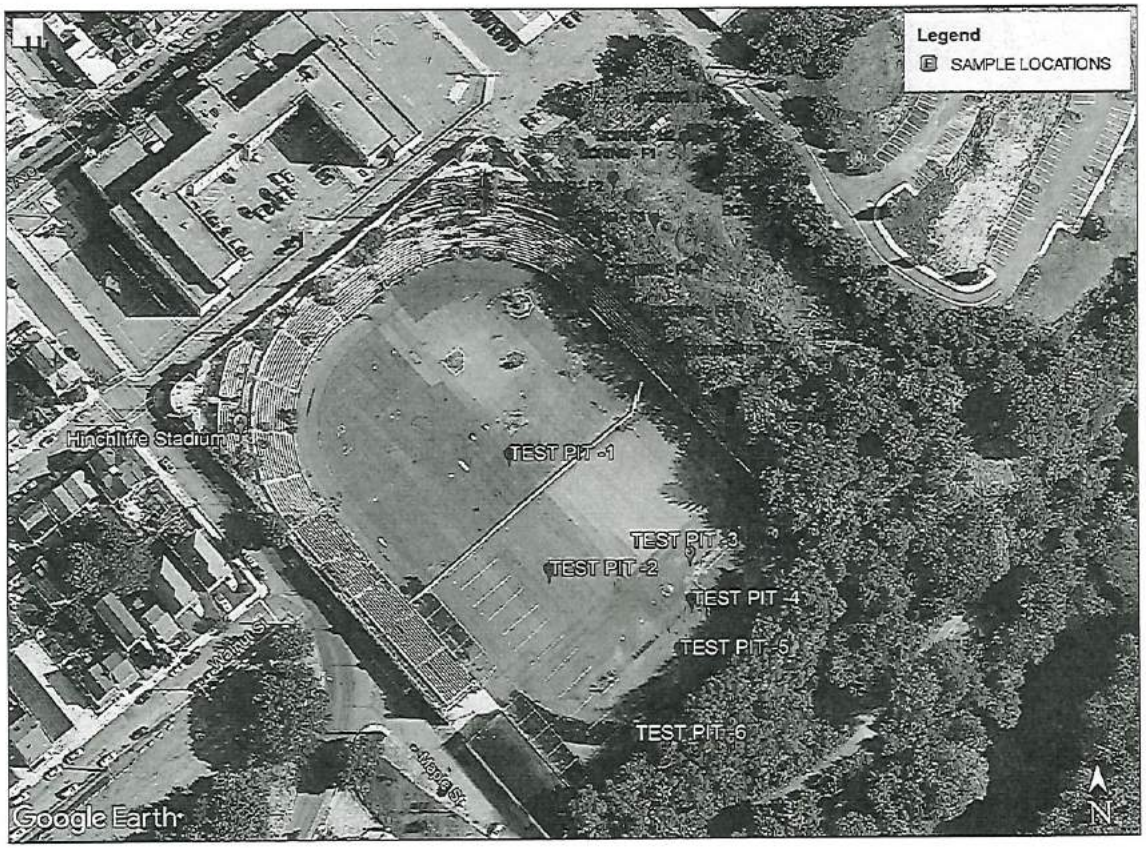
A T Cameron

A.T. Cameron, PG

Attachments



Hinchliffe Stadium Maple and Jasper Streets. Paterson, NJ 07506	**Figure 1 – Topographic Map**	↑N
	Source: U.S.G.S. 7.5 Minute Topographic Map Paterson, NJ Quadrangle	



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HINCHLIFFE STADIUM MAPLE STREET PATERSON, NJ	
Title: SITE PLAN WITH SAMPLE LOCATIONS	
Drawn By: ATC	Date: 12/16/20
Approved By:	Checked By:
Scale 1"=150'	Drawing No. FIG 2 HINCHCLIFFE

WHITESTONE
ASSOCIATES, INC.
Environmental & Geotechnical Engineers & Consultants

2430 HIGHWAY 34
BUILDING B, SUITE 101
MANASQUAN, NJ 08736
732.592.2101
whitestoneassoc.com

REPORT OF GEOTECHNICAL INVESTIGATION

PROPOSED MIXED-USE DEVELOPMENT
LIBERTY STREET & MAPLE STREET
CITY OF PATERSON, PASSAIC COUNTY, NEW JERSEY

Prepared for:

SHORE POINT ENGINEERING
P.O. Box 257
Manasquan, New Jersey 08736

Prepared by:

WHITESTONE ASSOCIATES, INC.
2430 Highway 34
Building B, Suite 101
Manasquan, New Jersey 08736

Kyle J. Kopacz, P.E.
Project Manager

Laurence W. Keller, P.E.
Principal, Geotechnical Services

Whitestone Project No.: GS2016988.000
April 9, 2020

WHITESTONE
ASSOCIATES, INC.
Environmental & Geotechnical Engineers & Consultants

2430 HIGHWAY 34
BUILDING B, SUITE 101
MANASQUAN, NJ 08736
732.592.2101
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April 9, 2020

via email

SHORE POINT ENGINEERING
P.O. Box 257
Manasquan, New Jersey 08736

Attention: Kevin E. Shelly, P.E.
Owner

Regarding: REPORT OF GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE DEVELOPMENT
LIBERTY STREET & MAPLE STREET
BLOCK 801, LOTS 6, 7, & 23
CITY OF PATERSON, PASSAIC COUNTY, NEW JERSEY
WHITESTONE PROJECT NO.: GS2016988.000

Dear Mr. Shelly:

Whitestone Associates, Inc. (Whitestone) is pleased to submit the attached *Report of Geotechnical Investigation* for the above-referenced project. The attached report presents the results of Whitestone's soils exploration efforts and presents recommendations for design of the proposed structural foundations, floor slabs, pavements, and related earthwork associated with the proposed development.

Whitestone appreciates the opportunity to be of service to Shore Point Engineering (Shore Point). Please note that Whitestone has the capability to perform the additional geotechnical engineering services recommended herein. Please contact us at (908) 668-7777 with any questions regarding the enclosed report.

Sincerely,

WHITESTONE ASSOCIATES, INC.

Kyle J. Kopacz, P.E.
Project Manager

Laurence W. Keller, P.E.
Principal, Geotechnical Services

KK/pwd L:\Job Folders\2020\2016988GS\Reports and Submittals\16988 ROGI.docx
Enclosures

REPORT OF GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE DEVELOPMENT
Liberty Street & Maple Street
Block 801, Lots 6, 7, & 23
City of Paterson, Passaic County, New Jersey

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Block 801, Lots 6, 7, & 23
City of Paterson, Passaic County, New Jersey

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SECTION 1.0
Summary of Findings

Whitestone Associates, Inc. (Whitestone) has performed an exploration and evaluation of the subsurface conditions on the site of the proposed mixed-use development to be located at Liberty Street and Maple Street (Block 801, Lots 6, 7, & 23) in Paterson, Passaic County, New Jersey. The site of the proposed construction is shown on the *Test Location Plan* included as Figure 1.

At the time of Whitestone's investigation, the subject site housed the vacant Hinchliffe Stadium with associated pavements, utilities, and landscaped areas. The northern portion of the site consists of a vacant parcel. Based on March 4, 2020 (last revised March 10, 2020) *ALTA & NSPS Land Title Survey* prepared by Stonefield Engineering & Design, LLC (Stonefield), the subject site has a high elevation of approximately 159 feet above North American Vertical Datum 1988 (NAVD 88) in the northern portion of the site with a low elevation of approximately 129 feet above NAVD 88 in the western portion of the site.

Based on the *Hinchliffe Stadium Concept Plan* prepared by Clarke Caton Heinz Architecture, the proposed redevelopment will include partial demolition of the existing site structures and renovation of the existing Hinchliffe Stadium and surrounding areas. The scope of work includes the construction of a six-story, 5,877-square feet (footprint) residential building, a four-story, 29,894-suqre feet (footprint) parking garage, and an approximately 5,000-spaire feet (footprint) restaurant building with associated pavements and utilities. New stormwater management (SWM) areas will be constructed around the proposed building footprint, however, at the time of this report, the exact type, location, and depth of the SWM area(s) were not finalized.

The subsurface exploration included performing a reconnaissance of the project site, drilling soil test borings, excavating soil profile pits, and collecting soil samples for laboratory analyses. The data from this exploration was analyzed by Whitestone in light of the project information provided by Shore Point.

- **Subsurface Conditions:** At the surface, the subsurface tests encountered either six inches of topsoil or up to four inches of asphalt pavement with no apparent subbase. Underlying the surface cover, existing fill material was encountered ranging in depth from two feet below ground surface (fbgs) and 13 fbgs. The existing fill material consisted of silty sand with trace debris including brick, concrete, coal, cinders, plastic, and metal. Beneath the existing fill materials, fourteen soil borings encountered natural glacial deposits consisting of silty sand (USCS: SM), clayey sand (USCS: SC), lean clay (USCS: CL) with variable amounts of sand, poorly graded sand with silt (USCS: SP-SM), and poorly graded sand (USCS: SP) with various amounts of gravel to depths ranging from 0.5 fbgs to 28 fbgs. Beneath the glacial deposits, seven soil borings encountered residual soils consisting of silty sand (USCS: SM) with various amounts of gravel and sandy silt (USCS: ML) with various amounts of

gravel to depths ranging from nine fbgs to 28 fbgs. Underlying the existing fill materials, glacial deposits, and residual soils, 16 soil borings were terminated in weathered rock at depths ranging from 6.5 fbgs to 33.1 fbgs.

Recommendations developed upon consideration of these results are summarized below and presented in greater detail in the following report.

- **Foundations:** Whitestone recommends supporting the proposed structure on conventional spread and continuous wall footings designed to bear within the improved and approved existing fill materials, the naturally occurring approved site soils, and/or on properly placed and compacted structural fill. Foundations bearing within these materials may be designed using a maximum allowable net bearing pressure of 4,000 pounds per square foot (psf). Limited overexcavation of the existing fill materials should be anticipated due to the general variability encountered within this stratum. In addition, all footing excavation bottoms should be compacted in-place by hand operated equipment in the presence of a geotechnical engineer to densify sporadic loose/soft zones or disturbed soils resulting from the excavation.

- **Floor Slabs and Pavements:** Whitestone anticipates that the underlying natural soils and/or controlled structural fill will be suitable for support of the proposed floor slabs and pavements provided these materials are properly recompacted, proofrolled, and evaluated during the construction phase.

- **Soil Reusability:** Whitestone anticipates that a majority of the underlying fill materials will be suitable for selective reuse bearing an evaluation. Natural glacial deposits and residual soils will also be suitable for reuse as structural fill and/or backfill throughout the site provided that moisture contents are controlled within two percent of the optimum moisture content. The majority of on-site soils are silt blended with various amounts of sand that can be moisture sensitive. Immediate reuse of on-site soil should not be expected. Imported materials and soil exchange may be required if extended periods of warm, dry weather are not available during earthwork operations.

More detailed design criteria and construction recommendations for proposed foundations, slabs, pavements, and earthwork are discussed in the following report.

SECTION 2.0
Introduction

2.1 AUTHORIZATION

Kevin E. Shelly, P.E. with Shore Point issued authorization to Whitestone to perform the geotechnical investigation at this site relevant to the proposed site development. The geotechnical investigation was performed in general accordance with Whitestone's November 13, 2019 proposal to Shore Point.

2.2 PURPOSE

The purpose of this subsurface exploration and analysis was to:

- ascertain the various soil profile components at test locations;
- estimate the engineering characteristics of the proposed foundation bearing and subgrade materials;
- provide geotechnical criteria for use by the design engineers in preparing the foundation, floor slab, SWM and pavement design;
- provide recommendations for required earthwork and subgrade preparation;
- record groundwater levels (if encountered) at the time of the investigation and discuss the potential impact on the proposed construction; and
- recommend additional investigation and/or analysis (if warranted).

2.3 SCOPE

The scope of the exploration and analysis included the subsurface exploration, field testing and sampling, laboratory analyses, and a geotechnical engineering analysis and evaluation of the subsurface materials. This *Report of Geotechnical Investigation* is limited to addressing the site conditions related to the physical support of the proposed construction. Any references to suspicious odors, materials, or conditions are provided strictly for the client's information.

2.3.1 Field Exploration

The field exploration of the project site was conducted by means of 19 soil test borings with two offset borings (identified as B-1 through B-19) performed with an truck mounted drill rig using hollow stem

augers and split-spoon sampling techniques, and excavating four soil profile pits (identified as SPP-1 through SPP-4) performed with a rubber tire backhoe. The borings were performed within the proposed building footprints and parking garage footprint areas and were terminated at depths ranging from approximately 6.5 fbgs to 33.1 fbgs. The soil profile pits were performed within proposed SWM areas and were terminated at depths ranging from approximately 11 fbgs to 12 fbgs. The soil borings and soil profile pits were backfilled with soil cuttings generated from the investigation. The locations of the subsurface tests are shown on the accompanying *Test Location Plan* included as Figure 1.

The subsurface tests were conducted in the presence of Whitestone personnel who performed field tests, recorded visual classifications, and collected samples of the various strata encountered. The test locations were located in the field using normal taping procedures and estimated right angles. These locations are presumed to be accurate within a few feet.

Soil borings and Standard Penetration Tests (SPTs) were conducted in general accordance with American Society for Testing Materials (ASTM) designation D 1586. The Standard Penetration Resistance value (N) can be used as an indicator of the consistency of fine-grained soils and the relative density of coarse-grained soils. The N-value for various soil types can be correlated with the engineering behavior of earthworks and foundations.

Groundwater level observations, although not encountered, were recorded during and immediately following the completion of the testing operations within the soil borings and test excavations. Seasonal variations, temperature effects, and recent rainfall conditions may influence the levels of the groundwater, and the observed levels will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitoring wells may not be representative of true groundwater levels.

2.3.2 Laboratory Program

In addition to the field investigation, a laboratory testing program was conducted to determine additional, pertinent engineering characteristics of representative samples of on-site soils. The laboratory program was performed in general accordance with applicable ASTM standard test methods and included physical/textural testing of representative samples of various strata.

The results of the laboratory program are presented in this section in a general manner and qualitatively interpreted. The results are incorporated into the findings and recommendations discussed throughout this report. Quantitative test results are provided in Appendix B.

Physical and Textural Analysis: Representative samples of selected strata encountered were subjected to a laboratory program that included moisture content determinations (ASTM D-2216) and washed

gradation analyses (ASTM D-422) in order to perform supplementary engineering soil classifications in general accordance with ASTM D-2487. The soil strata tested were classified by the Unified Soil Classification System (USCS) and results of the laboratory testing are summarized in the following table.

LABORATORY TESTING SUMMARY							
Source of Sample	**Sample Number**	**Depth (fbgs)**	**Natural Moisture (%)**	**Liquid Limit (%)**	**Plastic Index (%)**	**Passing No. 200 Sieve (%)**	**USCS Classification**
B-2	S-4	6.0 - 8.0	17.2	27	9	53.5	CL
B-4	S-2	2.0 - 4.0	11.7	NP	NP	31.9	SM
B-5	S-3	4.0 - 6.0	4.3	NP	NP	11.9	SP-SM
B-10	S-5	8.0 - 10.0	18.8	NP	NP	64.2	ML

Notes: NP = Non-Plastic

The engineering classifications are useful when considered in conjunction with the additional site data to estimate properties of the soil types encountered and to predict the soil's behavior under construction and service loads. Laboratory test results are provided in Appendix B.

SECTION 3.0
Site Description

3.1 LOCATION AND DESCRIPTION

The subject property is located at Liberty Street & Maple Street, Paterson, Passaic County, New Jersey and can be identified further as Block 801, Lots 6, 7 & 23. The site is bound to the north by industrial buildings, to the south by a wooded lot, to the east by a public followed by a wooded parcel, and to the west by a public park followed by the Passaic River. The site of the proposed construction is shown on the *Test Location Plan* included as Figure 1.

3.2 EXISTING CONDITIONS

Surface Cover/Development: At the time of Whitestone's investigation, the subject site consisted vacant Hinchliffe Stadium along with a vacant parcel to the north.

Topography: Based on *ALTA & NSPS Land Title Survey* prepared by Stonefield, the subject site has a high elevation of approximately 159 feet above NAVD 88 in the northern portion of the site with a low elevation of approximately 129 feet above NAVD 88 in the western portion of the site.

Utilities: At the time of Whitestone's investigation, the subject site near vacant Hinchcliffe was serviced by underground utilities including gas, water, sanitary and by above ground utilities including electric and telephone.

Site Drainage: Surface runoff is anticipated to follow existing site contours draining toward inlets located within the adjacent right-of-way. The termination of these inlets are unknown.

3.3 SITE GEOLOGY

The subject site is situated within the Piedmont Geomorphic Province of New Jersey. Specifically, the subject site is underlain by the Lower Jurassic-aged Orange Mountain Basalt formation, which is part of the Brunswick Group. The Orange Mountain Basalt formation generally consists of dark-greenish-gray to greenish-black basalt composed mostly of calcic plagioclase and clinopyroxene. The overburden materials at the site include late Wisconsinan glaciofluvial terrace deposits generally consisting of sand, pebble-to-cobble gravel, minor silt and clay. Overburden materials also include sporadic organic marsh soils and artificial fill associated with past and present development.

3.4 PROPOSED CONSTRUCTION

Based on the *Hinchliffe Stadium Concept Plan* prepared by Clarke Caton Heinz Architecture, the proposed redevelopment will include partial demolition of the existing site structures and renovation of the existing Hinchliffe Stadium and surrounding areas. The scope of work includes the construction of a six-story, 5,877-square feet (footprint) residential building, a four-story, 29,894-suqre feet (footprint) parking garage, and an approximately 5,000-spaire feet (footprint) restaurant building with associated pavements and utilities. New SWM areas will be constructed around the proposed building footprint, however, at the time of this report, the exact type, location, and depth of the SWM area(s) were not finalized. No new retaining walls currently are planned.

The anticipated maximum loads are expected to be less than the following:

- column loads - 450 kips;
- wall loads - 7.0 kips/linear foot; and
- floor slabs - 125 pounds per square foot.

The above-referenced structural loads were assumed based upon Whitestone's previous experience with similar facilities and should be confirmed by the structural engineer. The scope of Whitestone's investigation and the professional advice contained in this report were generated based on the project details noted herein. Any revisions or additions to the design details enumerated in this report should be brought to the attention of Whitestone for additional evaluation as warranted.

SECTION 4.0
Subsurface Conditions

Details of the subsurface materials encountered are presented on the *Records of Subsurface Exploration* presented in Appendix A of this report. The subsurface soil conditions encountered in the soil borings and profile pits consisted of the following generalized strata in order of increasing depth.

4.1 SUBSURFACE SOIL CONDITIONS

Surface Cover: The soil borings and profile pits were performed within the vacent parcel to the north and around an existing one-story building to the west near Hinchliffe Stadium encountered approximately six inches of topsoil at the surface and approximately four inches of asphaltic pavement and concrete.

Existing Fill Materials: At or underlying the surface cover materials, 17 soil borings and one profile pit encountered existing fill materials. The existing fill materials generally consisted of: sand with variable amounts of gravel and debris and silty sand with variable amounts of gravel, silt, and debris. The debris encountered consisted of wood, concrete, brick, asphalt, fabric, metal, plastic, steel, and tile. Where encountered, the existing fill materials extended to depths ranging from approximately two fbgs to 13.0 fbgs. SPT N-values within the existing fill materials ranged between seven blows per foot (bpf) and refusal (refusal defined as greater than 50 blows per six inches of split-spoon sampler advancement) and averaged approximately 22 bpf.

Glacial Deposits: Underlying the existing fill materials, the borings and profile pits encountered natural glacial deposits generally consisting of silty sand (USCS: SM), clayey sand (USCS: SC), lean clay (USCS: CL) with variable amounts of sand, poorly graded sand with silt (USCS: SP-SM), and poorly graded sand (USCS: SP) with variable amounts of gravel. Where encountered, the glacial deposits extended to depths ranging from approximately six fbgs to 28 fbgs. SPT N-values within this stratum ranged between six bpf and refusal (refusal defined as greater than 50 blows per six inches of split-spoon sampler advancement), generally indicating loose to very dense relative densities and averaging approximately 23 bpf.

Residual Soils: Underlying the existing fill materials and glacial deposits, seven borings encountered natural residual soils consisting of silty sand (USCS: SM) with various amounts of gravel and sandy silt (USCS: ML) with various amounts of gravel. Where encountered, the residual soils extended to depths ranging from approximately nine fbgs to 33 fbgs. SPT N-values within this stratum ranged between six bpf and 50 bpf, indicating loose to very dense relative densities and averaging approximately 21 bpf.

Weathered Rock/Bedrock: Underlying the glacial deposits and residual soils, the subsurface tests encountered highly basalt. The borings and profile pits were terminated at the apparent weathered rock/bedrock interface at depths ranging from approximately 6.5 fbgs to 33.1 fbgs. SPT N-values within this stratum were consistently in the refusal range (defined as more than 50 blows per six inches of split spoon sampler penetration.

4.2 GROUNDWATER

Static groundwater was not encountered within the subsurface tests to a maximum depth explored of approximately 20 fbgs, however, indications of impeded drainage were encountered at variable depths across the subject site. Groundwater conditions likely will fluctuate seasonally and following periods of precipitation.

SECTION 5.0
Conclusions and Recommendations

5.1 GENERAL

Following construction phase evaluation, Whitestone recommends supporting the proposed structures on conventional shallow foundations bearing within the improved and approved existing fill, natural soils, and/or controlled structural fill soils that are properly inspected, placed, and compacted in accordance with Sections 5.2, 5.3, and 5.11 of this report. Areas of existing fill may require overexcavation due to inherent variability of existing fill.

Whitestone anticipates that proposed floor slabs and pavements may be supported on approved and improved existing fill materials, underlying natural soils, and/or controlled structural fill materials subject to supplemental evaluation and subgrade preparation as described herein with areas of recompaction, overexcavation and replacement and/or mechanical stabilization anticipated due to the inherent variability that exists within existing fill, evidenced by the debris encountered and sporadic N-values.

5.2 SITE PREPARATION AND EARTHWORK

Surface Cover Stripping and Demolition: Prior to any remaining stripping operations, all utilities should be identified and secured. The existing surface cover to be stripped should be removed from within and at least five feet beyond the limits of areas requiring structural fill placement, where possible. Former structural elements, although not anticipated, encountered during excavations, should be removed entirely from below proposed foundations and their zones of influence (as determined by lines extending at least one foot laterally beyond footing edges for each vertical foot of depth) and excavated to at least two feet below proposed construction subgrade levels elsewhere. All fill or backfill placed in structural areas during any demolition operations should be placed as structural fill in accordance with Section 5.2, 5.3, and 5.11 of this report.

Surface Preparation/Proofrolling: Prior to placing any fill or subbase materials to raise or restore grades to the desired subgrade elevations, the existing exposed soils should be compacted to a firm surface with several passes in two perpendicular directions of a minimum 10-ton roller. The surface then should be proofrolled with a loaded tandem axle truck in the presence of the geotechnical engineer to help identify soft or loose pockets which may require removal and replacement or further investigation. Proofrolling should be performed after a suitable period of dry weather to avoid degrading an otherwise stable subgrade. Any fill or backfill should be placed and compacted in accordance with Section 5.3.

Subgrade Protection and Inspection: Every effort should be made to minimize disturbance of the on-site materials by construction traffic and surface runoff. The on-site soils will deteriorate when subjected to repeated wetting and construction traffic and may require wetting or drying to achieve proper compaction. The site contractors should employ necessary means and methods to protect the subgrade.

Difficult Excavation Considerations: Very dense soil, weathered rock, and apparent bedrock were encountered during this subsurface investigation at variable depths. Based on proposed site grading, removal of weathered rock and intact rock should be anticipated during construction. Excavation difficulties will be more prevalent in confined excavations, such as foundations and utilities, footing and utility excavations may inadvertently become oversized due to irregular excavation and require additional backfill materials. The speed and ease of excavation will depend on the type of grading equipment, the equipment operator, and the geologic structure of the material, such as planes of weakness and spacing between discontinuities. Based on local experience and the results of test boring efforts, Whitestone expects that the upper few feet of the weathered rock materials typically can be removed with a large excavator equipped with ripping tools and extreme service buckets with rock teeth without considerable difficulty during mass grading operations. However, planned excavations beyond a few feet into the weathered materials and refusal depths in confined excavations are expected to require the use of large excavation machinery equipped with ripping tools and/or pneumatic hammers.

5.3 STRUCTURAL FILL AND BACKFILL

Imported Fill Material: Any imported material placed as structural fill or backfill to raise elevations or restore design grades should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and five percent to 20 percent of material finer than a #200 sieve. Alternatively, inorganic soil types including silty and clayey sands and gravels with higher percentage of fine material and silts and clays with a liquid limit less than 40 and a plasticity index less than 20 may be considered subject to the owner's approval, provided that the required moisture content and compaction controls are met. The material should be free of clay lumps, organics and deleterious material.

On-Site Material: Based on the conditions disclosed by the subsurface tests, Whitestone anticipates that a majority of the natural soils will be suitable for selective reuse as structural fill and/or backfill provided moisture contents are controlled within two percent of the optimum during favorable weather conditions. Reuse of the site soils will be contingent on careful inspection in the field by the owner's geotechnical engineer by visual observation and/or test pit excavations either prior to or during construction.

Laboratory results indicate that the existing fine-grained soils (USCS: ML and CL) are highly moisture sensitive. The reuse of these materials typically is possible only during ideal weather conditions. Reuse of these soils is expected to require mixing with a granular material, extensive moisture conditioning,

and/or drying to facilitate their reuse, workability, and compaction in fill areas. The on-site soils will become increasingly difficult to reuse and compact where wetted beyond the optimum moisture content.

Materials that are, or become, exceedingly wet likely will require discing and aerating that may not be practical. Alternatively, imported fill materials and soil exchange may be required to attain the desired grades, backfill utility trenches, and expedite earthwork operations. The stripped topsoil should not be used as fill or backfill.

Compaction and Placement Requirements: All fill and backfill should be placed in maximum nine-inch loose lifts and compacted to 95 percent of the maximum dry density within two percent of the optimum moisture content as determined by ASTM D 1557 (Modified Proctor) unless otherwise recommended in subsequent sections of this report. Whitestone recommends using a vibratory drum roller to compact the on-site soils or a small hand-held vibratory compactor within excavations.

Structural Fill Testing: A sample of the imported fill material and on-site materials to be re-used should be submitted to the geotechnical engineer for analysis and approval prior to use. The placement of all fill and backfill should be monitored by a qualified engineering technician to ensure that the specified material and lift thicknesses are properly installed. A sufficient number of in-place density tests (methods ASTM D 6938 or ASTM D 1556) should be performed on each lift to ensure that the specified compaction is achieved throughout the height of the fill or backfill.

5.4 GROUNDWATER CONTROL

Groundwater was not encountered within the borings and profile pits to a maximum depth explored of approximately 33 fbgs. Therefore, Whitestone anticipates that static groundwater will be deeper than proposed foundation excavations. However, trapped/perched water may be expected to be encountered across the subject site, especially following precipitation events. As such, construction phase dewatering of perched groundwater through the use of gravity fed sump pumps may be anticipated during excavation activities for this site. Whitestone anticipates that dewatering typically would include numerous sump pumps along the excavation perimeter.

Because the subsurface soils will soften when exposed to water, every effort must be made to maintain drainage of surface water runoff away from construction areas by grading and limiting the exposure of excavations to rainfall. Overexcavation of saturated soils and replacement with controlled structural fill and/or one foot to two feet of open graded gravel (such as 3/4 inch clean crushed stone) may be required prior to resuming work on disturbed subgrade soils.

5.5 FOUNDATIONS

Shallow Foundation Design Criteria: Contingent upon construction phase evaluation, Whitestone recommends supporting the proposed on conventional spread and continuous wall footings designed to bear within the improved and approved existing fill materials, the natural site soils, and/or on properly placed and compacted structural fill that is properly evaluated, placed, and compacted in accordance with Sections 5.2, 5.3, and 5.11 of this report. Foundations bearing within these materials may be designed to impart a maximum allowable net bearing pressure of 4,000 psf. Areas of overexcavation should be anticipated due to the general variability encountered within the existing fill materials.

All footing bottoms should be improved by in-trench compaction in the presence of the geotechnical engineer. Regardless of loading conditions, proposed foundations should be sized no less than minimum dimensions of 24 inches for continuous wall footings and 36 inches for isolated column footings.

Below-grade footings and footings subject to overturning should be designed so that the maximum toe pressure due to the combined effect of vertical loads and overturning moment does not exceed the recommended maximum allowable net bearing pressure. In addition, positive contact pressure should be maintained throughout the base of the footings such that no uplift or tension exists between the base of the footings and the supporting soil. Uplift loads should be resisted by the weight of the concrete. Side friction should be neglected when proportioning the footings so that lateral resistance should be provided by friction resistance at the base of the footings. A coefficient of friction against sliding of 0.35 is recommended for use in the design of the foundations bearing within the existing site soils or imported structural fill soils.

Partial Weathered Rock/Bedrock Support: Foundations should not be supported partially on weathered rock, weathered rock-sized cobbles/boulders, or bedrock and partially on soil because of the risk of brittle fracture due to a hinging effect. If the proposed bearing elevations result with partial bearing on such materials, Whitestone recommends removing a minimum of six inches of the weathered rock/bedrock and restoring the bearing elevation with structural fill.

Foundation Inspection: Whitestone recommends that the suitability of the bearing soils along and below the footing bottoms be verified by the owner's geotechnical engineer with specific knowledge of the site subsurface conditions and design assumptions prior to placing concrete for the footings. Where areas of unsuitable materials are encountered in footing excavations, overexcavation and recompaction or replacement may be necessary to provide a suitable footing subgrade in accordance with Section 5.2. Any overexcavation to be restored with structural fill will need to extend at least one foot laterally beyond footing edges for each vertical foot of overexcavation. Lateral overexcavation can be reduced if the grade is restored with lean concrete or approved flowable fill. The bottom of overexcavation should be

compacted with vibrating plates or plate tampers ("jumping jacks") to compact locally disturbed materials.

Settlement: Whitestone estimates post construction settlements of proposed building foundations to be less than one inch if the recommendations outlined in this report are properly implemented. Differential settlement of building foundations should be less than one-half inch.

Frost Coverage: Footings subject to frost action should be placed at least 36 inches below adjacent exterior grades or the depth required by local building codes to provide protection from frost penetration. Interior footings not subject to frost action may be placed at a minimum depth of 18 inches below the slab subgrade.

5.6 FLOOR SLAB

Whitestone anticipates that the improved and approved existing fill materials, the underlying natural soils and/or controlled structural fill materials will be suitable for support of the proposed floor slabs provided these materials are properly evaluated, placed, compacted and proofrolled in accordance with Sections 5.2, 5.3, and 5.11 of this report. Localized areas of overexcavation may be anticipated due to the presence of existing fill materials and if the subgrades are exposed to precipitation or repeated construction traffic. Any areas that become softened or disturbed as a result of wetting and/or repeated exposure to construction traffic should be removed and replaced with compacted structural backfill. The properly prepared on-site soils are expected to yield a minimum subgrade modulus (k) of 150 psi/in.

A minimum four-inch layer of coarse aggregate, such as AASHTO #57 stone, dense graded aggregate, or equal, should be installed below ground-supported floor slabs to provide a capillary break. An impervious membrane also should be provided as a moisture vapor barrier beneath all floor slabs.

5.7 PAVEMENT DESIGN CRITERIA

General: Whitestone anticipates that the improved and approved existing fill materials, natural soils and/or compacted structural fill and/or backfill placed to raise or restore design elevations are expected to be suitable for support of the proposed pavements provided these materials are properly evaluated, compacted, and proofrolled in accordance with Sections 5.2, 5.3, and 5.11 of this report during favorable weather conditions. Localized areas of overexcavation may be anticipated due to presence of existing fill materials and if the subgrades are exposed to precipitation. If the risk of increased maintenance is not acceptable, more extensive subgrade preparation recommendations can be developed. The following pavement section recommendations are based on the assumption that such an increased risk is acceptable. Whitestone would be pleased to prepare alternative recommendations for the more substantial subgrade improvements.

Design Criteria: A California Bearing Ratio value of five has been assigned to the properly prepared subgrade soils for pavement design purposes. This value was correlated with pertinent soil support values and assumed traffic loads to prepare flexible and rigid pavement designs per the AASHTO *Guide for the Design of Pavement Structures*.

Design traffic loads were estimated based on Whitestone's past experience with similar projects and correlated with 18-kip equivalent single axle loads (ESAL) for a 20-year life. Estimated maximum pavement loads of 25,000 ESALs and 60,000 ESALs were used for Standard-Duty and Heavy-Duty pavement areas, respectively.

Pavement Sections: The following recommended flexible pavement section is presented below:

FLEXIBLE PAVEMENT SECTION DESIGN			
Layer	**Material**	**Standard Duty Thickness (Inches)**	**Heavy Duty Thickness (inches)**
Asphalt Surface	NJDOT I-5	1.5	1.5
Asphalt Base	NJDOT I-2 Base	2.0	3.0
Granular Subbase	NJDOT DGA Base Course	6.0	7.0

A rigid concrete pavement should be used to provide suitable support at areas of high traffic or severe turns (such as loading dock areas and access aprons). The recommended rigid pavement is presented below in tabular format:

RIGID PAVEMENT SECTION DESIGN			
Layer	**Material**	**Standard Duty Thickness (Inches)**	**Heavy Duty Thickness (inches)**
Surface	4000 psi Air-Entrained Concrete	6.0	7.0
Base	NJDOT DGA Base Course	6.0	6.0

Additional Design Considerations: The pavement section thickness designs presented in this report are based on the design parameters detailed herein and are contingent on proper construction, inspection, and maintenance. Additional thickness may be required by local code. The designs are contingent on achieving the minimum soil support value in the field. To accomplish this requirement, all subgrade soil and supporting fill or backfill must be placed, compacted, and evaluated in accordance with Sections 5.2, 5.3, and 5.11 of this report. Proper drainage must be provided for the pavement structure including appropriate grading and surface water control.

The performance of the pavement also will depend on the quality of materials and workmanship. Whitestone recommends that NJDOT standards for materials, workmanship, and maintenance be applied to this site. Project specifications should include verifying that the installed asphaltic concrete material composition is within tolerance for the specified materials and that the percentage of air voids of the installed pavement is within specified ranges for the respective materials. All rigid concrete pavements should be suitably air-entrained, jointed, and reinforced.

5.8 RETAINING WALLS/LATERAL EARTH PRESSURES

No site retaining walls were identified on the aforementioned plans. Whitestone should be notified if any other retaining structures or design considerations requiring lateral earth pressure estimations are proposed.

5.9 SEISMIC AND LIQUEFACTION CONSIDERATIONS

Based on a review of the subsurface conditions relevant to the *2018 International Building Code - New Jersey Edition*, the subject site may be assigned a Site Class C. Based on the seismic zone and soil profile liquefaction considerations are not expected to have a substantial impact on design.

5.10 EXCAVATIONS

The soils encountered during this investigation within anticipated excavation depths are at least consistent with Type C Soil Conditions as defined by 29 CFR Part 1926 (OSHA) which require a maximum unbraced excavation angle of 1.5:1 (horizontal:vertical). Actual conditions encountered during construction should be evaluated by a competent person (as defined by OSHA) to ensure that safe excavation methods and/or shoring and bracing requirements are implemented.

5.11 SUPPLEMENTAL POST INVESTIGATION SERVICES

Construction Inspection and Monitoring: The owner's geotechnical engineer with specific knowledge of the site subsurface conditions and design assumptions should perform inspection, testing, and consultation during construction as described in previous sections of this report. Monitoring and testing should also be performed to verify that the existing surface cover is properly removed and suitable materials used for controlled fill are properly placed and compacted over suitable subgrade soils. The owner's geotechnical engineer should also evaluate existing fill materials for structural support and proofroll all subgrades prior to foundation, floor slab, and pavement support.

5.12 PRELIMINARY STORMWATER MANAGEMENT AREA EVALUATION

General: Soil profile pits SPP-1 through SPP-4 were performed within accessible areas across the subject site. The soil profile pits performed within the SWM areas were terminated at depths ranging from approximately 11 fbgs to 12 fbgs.

Estimated Seasonal High Groundwater Levels: The methods used in determining the seasonal high groundwater level include evaluating the soil morphology within a test excavation and identifying irregular spots or blotches of different colors or minerals unlike that of the surrounding soil (mottles). A summary of the estimated seasonal high groundwater observations, where encountered, as well as infiltration and permeability test results are included in the following table.

INFILTRATION/PERMEABILITY TEST SUMMARY					
Profile Pit #	Surface Elevation (feet above NAVD 88)	ESHGW (fbgs)	USDA Classification @ Test	Infiltration/Permeability Test	
				Depth (fbgs)	Rate (in/hour)
SPP-1	158.0	NE	Loamy Sand	4.0	9.0
SPP-2	160.0	NE	Sand	4.0	9.0
SPP-3	158.0	NE	Sandy Clay Loam	4.0	< 0.2
SPP-4	158.0	NE	Sand	4.0	12.0

*NS – Not Surveyed; NE – Not Encountered

Soil Infiltration Rates: Representative samples within the profile pits were subjected to in-site infiltration testing and laboratory tube permeameter analysis as detailed in *New Jersey Stormwater Best Practices Manual.* Testing resulted in rates ranging from less than 0.2 inches per hour (iph) to 12.0 iph. Individual tube permeameter test results are provided in Appendix B.

SECTION 6.0
General Comments

Supplemental recommendations may be required upon finalization of construction plans or if significant changes are made in the characteristics or location of the proposed structures. Soil bearing conditions should be checked at the appropriate time for consistency with those conditions encountered during Whitestone's geotechnical investigation.

The possibility exists that conditions between borings may differ from those at specific boring locations, and conditions may not be as anticipated by the designers or contractors. In addition, the construction process may alter soil and rock conditions. Therefore, experienced geotechnical personnel should observe and document the construction procedures used and the conditions encountered.

The recommendations presented herein should be utilized by a qualified engineer in preparing the project plans and specifications. The engineer should consider these recommendations as minimum physical standards which may be superseded by local and regional building codes and structural considerations. These recommendations are prepared for the sole use of Shore Point Engineering for the specific project detailed and should not be used by any third party. These recommendations are relevant to the design phase and should not be substituted for construction specifications.

Whitestone assumes that a qualified contractor will be employed to perform the construction work, and that the contractor will be required to exercise care to ensure all excavations are performed in accordance with applicable regulations and good practice. Particular attention should be paid to avoiding damaging or undermining adjacent properties and maintaining slope stability.

Whitestone recommends that the services of the geotechnical engineer be engaged to test and evaluate the soils in the footing excavations prior to concreting in order to determine that the soils will support the bearing capacities. Monitoring and testing also should be performed to verify that suitable materials are used for controlled fills and that they are properly placed and compacted over suitable subgrade soils.

The exploration and analysis of the foundation conditions reported herein are considered sufficient in detail and scope to form a reasonable basis for the foundation design. The recommendations submitted for the proposed construction are based on the available soil information and the preliminary design details furnished by Shore Point Engineering. If deviations from the noted subsurface conditions are encountered during construction, they should be brought to the attention of the geotechnical engineer.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been promulgated after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology. No other warranties are implied or expressed.

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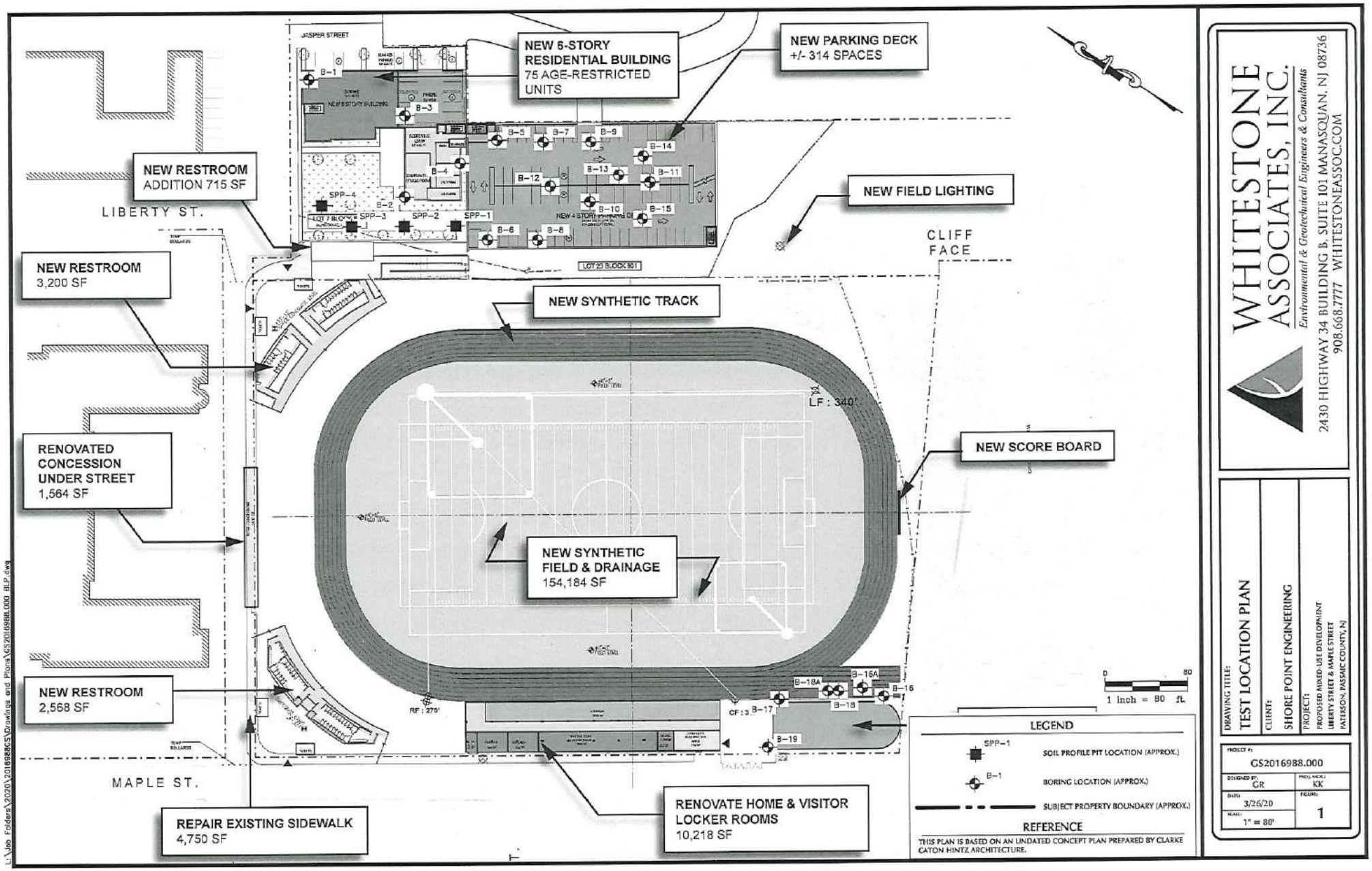
FIGURE 1
Test Location Plan



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DRAWING TITLE: TEST LOCATION PLAN
CLIENT: SHORE POINT ENGINEERING
PROJECT: PROPOSED MIXED-USE DEVELOPMENT LIBERTY STREET & MAPLE STREET PATERSON, PASSAIC COUNTY, NJ

PROJECT #:	GS2016988.000
DESIGNED BY: GR	PREPARED BY: KK
DATE: 3/26/20	FIGURE: 1
SCALE: 1" = 80'	

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APPENDIX A
Records of Subsurface Exploration

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-1

Page 1 of 1

Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 158.0 feet	**Date Started:**	3/18/2020
Termination Depth:	22.1 feet bgs	**Date Completed:**	3/18/2020
Proposed Location:	Building	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	22.0P | 136.0		
At Completion:	NE | ---	At Completion:	17.0 | 141.0
24 Hours:	--- | ---	24 Hours:	— | —

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	TOPSOIL		4" Topsoil	
0 - 2	S-1	X	1 - 5 - 6 - 6	20	11	0.3	GLACIAL DEPOSITS		Brown Silty Sand, Moist, Medium Dense (SM)	
2 - 4	S-2	X	5 - 5 - 6 - 9	22	11	2.0			Brown Poorly Graded Sand, Moist, Medium Dense (SP)	Trace Gravel Pumice Grains
4 - 6	S-3	X	7 - 9 - 9 - 11	22	18	5.0			As Above (SP)	Finer Sand
6 - 8	S-4	X	6 - 8 - 9 - 11	22	17	6.0			Brown Poorly Graded Sand with Silt, Moist, Medium Dense (SP-SM)	
8 - 10	S-5	X	7 - 7 - 7 - 8	22	14	8.0			Brown Poorly Graded Sand, Moist, Medium Dense (SP)	
						10.0				
						13.0				
13 - 15	S-6	X	5 - 5 - 6 - 8	22	11	15.0			Brown Silty Sand, Moist, Medium Dense (SM)	
										Hard Augering @ 15.5 fbgs to 22.0 fbgs
18 - 20	S-7	X	23 - 19 - 19 - 18	16	38	18.0	RESIDUAL		Reddish-Brown Poorly Graded Sand with Gravel, Moist, Dense (SP)	Possible Weathered Rock
						20.0				Spoon Wet
22 - 22.1	S-8	X	50/1"	NR	50/1"				Boring Log B-1 Terminated at a Depth of 22.1 Feet Below Ground Surface Due to Auger Refusal on Rock	
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-2

Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering

Surface Elevation:	± 158.0 feet	**Date Started:**	3/18/2020	**Water Depth | Elevation (feet bgs) | (feet)**		**Cave-In Depth | Elevation (feet bgs) | (feet)**	
Termination Depth:	33.1 feet bgs	**Date Completed:**	3/18/2020				
Proposed Location:	Building	**Logged By:**	MH	**During:**	33.0 | 125.0		
Drill / Test Method:	HSA / SPT	**Contractor:**	JG	**At Completion:**	NE | ---	**At Completion:**	22.0 | 136.0
		Equipment:	CME-55	**24 Hours:**	--- | ---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	TOPSOIL		6" Topsoil	
0 - 2	S-1	X	3 - 5 - 8 - 9	20	13		FILL		Brown Sand, Moist (FILL)	
2 - 4	S-2	X	5 - 5 - 4 - 4	20	9	4.0			As Above (FILL)	Topsoil Odor Trace Roots
4 - 6	S-3	X	3 - 3 - 4 - 4	20	7	5.0	GLACIAL DEPOSITS		Brown Clayey Sand, Moist, Loose (SM)	
6 - 8	S-4	X	2 - 3 - 3 - 4	22	6	6.0			Brown Sandy Lean Clay, Moist, Medium Stiff (CL)	Qu = 0.50 tsf
8 - 10	S-5	X	4 - 5 - 6 - 6	22	11	8.0			Brown Poorly Graded Sand, Moist, Medium Dense (SP)	
						10.0				
13 - 15	S-6	X	7 - 9 - 8 - 7	20	17	15.0			As Above, Gravel (SP)	
18 - 20	S-7	X	5 - 6 - 8 - 8	20	14	20.0			As Above (SP)	
23 - 25	S-8	X	8 - 11 - 13 - 14	22	24	25.0			As Above (SP)	

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-2

Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 158.0 feet	**Date Started:**	3/18/2020
Termination Depth:	33.1 feet bgs	**Date Completed:**	3/18/2020
Proposed Location:	Building	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	33.0 | 125.0		
At Completion:	NE | ---	At Completion:	22.0 | 136.0
24 Hours:	--- | ---	24 Hours:	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (In.)	N	(feet)			
						25.0	GLACIAL DEPOSITS		
						28.0	RESIDUAL		
28 - 30	S-9	X	6 - 6 - 5 - 6	20	11			Brown Sandy Silt, Moist, Stiff (ML)	Qu = 1.0 tsf
						30.0			
						33.0		No Recovery, Presumed Boulder/Rock	Spoon Wet
33 - 33.1	S-10	X	50/1"	NR	50/1"			Boring Log B-2 Terminated at a Depth of 33.0 Feet Below Ground Surface Due to Auger Refusal	
						35.0			
						40.0			
						45.0			
						50.0			

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-3

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering

				Water Depth | Elevation (feet bgs) | (feet)	Cave-In Depth | Elevation (feet bgs) | (feet)
Surface Elevation:	± 158.0 feet	**Date Started:**	3/18/2020		
Termination Depth:	25.0 feet bgs	**Date Completed:**	3/18/2020		
Proposed Location:	Building	**Logged By:**	MH	**During:** 23.0P | 135.0	
Drill / Test Method:	HSA / SPT	**Contractor:**	JG	**At Completion:** NE | —	**At Completion:** 20.0 | 138.0
		Equipment:	CME-55	**24 Hours:** — | —	**24 Hours:** — | —

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	TOPSOIL		6" Topsoil	
0 - 2	S-1		4 - 5 - 7 - 7	20	12		GLACIAL DEPOSITS		Brown Poorly Graded Sand, Moist, Medium Dense (SP)	
2 - 4	S-2		8 - 7 - 6 - 7	20	13	4.0			As Above, Gravel (SP)	
4 - 6	S-3		4 - 3 - 3 - 3	16	6	5.0 6.0			Brown Clayey Sand, Moist, Loose (SC)	
6 - 8	S-4		4 - 5 - 7 - 7	20	12				Brown Poorly Graded Sand, Moist, Medium Dense (SP)	
8 - 10	S-5		7 - 8 - 9 - 9	22	17	10.0			As Above (SP)	
13 - 15	S-6		5 - 5 - 6 - 6	22	11	15.0			As Above (SP)	Silt Lenses
18 - 20	S-7		4 - 5 - 5 - 6	22	10	18.0 20.0			Brown Poorly Graded Sand with Silt, Moist, Medium Dense (SP-SM)	
23 - 25	S-8		6 - 10 - 25 - 27	22	35	23.0 25.0			Brown Silty Sand, Wet, Dense (SM)	Possible Weathered Rock in Spoon
									Boring Log B-3 Terminated at a Depth of 25.0 Feet Below Ground Surface	

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-4

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 158.0 feet	**Date Started:**	3/19/2020
Termination Depth:	23.5 feet bgs	**Date Completed:**	3/19/2020
Proposed Location:	Building	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)			Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	23.0	135.0		
At Completion:	NE	---	At Completion:	19.0 | 139.0
24 Hours:	---	---	24 Hours:	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
0 - 2	S-1		2 - 3 - 4 - 4	20	7	0.5	TOPSOIL		6" Topsoil	
							FILL		Brown Sand, Debris, Moist (FILL)_	Debris: Trace Coal
						2.0				
2 - 4	S-2		4 - 4 - 4 - 4	22	8		GLACIAL DEPOSITS		Brown Silty Sand, Moist, Loose (SM)	
						4.0				
4 - 6	S-3		4 - 4 - 5 - 5	22	9	5.0			Brown Poorly Graded Sand with Silt, Moist, Loose (SP-SM)	
						6.0				
6 - 8	S-4		6 - 9 - 9 - 12	22	18				Brown Poorly Graded Sand, Moist, Medium Dense (SP)	
8 - 10	S-5		8 - 8 - 9 - 9	22	17				As Above (SP)	
						10.0				
13 - 15	S-6		5 - 6 - 6 - 8	22	12				As Above (SP)	Silt Lenses
						15.0				
18 - 18.2	S-7		50/2"	NR	50/2"				No Recovery, Presumed Boulder	Hard Augering 18.0 fbgs to 19.0 fbgs
						20.0				
						23.0				
23 - 23.3	S-8		50/4"	3	50/4"	23.3	WR		Brown Weathered Rock, Wet, Very Dense (WR)	
									Boring Log B-4 Terminated at a Depth of 23.3 Feet Below Ground Surface Due to Auger Refusal	
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-5

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 157.0 feet	**Date Started:**	3/19/2020
Termination Depth:	21.0 feet bgs	**Date Completed:**	3/19/2020
Proposed Location:	Parking Deck	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	NE | ---		
At Completion:	— | —	At Completion:	19.0 | 138.0
24 Hours:	— | —	24 Hours:	— | —

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
0 - 2	S-1		3 - 4 - 5 - 5	20	9	0.5	TOPSOIL		6" Topsoil	
						2.0	GLACIAL DEPOSITS		Brown Silty Sand, Moist, Loose (SM)	Trace Gravel
2 - 4	S-2		6 - 7 - 7 - 9	22	14				Brown Poorly Graded Sand, Moist, Medium Dense (SP)	
4 - 6	S-3		6 - 7 - 9 - 10	22	16	5.0			As Above (SP)	
6 - 8	S-4		8 - 9 - 11 - 14	22	20	6.0			Brown Poorly Graded Sand with Silt, Moist, Medium Denes (SP-SM)	
8 - 10	S-5		8 - 8 - 10 - 13	22	18	10.0			As Above (SP-SM)	
						13.0				
13 - 15	S-6		5 - 6 - 6 - 10	22	12	15.0			Brown Poorly Graded Sand, Moist, Medium Dense (SP)	Fine Sand
						18.0				
18 - 19.7	S-7		7 - 11 - 16 - 50/4"	20	27				Brown Silty Sand with Gravel, Very Moist, Medium Dense (SM)	Possible Weathered Rock in Spoon Tip
						20.0				
						21.0			Boring Log B-5 Terminated at a Depth of 21.0 Feet Below Ground Surface Due to Auger Refusal	
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-6

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 157.0 feet	**Date Started:**	3/19/2020
Termination Depth:	15.5 feet bgs	**Date Completed:**	3/19/2020
Proposed Location:	Building	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	NE | ---		
At Completion:	--- | ---	At Completion:	13.0 | 144.0
24 Hours:	--- | ---	24 Hours:	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (In.)	N	(feet)				
						0.0				
						0.5	TOPSOIL		6" Topsoil	Topsoil Measured After Termination
0 - 2	S-1	X	3 - 6 - 7 - 9	NR	13		FILL		No Recovery, Presumed as Below (FILL)	
2 - 4	S-2	X	4 - 6 - 7 - 9	NR	13				No Recovery, Presumed Fill	Tile and Plastic in Cuttings
						4.0				
4 - 6	S-3	X	6 - 8 - 11 - 12	22	19	5.0	GLACIAL DEPOSITS		Brown Poorly Graded Sand, Moist, Medium Dense (SP)	
						6.0				
6 - 8	S-4	X	7 - 7 - 9 - 11	22	16				Brown Poorly Graced Sand with Silt, Moist, Medium Dense (SP-SM)	Fine Sand
8 - 10	S-5	X	9 - 11 - 11 - 12	22	22				As Above (SP-SM)	
						10.0				
						13.0				
13 - 15	S-6	X	9 - 16 - 21 - 33	16	37		RESIDUAL		Reddish-Brown Silty Sand with Gravel, Moist to Very Moist, Dense (SM)	Possible Weathered Rock in Spoon Tip
						15.0				
						15.0			Boring Log B-6 Terminated at a Depth of 15.5 Feet Below Ground Surface Due to Auger Refusal	
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-7

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 156.0 feet	**Date Started:**	3/19/2020
Termination Depth:	20.5 feet bgs	**Date Completed:**	3/19/2020
Proposed Location:	Parking Deck	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	18.0P | 138.0		
At Completion:	--- | ---	At Completion:	19.0 | 137.0
24 Hours:	--- | ---	24 Hours:	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	TOPSOIL		6" Topsoil	
0 - 2	S-1	X	2 - 4 - 5 - 6	20	9		GLACIAL DEPOSITS		Brown Poorly Graded Sand, Moist, Loose (SP)	
2 - 4	S-2	X	5 - 6 - 10 - 11	22	16				As Above (SP)	
4 - 6	S-3	X	9 - 11 - 11 - 11	22	22	5.0			As Above (SP)	
6 - 8	S-4	X	9 - 11 - 12 - 14	22	23	6.0			Brown Poorly Graded Sand with Silt, Moist, Medium Dense (SP-SM)	
8 - 10	S-5	X	14 - 16 - 15 - 14	22	31	10.0			As Above, Dense (SP-SM)	
						13.0				
13 - 15	S-6	X	7 - 12 - 16 - 20	20	28				Brown Silty Sand, Moist, Medium Dense (SM)	Fine Sand
						15.0				
						18.0				
18 - 18.7	S-7	X	16 - 50/3"	3	50/3"		WEATHERED ROCK		Reddish-Brown Weathered Rock, Wet, Very Dense (WR)	
						20.0				
						20.5			Boring Log B-7 Terminated at a Depth of 20.5 Feet Below Ground Surface Due to Auger Refusal	
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-8

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Project:	Proposed Mixed-Use Development	WAI Project No.:	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	Client:	Shore Point Engineering
Surface Elevation:	± 156.0 feet	Date Started:	3/20/2020
Termination Depth:	14.0 feet bgs	Date Completed:	3/20/2020
Proposed Location:	Parking Deck	Logged By:	MH
Drill / Test Method:	HSA / SPT	Contractor:	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)			Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	13.0P	143.0		
At Completion:	NE	---	At Completion:	--- | ---
24 Hours:	---	---	24 Hours:	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
0 - 2	S-1		1 - 2 - 6 - 7	14	8	0.4	TOPSOIL		5" Topsoil	
							FILL		Brown Silty Sand, Debris, Moist (FILL)	Debris: Trace Coal
						2.0				
2 - 4	S-2		5 - 5 - 8 - 10	20	13		GLACIAL DEPOSITS		Brown Silty Sand, Moist, Medium Dense (SM)	
						4.0				
4 - 6	S-3		10 - 12 - 12 - 13	22	24	5.0			Brown Poorly Graded Sand with Silt, Moist, Medium Dense (SP-SM)	
6 - 8	S-4		10 - 12 - 13 - 15	22	25				As Above (SP-SM)	
8 - 10	S-5		13 - 15 - 17 - 21	22	32				As Above (SP-SM)	
						10.0				
						13.0				
13 - 13.3	S-6		50/4"	4	50/4"		WEATHERED ROCK		Reddish-Brown Weathered Rock, Wet, Very Dense (WR)	
						14.0				
						15.0			Boring Log B-8 Terminated at a Depth of 14.0 Feet Below Ground Surface Due to Auger Refusal	
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-9

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 156.0 feet	**Date Started:**	3/20/2020
Termination Depth:	15.5 feet bgs	**Date Completed:**	3/20/2020
Proposed Location:	Parking Deck	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)			Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	13.0P	143.0		
At Completion:	NE	---	At Completion:	11.0 | 145.0
24 Hours:	—	—	24 Hours:	— | —

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
0 - 2	S-1		3 - 6 - 13 - 13	3	19	0.4	TOPSOIL		5" Topsoil	Topsoil Measured After Termination
							FILL		Low Recovery, Concrete in Spoon Tip (FILL)	
2 - 4	S-2		4 - 6 - 6 - 7	20	12	2.0	GLACIAL DEPOSITS		Brown Silty Sand, Moist, Medium Dense (SM)	
4 - 6	S-3		7 - 8 - 8 - 11	22	16	5.0			As Above (SM)	
6 - 8	S-4		8 - 10 - 11 - 14	22	21				As Above (SM)	Fine Sand
8 - 10	S-5		11 - 11 - 13 - 16	22	24	8.0			Brown Poorly Graded Sand with Silt, Moist, Medium Dense (SP-SM)	
						10.0				
						13.0				
13 - 14.3	S-6		14 - 19 - 50/4"	10	69/10"		WEATHERED ROCK		Reddish-Brown Weathered Rock, Wet, Very Dense (WR)	
						15.0				
						15.5			Boring Log B-9 Terminated at a Depth of 15.5 Feet Below Ground Surface Die to Auger Refusal	
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-10

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 156.0 feet	**Date Started:**	3/20/2020
Termination Depth:	13.5 feet bgs	**Date Completed:**	3/20/2020
Proposed Location:	Parking Deck	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	13.0P | 143.0		
At Completion:	--- | ---	At Completion:	11.0 | 145.0
24 Hours:	--- | ---	24 Hours:	--- | ---

Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	DEPTH (feet)	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
						0.0			
0 - 2	S-1		4 - 7 - 11 - 13	20	18	0.5	TOPSOIL	6" Topsoil	
							FILL	Brown Silty Sand, Debris, Moist (FILL)	Debris: Trace Coal, Cinders
2 - 4	S-2		11 - 13 - 10 - 11	22	23	2.0	GLACIAL DEPOSITS	Brown Poorly Graded Sand, Moist, Medium Dense (SP)	
4 - 6	S-3		10 - 8 - 8 - 10	22	16	4.0		Brown Silty Sand, Moist, Medium Dense (SM)	
6 - 8	S-4		12 - 12 - 12 - 20	22	24	5.0		As Above (SM)	
8 - 10	S-5		22 - 25 - 25 - 31	22	50	9.0		As Above, Very Dense (SM)	
						10.0	RESIDUAL	Reddish-Brown Sandy Silt, Moist, Very Dense (ML)	
						13.0			Hard Augering 12.0 fbgs to 13.5 fbgs
13 - 13.5	S-6		50/1"	1	50/1"	13.5	WR	Reddish-Brown Weathered Rock, Wet, Very Dense (WR)	
						15.0		Boring Log B-10 Terminated at a Depth of 13.5 Feet Below Ground Surface Due to Auger Refusal	
						20.0			
						25.0			

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-11

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Project:	Proposed Mixed-Use Development	WAI Project No.:	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	Client:	Shore Point Engineering

				Water Depth | Elevation (feet bgs) | (feet)	Cave-In Depth | Elevation (feet bgs) | (feet)
Surface Elevation:	± 156.0 feet	Date Started:	3/24/2020		
Termination Depth:	9.0 feet bgs	Date Completed:	3/24/2020		
Proposed Location:	Parking Deck	Logged By:	MH	During: NE | ---	
Drill / Test Method:	HSA / SPT	Contractor:	JG	At Completion: --- | ---	At Completion: --- | ---
		Equipment:	CME-55	24 Hours: --- | ---	24 Hours: --- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.3	TOPSOIL		3" Topsoil	
0 - 2	S-1		2 - 4 - 8 - 11	20	12		FILL		Brown Silty Sand with Gravel, Debris, Moist (FILL)	Debris: Trace Brick
2 - 4	S-2		16 - 10 - 11 - 7	20	21				As Above (FILL)	
4 - 6	S-3		6 - 8 - 11 - 12	16	19	5.0			As Above, Very Moist (FILL)	Brick in Cuttings
6 - 6.2	S-4		50/2"	NR	50/2"				No Recovery (FILL)	Metal in Cuttings
										Hard Augering 5.0 fbgs to 9.0 fbgs
						8.0				
8 - 8.3	S-5		50/3"	3	50/3"		WEATHERED ROCK		Reddish-Brown Weathered Rock, Moist, Very Dense (WR)	
						9.0				
						10.0			Boring Log B-16 Terminated at a Depth of 9.0 Feet Below Ground Surface Due to Auger Refusal on Rock	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-12

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 156.0 feet	**Date Started:**	3/24/2020
Termination Depth:	16.0 feet bgs	**Date Completed:**	3/24/2020
Proposed Location:	Building	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	NE | ---		
At Completion:	--- | ---	At Completion:	14.0 | 142.0
24 Hours:	--- | ---	24 Hours:	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
0 - 2	S-1		2 - 3 - 7 - 9	20	10	0.5	TOPSOIL		6" Topsoil	
							FILL		Brown Silty Sand with Gravel, Moist (FILL)	Apparent Re-Worked Material
2 - 4	S-2		8 - 10 - 11 - 15	22	21	2.0	GLACIAL DEPOSITS		Brown Silty Sand, Moist, Medium Dense (SM)	
4 - 6	S-3		9 - 14 - 15 - 15	22	29	5.0			As Above (SM)	
6 - 8	S-4		10 - 11 - 11 - 12	22	22	6.0			Brown Poorly Graded Sand with Silt, Moist, Medium Dense (SP-SM)	
8 - 10	S-5		11 - 13 - 16 - 16	22	29	8.0			Brown Silty Sand, Moist, Medium Dense (SM)	
						10.0				
13 - 14.7	S-6		12 - 15 - 26 - 50/1"	20	41				As Above, Dense (SM)	
						15.0				
						16.0	WEATHERED ROCK		Reddish-Brown Weathered Rock, Moist, Very Dense (WR)	Possible Weathered Rock in Spoon Tip
16 - 16.1	S-7		50/1"	1	50/1"				Boring Log B-12 Terminated at a Depth of 16.0 Feet Below Ground Surface Due to Auger Refusal	
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-13

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 156.0 feet	**Date Started:**	3/24/2020
Termination Depth:	13.5 feet bgs	**Date Completed:**	3/24/2020
Proposed Location:	Parking Deck	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	13.0P | 143.0		
At Completion:	--- | ---	At Completion:	12.0 | 144.0
24 Hours:	--- | ---	24 Hours:	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							TOPSOIL		7" Topsoil	
0 - 2	S-1		3 - 4 - 7 - 22	16	11	0.6	FILL		Dark Brown Silty Sand, Debris, Moist (FILL)	Debris: Trace Asphalt
2 - 2.3	S-3		50/3"	3	50/3"				Low Recovery, Presumed As Above (FILL)	Gravel in Spoon Tip
										Hard Augering 2.0 fbgs to 4.0 fbgs
						4.0				
4 - 6	S-3		3 - 6 - 7 - 13	20	13	5.0	GLACIAL DEPOSITS		Brown Silty Sand, Moist, Medium Dense (SM)	
6 - 8	S-4		9 - 11 - 11 - 12	20	22				As Above (SM)	
8 - 10	S-5		11 - 14 - 19 - 22	22	33				As Above, Dense (SM)	
						10.0				
						13.0				
13 - 13.5	S-6		50/3"	3	50/3"	13.5	WR		Reddish-Brown Weathered Rock, Wet, Very Dense (WR)	
									Boring Log B-13 Terminated at a Depth of 13.5 Feet Below Ground Surface Due to Auger Refusal	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-14

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering
Surface Elevation:	± 156.0 feet	**Date Started:**	3/24/2020
Termination Depth:	24.0 feet bgs	**Date Completed:**	3/24/2020
Proposed Location:	Parking Deck	**Logged By:**	MH
Drill / Test Method:	HSA / SPT	**Contractor:**	JG
		Equipment:	CME-55

Water Depth | Elevation (feet bgs) | (feet)			Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	13.0P	143.0		
At Completion:	NE	---	At Completion:	12.0 | 144.0
24 Hours:	---	---	24 Hours:	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	TOPSOIL		4" Topsoil	
0 - 2	S-1		2 - 4 - 12 - 11	14	16	0.3	FILL		Brown Silty Sand with Gravel, Moist (FILL)	Apparent Re-Worked Material
2 - 4	S-2		7 - 6 - 8 - 8	8	14				As Above, Dark Gray to Brown (FILL)	
4 - 6	S-3		9 - 12 - 21 - 17	12	33	5.0			As Above (FILL)	
6 - 8	S-4		9 - 7 - 7 - 7	NR	14	8.0			No Recovery, Presumed As Above (FILL)	
8 - 10	S-5		6 - 6 - 8 - 9	20	14	10.0	GLACIAL DEPOSITS		Brown Silty Sand, Moist, Medium Dense (SM)	
						13.0	RESIDUAL			
13 - 15	S-6		4 - 7 - 11 - 16	20	18	15.0			Brown Sandy Silt with Gravel, Wet, Stiff (ML)	Qu = 1.5 tsf
18 - 20	S-7		6 - 6 - 8 - 12	22	14	20.0			As Above (ML)	
						23.0				
23 - 23.8	S-8		9 - 50/3"	6	50/3"	24.0	WEATHERED ROCK		Reddish-Brown Weathered Rock, Wet, Very Dense (WR)	
						25.0			Boring Log B-14 Terminated at a Depth of 24.0 Feet Below Ground Surface	

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WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-15

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Project:	Proposed Mixed-Use Development	**WAI Project No.:**	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	**Client:**	Shore Point Engineering

				Water Depth | Elevation (feet bgs) | (feet)	Cave-In Depth | Elevation (feet bgs) | (feet)
Surface Elevation:	± 156.0 feet	**Date Started:**	3/24/2020		
Termination Depth:	6.5 feet bgs	**Date Completed:**	3/24/2020		
Proposed Location:	Building	**Logged By:**	MH	**During:** NE | ---	
Drill / Test Method:	HSA / SPT	**Contractor:**	JG	**At Completion:** --- | ---	**At Completion:** --- | ---
		Equipment:	CME-55	**24 Hours:** --- | ---	**24 Hours:** --- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
0 - 2	S-1		4 - 5 - 11 - 13	NR	16	0.6	TOPSOIL		7" Topsoil	Topsoil Measured Following Termination
							FILL		No Recovery, Presumed As Below (FILL)	
2 - 4	S-2		6 - 17 - 17 - 15	20	24	4.0			Brown to Dark Brown Silty Sand with Gravel, Debris, Moist (FILL)	Debris: Trace Brick, Wood
4 - 6	S-3		11 - 17 - 18 - 15	22	35	5.0	GLACIAL DEPOSITS		Brown Silty Sand with Gravel, Moist, Dense (SM)	
6 - 6.5	S-4		50/3"	NR	50/3"	6.5	WR		Reddish-Brown Weathered Rock, Moist, Very Dense (WR)	
									Boring Log B-15 Terminated at a Depth of 6.5 Feet Below Ground Surface Due to Auger Refusal	
						10.0				
						15.0				
						20.0				
						25.0				

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WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-16

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Project:	Proposed Mixed-Use Development	WAI Project No.:	GS2016988.000
Location:	Liberty Street & Maple Street; Paterson, Passaic County, NJ	Client:	Shore Point Engineering

				Water Depth | Elevation (feet bgs) | (feet)	Cave-In Depth | Elevation (feet bgs) | (feet)
Surface Elevation:	± 130.0 feet	Date Started:	3/25/2020		
Termination Depth:	9.3 feet bgs	Date Completed:	3/25/2020		
Proposed Location:	Building	Logged By:	MH	During: 9.0 | 121.0	
Drill / Test Method:	HSA / SPT	Contractor:	JG	At Completion: NE | ---	At Completion: --- | ---
		Equipment:	CME-55	24 Hours: --- | ---	24 Hours: --- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	PAVEMENT		3" Asphalt, Subbase Stone	
						0.3	FILL			
1 - 1.3	S-1	X	50/3"	2	50/3"				Low Recovery, Presumed Fill	Fabric and Wood in Cuttings
3 - 5	S-2	X	6 - 13 - 18 - 22	20	31				Brown Silty Sand, Debris, Moist (FILL)	
						5.0				
5 - 6.2	S-3	X	15 - 19 - 50/2"	2	69/8"				Low Recovery, Presumed Boulder (FILL)	Gravel in Spoon Tip
										Hard Augering 4.0 fbgs to 9.3 fbgs
7 - 9	S-4	X	21 - 8 - 17 - 9	12	25				As Above, Debris, Very Moist (FILL)	
						9.0 ▼				
9 - 9.3	S-5	X	9 - 50/0"	3	50/0"	9.3	WR		Reddish-Brown Weathered Rock, Wet, Very Dense (WR)	
						10.0			Boring Log B-16 Terminated at a Depth of 9.3 Feet Below Ground Surface Due to Auger Refusal; Offset to B-16A	
						15.0				
						20.0				
						25.0				

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