RAD Green PCA Report

Housing Authority of Bergen County

One Bergen County Plaza, Floor 2
Hackensack, New Jersey 07601
George Stavrou

RAD Program
Green Physical Condition Assessment
of
Mahwah Public Housing

1600 Ramapo Brae Lane
Mahwah, New Jersey 07430

Prepared by:

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Date of Report: August 7, 2014
On site Date: March 5, 2014

GREEN RECOMMENDATIONS AT A GLANCE

GREEN CONSERVATION MEASURE	RECOMMEND FOR REHABILITATION				
BUILDING ENVELOPE	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference/ Comment**
Install EnergyStar Windows			✓		Section 3.3.3
Install EnergyStar Sliding Doors			✓		Section 3.3.3
Install Storm Windows		✓			Section 3.3.3
Install Window Sun Shades			✓		Section 3.3.3
Install Additional Thermal Insulation	✓				Section 3.3.4
Install Vegetative Roofing		✓			Section 3.3.4
Install EnergyStar Rated Reflective Metal		✓			Section 3.3.4
Install EnergyStar Rated Asphalt Shingle	✓				Section 3.3.4
Convert Carpeted Surfaces to Smooth-and-Cleanable Surfaces		✓			Section 3.7.2
Replace Siding with Cementitious (cement fiber) Siding	✓				Section 3.3.2
Implement Air Leakage Control			✓		Section 3.3.2
MECHANICAL SYSTEMS	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference/ Comment**
Install Vent Dampers	✓				Section 3.4.1 and 3.4.2
Convert Equipment to Electronic Ignition	✓				Section 3.4.1 and 3.4.2
Install Boiler Controls	✓		✓		Section 3.4.2.1
Replace Inefficient Boiler	✓		✓		Section 3.4.2.1
Install Programmable/Setback Thermostats			✓		Sections 3.4.2.1, 3.4.2.2
Insulate Hot Water or Steam Pipes			✓		Sections 3.4.1.1, 3.4.2.1, 3.4.2.2
Seal and Insulate Ducts		✓			Sections 3.4.2.1, 3.4.2.2
Install Geothermal Heat Pumps				✓	Energy Audit Section 4.4
Install Geothermal System for Heating and Hot Water				✓	Energy Audit Section 4.4
Install Swamp Coolers				✓	Energy Audit 5
Implement Temperature and Humidity Monitoring				✓	Section 4.4
Install Photo-Controls for Exterior Lighting	✓		✓		Section 3.2.6
Upgrade or Replace Inefficient Motors		✓			Energy Audit 5
Install Water-Saving Toilets	✓				Section 3.4.1.2
Install Water Saving Faucets/Showerheads					Section 3.4.1.2
Convert Exterior Lighting Fixtures **– currently MH**			✓		Section 3.2.6
Convert Hot Water Heater System to Solar			✓		Energy Audit 4.1
Install EnergyStar Heating Systems			✓		Sections 3.4.2.1, 3.4.2.2
Install EnergyStar Cooling Systems		✓			Sections 3.4.2.1, 3.4.2.2
Install Energy Efficient Water Heaters	✓		✓		Sections 3.4.1.1, 3.4.1.2

GREEN CONSERVATION MEASURE	RECOMMEND FOR REHABILITATION				
INDOOR AIR QUALITY	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference/ Comment**
Duct Bathroom Exhaust Fans to Exterior	✓				Section 3.4.2.2
Green Household Cleaning Products			✓		Section 4.4
Low VOC Carpeting		✓			Section 3.7.2.3
Install Rubber Walk Off Mats		✓			Section 4.4
Install Rubber Stair Treads		✓			Section 4.4
Install Carbon Monoxide Detectors	✓				Section 3.6
ELECTRICAL SYSTEMS	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference/ Comment**
Install Power Co-Generation System				✓	Energy Audit 4.3
Install Fuel Cells Owned by a Property				✓	Energy Audit 4.5
Install Wind Power System			✓		Energy Audit 4.2
Install Solar PV System			✓		Energy Audit 4.1
Replace Fluorescent Lamps with EnergyStar Lamps in Apartments			✓		Section 3.7.2.4
Replace Fluorescent Lamps with EnergyStar Lamps in Common Areas	✓				Section 3.7.1.2
Replace Ceiling Fans with EnergyStar Fans in Apartments	✓				Section 3.7.2.4
Install LED Exit Signs			✓		Section 3.6
Install Occupational Sensors for Interior Lighting	✓				Energy Audit 5.3
Install EnergyStar Refrigerators			✓		Section 3.7.2.2
Install EnergyStar Dishwashers		✓			Section 3.7.2.2
Install Lighting Controls in Building				✓	Energy Audit 5.2
RECYCLING/LANDSCAPING	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference/ Comment**
Consider Native/Xeriscape Landscaping Plan	✓				Section 3.2.3
Follow Integrated Pest Management Plan			✓		Part III
Implement Household Recycling Plan			✓		Section 3.2.6
Implement Household Hazardous Recycling Plan			✓		Section 3.2.6
Implement Construction Debris Recycling Plan			✓		Section 3.2.6
Porous Paving Surfaces			✓		Section 3.2.2
Install Soil Moisture Sensors			✓		Section 3.2.4
Utility Leak Monitoring Program			✓		Section 3.2.7

GREEN ELEMENT CHECKLIST AT A GLANCE

Checklist for Review of Green Physical Condition Assessment Elements	Report Reference
Sufficiently recent (within 120 days)	Cover Page - Date
Certification that contractor meets all required qualifications	Certification Section Page 1 and Appendix H
Green recommendations to reduce energy usage	Throughout Report
Green recommendations to reduce water usage	Section 3.4.1.2
Green recommendations to safeguard/improve indoor environmental air quality	Section 4.4
Summary of the green alternatives, their costs and cost/health impacts	Section 4.4
Utility/temperature and humidity monitoring costs	Section 4.4
Comments on the financial or health benefits of suggested green alternatives	Section 4.4
Green item recommendation data source and pricing identified	UW Model and Part II Energy Audit Section 1
Payback analysis when recommending replacement of traditional items with green items at the end of their useful life	UW Model
Payback analysis when recommending early replacement of existing items with green(er) items	UW Model
IPM and EA recommendations for rehab/reserves/operations	Part II Energy Audit Part III IPM Report
Evidence of sizing calculation for HVAC, or explanation as to inappropriateness	Energy Audit 3.1
Evidence the PCA contractor tested the duct-work for leakage	Energy Audit 3.1
Lighting replacements for all common areas	Section 3.7.1.2
Evidence of sizing consideration for DHW, if individual	Energy Audit 4
Kitchen and bath exhaust fans (Energy Star if cost-efficient)	Section 3.4.2.2
Carbon monoxide alarms	Section 3.6
Low- or non-VOC paint, caulking, sealants, etc	Sections 3.3.2
Carpet replacement (smooth surface flooring or low-VOC)	Section 3.7.2.3
Rubber walk- mats at entryways	Section 4.4
Rubber stair treads	Section 4.4
Cement board siding	Section 3.3.2
Green management of construction/rehab debris	Section 3.2.6
Green roofing (EnergyStar shingles, reflective roof, garden roof)	Section 3.3.5
Water efficient landscaping	Section 3.2.3
Thermostats (Energy Star)	Sections 3.4.2.1, 3.4.2.2
Checklist for Review of Green Energy Audit Elements	**Report Reference**
Certification that Energy Auditor meets all required qualifications	Certification Section Page 1 and Appendix H
Prudent energy-related improvements to the property with estimates of cost and financial calculations of probable payback when accounting for the remaining useful life of existing components	Energy Audit Section 5
Recommendations include such variables as operating hours, equipment efficiency, and building and occupant energy demand characteristics	Energy Audit Section 5
Building meets current code, with respect to energy-related items	Section 4.1
Actual costs, appropriate rates and utility configuration of the subject property (rather than sample or profile property)	Energy Audit 2.2
Financial calculations are sufficiently transparent to permit an understanding of the variables considered and their appropriateness	UW Model and Energy Audit Section 5
Recommendation on whether additional insulation, air sealing or caulking and sealing, is a cost-justified expenditure	Energy Audit 5.2
Co-generation, if potentially feasible	Energy Audit 4.3

Checklist for Review of Green Energy Audit Elements	Report Reference
Current energy usage and costs (kilowatt-hour, therms, utility cost)	Energy Audit 2.3, 2.4, 2.5
Recommended energy efficiency improvements	Energy Audit Section 5
Installed cost estimates for recommended energy efficiency measures	Energy Audit Section 5
Expected useful life of recommended energy measures	Energy Audit Section 5
Annual energy saving estimates (consumption and cost reductions)	Energy Audit Section 5
Simple payback period in years for each recommended measures	Energy Audit Section 5
Potential savings in water consumption expenses which are associated with energy improvements	Energy Audit Section 5
Checklist for Review of Green Integrated Pest Management (IPM) Elements	**Report Reference**
▪ IPM Study Exhibits 1 and 2 included and are complete ▪ Certification that inspector meets all required qualifications ▪ Methodology of inspection (including effort to distribute glue-traps to 100% of units, and to visit no fewer than 25% of units) ▪ Property inspection (exterior areas, common areas, trash areas) ▪ Specific recommendations included ▪ IPM recommendations are adequate based upon the glue-trap findings, property inspection results and incorporates IPM principles	Part III – Integrated Pest Management Program

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CERTIFICATION

EMG has completed a Green Physical Condition Assessment (GPCA) and a Limited Environmental Screening of the subject property, Mahwah Public Housing located at 1600 Ramapo Brae Lane in Mahwah, Bergen County, New Jersey 07430.

The GPCA was performed at the Client's request using methods and procedures consistent with good commercial and customary practice conforming with:

- Client supplied scope of work for market upgrades.
- Fannie Mae (FNMA) Document FNMA, Delegated Underwriting Services (DUS) Guide Section 3 entitled "Physical Needs Assessment Guidance to the Property Evaluator".
- Green Physical Condition Assessment Statement of Work and Contractor Qualifications.

This report is exclusively for the use and benefit of the Client identified on the first page of this report, the Clients successors, and the HUD RAD office. This report is not for the use or benefit of any other person or entity, nor may it be relied upon by any other person or entity, for any purpose, without the advance written consent of EMG. The purpose for which this report shall be used shall be limited to the use as stated in the contract between the client and EMG.

The opinions EMG expresses in this report were formed utilizing the degree of skill and care ordinarily exercised by any prudent architect or engineer in the same community under similar circumstances. EMG assumes no responsibility or liability for the accuracy of information contained in this report which has been obtained from the Client or the Client's representatives, from other interested parties, or from the public domain. The conclusions presented represent EMG's professional judgment based on information obtained during the course of this assignment. EMG's evaluations, analyses and opinions are not representations regarding the design integrity, structural soundness, or actual value of the property. Factual information regarding operations, conditions and test data provided by the Client or their representative has been assumed to be correct and complete. The conclusions presented are based on the data provided, observations made, and conditions that existed specifically on the date of the assessment.

EMG certifies that EMG has no undisclosed interest in the subject property, EMG's relationship with the Client is at arms-length, and that EMG's employment and compensation are not contingent upon the findings or estimated costs to remedy any deficiencies due to deferred maintenance and any noted component or system replacements.

EMG's PCA cannot wholly eliminate the uncertainty regarding the presence of physical deficiencies and the performance of a subject property's building systems. Preparation of a PCR in accordance with ASTM E2018-08 is intended to reduce, but not eliminate, the uncertainty regarding the potential for component or system failure and to reduce the potential that such component or system may not be initially observed. This GPCA was prepared recognizing the inherent subjective nature of EMG's opinions as to such issues as workmanship, quality of original installation, and estimating the remaining useful life of any given component or system. It should be understood that EMG's suggested remedy may be determined under time constraints, formed without the aid of engineering calculations, testing, exploratory probing, code compliance, the removal of materials, or design considerations. Furthermore, there may be other alternate or more appropriate schemes or methods to remedy the physical deficiency. EMG's opinions are generally formed without detailed knowledge from individuals familiar with the performance of the component or system.

In preparation of this report EMG has used staff who are certified to complete building energy audits by RESNET or BPI (or their training providers), or be a Certified Energy Manager (CEM), or be a State equivalent certified energy auditor, or be a professional architect, or be a registered professional engineer, or be a RESNET certified Home Energy Rater or BPI Certified Building Analyst.

EMG staff has training in evaluating building systems and conditions and continue to receive training on an annual basis. EMG staff is LEED certified or have equivalent certifications. EMG staff takes training classes in environmental and energy subjects on a regular basis with at least 10-hours of education per year.

EMG is not be under suspension or debarment by HUD, or involved as a defendant in criminal or civil action with HUD. EMG has an acceptable record of performance with HUD and has completed hundreds of reports where the residents receive Section 8 or public housing assistance. EMG produces reports that are well regarded in the marketplace in terms of content, timeliness and responsiveness. We have the capacity to complete the project inspection and prepare the report in a time frame acceptable to the Lender/Owner

Any questions regarding this report should be directed to the Program Manager at ebeeghly@emgcorp.com or at 800.733.0660, x7607.

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Edward Beeghly
Program Manager

PART I – GREEN PHYSICAL CONDITION ASSESSMENT

1. EXECUTIVE SUMMARY

The Client contracted with EMG to conduct a Green Physical Condition Assessment (GPCA) and a Limited Environmental Screening consisting of field observations, document review and related due diligence tasks of the subject property, Mahwah Public Housing located at 1600 Ramapo Brae Lane in Mahwah, Bergen County, New Jersey 07430. The PCA was performed on March 5, 2014.

The multi-family property has sixsections of two-story apartment townhouse buildings with a total of 35 rental apartment units and a single-story community center building with a sunken maintenance shop on a site of approximately 4.59 acres. Construction of the property was completed in 1986.

On site amenities consist of a basketball court, children's playground, community room and laundry facilities.

Generally, the property was constructed within industry standards, has been well maintained during recent years, and appeared to be in good to fair overall condition. The property representative provided EMG documentation and information regarding maintenance procedures and capital repair/s during the past three years. These upgrades include:

- All new roofs – 1 year
- All new kitchen and exhaust fans vented to exterior – 1 year
- 90% new refrigerators and ranges – 2 years
- Four new high efficiency boilers for heat and domestic water
- Some new domestic water storage tanks
- Additional insulation provided in attics and crawl spaces

EMG's cost evaluation takes into consideration these previous improvements, the quality as well as the level of maintenance and workmanship at the subject property. EMG observed elements of the reported work during the site reconnaissance.

There are a number of Critical Repairs, Rehabilitation Needs and Long Term Physical Needs which should be accomplished during the next 20 years as part of the preventive maintenance program. These needs are identified in the various sections of this report and are summarized in the tables.

The following Critical Repair items were observed:

- No smoke detectors in the bedrooms
- Polybutylene supply piping from storage tank to fixtures – it was reported that approximately 70% of it has issues
- Active leak in crawl space under unit 605

Property Management did not provide a REAC Score.

1.1. COST TABLES

The cost tables on the following pages identify the Critical Repairs, Rehabilitation Needs and Physical Needs over the Term for the property. The cost methodology is explained in Section 2 and further detail is provided for the individual cost items in report Sections 3 through 4.

Critical Needs Summary

Project Name: Mahwah Public Housing
Street Address: 1600 Ramapo Brae Lane
City, State: Mahwah, New Jersey
Zip Code: 07430

Critical Repair Description	PCA Contractor Estimate	Actual Cost	Included in Rehab or To Be Completed Prior To Closing?
Install smoke detectors in all tenant bedrooms	$26,265	$26,265	Included in Rehab
Replace polybutylene piping	$57,750	$57,750	Included in Rehab

TOTAL: All Critical Needs	**$84,015**	**$84,015**
TOTAL: Citical Needs Included in Rehab	**$84,015**	**$84,015**
TOTAL: Critical Needs To Be Completed Prior To Closing	**$0**	**$0**

Project Name	**Mahwah Public Housing**	**Total # of Units:**	**35**
Street Address	**1600 Ramapo Brae Lane**	**Original PCA Submission Date:**	1/0/00
City, State	**Mahwah, New Jersey**	**Last Time All Bids (Budget) Updated:**	
Zip Code	**07430**		

REHABILITATION SPECIFICATIONS
IMPROVEMENTS

WORK

Work Item (A)		Description of Improvements Work (B)	Quantity (C)	Unit Cost (D)	Budget (E)	Date of Bid Expiration (F)
Rehab Items (Code, Description)		***Increase row height to fully display description text***				
3.2.2	Storm Water Drainage		0	$0.00	$0	
3.2.4	Parking and Driveways		0	$0.00	$0	
3.2.4.01	Sidewalk - brick paver		0	$0.00	$0	
3.2.4.02	Concrete patio - add trench drain	Add drainage trench to patio slabs that slope towards unit	5	$750.00	$3,750	
3.2.6	Land and Grounds: Irrigation		0	$0.00	$0	
3.2.9.01	Site Signage	Add site signage	1	$1,650.00	$1,650	
3.2.9.02	Building mounted patio lighting		0	$0.00	$0	
3.2.9.03	Playground equipment	Replace playground equipment	1	$31,250.00	$31,250	
3.2.9.04	ADA van stall and signage	Add ADA van accessible space with sign	1	$200.00	$200	
3.3.2.2	Exterior Walls	Paint exterior walls	30,000	$1.25	$37,500	
3.3.2.3	Insulation		0	$0.00	$0	
3.3.2.4.01	Sliding Glass Doors		0	$0.00	$0	
3.3.2.4.02	Windows		0	$0.00	$0	
3.3.2.5.01	Exterior Doors		0	$0.00	$0	
3.3.2.5.02	Storm Doors		0	$0.00	$0	
3.3.2.9.01	Exterior Siding - Repair	Repair exterior siding damage	3,500	$7.27	$25,445	
3.3.2.9.02	Rental Office - Storefront		0	$0.00	$0	
3.3.2.9.03	Bldg Envelope Other #3		0	$0.00	$0	
3.3.2.9.04	Bldg Envelope Other #4		0	$0.00	$0	
3.3.4	Roofs		0	$0.00	$0	
3.4.1.2.01	Polybutylene Supply Piping -	Replace polybutylene piping in tenant units	35	$1,650.00	$57,750	
3.4.1.2.02	Indirect Fired Hot Water Storage		0	$0.00	$0	
3.4.1.2.03	Domestic and heating piping		0	$0.00	$0	
3.4.1.2.04	DHW #4		0	$0.00	$0	
3.4.1.3.01	Water Savers: Faucets	Replace faucets with low flow aerators	103	$154.85	$15,950	
3.4.1.3.02	Water Savers: Shower Heads		0	$0.00	$0	
3.4.1.3.03	Water Savers: Toilets		0	$0.00	$0	
3.4.2.1.01	HVAC Common Area Heating		0	$0.00	$0	
3.4.2.1.02	HVAC In-Unit Heating		0	$0.00	$0	
3.4.3.1.01	Bath Exhaust Fans		0	$0.00	$0	
3.4.3.1.02	HVAC Common Area Cooling		0	$0.00	$0	
3.4.3.1.03	HVAC In-Unit Cooling		0	$0.00	$0	
3.4.9.01	Programmable Thermostats		0	$0.00	$0	
3.4.9.02	Baseboard Hydronic Heaters	Replace hydronic water heaters	24	$500.00	$12,000	
3.4.9.03	M&E Other #2		0	$0.00	$0	
3.4.9.04	M&E Other #3		0	$0.00	$0	
3.5	Elevators		0	$0.00	$0	
3.5.01	Elevators Other #1		0	$0.00	$0	
3.6.01	CO Detectors/Alarms		0	$0.00	$0	
3.6.02	Smoke Detectors	Install smoke detectors in tenant bedrooms	103	$255.00	$26,265	
3.6.03	Fire Alarm Panel		0	$0.00	$0	
3.7.1.01	Common Area Floor Coverings		0	$0.00	$0	
3.7.1.02	Common Area Interior Lighting		0	$0.00	$0	
3.7.1.03	Common Area Interior Lighting		0	$0.00	$0	
3.7.1.04	Exit Signs		0	$0.00	$0	
3.7.1.05	Exterior Lighting		0	$0.00	$0	
3.7.1.9.01	Common Area Washing Machines		0	$0.00	$0	
3.7.1.9.02	Common Area Dryers		0	$0.00	$0	
3.7.2.1.01	Kitchen Cabinets		0	$0.00	$0	
3.7.2.1.02	Kitchen Counter Tops, Sinks		0	$0.00	$0	
3.7.2.1.03	Kitchen Floor Coverings		0	$0.00	$0	
3.7.2.11.01	Dishwashers		0	$0.00	$0	
3.7.2.11.02	Range Hoods		0	$0.00	$0	
3.7.2.11.03	Ranges		0	$0.00	$0	
3.7.2.11.04	Refrigerators 1		0	$0.00	$0	
3.7.2.11.05	Refrigerators 2		0	$0.00	$0	
3.7.2.19	Other Appliances		0	$0.00	$0	
3.7.2.19.01	Kitchen Exhaust Fans		0	$0.00	$0	
3.7.2.19.02	Kitchen Other #1		0	$0.00	$0	
3.7.2.19.03	Kitchen Other #2		0	$0.00	$0	
3.7.2.19.04	Kitchen Other #3		0	$0.00	$0	
3.7.2.2.01	Bath Counter Tops, Sinks		0	$0.00	$0	
3.7.2.2.02	Bath Floor Covering		0	$0.00	$0	
3.7.2.2.03	Bath Vanities		0	$0.00	$0	
3.7.2.29.01	Bath Other #1		0	$0.00	$0	
3.7.2.29.02	Bath Other #2		0	$0.00	$0	
3.7.2.29.03	Bath Other #3		0	$0.00	$0	
3.7.2.29.04	Bath Other #4		0	$0.00	$0	

WORK						
Work Item (A)		Description of Improvements Work (B)	Quantity (C)	Unit Cost (D)	Budget (E)	Date of Bid Expiration (F)
3.7.2.3.01	Interior Carpet		0	$0.00	$0	
3.7.2.3.02	Interior Doors		0	$0.00	$0	
3.7.2.3.03	Interior Painting		0	$0.00	$0	
3.7.2.39.01	Interior Unit Flooring		0	$0.00	$0	
3.7.2.39.02	Subfloor - replace particle board	Replace damaged subfloor	10	$1,500.00	$15,000	
3.7.2.39.03	Interior Other #3		0	$0.00	$0	
3.7.2.39.04	Interior Other #4		0	$0.00	$0	
3.7.2.4.01	Ceiling Fans		0	$0.00	$0	
3.7.2.4.02	In-Unit Lighting Bulbs		0	$0.00	$0	
3.7.2.4.03	In-Unit Lighting Fixtures	Install energy efficient lamps	105	$65.00	$6,825	
3.7.2.4.04	In-Unit Electrical Other #1		0	$0.00	$0	
3.7.2.4.05	In-Unit Electrical Other #2		0	$0.00	$0	
3.8.01	Exterior Stair Railing	Add railing for ADA compliance	7	$35.00	$245	
3.8.02	ADA - visual alarm	Add visual fire alarm	2	$250.00	$500	
3.8.03	ADA - toilet room accessories	Adjust height of bathroom acessories for ADA compliance	2	$200.00	$400	
3.8.04	ADA - drain pipe insulation	Add pipe insulation under sinks for ADA compliance	6	$35.00	$210	
3.8.05	ADA - hearing impaired unit	ADA improvements for audio/visual unit	1	$250.00	$250	
3.8.06	ADA - grab bars	Add grab bars in accessible bathrooms	4	$250.00	$1,000	
3.8.07	Other #07		0	$0.00	$0	
3.8.08	Other #08		0	$0.00	$0	
3.8.09	Other #09		0	$0.00	$0	
3.8.10	Other #10		0	$0.00	$0	
3.8.11	Other #11		0	$0.00	$0	
3.8.12	Other #12		0	$0.00	$0	
3.8.13	Other #13		0	$0.00	$0	
3.8.14	Other #14		0	$0.00	$0	
3.8.15	Other #15		0	$0.00	$0	
N/A	Relocation Costs		N/A	N/A	$0	

Total Improvements Eligible for Rehab Escrow	**$236,190**
10.0% Contingency	**$23,619**
Total Rehab Escrow Improvements Plus Contingency = TOTAL FUNDING	**$259,809**

Comment cells provided below:

Comments:

Additional comments:

20 Year Schedule for: Mahwah Public Housing

Mahwah Public Housing

Replacement Component	2015 Rehab	2015 Year 1	2016 Year 2	2017 Year 3	2018 Year 4	2019 Year 5	2020 Year 6	2021 Year 7	2022 Year 8	2023 Year 9	2024 Year 10	2025 Year 11	2026 Year 12	2027 Year 13	2028 Year 14	2029 Year 15	2030 Year 16	2031 Year 17	2032 Year 18	2033 Year 19	2034 Year 20	20 Year Total	20 Year + Rehab
3.2.2 Storm Water Drainage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.2.4 Parking and Driveways	0	0	0	4,690	0	0	0	0	4,690	0	0	0	0	4,690	0	0	0	0	4,690	0	0	18,760	18,760
3.2.4.01 Parking and Driveways Other #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.2.4.02 Parking and Driveways Other #2	3,750	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,750
3.2.6 Land and Grounds: Irrigation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.2.9.01 Site Signage	1,650	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,650
3.2.9.02 Building mounted patio lighting	0	4,550	0	0	0	0	4,550	0	0	0	0	4,550	0	0	0	0	4,550	0	0	0	0	18,200	18,200
3.2.9.03 Playground equipment	31,250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31,250
3.2.9.04 ADA van stall and signage	200	0	0	0	0	0	200	0	0	0	0	200	0	0	0	0	200	0	0	0	0	600	800
3.3.2.2 Exterior Walls	12,500	12,500	12,500	0	0	0	0	0	0	0	0	12,500	12,500	12,500	0	0	0	0	0	0	0	62,500	75,000
3.3.2.3 Insulation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.2.4.01 Sliding Glass Doors	0	0	18,667	18,667	18,667	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56,000	56,000
3.3.2.4.02 Windows	0	0	23,625	23,625	23,625	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70,875	70,875
3.3.2.5.01 Exterior Doors	0	11,562	11,562	11,562	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34,685	34,685
3.3.2.5.02 Storm Doors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.2.9.01 Exterior Siding - Repair	25,445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25,445
3.3.2.9.02 Rental Office - Storefront Entrance	0	0	2,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,500	2,500
3.3.2.9.03 Bldg Envelope Other #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.2.9.04 Bldg Envelope Other #4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.4 Roofs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.1.2.01 Polybutylene Supply Piping - replace	57,750	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57,750
3.4.1.2.02 Indirect Fired Hot Water Storage Tan	0	88,205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23,690	0	0	0	0	111,895	111,895
3.4.1.2.03 Domestic and heating piping insulatio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.1.2.04 DHW #4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.1.3.01 Water Savers: Faucets	15,950	0	0	0	0	0	0	0	0	0	0	15,950	0	0	0	0	0	0	0	0	0	15,950	31,899
3.4.1.3.02 Water Savers: Shower Heads	0	1,925	0	0	0	0	0	0	0	0	0	1,925	0	0	0	0	0	0	0	0	0	3,850	3,850
3.4.1.3.03 Water Savers: Toilets	0	21,760	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21,760	21,760
3.4.2.1.01 HVAC Common Area Heating	0	3,090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,090	0	0	0	0	6,180	6,180
3.4.2.1.02 HVAC In-Unit Heating	0	15,750	15,750	15,750	15,750	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63,000	63,000
3.4.3.1.01 Bath Exhaust Fans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,860	0	0	0	0	0	0	9,860	9,860
3.4.3.1.02 HVAC Common Area Cooling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.3.1.03 HVAC In-Unit Cooling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.9.01 Programmable Thermostats	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.9.02 Baseboard Hydronic Heaters	3,000	0	0	3,000	0	0	3,000	0	0	3,000	0	0	0	0	0	0	0	0	0	0	0	9,000	12,000
3.4.9.03 M&E Other #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.9.04 M&E Other #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5 Elevators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5.01 Elevators Other #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.6.01 CO Detectors/Alarms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.6.02 Smoke Detectors	26,265	0	0	0	0	0	0	0	0	0	0	26,265	0	0	0	0	0	0	0	0	0	26,265	52,530
3.6.03 Fire Alarm Panel	0	0	0	0	0	3,906	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,906	7,812	7,812
3.7.1.01 Common Area Floor Coverings	0	3,280	0	0	0	3,280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,560	6,560
3.7.1.02 Common Area Inter. Lighting Bulbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.1.03 Common Area Inter. Lighting Fixtures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.1.04 Exit Signs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.1.05 Exterior Lighting	0	19,800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,800	0	0	0	0	39,600	39,600
3.7.1.9.01 Common Area Washing Machines	0	0	0	0	0	0	0	0	0	0	11,369	0	0	0	0	0	0	0	0	0	0	11,369	11,369
3.7.1.9.02 Common Area Dryers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11,369	0	0	0	0	0	11,369	11,369

20 Year Schedule for: Mahwah Public Housing

Mahwah Public Housing

Replacement Component	2015 Rehab	2015 Year 1	2016 Year 2	2017 Year 3	2018 Year 4	2019 Year 5	2020 Year 6	2021 Year 7	2022 Year 8	2023 Year 9	2024 Year 10	2025 Year 11	2026 Year 12	2027 Year 13	2028 Year 14	2029 Year 15	2030 Year 16	2031 Year 17	2032 Year 18	2033 Year 19	2034 Year 20	20 Year Total	20 Year + Rehab
3.7.2.1.01 Kitchen Cabinets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.1.02 Kitchen Counter Tops, Sinks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.1.03 Kitchen Floor Coverings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.11.01 Dishwashers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.11.02 Range Hoods	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,525	0	0	0	0	0	0	7,525	7,525
3.7.2.11.03 Ranges	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22,068	0	0	0	0	22,068	22,068
3.7.2.11.04 Refrigerators 1	0	0	1,305	0	0	0	870	0	0	0	0	0	0	13,050	0	0	0	1,305	0	0	0	16,530	16,530
3.7.2.11.05 Refrigerators 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.19 Other Appliances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.19.01 Kitchen Exhaust Fans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.19.02 Kitchen Other #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.19.03 Kitchen Other #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.19.04 Kitchen Other #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.2.01 Bath Counter Tops, Sinks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.2.02 Bath Floor Covering	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.2.03 Bath Vanities	0	25,840	25,840	25,840	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77,520	77,520
3.7.2.29.01 Bath Other #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.29.02 Bath Other #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.29.03 Bath Other #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.29.04 Bath Other #4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.3.01 Interior Carpet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.3.02 Interior Doors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.3.03 Interior Painting	0	7,426	7,426	7,426	7,426	7,426	0	0	0	0	0	7,426	7,426	7,426	7,426	7,426	0	0	0	0	0	74,256	74,256
3.7.2.39.01 Interior Unit Flooring	0	28,125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28,125	0	0	0	0	56,250	56,250
3.7.2.39.02 Subfloor - replace particle board	15,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15,000
3.7.2.39.03 Interior Other #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.39.04 Interior Other #4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.4.01 Ceiling Fans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.4.02 In-Unit Lighting Bulbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.4.03 In-Unit Lighting Fixtures	6,825	0	0	0	0	0	6,825	0	0	0	0	6,825	0	0	0	0	6,825	0	0	0	0	20,475	27,300
3.7.2.4.04 In-Unit Electrical Other #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.4.05 In-Unit Electrical Other #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.01 Exterior Stair Railing	245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	245
3.8.02 ADA - visual alarm	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500	0	0	0	0	500	1,000
3.8.03 ADA - toilet room accessories	400	0	0	0	0	0	0	0	0	0	0	400	0	0	0	0	0	0	0	0	0	400	800
3.8.04 ADA - drain pipe insulation	210	0	0	0	0	0	210	0	0	0	0	210	0	0	0	0	210	0	0	0	0	630	840
3.8.05 ADA - hearing impaired unit	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	250	0	0	0	0	250	500
3.8.06 ADA - grab bars	1,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,000	0	0	0	0	1,000	2,000
3.8.07 Other #07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.08 Other #08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.09 Other #09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.10 Other #10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.11 Other #11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.12 Other #12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.13 Other #13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.14 Other #14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.15 Other #15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**202,190**	**243,812**	**119,174**	**110,559**	**65,467**	**14,612**	**15,655**	**0**	**4,690**	**3,000**	**11,369**	**76,250**	**19,926**	**37,666**	**24,811**	**18,794**	**110,307**	**1,305**	**4,690**	**0**	**3,906**	**885,993**	**1,088,182**
Inflated Total	**202,190**	**243,812**	**122,153**	**116,156**	**70,501**	**16,128**	**17,712**	**0**	**5,575**	**3,655**	**14,198**	**97,607**	**26,144**	**50,656**	**34,202**	**26,556**	**159,758**	**1,937**	**7,136**	**0**	**6,244**	**1,020,130**	**1,222,320**

2. PURPOSE AND SCOPE

2.1. PURPOSE

The purpose of the RAD program is to allow Public Housing and Moderate Rehabilitation (Mod Rehab) properties to convert, to long-term Section 8 rental assistance contracts. The program also allows Rent Supplement (Rent Supp), Rental Assistance Payment (RAP), and Mod Rehab properties to convert tenant-based vouchers issued upon contract expiration or termination to project-based vouchers. The goal is to restructure the financing and to bring properties up to market standards through an initial rehabilitation and subsequent repairs and/or replacements over the next twenty year period. The restructuring program has three basic goals:

1. *Social* - Preserving the "affordable housing stock" by maintaining the long term physical integrity of HUD subsidized rental housing insured by FHA.
2. *Economic* - Reducing the long term Project based Section 8 rental assistance costs and reducing the costs of insurance claims paid by FHA.
3. *Administrative* - Promote greater operating cost efficiencies and establish systems to administer the program and terminate relationships owners/properties that violate agreements or program requirements

The purpose of the Green Physical Condition Assessment is to assist the client in assessing the physical condition of the property and meeting the stated goal of the program to encourage affordable multi-family rehabilitation of properties using sustainable Green Building principles. These sustainable Green Building principles are comprises of energy efficiency, sustainability, indoor air quality, and recycling. They also incorporate the "Health Housing" approach which was established by HUD in 1999 in response to a Congressional Directive regarding growing concerns about environmental health in children. This program is designed to incorporate Green principles into property rehabilitation and scheduled repairs and/or replacements over the next twenty years.

The Green PCA is comprised of four parts:

Part 1: PCA Report comparing Traditional and Green Requirements. The traditional PCA identifies repairs and/or replacements necessary in the first year and in the subsequent twenty years. The PCA will estimate costs using both "traditional" and "Green" principles and provides discussion on the benefits (financial and otherwise) of the green alternative material or system.

Part 2: Energy Audit. It evaluates how energy and water is used at the property. This documents and recommends energy-related improvements that can be made to the property, the costs of the improvements, and provides a simple financial payback analysis. It includes an initial assessment of potentially viable alternatives for generating electricity, heating water, and heating and cooling the conditioned space at the building.

Part 3: Utility Consumption Baseline – It contains data on utility usage at the property, both tenant-paid and owner-paid, and including all common areas for a full 12-month period. It establishes a baseline to allow for benchmarking, and for future measurement of consumption and costs. As such, the utility baseline creates a whole building consumption profile in achieving its aim of establishing the standard on which future consumption can be compared.

Part 4: Integrated Pest Management Plan Inspection: This inspection may reveal the need for additional repairs or site alterations that will need to be included in the first year rehabilitations needs. It includes an evaluation of existing pest control practices and procedures and recommendations for change in site practices, if necessary.

For this PCA, at least 25% of apartment units and a representative sample of major building systems and components were observed and their physical condition evaluated in accordance with ASTM E2018-08. The report identifies Critical Repairs, Rehabilitation Specifications, and Long Term Physical Needs. The report also estimates costs using both "traditional" and "green" principles and provides discussion on the benefits of the green alternative The standard is a non-luxury standard adequate for the rental market intended at the original approval of Project-based assistance. The physical needs identified are intended to reflect those necessary for the Project to retain its original market position as an affordable Project in a decent, safe and sanitary condition. The intent is to include those improvements that the Project requires to compete in the non-subsidized market, resulting in a marketable Project that competes on rent rather than amenities.

The property management staff and code enforcement agencies were interviewed for specific information relating to the physical property, code compliance, available maintenance procedures, available drawings and other documentation. The property systems and components were observed and evaluated for their present condition and the estimated cost for repairs and/or capital reserves are included in the cost estimates. All findings relating to these opinions of probable costs are included in the narrative sections of this report.

The physical condition of building systems and related components are typically defined as being in one of three categories: Good, Fair, and Poor. For the purposes of this report, the following definitions are used:

Good = Satisfactory as-is. Requires only routine maintenance during the reserve term. Repair or replacement may be required due to a system's estimated useful life.

Fair = Satisfactory as-is. Repair or replacement is required due to current physical condition and/or estimated remaining useful life.

Poor = Immediate repair, replacement, or significant maintenance is recommended.

In an effort to quickly find key information EMG has created the following quick reference guide for the client and report reviewer.

2.2. PROPERTY EXPECTED USEFUL LIFE ESTIMATE

Subject to the qualifications stated in this paragraph and elsewhere in this report, the remaining useful life (RUL) of the property is estimated to be not less than 35 years. The foregoing estimate as to useful life is an expression of a professional opinion and is not a guarantee or warranty, express or implied. This estimate is based upon the observed physical condition of the property at the time of the EMG's visit and is subject to the possible effect of concealed conditions or the occurrence of extraordinary events, such as natural disasters or other "acts of God", which may occur subsequent to the date of the on site visit.

The remaining useful life for the property is further based on the assumption that: (a) the Critical Repairs, Rehabilitation Needs, and future repairs for which replacements provided as capital reserves are recommended are completed in a timely and workmanlike manner; and (b) a comprehensive program of preventive and remedial property maintenance is continuously implemented using an acceptable standard of care. The estimate is made only with regard to the expected physical or structural integrity of the improvements on the property, and no opinion regarding economic or market conditions, the present or future appraised value of the property, or its present or future economic utility is expressed by EMG.

2.3. OPINIONS OF PROBABLE COST

This section provides estimates for Critical Repairs, Rehab Items, and 20 Year Reserve Items as noted within this GPCA.

These estimates are based on Invoice or Bid Documents provided either by the Owner or facility and construction costs developed by construction resources such as *EnergyStar.gov*, *R.S. Means* and *Marshall & Swift,* EMG's experience with past costs for similar properties, city cost indexes, and assumptions regarding future economic conditions.

2.4. METHODOLOGY

Based upon site observations, research and judgment, along with referencing Expected Useful Life (EUL) tables from various industry sources, EMG opines as to when a system or component will most probably require replacement. Accurate historical replacement records, if provided are typically the best sources of information. Exposure to the elements, initial quality and installation, extent of use, the quality and amount of preventive maintenance exercised, and other similar items are all factors that impact the effective remaining useful life of a system or component. The Remaining Useful Life (RUL) or effective remaining life of a component or system equals the EUL less its effective age. The estimated useful life calculations are based on those found in the Fannie Mae (FNMA) Document; FNMA, Delegated Underwriting Services (DUS) Guide Section 3 entitled "Physical Needs Assessment Guidance to the Property Evaluator".

Where quantities could not be derived from actual takeoff, lump sum or allowances are used. Estimated costs to correct are based on professional judgment and the probable or actual extent of the observed defect, inclusive of the cost to design, procure, construct and manage the corrections.

Each building system or component is further identified with the following references if costs or other actions are applicable:

RM = Routine maintenance
CR = Critical Repair
RS = Rehabilitation Scope
RR = Replacement Reserve
NA = Not Applicable

2.5. CRITICAL REPAIRS

Based on observations of readily apparent conditions, Critical Repairs have been identified as health and safety deficiencies, violations of Section 8 housing quality standards or FHA's regulatory agreement standards that require immediate attention. These repairs include conditions that endanger the safety or well being of residents. It is expected that Critical Repairs will be completed prior to closing.

2.6. REHABILITATION NEEDS AND GREEN SIGNIFICANT ADDITIONS

The Rehab cost estimate is an estimate of repairs, replacements, or significant deferred or other maintenance items recommended within the next year. The Rehab cost estimate includes items which pass the early replacement criteria or which provide a direct environmental benefit to the property. This Green PCA identifies repairs necessary in the first year following restructuring. It offers "traditional" and "green" components that meet local building codes. It clearly identifies if "green" components exceed local building code requirements. It gives two "green" options, if available, for example evaluating 16 SEER and 19 SEER air-conditioning costs and efficiencies. It estimates costs using both "traditional" and "green" principles and it provides comments on the benefits (financial and otherwise) of the green alternative. As part of the savings analysis, the analysis includes evaluating costs and benefits for two levels of "green" for certain mandatory "green" options that may apply to the property.

Green Building or sustainable building is the practice of reducing the impact of buildings on the environment, both during construction and as part of the operation of the building systems. Their use of water, energy, and materials should be reduced through the use of new planning methods and material usage.

EMG's goal was to identify all opportunities to: 1) improve energy efficiency; 2) minimize water use; 3) use recycled or recyclable materials, 4) protect the indoor air quality; 5) reduce the 'carbon footprint' of the buildings and site; and 6) proper disposal of replaced materials.

In the table located on the following pages, EMG has identified components which will require replacement either immediately, within the first year (Rehab items), or over the course of the next twenty years (20 Year Reserve Items). We compare the cost of traditional replacements and compare them to "green" replacements. The anticipated benefits of green approaches are discussed throughout the report, along with increased short term costs for the long term benefits of choosing "Green" or sustainable alternatives.

Green Significant Additions are those items that meet the "green principles" and are recommended for early replacement in the subsequent year.

2.7. LONG TERM PHYSICAL NEEDS

Long Term Physical Needs are for recurring probable expenditures, which are not classified as operation or maintenance expenses, which should be annually budgeted for in advance. Long Term Physical Needs are reasonably predictable both in terms of frequency and cost. However, they may also include components or systems that have an indeterminable life but nonetheless have a potential liability for failure within an estimated time period. These items are included in the 20 Year Reserve Schedule.

This methodology excludes systems or components that are estimated to expire after the reserve term of 20 years and that are not considered material to the structural and mechanical integrity of the subject property. Furthermore, systems and components that were not deemed to have a material effect on the use were also excluded. Costs that are caused by acts of God, accidents or other occurrences that are typically covered by insurance, rather than reserved for, are also excluded

Replacement costs were solicited from ownership/property management, EMG's discussions with service companies, manufacturers' representatives, and previous experience in preparing such schedules for other similar facilities. Costs for work performed by ownership's or property management's maintenance staff were also considered.

EMG's reserve methodology involves identification and quantification of those systems or components requiring reserve funds within the evaluation period which is defined as the age minus the reserve term. Additional information concerning systems or components respective replacement costs (in today's dollars), typical expected useful lives, and remaining useful lives were estimated so that a funding schedule could be prepared. The Long Term Physical Needs presupposes that all required remedial work has been performed or that monies for remediation have been budgeted for items defined as a Critical Repair or Rehab item.

2.8. PERSONNEL INTERVIEWED

In the process of conducting the Green PCA and follow-up telephone calls, the following personnel from the facility and government agencies were interviewed:

Name and Title	Organization	Phone Number
Jason Rooney Property Manager	Housing Authority of Bergen County	201.954.4577
Aldo Grimaldi Superintendent	Housing Authority of Bergen County	201.376.4804
Daniel Mairella Building Inspector	Mahwah Building Department	201.529.5757 x237

Name and Title	Organization	Phone Number
Gary Montroy Administrative/Zoning Officer	Township of Mahwah Department of Planning and Zoning	201.529.5757 x245
Michael Roe Fire Inspector	Township of Mahwah Fire Department	201.529.5757 x275

EMG met with Aldo Grimaldi, Superintendent, Housing Authority of Bergen County, the on site Point of Contact (POC). Mr. Grimaldi was cooperative and provided information that appeared to be accurate based upon our subsequent site observations. It is EMG's opinion that the on site contact was very knowledgeable about the subject property and questions EMG posed during the interview process. The POC's management involvement at the property has been during the past nine years.

2.9. OWNER PROVIDED DOCUMENTATION

Prior to the PCA, relevant documentation was requested that could aid in the knowledge of the subject property's physical improvements, extent and type of use, and/or assist in identifying material discrepancies between reported information and observed conditions. The review of submitted documents does not include comment on the accuracy of such documents or their preparation, methodology, or protocol. The following documents were provided for review while performing the GPCA:

- Site plan
- Floor plan
- Utility billing information
- Efficiencies of existing systems

No other documents were available for review.

2.10. CAPITAL IMPROVEMENTS FOR MARKET UPGRADES

The appraiser was not available for comment. Based on EMG's experience and observations, no market upgrades are recommended.

2.11. PRE-SURVEY QUESTIONNAIRE

A Pre-Survey Questionnaire was sent prior to EMG's on site visit. The completed questionnaire is included in Appendix G. Information obtained from the questionnaire has been used in preparation of this Green PCA.

2.12. WEATHER CONDITIONS

Weather conditions at the time of the on site review were partly cloudy, with temperatures in the low 20s (°F) and light winds. In addition, there was approximately six to eight inches of snow on the ground.

3. DESCRIPTION AND OBSERVATIONS

3.1. EXISTING BUILDING GENERAL DESCRIPTION

3.1.1. Apartment Unit Types and Unit Mix

A portion of the property is a separate parcel containing condominiums. In addition, a portion of the property is considered Ramsey Public Housing and is further described under separate report cover 107534.13R-006.306. It was reported that the unit designation and separation line between Mahwah and Ramsey units varies. The Ramsey portion of the Mahwah site consists of 19 townhouses. At the time of inspection, it was reported that those units in the east corner of the site are part of Ramsey Public Housing, in addition to a separate parcel within the Township of Ramsey.

The following table identifies the reported apartment types and mix at the subject property. Measurements were obtained by EMG through rough measurement of the unit types.

Apartment Unit Types and Mix		
Quantity	**Type**	**Floor Area**
2	2 Bedrooms/1 Bathroom - ADA	Approximately 600 SF
33	3 Bedrooms/1.5 Bathrooms	1,100 SF
There are currently no vacant units.		
There are currently no down units.		
35	**TOTAL**	

There were no vacant units reported or observed on the day of our site visit.

3.1.2. Apartment Units Observed

20 percent of the apartment units and all vacant units were observed in order to gain a clear understanding of the overall property condition. Other areas accessed included the exterior of the entire property, the roofs observed from grade, an attic and crawl space. The interior common areas of the rental office/community center were also observed. The following apartments were observed:

Apartment Units Observed		
Unit/Floor	**Type**	**Remarks**
905	3 Bedrooms/1.5 Bathrooms	Occupied, fair condition. Boiler is rattling.
506	3 Bedrooms/1.5 Bathrooms	Occupied, good to fair condition.
605	2 Bedrooms/1 Bathroom - ADA	Occupied, good condition. Active leak in crawl space.
502	3 Bedrooms/1.5 Bathrooms	Occupied, good to fair condition.

Apartment Units Observed		
Unit/Floor	**Type**	**Remarks**
501	3 Bedrooms/1.5 Bathrooms	Occupied, fair to poor condition. Window in bedroom is off track and held in place tenuously. Damaged vinyl flooring. Radiator fins are bent.
402	3 Bedrooms/1.5 Bathrooms	Occupied, fair to poor condition. Damaged vinyl flooring from tenant installed washer tapped off storage tank. Possible mold reported in crawl space; although, no access provided.
401	3 Bedrooms/1.5 Bathrooms	Occupied, fair condition. Mildew over tub.
Vacant Units		
None		
Down Units		
None		

A "down unit" is a term used to describe a non-rentable apartment due to fire damage, water damage, missing appliances, damaged floor, wall or ceiling surfaces, or other significant deficiencies. The Point of Contact stated that there were no down units at the subject property.

All areas of the property were available for observation while on site.

3.2. SITE

3.2.1. Topography

Item	Description	Action	Condition	Replacement
Topography	Gentle slope running from southwest to north with abrupt and steep change in elevation stepping down along front of southeast buildings. Steep slope up to north along property line.	RM	Good	NA
Adjacent Properties	Residential condominiums adjacent to subject townhouses to northwest and heavily wooded perimeter	RM	Good	NA
Retaining Walls	Timber	RM	Good	NA

Green Physical Condition Discussions: As part of any re-landscaping plan, incorporate design features that enhance the soil quality, reduce storm water runoff and pollution, and encourage beneficial insects and wildlife. This measure also minimizes ongoing water requirements, maintenance needs, and green waste. In addition, seek to incorporate design features into the site that channel runoff to swales, porous surfaces, and holding areas. These measures reduces water runoff, helps filter and treat storm water, and protects the local ecosystem.

Observations/Comments:

- The property topography and adjacent uses did not appear to present conditions detrimental to the property. No significant areas of erosion were observed affecting the property. Based on the results of this assessment, no further actions appear to be required at this time.
- The timber retaining walls appear to be in good condition requiring routine maintenance.

3.2.2. Storm Water Drainage

Item	Description	Action	Condition	Replacement
Drainage Systems and Erosion Control	Surface flow to swales and inlets discharging to underground piping to municipal system	RM	Good	NA
On site Retention	Not Applicable	NA	NA	NA

Green Physical Condition Discussions: Increasing porous surfaces decreases runoff and protects the health of creeks, wetlands and other bodies of water. Reducing runoff improves soil health because it retains valuable topsoil on site. EMG evaluated opportunities to increase storm water retention on site by replacing or rehabilitating parking lots, sidewalks, and other hardscape features with porous pavement. These measures help reduce water runoff, help filter and treat storm water, and protect the local ecosystem. Pervious paving surfaces can cost more than hard surfaces but can easily be incorporated into future on site hard surface repairs and replacements.

Observations/Comments:

- Evidence of storm water runoff from adjacent properties was not observed. Based on the results of this assessment, no further actions appear to be required at this time.
- The storm water system appeared to provide adequate runoff with no evidence of major ponding or erosion noted. Based on the results of this assessment, no further actions appear to be required at this time.

3.2.3. Parking, Paving and Sidewalks

Item	Description	Action	Condition	Replacement
Parking and Paving	Surface lots 7 spaces at rental office/community center plus 60 throughout site for a total of 67 parking stalls, including three handicapped-accessible stalls (one at rental office and one each at ADA units) Three handicapped-accessible parking stalls of which none are van-accessible Shared parking area Asphalt	RR	Good	Traditional
Sidewalks, Curbs and Gutters	Concrete with brick paver borders. Asphalt at limited areas.	CR and RM	Good with isolated poor	Traditional
Site Access	One driveway into site from adjacent street.	RM	Good	Traditional

Green Physical Condition Discussions: For replacement or rehabilitation of sidewalks and other hardscape features such as footings, mat foundations, slab on grade, slabs on metal deck, cast in place and tilt up walls, drives and equipment pads, displace Portland cement in concrete mixes with at least 20 percent recycled content materials (flyash or slag). This measure increases the durability and strength of the concrete, reduces greenhouse gas emissions associated with cement production, and helps keep flyash out of landfills.

Increasing porous surfaces decreases runoff and protects the health of creeks, wetlands and other bodies of water. Reducing runoff improves soil health because it retains valuable topsoil on site. Types of pervious or porous pavement include porous aggregate, porous turf, plastic geocells, open-jointed paving blocks, open-cell paving grids, porous concrete, granite or crushed rock, and soft porous surfacing such as bark or mulch.

Specify light color pigments or aggregates for any replacement or rehabilitation of sidewalks and other hardscape features. This measure reduces the building's cooling costs and minimizes the heat island effect by reducing the amount of heat retained by surrounding asphalt, concrete, and building structures. Adding colorants and pigments to mixes of concrete and asphalt does not generally increase costs. Changing aggregate colors is also relatively inexpensive.

Observations/Comments:

- In order to maximize the pavement life, pothole patching, crack sealing, seal coating and re-striping of the asphaltic concrete paving will be required during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The concrete sidewalk appeared to be in good condition with no significant signs of cracking or surface deterioration. During the reserve term, epoxy sealing of minor cracks is recommended.
- Swatches of pedestrian routes between the concrete walkway and the parking lots are finished with brick pavers. Isolated areas have sunken and require repair. The cost of this work is relatively minimal and should be performed as part of routine maintenance.
- A tree root is causing an isolated area to heave near the playground and behind unit 605. The area should be repaired immediately to avoid potential tripping hazards. The cost of this work is relatively minimal and should be performed as part of routine maintenance.
- The property will be subjected to only minor concrete repairs of flatwork during the life of the loan and no repairs are noted as immediate needs. High-volume fly-ash concrete mixes are widely available and typically cost the same as low-volume mixes. The recommendation is made to specify recycled concrete materials for flatwork repairs. Use of recycled concrete will comply with LEED-EB Material and Resources Credit 2 – Optimize Use of Alternative Materials.

3.2.4. Landscaping and Grounds

Item	Description	Action	Condition	Replacement
Landscaping	Trees, shrubs and grass with drought-tolerant plants	RM	Good	NA
Irrigation	Automatic underground system	RM	Fair to poor	NA

Green Physical Condition Discussions: As part of any re-landscaping plan, incorporate design features that enhance the soil quality, reduce storm water runoff and pollution, and encourage beneficial insects and wildlife. This measure also minimizes ongoing water requirements, maintenance needs, and green waste. In addition, seek to incorporate design features into the site that channel runoff to swales, porous surfaces, and holding areas. These measures reduces water runoff, helps filter and treat storm water, and protects the local ecosystem.

Observations/Comments:

- Landscaping is minimal at the property and improvements are not necessary or planned. However, future landscaping efforts at the property should be "sustainable" featuring native plants and shrubs. Native landscaping can achieve significant savings over time by reducing labor, water, and chemical costs.
- The in-ground sprinkler system is controlled by manual valves operated by the maintenance staff.
- EMG recommends installing soil moisture sensors to detect the amount of moisture contained in soil. Once the specified level of moisture is reached, the sensors would activate a future automated watering system.
- The site point of contact reported there are problems with the underground irrigation system. Repairs are required to return the system to normal operation. Approximately $10,000 was spent on the system last year and it was reported that nearly 70% of the heads are already damaged from vandalism. It was reported that the system is not needed and no repairs are recommended at this time to bring the system back to operation.

3.2.5. Patio, Terrace, and Balcony

Item	Description	Action	Condition	Replacement
Patios	Concrete-paver raised terrace along the basketball court	RR	Good to fair	Traditional
Balconies	Private unit balcony/decks with treated wood guardrails	RM	Good to fair	NA

Observations/Comments:

- The ground-level patio pavers were under deep snow. Isolated areas were visible and appeared to be in good condition requiring routine maintenance. It was reported that approximately five units have patio slabs sloped towards apartment. EMG suggests installing a trench drain with a grille to direct water away from the unit. A cost allowance for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- The wood framed decks have some isolated damaged or missing sections. They were recently power washed and sealed. Based on the Estimated Useful Life and the observed conditions, repair of the balcony railings is required. The cost for this work is relatively insignificant in cost and can be performed through routine maintenance due to the low change in elevation.

3.2.6. General Site Improvements

Item	Description	Action	Condition	Replacement
Signage	Street address numbers	CR	Good	Traditional
Site Lighting	Parking lot light standards Building-mounted fixtures 15 Metal Halide Pole Fixtures at 150 Watts 2 Metal Halide Building-mounted Fixtures at 150 Watts Photosensor	GS	Good	Green

Item	Description	Action	Condition	Replacement
Building Lighting	Wall-mounted fixtures and recessed soffit fixtures 2 Compact Fluorescent Fixtures 7 Metal Halide Fixtures at 150 Watts Photo	GS	Good	Green
Fencing	Chain link	RM	Good	NA
Playground	Metal and plastic equipment	RR	Fair	Green
Dumpsters	Set on pads in partial enclosures	RM	Good	NA
Recycling and Waste Management	Recycling plan is not in place Construction debris plan is recommended	NA	NA	NA

Green Physical Condition Discussions: High-density residential properties should always consider, where space permits, the provision of bike parking/storage for residents, visitors, and employees. This measure will reduce traffic and pollution while increasing occupant/worker health. Secured and covered storage can be under building overhangs, stairwells (inside or out), bike lockers, in parking garages, or other means. The property may benefit by providing bicycle storage. The property layout provides several areas that could be converted to locked bicycle storage for residents; however, management has identified that there is not a great demand for bicycle storage at the facility.

Observations/Comments:

- There is no property identification signage. Installation is recommended within the year year. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- A payback analysis was completed for replacement of the existing site and building-mounted lighting with high efficacy LED wall packs. The payback period is 22.7 years and early replacement is not recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The existing patio lighting is on photocell, but many are reportedly not working. Fixture replacement with energy efficient fixtures is recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- The children's playground equipment is more than 10 years old. The playground equipment was power washed and properly painted. It no longer is peeling. Based on the Estimated Useful Life and the observed conditions, replacement is recommended during the reserve term. If the playground equipment is to be replaced EMG recommends consideration of equipment with a protective fall zone that is sustainable and made out of recycled materials. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- The site fencing is in good condition. Based on the Estimated Useful Life and the observed conditions, fencing replacement is not recommended during the reserve term.
- The dumpsters are owned and maintained by the property. Based on the results of this assessment, no further actions appear to be required at this time.
- EMG recommends the property owners institute a community sponsored recycling program. Provide an accessible area dedicated to the separation, collection, and storage of materials; paper, corrugated cardboard, glass, plastics, and metals. Some recyclables provide revenue, which can be used for community improvements.
- EMG recommends the property owners institute a management sponsored recycling program for the proper collection and disposal of maintenance and resident generated household hazardous waste. Provide an accessible area dedicated to the separation, collection, and storage of materials; electronic equipment, computer printer ink, compact fluorescent bulbs, and lithium batteries. The addition of recycling stations for hazardous household waste is recommended as a Green Restructuring item. The cost for this work is relatively insignificant and can be done through routine maintenance.

- EMG recommends the property owners institute a Green Waste Management Plan that includes items from future construction/renovation. The plan should set a 50% recycle and/or salvage goal to reduce landfill disposal. Materials to be recycled and/or salvaged include: clean dimensional wood, plywood, concrete, CMU, brick, gypsum board, asphalt shingles, glass, carpet and pad, and pipe. This type of plan has little or no direct cost to the property. Requirements for including recycling and/or salvage costs should be added to all Requests for Proposals put out for contractor bids.

3.2.7. Utilities

The following is a table of utilities supplied to the site and the names of the suppliers:

Site Utility Providers	
Utility	**Supplier**
Sanitary sewer	Mahwah Water
Storm sewer	Mahwah Water
Domestic water	Mahwah Water
Electric service	Rockland Electric
Natural gas service	PSE&G
Telephone service	Cablevision
Cable Television	Cablevision

Green Physical Condition Discussions: It is recommended that property management perform regular visual assessments of known underground piping locations. These assessments can be performed as part of routine activities such as trash pickup, lawn mowing or while walking from one area of the property to another. The purpose is to look for tell-tale signs of utility piping leakage. These tell-tale sign manifest themselves as wet spots, non-weather related puddles, areas are always wet, soil undermining and noticeable increases in domestic water consumption. Such occurrence should be report to the local utility supplier immediately.

It is recommended that property management perform regular visual assessments of building and common area lighting. These assessments can be performed as part of routine activities such as trash pickup, lawn mowing or while walking from one area of the property to another. The purpose is to look for tell-tale signs of electrical utility waste. These spot assessments document light fixtures that are on during the day, damage or missing lighting fixtures, malfunctioning timer or photo cells.

Observations/Comments:

- The on site representatives reported that the utilities provided are adequate for the property. Due to vandalism, the electric and gas meters are within locked gates. EMG recommends investigating if this is allowed by the utility companies or if there is a better solution.
- Green Energy Technologies are evaluated in the Energy Audit in Part II of this report.

3.3. STRUCTURAL FRAME AND BUILDING ENVELOPE

3.3.1. Foundations

Item	Description	Action	Condition	Replacement
Floor	Raised wood floor	RM	Good to fair	NA

Item	Description	Action	Condition	Replacement
Footings	Concrete perimeter footings and pad footings	RM	Good	NA
Basements and Crawl Spaces	Subterranean crawl space with perimeter CMU retaining and bearing walls.	RM	Good	NA

Green Physical Condition Discussions: For replacement or rehabilitation of features such as footings, mat foundations, slab on grade, slabs on metal deck, cast in place and tilt up walls, drives and equipment pads, displace Portland cement in concrete mixes with at least 20 percent recycled content materials (flyash or slag). This measure increases the durability and strength of the concrete, reduces greenhouse gas emissions associated with cement production, and helps keep flyash out of landfills.

Observations/Comments:

- The foundations and footings could not be directly observed while on site. No apparent signs of significant cracking or movement that would indicate excessive settlement were observed. Based on the results of this assessment, no further actions appear to be required at this time.
- The crawlspace walls do not have excessive cracking, displacement or excessive moisture.
- An active leak was observed under unit 605. Repairs are required immediately. The joint was tightened while on site. Monitoring of the area through routine maintenance should be considered to ensure no further leaks.
- The construction drawings indicated concrete footings approximately 60 inches below grade.

3.3.2. Exterior Walls

Item	Description	Action	Condition	Replacement
Typical Finishes and Cladding	Painted fiber cement siding	RS and RR	Fair to poor	Green
Other finishes	Painted fiber cement trim	RS and RR	Fair	Green
Sealants	Caulking and sealants at joints, finish transitions, and at wall openings.	RR	Fair	Traditional

Green Physical Condition Discussions: For repainting, specify recycled-content paint. The recycled-content should be at least 50 percent and can come from post-industrial or post-consumer sources. VOCs shall not exceed 250 grams per liter for recycled paint. This measure keeps unwanted paint out of landfills.

For rehabilitation or replacement of exterior siding, specify environmentally preferable siding products. Fiber cement, stucco, metal, brick and stone are durable and easy to maintain. FSC-certified wood siding is made with sustainably harvested wood. Depending on the siding product chosen, this measure may increase durability, reduce waste, maintenance and replacement costs, or support sustainable forestry practices.

Three popular forms of siding are not recommended due to environmental and durability concerns:

- Vinyl siding is a non-recyclable product that poses a landfill burden. In addition, vinyl manufacture produces dioxin, a persistent environmental toxin.
- Conventional wood siding imposes high maintenance costs and may involve detrimental harvesting practices.
- Composition siding (or hardboard) looks like wood siding and requires more ongoing maintenance than wood siding. It is made with wood fibers from industrial process waste or fast-growing tree species. The product is susceptible to water damage when improperly installed and is not recommended.

In addition to its aesthetic function, siding protects a building's exterior walls from wind, sunlight, pests and water. The following siding options are environmentally preferable compared to vinyl, conventional wood or composition siding:

- Fiber-cement siding is gaining popularity as a safe, durable product and is made of Portland cement, sand and cellulose fibers.
- Stucco is a common siding material in many areas of the country. It is made of sand, water, and cement. Some stucco has an acrylic finish.
- Brick or stone veneers are often used in new construction to give the façade a classic look.
- Metal siding is gaining popularity due to its durability, lack of maintenance needs, and because it is lightweight.
- Wood siding certified by the Forest Stewardship Council (FSC) comes from sustainably managed forestry operations. Another environmentally preferable option is siding made from reclaimed wood that may come from old buildings, telephone poles, or river and lake bottoms. Wood can hold up with proper maintenance, but the siding options listed above are likely to last longer and require less maintenance than wood.

Observations/Comments:

- Painting and patching of the exterior walls are recommended during the reserve term. The costs are included in the 20 Year Reserve Schedule as a Rehab item.
- Replacement of caulking, building sealants and weather stripping is recommended as part of the measures to control air leakage in the buildings. The cost for this work is included with the repainting costs.
- EMG observed damaged areas of siding. Peeling paint and rotted sections were apparent in isolated areas. Repair and replacement are recommended within the year. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.

3.3.3. Exterior and Interior Stairs

Item	Description	Action	Condition	Replacement
Exterior Wood Stairs	The exterior stairs are constructed of wood timbers and have closed risers and wood treads. The handrails are constructed of metal.	RM	Good	NA
Exterior Concrete Stairs and Ramp	The exterior stairs at the playground and exterior ramp at the basketball court are constructed of cast in place concrete. The handrails are constructed of metal.	RM	Good	NA
Interior Wood Stairs	The interior stairs are constructed of wood. The handrails and balusters are constructed of wood.	RM	Good	NA

Observations/Comments:

- The exterior and interior stairs, balusters, and handrails are in good condition and will require routine maintenance over the evaluation period.

3.3.4. Exterior Windows and Doors

Item	Description	Action	Condition	Replacement
Windows	Community Center – awning style, double glazed, wood framed units Units - Vinyl-framed sliding units with exterior screens Double–glazed No Low-E Coating Caulking at perimeter of frames	GS	Fair to poor	Green
Exterior Doors	Community Center - Aluminum storefront entrance door and hollow metal service doors in metal frames Push/pull hardware at storefront Knob handles with deadbolt at service door	GS	Good to fair	Green
Apartment Doors	Insulated metal entrance doors with aluminum screen doors Lever or knob handles with deadbolts Vinyl framed sliding deck doors	RR	Good	Traditional
Overhead Doors	None	NA	NA	NA

Green Physical Condition Discussions: Windows and patio doors generally make up a significant fraction of a multi-family unit's exterior walls. They are also generally the weakest link in the building's thermal envelope. Windows can allow unwanted heat into the building during the summer and can account for as much as 25 percent of heat loss in the winter. High-performance windows help control heat gain and loss. Unfortunately replacing single-pane windows with newer, more efficient ones is generally not cost effective as a stand-alone retrofit. Replacement is generally more cost effective when pursued in conjunction with general wall rehabilitation to address rot, water damage, and other issues.

Rehabilitation provides an opportunity for increased energy savings and thermal comfort via door replacement and repair. Poor entrance door construction, an absence of wind barriers or airlocks, and inadequate weather-stripping can allow unwanted heat and cold into the building.

Observations/Comments:

- The windows and sliding glass doors appeared to be more than 15 years old. Based on their Estimated Useful Life and the observed conditions, sliding glass door replacements are recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- Window deterioration noted includes: warped sashes so the panels do not sit properly and safely in the tracks. The damage was noted at unit 501 and was reported to be in several units. Based on the observed conditions and the Estimated Useful Life, repairs are recommended within the year. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- A payback analysis was completed for replacement of the existing windows and sliding glass doors with Energy Star rated units having low-E glazing and argon-filled panes. The payback period is 45.6 years and early replacement is not recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The main entrance lobby at the community center acts as an airlock and maintaining weather stripping on these doors should be part of an ongoing operations and maintenance program. Daylight was observed under the door frame.

- EMG recommends that all future replacements of doors exposed to the weather are performed using EnergyStar rated systems and that all future apartment and common area doors not exposed to the weather are replaced with appropriately fire rated renewable resource or rapidly renewable wood products.
- Based on the Estimated Useful Life and the observed conditions, replacement of the storefront building access system is recommended during the reserve term. The common area door was not found to be of good energy efficiency rating. The glass was single glazed. Where possible, we recommend all future replacements utilize a well-sealed, insulated-pane storefront access system. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- No significant problems were observed with the exterior apartment entry doors. Based on their Estimated Useful Life and the observed conditions, replacements are recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- All future replacements of dwelling unit doors are recommended to utilize renewable resource or rapidly renewable wood products.
- The sealant appeared to be flexible and smooth. Replacement and/or repairs should be addressed as part of routine maintenance. Based on the results of this assessment, no further actions appear to be required at this time.

3.3.5. Roofing

Item	Description	Action	Condition	Replacement
Type	Rental office/community building – modified hip Townhouses - Gabled			
Finish	Asphalt shingles	RR	Good	Green
Maintenance	Maintained by outside contractor			
Age	The roof finishes are one year old			
Warranties	According to the POC, the roofs are covered by a warranty. A copy of the warranty was requested, but was not available.			
Drainage	Gutters and downspouts	RM	Good to fair	NA
Flashing	Sheet metal	RM	Good	NA
Parapet and Copings	Rental office only	RM	Good	NA
Soffits, Eaves, and Fascias	Concealed soffits with fiber cement panels	RM	Good	NA
Skylights	None	NA	NA	NA
Attics	Wood trusses with plywood sheathing	RM	Good	NA
Ventilation	Soffit vents	RM	Good	NA
Other	None	NA	NA	NA

Green Physical Condition Discussions:

Reflective Roofing

As part of any roofing rehabilitation, reduce the roof temperature by specifying cool roof products that meet Energy Star levels of efficiency. Installing a radiant barrier can reduce 90 percent or more of roof deck

radiant heat. This measure reduces the air-conditioning load, minimizes the heat island effect, and extends the roof life.

To qualify for the Energy Star label, roofing products must meet the following specifications:

- For low-slope roofs (surfaces with a slope of 2:12 inches or less), the initial solar reflectance must be at least 0.65. The material must maintain a solar reflectance of at least 0.50 after three years of installation under normal conditions.
- For high-slope roofs (surfaces with a slope of 2:12 inches or greater), the initial solar reflectance must be at least 0.25. The material must maintain a solar reflectance of at least 0.15 after three years of installation under normal conditions.

A payback analysis was performed to install an Energy Star rated reflective roofing system. The payback period was not calculated since it is only one year old. Based on the results of the payback analysis, the use of reflective roofing materials is not recommended.

Vegetative Roofing

Green roofs are a combination of vegetation and soil planted on a waterproof membrane atop a roof. They reduce roof temperature, cooling costs, and storm runoff. In addition to reducing cooling costs and minimizing storm water runoff, green roofs also:

- Filter pollution
- Reduce sewage system loads
- Protect underlying roof material from UV and temperature fluctuations
- Provide habitat for small animals
- Absorb carbon dioxide (CO2)
- Offer an attractive alternative to traditional roofs
- Reduce noise transfer from the outdoors

The current structure and roofing configuration are not conducive to a vegetative roofing system. Green roofing is not recommended.

Observations/Comments:

- The subject property does not have central common area or dwelling unit air-conditioning and therefore is not a candidate for energy savings related to installing an EnergyStar rated roofing system based on financial payback.
- According to the Point of Contact, there are no active roof leaks. This opinion was confirmed by visual observations.
- No evidence of roof deck or insulation deterioration was observed or, according to the Point of Contact, reported. These items should be inspected during any future roofing repair or replacement. Based on the results of this assessment, no further actions appear to be required at this time.
- No evidence of fire retardant treated plywood (FRT) was observed in EMG's limited survey, and no use of FRT was reported by the Point of Contact. Based on the results of this assessment, no further actions appear to be required at this time.
- The primary roofing is approximately one year old. According to the Point of Contact, the previous roofing replacements have included the complete removal of the prior roof. Based on the Estimated Useful Life and the observed conditions, replacement is recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- Roof drainage appeared to be adequate. Clearing and minor repair of drain system components should be performed regularly as part of routine maintenance.

3.4. MECHANICAL AND ELECTRICAL SYSTEMS

3.4.1. Plumbing

3.4.1.1 Common Area Plumbing and Domestic Hot Water

Item	Description	Action	Condition	Recommendation
Water Meter	Meters in pantries within each apartment Rental office/community building – maintenance shop	RM	Good	NS
Domestic Water Supply	Polybutylene pipe - insulated Copper - uninsulated	TR	Poor	Green
Domestic Waste and Ventilation	PVC pipe	RM	Good to fair	NA
Domestic Hot Water	Rental office/community building –gas-fired domestic water heater. 2007 construction; 2009 installation	GS	Good to fair	Green
Vent Damper	See 3.4.2.2 for boiler			
Electronic Ignition	Water heater storage tanks have electronic ignition			
Insulation	Piping and tank insulation	RM	Good to fair	NA
Common Area Restroom Fixtures	Commercial grade bath fixtures and accessories Standard flow fixtures	GS	Good	Green

Apartments are supplied with hot water by individual water heaters in each apartment as described in Section 3.4.1.2.

Observations/Comments:

- The plumbing systems appear to be well maintained. The water pressure appears to be adequate. The plumbing systems will require routine maintenance during the reserve term.
- The property uses polybutylene piping for domestic water distribution and, according to the POC, it is installed throughout the property. In regions where the chlorine levels exceed 2.0 parts per million (milligrams per liter), the use of this type of piping is not recommended because the higher chlorine levels increase the possibility of pipe failure. According to the POC, there is a history of leaks at the property. It was reported that 70% of the units have issues. The estimated Remaining Useful Life (RUL) of this material is approximately 28 years. Based on the estimated Remaining Useful Life (RUL), the polybutylene piping will require replacement during the evaluation period. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- The pressure and quantity of hot water appear to be adequate.
- Domestic water heater sizing is included in the Energy Audit.
- The water heaters for the common areas are in good to fair condition and will require routine maintenance during the evaluation period.

- Hot water piping is poorly insulated. Approximately 15 linear feet of insulation is missing and will require installation. Refer to the Energy Audit for further discussion and payback analysis if appropriate. The cost for this work is relatively insignificant and can be performed through routine maintenance.

3.4.1.2 In-Unit Plumbing and Domestic Hot Water

Item	Description	Action	Condition	Recommendation
Domestic Hot Water	Individual gas-fired boilers – heat and domestic Individual, indirect fired water heater storage tanks at 36 gallons	GS and RR	Good to fair	Green
Insulation and Piping	Piping and tank insulation Polybutylene pipe - insulated Copper - uninsulated	GR	Fair	Green
Apartment Bathrooms	Lavatory, vanity, shower or bathtub, water closet	RR	Good to fair	Traditional

Where accessible we observed that the domestic hot water piping in the individual dwelling unit is partially insulated.

The existing showers and sinks have water saving fixtures. Plumbing fixture flow rates are detailed in the water testing table below. The existing unit toilets are rated at 1.6 gallons per flush (GPF).

Hot water temperature was physically measured at a random but representative number of dwelling units. The temperatures recorded are as follows:

Sample Location	Faucet Location	Measured Temperature
Dwelling Unit - 905	Kitchen	149° F
Dwelling Unit - 506	Main Bathroom	138° F
Dwelling Unit - 506	Kitchen	138.4° F
Laundry Room	Laundry Sink	133.2° F
Community Room	Kitchen	132.7° F
Rental Office Common Area – Women's	Restroom	130.6° F

EMG performed a flow test of the bathroom and kitchen faucets and showerhead and found each fixture to meet the requirements of the 1995, the National Energy Policy Act as follows:

Sample Location	Fixture	NEPA Guidance – Gallon Per Minute/Flush	Flow Test Results
Dwelling Unit - 905	Faucet - kitchen	2.2 gpm	1.2-2.2 gpm
Dwelling Unit - 905	Faucet - bathroom	1.5 gpm	1.2-2.2 gpm
Dwelling Unit - 905	Toilet	1.6 gpf	1.2-2.2 gpm

Sample Location	Fixture	NEPA Guidance – Gallon Per Minute/Flush	Flow Test Results
Dwelling Unit - 506	Faucet - kitchen	2.0 gpm	1.2-2.2 gpm
Dwelling Unit - 605	Toilet	1.6 gpf	1.2-2.2 gpm

It was reported by Mr. Grimaldi, that approximately 90 percent of the hot water storage tanks are over ten years old. A replacement program is in place on an "as needed" basis.

Observations/Comments:

- The water pressure and quantity of hot and cold water was observed to be adequate. Based on the results of this assessment, no further actions appear to be required at this time.
- Domestic water heater sizing is included in the Energy Audit.
- It was reportedly that approximately four indirect fired hot water storage tanks were replacements and the remaining units are estimated to be more than ten years old. Based on the Estimated Useful Life and the observed conditions, replacement is recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- Bathroom and kitchen plumbing fixtures were generally replacements. Based on the level of maintenance, type of material, and observed conditions, significant replacements are not anticipated during the term. However, some repairs and/or replacements are anticipated during the reserve period. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The vanities are generally over ten years of age. Based on the Estimated Useful Life and the observed conditions, replacement is recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The domestic water distribution piping does have a history of chronic leaks.
- Polybutylene piping was observed, and the maintenance supervisor reported that it was used throughout the property. The maintenance supervisor reported that there has been a history of leaks associated with this piping. EMG anticipates that the facility will need to be replumbed. Plumbing replacement costs, which must include costs for wall repairs as well, is considered to be an immediate repair, and the cost is included in the 20 Year Reserve Schedule as a Rehab Item. There is no Green Alternative for this item.
- Hot water piping is poorly insulated. Approximately 25 linear feet of insulation per apartment is missing and will require installation. Refer to the Energy Audit for further discussion and payback analysis if appropriate. The cost for this work is relatively minimal and should be performed as part of routine maintenance.

3.4.2. Heating, Ventilating, and Air-conditioning (HVAC)

3.4.2.1 Common Area HVAC

Item	Description	Action	Condition	Recommendation
Maintenance	Maintained by in-house staff			
Age and Type	HVAC equipment is reportedly replaced on an "as needed" basis.			
Heating and Air-conditioning	Heat Pumps – community room and office Electric fan coil units	RR	Good	Green
Refrigerant	Could not be determined			

Item	Description	Action	Condition	Recommendation
Quantity/Capacity	3 PTAC heat pumps at approximately 0.5 tons each, 11.6 EER			
Vent Damper	Not applicable			
Boiler Controls	Not applicable			
Distribution	Through the wall	NA	NA	NA
Controls	Local thermostats	RM	Good	Traditional
Ducts	None	NA	NA	NA
Insulation	None	NA	NA	NA
Supplemental systems	Electric space unit heaters	RM	Good	NA
Ventilation	Bathroom exhaust fans 2 Fans	RM	Good	Green
Load Sizing	Manual J Load Sizing Calculations are included in the Energy Audit	NA	NA	NA

Observations/Comments:

- The through the wall heat pumps were reported to be original. Based on the Estimated Useful Life and the observed conditions, replacements are recommended during the reserve term.
- A payback analysis was completed for replacement of the existing heat pump units with Energy Star rated heat pumps (16 SEER or better). Early replacement is not recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The electric unit ceiling-mounted heaters appeared to be original. Based on the Estimated Useful Life and the observed conditions, replacement is recommended during the reserve term. However, the minimal aggregate quantity allows for the work to be completed as part of routine maintenance. Based on the results of this assessment, no further actions appear to be required at this time.

3.4.2.2 In-Unit HVAC

Item	Description	Action	Condition	Recommendation
Maintenance	Maintained by in-house staff			
Age and Type	The HVAC equipment appears to vary in age HVAC equipment is reportedly replaced on an "as needed" basis.			
Heating and Air-conditioning	Gas-fired boilers - individual Tenant supplied window AC units	GS and RR	Good to fair	Green
Refrigerant	Could not be determined			
Quantity/Capacity	35 boilers Approximately 31 at 60 MBH per apartment, 85% Efficiency Approximately 4 at 70 MBH per apartment, 92.8% Efficiency			
Distribution	Hydronic Baseboard Heating	RM	Good to fair	NA

Item	Description	Action	Condition	Recommendation
Controls	Digital thermostats	RM	Good to fair	NA
Ducts	None	NA	NA	NA
Insulation	Piping uninsulated – see 3.4.1.2 for domestic water line information	NA	NA	NA
Ventilation	Bathroom and kitchen exhaust fans Range hoods vented to exterior	RM	Good	Green
Load Sizing	Manual J Load Sizing Calculations are included in the Energy Audit	NA	NA	NA

It was reported by Mr. Grimaldi, that approximately 90 percent of the boilers are original. A replacement program is in place on an "as needed" basis.

The apartment units are not equipped with programmable thermostats. The pre-programmed settings that come with Energy Star qualified programmable thermostats are intended to deliver savings without sacrificing comfort. Depending on the tenant's schedule, one can see significant savings. The key is to establish a program that automatically reduces heating and cooling based on the tenants' lifestyles. Programmable thermo stats are recommended for this property as a Green Significant Addition. Installation of programmable thermostats should be performed as part of routine maintenance. The cost for installation of the programmable thermostats is not included in the tables.

The kitchen in each apartment unit is vented to the exterior by standard range hoods. The bathroom is ventilated to the exterior by ceiling-mounted exhaust fans.

Observations/Comments:

- Most of the boilers are original and have exceeded the typical Estimated Useful Life and were observed to have deterioration in the form of rattling noises. Based on the Estimated Useful Life and the observed conditions, replacement is recommended.
- A payback analysis was completed for replacement of the existing boilers with high efficiency condensing boilers. The payback period is 32.7 years and early replacement is not recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- Refer to the Energy Audit for discussion of boiler controls and vent dampers as Energy Conservation Measures, as appropriate.
- The majority of the hot water baseboard fin-tube units are original. Some fins have been compressed and a few were corroded. Due to the estimated Remaining Useful Life (RUL) and condition of some of the units, approximately 15% of the baseboard heaters should be replaced. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- The window air-conditioning units are supplied by the residents and are reportedly their responsibility to maintain or replace. Based on the results of this assessment, no further actions appear to be required at this time.
- The range hoods are ducted to the exterior of the building. Based on their estimated Remaining Useful Life (RUL), replacement of the exhaust fans with energy star rated fans during the reserve term is recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- It was reported that the exhaust fans were replaced during the roof replacement one year ago. Some were observed with excessive dust accumulation which inhibits function of the system and prevents adequate ventilation. Cleaning should occur regularly and can be performed through routine maintenance.
- It was also reported that the switches are going to be replaced to work in conjunction with the bathroom light switches.

- The bathroom exhaust fans are ducted to the exterior of the building. Based on their estimated Remaining Useful Life (RUL), replacement of the exhaust fans with energy star rated fans during the reserve term is recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.

3.5. BUILDING ELEVATORS AND CONVEYING SYSTEMS

Not applicable. There are no elevators or conveying systems present.

3.6. FIRE PROTECTION AND SECURITY SYSTEMS

Item	Description	Action	Condition	Recommendation
Sprinkler Systems	Wet pipe, automatic sprinkler system with flow switches, pull stations, and alarm horns and backflow preventer	RM	Good	NA
Other Equipment and Devices	Central alarm panel, strobe light alarms, illuminated exit signs, battery back-up light fixtures	RM	Good	NA
Special Systems	Units – carbon monoxide detectors on each floor in hallway. Hardwired with battery back-up	RM	Good	NA
Fire Extinguishers	Located throughout interior spaces Last service date in August 2012 – expired	RM	Good	NA
Fire Hydrants	Located along parking lot drive aisles	RM	Good	NA
Stairwells	Units - drywall-finished stairwell walls No common area stairwells	RM	Good	NA

Smoke detectors were observed in in the immediate vicinity of the bedrooms outside of the bedroom, and on all levels of the dwelling unit. The smoke detectors are hardwired and meet the NFPA 101 requirements.

Carbon monoxide detectors were observed in dwelling units adjacent to fuel-fired combustion equipment.

Observations/Comments:

- Information regarding fire department inspections is included in Section 4.2.
- Per the NFPA 101 requirements, smoke detectors are not located at appropriate locations. Smoke detectors are required in every bedroom, in the immediate vicinity of the bedrooms outside of the bedroom, and on all levels of the dwelling unit. Additionally, the smoke detectors must be hard-wired, or the battery operated-type must have 10-year life, be tamper resistant, and are not interchangeable with appliances or toys. As such, smoke detector installation is required in all of the above noted locations. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item. There is no Green Alternative for this item.
- Carbon monoxide detectors are required in dwelling units where fuel-fired combustion equipment such as water heaters or furnaces is located. As such, CO detector installation is required in all of the above noted locations.
- The fire sprinklers are inspected by a qualified contractor on a routine basis. The fire sprinklers will require routine maintenance during the reserve term. The sprinklers are tapped off the domestic water line and serve the community room, kitchen, paper storage, office and maintenance shop only.
- The fire extinguishers are serviced annually. They were inspected and all tagged for 2014. This work should be completed as part of routine maintenance.

- The pull stations and alarm horns will require routine maintenance during the reserve term.
- The alarm horns are not equipped with strobe lights. The only strobe light observed was in the community room.
- Smoke detector replacement is considered to be routine maintenance.
- Exit sign and emergency light replacement is considered to be routine maintenance.
- The central alarm panel is serviced regularly by a qualified fire equipment contractor. Equipment testing is not within the scope of a Physical Condition Assessment. Based on inspection documents displayed by the panel, the central alarm panel has been inspected within the last year. Based on the Estimated Useful Life and the observed conditions, replacement is recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.

3.7. INTERIOR ELEMENTS

3.7.1. Common Areas

3.7.1.1 Interior Finishes

Not applicable. There are no interior common areas as part of the townhouses; see Section 3.8 for rental office/community center interiors.

3.7.1.2 Building Electrical Service and Lighting

Item	Description	Action	Condition	Recommendation
Service Type	Underground lines to pad-mounted transformers			
Service Size	Rental office/community center - (2) 100-Amp, 120/240-Volt, single-phase, three-wire, alternating current (AC).			
Electric Meters and Equipment	Meters along side elevation Circuit breaker panels located inside	RM	Good	NA
Wiring	Copper wire in metallic sheathed cable	RM	Good	NA
Common Area Lighting	Energy Efficient Fluorescent Light Fixtures (14) 4 foot linear T-8 fixtures, 32 Watt – on switch (2) 2 foot linear T-8 fixtures, 32 Watt – on switch	RM	Good	NA
Emergency generator	None	NA	NA	NA

Observations/Comments:

- The electrical power was reported to be adequate for the building demands. Based on the results of this assessment, no further actions appear to be required at this time.
- The switchgear, circuit breaker panels and electrical meters appeared to be in good condition. Based on the results of this assessment, no further actions appear to be required at this time.

3.7.2. Dwelling Units

3.7.2.1 Cabinetry and Countertops

The kitchen cabinets are constructed of plastic-laminated wood. The countertops are wood and have a plastic-laminated finish.

Green Physical Condition Discussions: Cabinet and countertop replacement projects should specify durable, formaldehyde-free materials, which will increase indoor air quality. Cabinets should feature hardwood assemblies and doors, or exterior-grade plywood or formaldehyde-free MDF boxes assembled with adhesives, screws, and bolts. Many composite woods are produced with formaldehyde binders that off-gas after installation. Formaldehyde glues in composite wood products come in two forms: urea and phenol. Urea-formaldehyde binders are more common.

Observations/Comments:

- The kitchen cabinets and countertops are replacements from less than one year ago. The cabinets and countertops will require routine maintenance.

3.7.2.2 Appliances

Each apartment unit kitchen typically includes the following appliances:

Appliance	Comment
Refrigerator	Frost-free
Range	Gas
Hood	Ducted
Dishwasher	Not provided
Disposal	Not provided

Green Physical Condition Discussions: Rehabilitation projects should encourage the use of EnergyStar rated refrigerators, dishwashers, and clothes washers as part of any appliance replacement. EnergyStar® appliances save water, energy, and money. EnergyStar is a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE). It is a voluntary labeling program that aims to reduce greenhouse gas emissions by helping consumers to purchase the most energy-efficient products available. EnergyStar sets standards for energy efficiency that roughly target the upper 20 percent of current off-the-shelf technologies. Products that meet the energy efficiency requirements are eligible for the EnergyStar label. In addition to saving energy, many qualified products also save water. The planned rehabilitation project should include replacement of all refrigerators within the dwelling units and community room. The recommendation is made to ensure that EnergyStar compliant refrigerators be installed. Electric ranges are not rated by EnergyStar.

Hookups are not available for washers or dryers, appliances are not provided by the property management.

Observations/Comments:

- Approximately 90 percent of the kitchen appliances are two years old. Apartment appliances are reportedly replaced on an "as needed" basis.
- The refrigerators are not Energy Star rated. Based on their estimated Remaining Useful Life (RUL, the refrigerators will require replacement during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.

- The ranges appear to be well maintained and are two years old. Based on their estimated Remaining Useful Life (RUL), the ranges will require replacement during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.

3.7.2.3 Interior Finishes

The following table generally describes the interior finishes in apartment units:

Typical Apartment Finishes			
Room	**Floor**	**Walls**	**Ceiling**
Living room	Vinyl tile	Painted drywall	Painted drywall
Kitchen	Vinyl tile	Painted drywall	Painted drywall
Bedroom	Vinyl tile	Painted drywall	Painted drywall
Bathroom	Sheet vinyl or vinyl tile	Painted drywall with fiberglass tub surround	Painted drywall

The interior doors in each apartment unit are painted hollow-core wood doors set in wood frames. Wardrobe closets are accessed by bi-fold doors.

Green Physical Condition Discussions: Flooring products may emit formaldehyde and other VOCs. As part of any flooring replacement, specify flooring products that have been tested and approved for low emissions according to the California "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers," also known as Specification 01350. Any adhesives used in installing flooring materials should be under 50 gm/VOCs). This measure will improve indoor air quality for occupants and reduce environmental damage associated with VOCs. In addition, to improve indoor air quality, alternate flooring materials should be explored (e.g. natural linoleum, bamboo, wool, natural grasses/fibers and ceramic tile). Vinyl flooring is often referred to as "linoleum;" however, does not feature the same physical properties of linoleum. The use of natural linoleum will reduce replacement costs, increase durability, and minimize the impact on the environment. Natural linoleum is made from rapidly renewable materials including linseed oil (from flax), powdered wood and/or cork, ground limestone, resin binders, and dry pigments with a natural jute fiber backing. Where carpet is installed or replaced, specification of low-VOC carpet (Carpet and Rug Institute (CRI) "Green Label"), and a "green" installation method (e.g. no adhesives for carpet padding or carpet, air changes after installation, etc.) is recommended.

Observations/Comments:

- The residential units are typically renovated upon tenant turnover. The renovation generally consists of floor finish cleaning or replacement, interior painting, general cleaning, and repair or replacement of any damaged items.
- The interior finishes in the apartment units are not original. Based on estimated Remaining Useful Life (RUL), apartment unit painting will be required during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- Most of the floor coverings in the apartment units are in good condition. Approximately ten units have original flooring and some unit flooring is worn with cracks and mismatched colors and patterns such as in unit 905, 501 and 402. The sub-floor in unit 402 is saturated due to continuing leak from tenant installed washing machine. In addition, the subfloor was originally particle board which is not an appropriate subfloor material once it gets wet. Based on its estimated Remaining Useful Life (RUL), the vinyl flooring will require replacement during the reserve term. Some sub-flooring will require replacement. The recommendation is made for future improvements and replacement to use linoleum with no-VOC

adhesive. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item and as a Rehab Item for the units with damaged flooring.

- The interior doors and door hardware are in good condition. An isolated few have been damaged and will require replacement. The cost of this work is relatively insignificant and can be performed through routine maintenance.

3.7.2.4 In-Unit Electrical Service and Lighting

Item	Description	Action	Condition
Apartment Service Size	100-Amps, 120/240-Volt, single-phase, three-wire, alternating current (AC).		
Electric Equipment	Circuit breaker panels at each apartment	RM	Good
Wiring	Copper wire in non-metallic sheathed cable	RM	Good

Lighting fixtures in the apartments are a mixture of residential-style fixtures. The following table describes the lighting configuration in each apartment unit type.

Apartment Unit Type	Incandescent (40 Watt) Fixtures/Bulbs	Fluorescent (CFL, 34 Watt) Fixtures/Bulbs
2-Bedroom	2/2	3/3
3-Bedroom	3/3	4/4
TOTALS	**5/5**	**7/7**

Ground fault circuit interrupters (GFCI) were observed in the kitchen but not the bathroom in each unit. Ground fault circuit interrupter breakers (GFCI) were observed in the breaker boxes for the bathroom in each unit.

Observations/Comments:

- The electrical service to the tenant units is adequate. The observed wiring was copper.
- The interior light fixtures appeared to be in good condition. Based on the Estimated Useful Life and the observed conditions, replacements are recommended during the reserve term.
- A payback analysis was completed for replacement of the incandescent lighting in the apartment units with Energy Star rated compact fluorescent (CFL) bulbs. The payback period is 3.6 years and early replacement is recommended for the older lamps. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- GFCI must be present in the kitchen and bathroom and should be installed as a life/safety item. Since the breaker was observed to have a GFCI rated circuit dedicated for the bathroom, no further action is recommended at this time. There is no Green Alternative for this item.

3.8. OTHER STRUCTURES

Item	Description	Action	Condition
Maintenance building/Rental Office/Community Building	Concrete masonry unit bearing walls with wood framed roofing set on a concrete slab with brick veneer and asphalt shingle roof	RM	Good

Item	Description	Action	Condition
Storage shed	Fiber cement sided structure on concrete slab with asphalt shingled room	RM	Good

The following table identifies the interior common areas and generally describes the finishes in each common area.

Common Areas						
Renovations/FF&E	The common area kitchen was last renovated approximately one year ago. The remaining finishes appear to be approximately nine years old. The FF&E primarily consists of chairs, desks, tables, bookshelves and office equipment					
Area	**Floor**	**Walls**	**Ceilings**	**Action**	**Condition**	**Replacement**
Rental Office	Vinyl tile	Painted drywall	Painted drywall	RR	Good	Green
Lobby	No lobby	No lobby	No lobby	NA	NA	NA
Elevator lobbies	No elevators	No elevators	No elevators	NA	NA	NA
Corridor	Vinyl tile	Painted drywall	Painted drywall	RR	Good	Green
Common Area Restrooms	Ceramic tile	Painted drywall with ceramic tile wainscots	Painted drywall	RR	Good	Green
Community Room	Vinyl tile	Painted drywall with carpet wainscots	Painted drywall	RR	Good	Green
Community Room Kitchen	Vinyl tile	Painted drywall with ceramic tile backsplash	Painted drywall	RR	Good	Green
Laundry Room	Vinyl tile	Painted drywall	Painted drywall	RR	Good	Green
Laundry Equipment	5 Washers, Commercial, Coin-Op 5 Dryers, Commercial, Coin-Op			RR	Good	Green

Green Physical Condition Discussions: For all residential or commercial-grade clothes washers, purchase or lease products that are Energy Star–qualified with a modified energy factor (MEF) of at least 1.72 and a maximum water factor of 8.0. For all residential-grade clothes dryers, purchase or lease products that are natural gas–fueled and ventless (require no exhaust). In addition, look for a dryer with a moisture sensor that automatically shuts off when your clothes are dry. This measure reduces energy and water bills.

Consider energy conservation measures, such as scheduling of operation of laundry facilities during non-peak electrical demand periods and using cold water rinse cycles in all new machines. Although warm or hot water is necessary to wash many types of clothing, cold water can be used in the rinse cycle for all applications. Converting laundries to cold rinse cycle can generate significant energy savings by cutting down on hot water use.

Observations/Comments:

- Based on the Estimated Useful Life and the observed conditions, painting of the interior walls is recommended during the reserve term. The cost of this work is relatively insignificant and can be performed through routine maintenance.

- Recommended replacement of the common area flooring should use a green natural linoleum product, as this material has an extended useful life and natural anti-microbial properties. Similar green flooring should be installed within the common laundry room. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The public restrooms have not been renovated since the building was constructed. The estimated Remaining Useful Life (RUL) of the finishes indicates that some replacement of fixtures, flooring, wall and ceiling finishes will be necessary during the reserve term. The cost for this work is relatively insignificant and can be performed through routine maintenance.
- The building's laundry room contains washers and dryers owned and maintained by the property. The washers, dryers and the water heater have been replaced within the last five years. Due to the estimated Remaining Useful Life (RUL) replacement of the washers and dryers is anticipated during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item. The Green Alternatives are recommended.
- EMG recommends the common laundry facilities are modified to a cold water rinse cycle in an effort to conserve energy. If the washing machines are owned by the property, conversion of the laundry rinse cycle to cold water can be done by maintenance staff or an outside service person.

4. CODE COMPLIANCE AND ACCESSIBILITY

4.1. ENERGY CONSERVATION CODE REVIEW

The Energy Conservation Code applies to new construction and is utilized as minimum requirement standard. The methodology of this report offers assurance that recommended "green" replacements exceed the requirements of the local energy conservation code.

The 2009 version of the New Jersey Energy Conservation Construction Code was formally adopted on September 7, 2010. All projects permitted after this date will require compliance with the code. The ECCC is based upon the 2009 version of the International Energy Conservation Code (IECC). Based upon the current interpretation of the IECC, and the original date of construction of the property built in 1982, regulations regarding energy efficiency cannot be retroactively applied to the property. However, the recommended green replacements within the 12-month repair schedule of this report exceed the performance requirements set by the IECC as outlined in the following table:

Energy Conservation Code (ECC)			
Equipment Type	**Subcategory or Rating Condition**	**Local ECC Minimum Efficiency**	**EMG Green Replacement Recommendation**
Heating	Gas Furnace	90% AFUE	AFUE > = 95 or EnergyStar Rated
Cooling	Central Air-conditioning	13 SEER	>13 SEER or EnergyStar
Appliances	Appliances	No Standard	EnergyStar Rated
Insulation	Ceiling/Attic	R Value 38	R Value 40 and meet 2009 IECC and Amendments
Insulation	Floor above crawlspace or unfinished basement	R Value 30	R Value 38 and meet 2009 IECC and Amendments
Window	Double Glazed	U Factor.35	U factor < = 0.30 or EnergyStar Rated
Water heater	Natural Gas	In accordance with prevailing federal minimum standards	EnergyStar Rated
Water heater	Electric	In accordance with prevailing federal minimum standards	Energy Factor > = .82 or a thermal efficiency of at least 90%.

4.2. BUILDING, ZONING, AND FIRE CODE COMPLIANCE

According to the New Jersey State Bureau of Housing Inspection, the Bureau does not have an annual inspection program for the Housing Authority. The Housing Authority performs self-inspections. A copy of the original Certificates of Occupancy were requested but were not available.

According to Daniel Mairella at the Township of Mahwah Department of Planning and Zoning, the Department does not have an annual inspection program. They only inspect new construction, work that requires a building permit, and citizen complaints. A copy of the original Certificates of Occupancy were requested but were not available.

According to the Township of Mahwah Fire Department, the Department does have an annual inspection program. Only the community building/rental office is inspected. The last inspection occurred on June 6, 2013. According to Inspector Michael Roe, no active fire code violations are on file.

According to the Flood Insurance Rate Map, published by the Federal Emergency Management Agency (FEMA) and dated September 30, 2005, the property is located in Zone X, defined as an area outside the 500-year flood plain with less than 0.2% annual probability of flooding. Annual Probability of Flooding of Less than one percent.

According to the 1997 Uniform Building Code Seismic Zone Map of the United States, the property is located in Seismic Zone 2A, defined as an area of low to moderate probability of damaging ground motion.

4.3. ACCESSIBILITY

Section 504 of the Rehabilitation Act of 1973 is a Federal accessibility law that was enacted on June 2, 1988. Section 504 applies to multi-family properties that have or are currently receiving funding from a Federal source. In the case of new construction, substantial rehabilitation (15 or more units with the cost of alteration is 75 percent or more of the replacement cost of the completed facility), and Other Alterations (modernizations and alterations to the property), the property must have a minimum of five percent mobility accessible units and two percent of the units for visual/audio hearing impairments. The percentage can be increased by HUD involved at their discretion. In the case of Other Alterations, exceptions can be considered due to undue financial burdens or structural restrictions. However, the exceptions do not relieve the recipients from compliance utilizing other units/buildings or other methods.

Reasonable Accommodations as described in 24 CFR 8.4(b)(i), 8.24 and 8.33 are described as follows: When a family member requires an accessible feature(s) or policy modification to accommodate a disability, property owners must provide such feature(s) or policy modification unless doing so would resulting in a fundamental alteration in the nature of its program or result in a financial and administrative burden.

The Uniform Federal Accessibility Standard (UFAS) 24 CFR part 40 was adopted by HUD and made effective October 4, 1984. The UFAS applies only to new construction or to alterations to the existing buildings. Alterations are defined as work that costs 50 percent or more of the building's value when the work performed occurs within a twelve month period.

Attachment B of the M2M Program Operating Procedures Guide indicates that Accessibility for Persons with Disabilities should be assessed when required by the program or for newly built properties.

The Fair Housing Amendments Act (FHA) of 1988 amended Title VIII of the Civil Rights Act of 1968 to aid in the prohibitions against discrimination in housing on the basis of disability and familial status. The Fair Housing Act also made it unlawful to design and construct certain "covered multi-family dwellings" for first occupancy after March 13, 1991, in a manner that makes them inaccessible to persons with disabilities. The Fair Housing Act also established design and construction requirements to make such dwellings readily accessible to, and usable by, persons with disabilities.

Covered multi-family structures meeting the FHA criteria, and first occupied on or after March 13, 1991, are required to comply fully with FHA. Existing facilities constructed prior to this date are not addressed by FHA unless the property receives federal subsidies. EMG provides a general assessment of the property's construction as it pertains to FHA. EMG does not assess FHA accessibility as it pertains to discrimination against persons as outlined in the Civil Rights Act.

Fair Housing Act FHA requires that certain "covered multi-family buildings" be accessible. FHA indicates that all ground floor units on a property, be upgradeable to accommodate persons that are mobility impaired. The elements as defined by FHA for accessibility are outlined on EMG's Accessibility Checklist included in the Appendices.

Generally, Title III of the Americans with Disabilities Act (ADA) prohibits discrimination by entities to access and use of "areas of public accommodations" and "commercial facilities" on the basis of disability. Regardless of their age, these areas and facilities must be maintained and operated to comply with the Americans with Disabilities Act Accessibility Guidelines (ADAAG).

Buildings completed and occupied after January 26, 1992 are required to comply fully with ADAAG. Existing facilities constructed prior to this date are held to the lesser standard of complying to the extent allowed by structural feasibility and the financial resources available; otherwise a reasonable accommodation must be made.

During the Green PCA, a limited visual observation for accessibility was conducted. The scope of the visual observation was limited to those areas set forth in the EMG Accessibility Checklist provided in Appendix F. It is understood by the Client that the limited observation described herein does not comprise a full Accessibility Compliance Survey, and that such a survey is beyond the scope of EMG's undertaking. Only a representative sample of areas were observed and, other than as shown on the accessibility checklist, actual measurements were not taken to verify compliance.

Based on the date of construction, 1986, the accessibility standards that apply to the Project are 504, UFAS and the ADA Guidelines. However, as the property is not new construction, or completing substantial rehabilitation or other rehabilitation, the property is only required to complete reasonable accommodations. Property management stated that Section 504 requests are completed on an individual case-by-case basis. Based on EMG's observations and interview of the Property Manager, the property is generally non-compliant with Section 504. Presently, two percent of the units are accessible for individuals with mobility impairments according to property management. There are no units at present which have visual/audio modifications, thus not meeting the two percent accessible requirements of 504. Based on EMG's assessment, one additional unit should be made accessible to the hearing impaired during rehabilitation projects.

Based on EMG's observations, the facility did not appear to be fully accessible with Section 504, UFAS and ADA. Elements e observed at the property that were not accessible are as follows:

Parking

- An adequate number of designated parking stalls and signage for van access were not provided. No van sign and existing car sign is mounted too low.

  Estimated Cost: 1 @ $200 each = ... $200

Exterior Accessible Route

- Existing exterior stairs are not equipped with the required handrails. The stairs to basketball court has railing on only one side.

  Estimated Cost: 7 ft. @ $35 LF = ... $245

Common Area Accessible Route

- Add visual alarm to existing audible fire alarm.

  Estimated Cost: 2 @ $250 each = ... $500

Common Area Restrooms

- Modify existing toilet room accessories and mirrors. Mirrors are mounted too high.

  Estimated Cost: 2 @ $200 each = ... $400

- Wrap drain pipes below lavatory with insulation; protect against contact with hot, sharp or abrasive surfaces.

  Estimated Cost: 2 @ $35 each = ... $70

Unit Accessibility

- Wrap drain pipes below lavatory with insulation; protect against contact with hot, sharp or abrasive surfaces. Kitchen and bathroom have no drain pipe insulation.

  Estimated Cost: 4 @ $35 each = ... $140

- No hearing impaired units were observed or reported. Modify door bell, light switches, fire safety alarms for hearing impaired

  Estimated Cost: 1 @ $250 each = ... $250

Unit Bathrooms

- Install grab bars in accessible stalls at 36" above the floor. Side grab bar is non-compliant in length and rear grab bar is missing.

  Estimated Cost: 4 @ $250 each = ... $1,000

A full Accessibility Survey may reveal further aspects of the facility which are not in compliance.

The cost to address the achievable items noted above is included as an Accessibility item in the Rehab Cost Tables. These corrective actions are not design standards and should not be interpreted as all inclusive. Building and structural design elements need to be reviewed by a local licensed architect or professional engineer for appropriate remedial action.

4.4. INDOOR AIR QUALITY AND MOLD

EMG performed a limited visual assessment of indoor air quality improvement opportunities in readily accessible interior areas of the property. EMG recommends that property owners and tenants consider implementing the following methods to improve indoor air quality:

- Utilize non-toxic cleaning products can often be made with products you already have in your home, including baking soda, vinegar, and lemon juice
- Designate an outside area, away from doors, windows, and air intakes for your HVAC system for smoking
- Minimize allergy and asthma triggers from pests like cockroaches and mice, keep food tightly sealed, and allow eating only in certain areas. Clean those areas daily.
- When dusting, wipe down surfaces with a damp cloth to keep the dust down. Mop regularly.
- Carpets hold a lot of dust and can also hold moisture. Clean up spills immediately and get the area very dry to reduce the possibility of mold growth.
- If you have hardwood floors or other smooth surfaces underneath the carpet, consider removing carpeting completely.
- Eliminate "dust catchers" from sleeping areas. These include fabric curtains, and stuffed animals.

- Plants can purify some toxins from the air, but also can hold a lot of dust, and if overwatered, mold. Dust your plants regularly and don't overwater. Remove plants from rooms where sensitive individuals spend a lot of time, especially the bedroom.
- Wash bedding at least weekly in hot water to eliminate dust mites. Cold water washes designed to eliminate dust mites can also be found in online stores.
- Check your temperature and humidity levels. High temperatures and humidity levels can lead to mold growth.
- Consider carpeting that comes from sources that are naturally void of VOCs and other toxins. Moving away from petrochemical-based products, even if they are recycled, and are using natural fibers such as wool, jute, sisal, hemp, or coir (from coconut husks) benefit both environmentally-sensitive tenants and the environment.
- Install rubber "walk-off" mats or rugs for inside or outside of apartment unit doorways that can be washed in hot water (to eliminate dust and other particulate).
- Install rubber stair treads on common area stairways that can be easily swept, vacuumed and washed to eliminate dust and other particulate.

EMG performed a limited visual assessment for the presence of mold, conditions conducive to mold, and evidence of moisture in readily accessible interior areas of the property.

No suspect mold was observed, but moisture was observed in the following areas:

- Above tub in unit 401. The area affected by the moisture was approximately two square feet in size.
- Crawl space in 605 – active leak. The area affected by the moisture was approximately five square feet in size. Trap under kitchen sink was tightened while on site and the leak appears to have been corrected.
- Unit 402 domestic water storage area – saturated sub-floor. The area affected by the moisture was approximately ten square feet in size. Tenant tapped washing machine into domestic storage tank against regulations. Leaks occurred and have saturated sub-floor and damaged finish flooring. Reported potential for mold in crawl space. No access provided.

Additional discussion and description of the correction efforts required with regard to the moisture infiltration issues in Unit 402 are discussed in Section 3.7.2.3 of this report, and associated costs are included within that section.

Remediation can be conducted by properly trained building maintenance staff. In addition, the source of this moisture should be addressed in order to prevent future mold problems. The estimated costs of corrective action are of a minimal quantity, and consequently, are considered to be part of routine maintenance operations. No other costs are included in the tables.

Observations/Comments:

- EMG recommends installing rubber "walk-off" mats or rugs for inside or outside of apartment unit doorways that can be washed in hot water (to eliminate dust and other particulate). Wash the mats regularly and install a durable mat outside, in front of main building entry doorways.

4.5. FOLLOW UP RECOMMENDATIONS

No conditions observed require the follow up recommendations.

5. ENVIRONMENTAL CONCERNS

The Environmental Restrictions Checklist was completed by an EMG Registered Architect or Professional Engineer through interviewing a knowledgeable person associated with the Project (e.g., a Project manager, maintenance person or owner who has been involved with the Project for a sufficient period of time so as to be familiar with any environmental issues); followed by a walk-through assessment, providing a cursory observation of representative areas of the Project and surrounding properties viewed from the Project. The information provided by the knowledgeable person associated with the Project is assumed to be complete and correct.

Based solely upon review of the information obtained from the Environmental Restriction Checklist, no further inquiry is recommended.

RAD Environmental Restrictions Checklist

Project Name and Location (Street, City, County, State, Zip Code):	**Owner Name, Address (Street, City, State, Zip Code), and Phone:**
Mahwah Public Housing 1600 Ramapo Brae Lane Mahwah, New Jersey 07430	Housing Authority of Bergen County One Bergen County Plaza Hackensack, New Jersey 07601 201.569.7454 Mr. George Stavrou

Project Description:

The multi-family property has six sections of two-story apartment townhouse buildings with a total of 35 rental apartment units and a single-story rental office/community center building with a sunken maintenance shop on a site of approximately 4.59 acres. Construction of the property was completed in 1986.

On site amenities consist of a basketball court, children's playground, community room and laundry facilities.

ENVIRONMENTAL REVIEW FINDINGS	**YES**	**NO**
FLOOD PLAIN		
Is the project located in a FEMA Special Flood Hazard Area?		√
Identify Map Panel and Date		
Does the project currently carry Flood Insurance?		
Do any structures appear to be within or close to the floodplain.?		√
HISTORIC PRESERVATION		
Is the property listed on the National Register of Historic Places?		√
Is the property located in a historic district listed on the National Register of Historic Places?		√
Is the property located in a historic district determined to be eligible for the National Register?		√
AIRPORT HAZARDS		
Is the project located in the clear zone of an airport? (24 CFR Part 51 D).		√
HAZARDOUS OPERATIONS		
Is there any evidence or indication of manufacturing operations utilizing or producing hazardous substances (paints, solvents, acids, bases, flammable materials, compressed gases, poisons, or other chemical materials) at or in close proximity to the site?		√
Is there any evidence or indication that past operations located on or in close proximity to the property used hazardous substances or radiological materials that may have been released into the environment?		√
EXPLOSIVE/FLAMMABLE OPERATIONS/STORAGE (24 CFR Part 51C)		
Is there visual evidence or indicators of above ground storage tanks (fuel oil, gasoline, propane etc.) or operations utilizing explosive/flammable material at or in close proximity to the property?		√
FOR YES RESPONSES, SUMMARIZE RESTRICTIONS BELOW:		

ENVIRONMENTAL REVIEW FINDINGS	YES	NO
TOXIC CHEMICALS AND RADIOACTIVE MATERIALS		
Petroleum Storage		
Is there any evidence or indication of the presence of commercial or residential heating activities that suggest that underground storage tanks may be located on the property?		√
If yes, are any such tanks being used? If yes, indicate below whether the tank is registered, when it was last tested for leaks, the results of that test, and whether there are any applicable state or local laws that impose additional requirements beyond those required under federal law.		
Are there any out-of-service underground fuel storage tanks? If yes, indicate whether the tank was closed out in accordance with applicable state, local and federal laws.		√
Is there any evidence or indication that any above ground storage tanks on the property are leaking?		
Polychlorinated Biphenyls (PCB)		
Is there any evidence or indication that electrical equipment, such as transformers, capacitors, or hydraulic equipment (found in machinery and elevators, installed prior to July 1, 1984) are present on the site?		√
If yes, is any such equipment (a) owned by anyone other than a public utility company; and (b) not marked with a "PCB Free" sticker?		
If yes, indicate below whether such equipment has been tested for PCBs, the results of those tests, and (if no testing has been performed) the proposed testing approach. (Electrical equipment need not be tested but will be assumed to have PCBs)		
If PCBs are found in non-electrical equipment over 50ppm it must be replaced or retrofitted, otherwise any equipment with PCBs or assumed to have PCBs require an O&M Plan.		
Asbestos-containing Materials (ACM)		
Is there any evidence or indication of ACM insulation or fire retardant materials such as boiler or pipe wrap, ceiling spray, etc. within the buildings on the property? If yes, the property is required to have an Operations and Maintenance Plan for asbestos-containing materials.		√
Lead Based Paint		
Are there residential structures on the property that were built prior to 1978?		√
If yes, has the property been certified as lead-free?		
If property has not been certified as lead-free, has a Risk Assessment been completed?		
If yes, has the owner developed a plan including Interim Controls to address the findings of the Risk Assessment including Tenant notifications and an Operations and Maintenance plan?		
If yes, has a qualified Risk Assessor reviewed the Owner's plan and O&M plan for compliance with 24 CFR 35?		
OTHER RESTRICTIONS		
Are there any other restrictions, including easements, on this property that you are aware of (other than those included above) (e.g. pipeline, aviation, microwave, utility, rights of way (ROW), ingress/egress etc.)		√
FOR YES RESPONSES, SUMMARIZE RESTRICTIONS BELOW:		

6. GREEN BUILDING PRINCIPLES

Green Building or sustainable building is the practice of reducing the impact of buildings on the environment, both during construction and as part of the operation of the building systems. Their use of water, energy, and materials should be reduced through the use of new planning methods and material usage.

EMG's goal was to identify all opportunities to: 1) improve energy efficiency, 2) minimize water use, 3) use recycled or recyclable materials, 4) protect the indoor air quality, 5) reduce the 'carbon footprint' of the buildings and site, and 6) proper disposal of replaced materials.

The available Green Building Alternatives have been evaluated and are described in terms of cost and specification in the Mark to Market Underwriting tool. Where available, the Green Alternatives evaluated exceed the requirements of the current local energy conservation code. We compare the cost of traditional replacements and compare them to "green" replacements. The anticipated benefits of green approaches are discussed along with increased short term costs for the long term benefits of choosing "Green" or sustainable alternatives.

PART II – ENERGY AUDIT

1. EXECUTIVE SUMMARY

The Client contracted with EMG to conduct an Energy Audit consisting of field observations, utility review, benchmarking, and energy saving recommendations for the subject property, Mahwah Public Housing located at 1600 Ramapo Brae Lane in Mahwah, Bergen County, New Jersey 07430. The GRPCA was performed on March 5, 2014.

The multi-family property has six sections of two-story apartment townhouse buildings with a total of 35 rental apartment units and a single-story rental office/community center building with a sunken maintenance shop on a site of approximately 4.59 acres. Construction of the property was completed in 1986.

On site amenities consist of a basketball court, children's playground, community room and laundry facilities.

Many of the items covered in the Green PCA also provide useful information to the energy audit. In lieu of redundant reporting on these items, the following table provides report references to relevant items in the Green PCA:

Component	PCA Report Reference Section	Comments
Insulation (Wall, Attic, and Basement)	4.1	New construction code requirements outlined in Section 4.1. Upgrade to R-30
Exterior Doors	3.3.3	Energy Star replacements recommended at end of EUL.
Storm Doors	Not applicable	The property does not have storm doors.
Dishwashers	Not applicable	The property does not have dishwashers
Windows	3.3.3	Existing windows are double-paned. Energy Star replacements recommended at end of EUL.
Sliding Glass Doors	3.3.3	Energy Star replacements recommended at end of EUL.
Thermostats	3.4.2.1, 3.4.2.2	Setback thermostats are recommended as part of routine maintenance.
Domestic Water Heaters	3.4.1.1, 3.4.1.2	Indirect fired domestic water storage heaters piped off boilers.
Refrigerators	3.7.2.2	Replacement with Energy Star units recommended at end of EUL.
Water (Flow, Temperature)	3.4.1.2	Water testing outlined in section 3.4.1.2.
Ventilation	3.4.2.2	Replacement with Energy Star equipment recommended. See Green Comparison table.
Interior Lighting	3.7.2.4	CFL retrofit is recommended.
Common Areas	3.7.1.2	T-8 ballasts/bulbs recommended
Exterior Lighting	3.2.6	Replace MH roof-mounted and wall packs with LED roof-mounted and wall pack fixtures.
Furnaces	3.4.2.1, 3.4.2.2	Property does not have furnaces.
Boilers (gas)	3.4.2.1, 3.4.2.2	Replacement with high efficiency models recommended. See Green Comparison table.

Component	PCA Report Reference Section	Comments
Heat Pump	3.4.2.1, 3.4.2.2	Replacement with high efficiency models recommended. See Green Comparison table.
PTAC	3.4.2.1, 3.4.2.2	See heat pumps above
AC (thru-the-wall)	3.4.2.1, 3.4.2.2	Residents supply their own
Laundry Area	3.7.1	Energy Star washers with cold rinse restriction recommended.
Other Commercial Space	Not applicable	Property does not have commercial spaces.
HVAC system conversion	3.4.2	System conversion not recommended.
Utility Rate Options	1.1 (Energy Audit)	Current utility rates were reviewed and appear acceptable. The existing utility rates are similar to the typical rates observed at similar properties.

2. UTILITIES & BENCHMARKING

2.1. UTILITY METERING

On site Utilities

The following is a summary of relevant information, addressed within the Utilities Data Sheet. See Section 3.2.7 for a listing of Utility Service providers.

Question	Answer
Water	
Identify the provider of water to the property.	Mahwah Water
Is gray water or well water is used for some purposes	No
How is the water usage measured	One meter per apartment
Is the water paid by the residents via a separate meter?	No
Are there separate meters at the unit level	Yes
Is there a single water intake for each unit with unit specific water heaters	Yes
Where are the water meters physically located?	Pantry or crawl space
What is the number of water meters	Residential: 35 Common: 1 Master Meters: None Commercial: NA
Electric	
Are there any site generating activities to supplement (wind, solar)	No
What is the meter configuration? (How many covering what usage	One meter per apartment unit
Is the electricity paid by the residents via a separate meter?	Yes
Where are the electric meters physically located?	Side elevation - exterior
Are property and residential unit use separately metered?	No
Are there unit level electric meters or unit level breaker boxes?	Yes
What is the number of electrical meters	Residential: 35 Common: 2 Mixed Residential and Common: None Commercial: NA
Heating Fuel	
How is the property heated?	Apartments - boilers
What is the heat source	Natural gas
Are there individual heating units for each unit?	Yes
Are there individual meters for the heating fuel?	Yes
Are there separate heat sources for common areas/commercial areas?	Yes

Question	Answer
Are all units/areas heated the same way?	Yes
Is the heating fuel included in a utility paid by the tenant via a separate meter	No
For natural gas heat source, what is the number of heating fuel meters?	Residential: 35 Common: 1 Mixed Residential and Common: None Commercial: NA
Additional Utility Use Questions	
Are stoves electric or gas?	Apartments - Gas
Are water heaters electric or gas?	Apartments – indirect fired storage type water heater fed off boiler Community Center/Rental Office – natural gas water heater
Are there individual unit water heaters?	Yes - see above
Are there different utility uses by building (rental or office/community use) due to renovations or scattered sites?	No

2.2. UTILITY RATES

Based upon the utility information provided about the Mahwah Public Housing, the following energy rates were utilized in determining existing and proposed energy costs.

Electricity (Blended Rate)	Natural Gas	Water/Sewer
$0.166/kWh	$1.04 ccf	$0.09 ccf

The data analyzed provides the following information: breakdown of utilities by consumption, cost and annual profile, baseline consumption in terms of energy/utility at the facility, the Energy Use Index, or Btu/sq ft, and cost/sq ft. For multiple water meters, the utility data was combined to illustrate annual consumption for each utility type.

2.3. ELECTRICITY

The electricity requirements of the facility are satisfied by **PSE&G**.

Based on the limited electric usage and cost information provided, the average price paid during the past 12 months was $0.166 per kWh. The total annual electricity consumption for the 12-month period analyzed is estimated to be 204,120 kWh for a total cost of $33,880.

These estimations are based on provided data for a portion of the tenant units.

2.4. NATURAL GAS

The natural gas requirements of the facility are satisfied by PSE&G.

Based on the provided natural gas usage and cost data, the average price paid during the past 12 months was $1.04 per ccf. The total annual natural gas consumption for the 12-month period analyzed is 26,317 ccf for a total cost of $27,370.

These estimations are based on provided data for a portion of the tenant units.

2.5. DOMESTIC WATER

The domestic water requirements of the facility are satisfied by Township of Mahwah Water Department.

Based on the provided domestic water usage and cost data, the average price paid during the past 12 months was $0.09 per cf. Domestic water is billed on a quarterly basis. The total annual domestic water consumption for the 12-month period analyzed is 310,713 cf for a total cost of $27,965.

These estimations are based on provided data for a portion of the tenant units.

2.6. BENCHMARKING

The following table lists the building's area and its total energy and cost indices. The total energy index is a measure of energy intensity, or annual energy usage per square foot of building area. Similarly, the energy cost index is a measure of annual energy costs per square foot of building area. This data is primarily used to measure a facility's energy intensity against that of other similar buildings. EMG researched data from the Energy Information Administration and reviewed the Energy Star Portfolio Manager Tool and found inapplicable information on subsidized rental housing. Based on EMG's experience and data from the Handbook of Energy audits, 7th edition by Albert Thumann, P.E., and C.E.M. and William J. Younger, C.E.M. published by the Association of Energy Engineers, the mix of similar housing units typically have an energy intensity of between 60 and 200 KBtuh/SF/yr. Mahwah Public Housing is at this range.

Heated Area (SF)	Total Annual Cost Of Energy ($)	Energy Cost Intensity $/SF-Year
37,500	$23,168	$1.63/SF

Although regression model-based benchmarking is not a perfect science, it serves as a good initial indication of whether a particular building or project currently uses more or less water than would normally be expected for that size and type of building in that climate.

The results from the utility analysis and the HUD Water Benchmarking Tool indicate that the subject property is slightly above the average benchmark for water consumption performance with 74 out of 100 as scored against peers. The total usage used in the benchmark calculation was an estimated usage value and the actual score may deviate from this value.

The results from the utility analysis and the HUD Energy Benchmarking Tool indicate that the subject property is below average for energy consumption performance with an 8 out of 100 as scored against peers. The total usage used in the benchmark calculation was an estimated usage value and the actual score may deviate from this value.

HUD Residential Energy Use Benchmarking Tool

For single-family, semi-detached, row/townhouse, multi-family walk-up, and elevator buildings.

The HUD Residential Energy Use Benchmarking Tool quantifies the performance of a user-defined building relative to the family of HUD residential buildings. A score of 75 denotes performance at the top 25th percentile of HUD residential buildings. A score of 50 denotes performance at the 50th percentile (in the middle) of HUD residential buildings. For definitions or help on the terms below, simply click on any underlined text. Click on "Return" to come back to this page.

Directions**: **Provide entries in ALL the grey spaces that apply for your Building Description and Annual Energy Consumption.

Building Description

Preliminary: 9/17/07

Building Name: Mahwah Public Housing (optional entry)

5-digit Zip Code: 07430 *Not Sure?*

Heating Degree Days: 4888

Mapping Location: *Paterson, NJ*

Cooling Degree Days: 1201

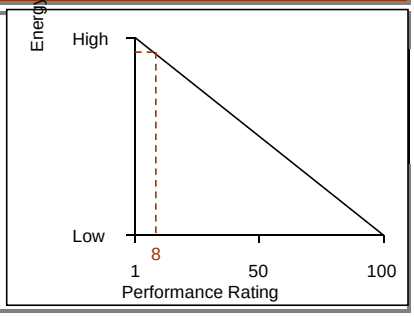
	Gross Floor Area (ft2)	Total Number of Units	Is This a Multifamily Building with Central Laundry? (Y/N)	Is this a Multi-Family Walkup Building? (Y/N)	Heated Floor Area (ft2)	Year Built
Building Description:	37,500	35	Y	Y	37,500	1989

Annual Consumption

	Electricity	Gas	#2 Fuel Oil	#4 Fuel Oil	District Steam	District Hot Water	Propane
Select Units:	kWh	100 CF	Gal	Gal	kLbs	MMBtu	Gal
Energy	204,120	26,317					
Cost ($)	33,883	27,369					
Calculated unit cost:	$0.17 $/kWh	$1.04 $/therm	$/gallon	$/gallon	$/klbs	$/kBtu	$/gallon

Results

	Your Building	HUD Typical
Score Against Peers	8	50
Building Site Energy Use (kBtu/year)	3,407,108	2,195,163
Site Energy Use Intensity (kBtu/ft2-year)	90.9	58.5
Energy Cost Intensity ($/ft2-year)	1.63	1.05
Total Annual Energy Cost ($/year)	61,252	39,464



HUD Residential Water Use Benchmarking Tool

For single-family, semi-detached, row/townhouse, multi-family walk-up and elevator buildings.

The HUD Residential Water Use Benchmarking Tool quantifies the performance of a user-defined building relative to the family of HUD residential buildings. A score of 75 denotes performance at the top 25th percentile of HUD residential buildings. A score of 50 denotes performance at the 50th percentile (in the middle) of HUD residential buildings. For definitions or help on the terms below, simply click on any underlined text. Click on "Return" text to come back to this page.

Directions: Provide entries in the gray spaces below with your building description and annual water consumption.

Building Description

ORNL 8/22/2007

Building Name: Mahwah Public Housing (optional entry)

5-digit Zip Code: 07430 *Not Sure?*

Mapping Location: ***Paterson, NJ***

	Gross Floor Area of Building(s) (ft2)	Building(s) is Single-Family Detached or Semi-Detached? (Y/N)	Is Residents Water Use Paid Directly by the PHA? (Y/N)	Number of Units in Building(s)	Number of Units in Building(s) with In-Unit Laundry Hookups or Central Laundry Access?	How Many Buildings share this Water Meter?
Building Description:	37,500	Y	Y	35	35	6

Annual Consumption

Building Annual Water Use: 1,997,263 (gallons/year)

Building Annual Water Use Cost: 27,247 ($/year)

Average Annual Water Cost: **$1.4** ($/100 gallons)

Results

	Your Building	HUD Typical
Score Against Peers	**74**	**50**
Annual Water Use (gal/year)	**1,997,263**	**3,639,211**
Annual Water Use Intensity (gal/ft2-year)	**53.3**	**97.0**
Annual Water Cost Intensity ($/ft2-year)	**0.73**	**1.32**
Total Annual Water Cost ($/year)	**27,247**	**49,647**

3. LOAD SIZING

3.1. HVAC SIZING RESULTS

The following is the efficiency information on the existing heating system:

Location Serviced	Description	Estimated Efficiency
Common area	GE Zoneline Heat/Cool Model 2200	Approximately 80%
2 bedroom	Older: Weil-McLain Model AHE-60 Newer: Weil-McLain Model WM 97 + 70 NG	85% 92.8%
3 Bedroom	Older: Weil-McLain Model AHE-60 Newer: Weil-McLain Model WM 97 + 70 NG	85% 92.8%

The following is the efficiency information on the existing cooling system:

Location Serviced	Description	Estimated SEER Rating
Common area	GE Zoneline Heat/Cool Model 2200	12 SEER
Apartments	Tenant provided through wall units	Not applicable

Manual J calculations estimate the building heat gain or loss based on the construction materials, level of insulation, door and window types and building orientation. The existing system appears to be appropriately sized based on the Manual J calculations. Future replacements should have an output rating that matches the current ratings.

Unit Type	Calculated Cooling Load	Calculated Heating Load
2 bedroom	Tenant supplied - 1 tons	31,310 btu/hr
3 Bedroom	Tenant supplied – 1.6 tons	51,050 btu/hr

3.2. DOMESTIC WATER HEATER SIZING RESULTS

The first hour rating is the amount of hot water in gallons a water heater can supply per hour (starting with a tank full of hot water). It depends on the tank capacity, source of heat (burner or element), and the size of the burner or element. The following is our analysis of the dwelling unit first hour recovery requirements based on specific hot water use events:

Domestic Water Heater Sizing Analysis (FHR)					
Hot Water Event	**Zero Bedroom Average gallons**	**One Bedroom Average gallons**	**Two Bedroom Average gallons**	**Three Bedroom Average gallons**	**Four Bedroom Average gallons**
Shower	5	7	8	12	14
Shaving	2	2	2	2	3
Hands and face washing	2	4	6	8	9
Hair shampoo	4	8	8	12	12
Hand dishwashing	2	4	4	4	4
Food preparation	8	10	10	10	10
Estimated First Hour-gallon	**23**	**35**	**38**	**48**	**54**

Domestic Water Heater Existing/Replacement Size Analysis					
Unit Type	**Required First Hour Rating gallons**	**Existing DWH Storage Size in gallons**	**Existing DWH First Hour Rating gallons**	**Comment**	**Recommended Replacement Size**
Two Bedroom	38	36	49 FHR	Existing Water Heater Appropriately Sized	49 FHR
Three Bedroom	48	36	49 FHR	Existing Water Heater Appropriately Sized	49 FHR

4. GREEN ENERGY TECHNOLOGY

4.1. SOLAR ENERGY FEASIBILITY

A photovoltaic array is a linked collection of photovoltaic modules, which are in turn made of multiple interconnected solar cells. The cells convert solar energy into direct current electricity via the photovoltaic effect. The power that one module can produce is seldom enough to meet requirements of a home or a business, so the modules are linked together to form an array. Most PV arrays use an inverter to convert the DC power produced by the modules into alternating current that can plug into the existing infrastructure to power lights, motors, and other loads. The modules in a PV array are usually first connected in series to obtain the desired voltage; the individual strings are then connected in parallel to allow the system to produce more current. Solar arrays are typically measured by the peak electrical power they produce, in watts, kilowatts, or even megawatts.

When determining if a site is suitable for a solar application, two basic considerations must be evaluated:

- At minimum, the sun should shine upon the solar collectors from 9 AM to 3 PM. If less, the application may still be worthwhile, but the benefit will be less.
- The array should face south and be free of any shading from buildings, trees, rooftop equipment, etc. If the array is not facing directly south, there will be a penalty in transfer efficiency, reducing the overall efficiency of the system.

Solar Arrays can be mounted on the ground and used as fencing, etc. or on the roof of a building. If the solar system is to be roof-mounted, a rough rule of thumb is that 200 to 400 square feet of roof space is needed for a 2 kilowatt (kW) installation. On flat surfaces (roofs or ground), tilted panel mounting can orient the PV panels to maximize energy generation and ensure visibility of the panels. The angle of the tilt is generally equal to the latitude of the location. Solar systems produce energy for as low 1.5-2¢ per kilowatt hour or $4-6 per million BTU delivered. Most electric utility customers spend about 7-15¢ per kilowatt hour ($20-44 per million BTU). Solar electricity costs about $10 to $12 a watt installed. Each standard solar panel is typically 4′ by 8′ and has a power generation capability between 185 watts/8 SF and 225 watts/8 SF. Typically, 200 watts/8 SF or 25 watts/SF are a good estimate to use.

Element	Response
Does the property have a south facing roof or available land of more than 250 square feet per required Solar Array Panel?	**No**
Is the area free from any shading such as trees, buildings, equipment etc throughout the whole day?	**No**
Is the property in an area with acceptable average monthly sunlight levels? http://www.verdeenergy.com/InsolationMap.pdf	**No**
Has the roofing been replaced within the past 3-5 years?	**Yes**
Is the roof structure sufficient to hold solar panels?	**Yes and verify with contractor**

Element	Response
Is the property located in a state eligible for net metering? http://www.verdeenergy.com/SolarNetMetering.pdf	**No**

Solar collectors gather the sun's energy, transform its radiation into heat, and then transfer that heat to water, solar fluid, or air. The solar thermal energy can be used in solar water-heating systems, solar pool heaters, and solar space-heating systems.

Most solar water-heating systems for buildings have two main parts: a solar collector and a storage tank. There are four main types of solar collectors, integral collector-storage collector, evacuated-tube collector, and most common collector is called a flat-plate collector. The flat-plate collector is mounted on the roof and it consists of a thin, flat, rectangular box with a transparent cover that faces the sun. Small tubes run through the box and carry either water or other freeze resistant fluid, such as an antifreeze solution, to be heated. The tubes are attached to an absorber plate, which is painted black to absorb the heat. As heat builds up in the collector, it heats the fluid passing through the tubes. The heated glycol circulates through seamless copper coils to a separate storage hot water tank. Water in the tank passes over the coils and is heated to be used for residential and commercial domestic hot water or potential space heating use through a custom design HVAC system.

Solar Hot Water Questionnaire	Response
Does the property have a south, east, or west facing roof or available land of more than 100 square feet per required Solar Collector Panel?	**Yes**
Is the area free from any shading such as trees, buildings, equipment etc throughout the whole day?	**No**
Can the collectors be mounted at an incline of roughly 25-45 degrees? (equal to latitude of property)	**Yes**
Is the property in an area with acceptable average monthly sunlight levels?	**No**
Has the roofing been replaced within the past 3-5 years?	**Yes**
Is the roof structure sufficient to hold solar thermal collectors?	**Yes and verify with contractor**
Does the property have a central domestic hot water system?	**No**
Is there potential for solar pool heating?	**Not Applicable**
Is sufficient mechanical room space available to fit additional solar hot water storage tanks?	**No**

The annual performance of a solar water heating system with a storage tank is dependent on system characteristics, solar radiation available, ambient air temperature and on heating load characteristics which require further in depth analysis.

4.2. WIND ENERGY FEASIBILITY

Wind energy (or wind power) refers to the process by which wind turbines convert the movement of wind into electricity. Winds are caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. Humans use this wind flow for many purposes: sailing boats, pumping water, and also generating electricity. Wind turbines convert the kinetic energy of the moving wind into electricity. A small wind energy system can provide a practical and economical source of electricity if all the following apply to the project:

Element	Response
Property has a good wind resource? *Based on a review of the windpower resource map at http://www.windpoweringamerica.gov/wind_maps.asp*	**Yes**
Project is located on at least one acre of land in a rural area?	**Yes**
Increased noise levels from the turbines is not a factor for the site and neighboring sites?	**No**
Project site has large amounts of undeveloped land that can be utilized for wind energy towers?	**NoExplore files**

4.3. COMBINED HEAT AND POWER (CHP) FEASIBILITY

The average efficiency of the fossil-fueled power plants in the U.S. is 33% and has remained virtually unchanged for 40 years. This means that two-thirds of the energy in the fuel is lost as heat, and 8% of the remainder is lost in transmission and distribution over wires. Combined Heat and Power (CHP)–also known as "cogeneration"—is the sequential production of two or more useful forms of energy from a single fuel consuming device. CHP systems recycle waste heat and convert it to useful energy, and they can achieve overall efficiencies of over 80%.

CHP can significantly reduce a multi-family building's annual energy costs. Instead of buying all the building's electricity from a utility and separately purchasing fuel for its heating (mechanical) equipment, most–or even all–of the electricity and heat can be produced for less money by a small on site power plant operating at a higher combined efficiency. The best economic prospects for CHP are single buildings with at least 100 units, master metered for utilities, with access to natural gas. The type of CHP system commonly applied to multi-family housing uses a "prime mover," that is, a reciprocating engine similar to that found in a car or truck, or a microturbine, that drives a generator to produce electricity. The heat (thermal energy) produced by this process is recovered and used to produce hot water or steam, operate a chiller or serve as a desiccant, instead of being exhausted from the engine and transferred through the engine radiator. CHP systems also often lead to increased ability to handle electric loads during power outages.

The following is a preliminary analysis to explore if CHP is an option that should be further investigated for the project. If three are answered "yes," the next step in assessing the potential of an investment in CHP is to perform a Level 1 Feasibility analysis to estimate the preliminary return on investment. The EPA CHP Partnership offers comprehensive Level 1 analysis services for qualifying projects and can provide contact information to others who perform these types of analyses.

Element	Response
Project pays more than $.07/kWh on average for electricity (including generation, transmission and distribution)?	**Yes**
Is there concern about the impact of current or future energy costs on the property?	**No**
Is your building located in a deregulated electricity market?	**Yes**
Are there concerns about power reliability? Is there a substantial financial impact to your building or residents if the power goes out for 1 hour? For 5 minutes?	**No**
Does the project have thermal loads throughout the year (including hot water, chilled water, hot air, steam, etc.)?	**Yes**
Does the building have an existing central plant?	**No**
Is there a plan to replace, upgrade or retrofit central plant equipment within the next 3-5 years?	**No**
Is there a plan for a significant building expansion or new construction project within the next 3-5 years?	**No**
Has the project already implemented energy efficiency measures and still have high energy costs?	**Yes**

4.4. GEOTHERMAL ENERGY FEASIBILITY

Geothermal systems utilize the relatively constant temperature of the earth as a heat synch to reject or absorb heat for a heating or cooling system. The predominate use of energy in such a system is the pumping energy used to circulate the fluid medium. Geothermal system configurations require wells to be bored into the ground to accommodate a pipe loop. A geotechnical survey of the property is required in order to estimate the cost of a geothermal installation. Generally multiple wells are required for multi-family applications and the costs become prohibitive if the electricity rate is reasonable.

4.5. FUEL CELL TECHNOLOGY

Fuel cell technology is in the early stages of development and to date is only being utilized in large commercial and industrial applications. EMG does not recommend the further exploration of fuel cell technology for the subject property based on high development cost, lack of technology for small scale applications and potential safety concerns in residential applications.

4.6. GREEN ENERGY TECHNOLOGY RECOMMENDATIONS

Observations/Comments:

- Since there was a negative response to three or more of the preliminary CHP analysis questions EMG concludes that further investigation of feasibility is not warranted at the subject property.
- Since there was a positive response to three or more of the preliminary Wind Energy analysis questions. EMG recommends assessing the potential of an investment in Wind Energy to estimate the preliminary return on investment. As the cost of this project is unknown, no costs are included in the tables.
- Since there was a negative response to preliminary Solar Energy analysis questions EMG concludes that further investigation of feasibility is not warranted at the subject property.
- Geothermal systems are not recommended for further study at this property. The cost of obtaining a geotechnical survey of the property and drilling the multiple wells required is likely prohibitive considering the reasonable electricity rate in the area.
- Since fuel cell technology is primarily used on large commercial and industrial applications, EMG concludes that further investigation of feasibility is not warranted at the subject property. No further action is needed at this time.

5. ENERGY CONSERVATION MEASURES

5.1. ENERGY CONSERVATION RECOMMENDATIONS

EMG has identified six Energy Conservation Measures (ECM) for this property. The basis for an ECM recommendation is a payback of less than the remaining useful life of the system or component. Recommended energy efficiency improvements and the installed cost estimates for recommended energy efficiency measures are provided in the following table:

Priority	Brief description of ECM	Initial Investment	Annual Savings	Payback Period (yrs)	Component EUL (yrs)
6	Replace Older Refrigerators with Energy Star Rated Refrigerators	$1,305	$44	13.1	15
3	Replace Incandescent Lighting with Energy Star Light Fixtures in Apartments	$6,825	$1,908	3.6	5
5	Replace Fluorescent Fixtures in Common Areas with T-8 Bulbs & Electronic Ballasts	$8,580	$959	8.9	15
1	Replace Incandescent Fixtures at Apartment Entry Lights with LED Wall Packs	$2,275	$2,417	0.9	5
4	Replace Older PTAC Units with PTHP Units	$3,090	$551	5.6	15
2	Install Setback Thermostats	$2,975	$1,129	2.6	15

5.2. ENERGY CONSERVATION DESCRIPTIONS

The following descriptions provide a summary of each energy savings recommendation, along with specific implementation considerations for High Point Apartments. These energy conservation measures are recommended for implementation as part of the Green Rehabilitation Significant Additions.

ECM: Replace Older Refrigerators with High-Efficiency Units

After lighting, refrigerators are the second largest users of electricity in most households (not including households with electric heat or hot water). Because refrigerators are such a significant user of energy, they should be a focus of conservation efforts. Older units use up to four times more electricity than the most efficient new models available in the same size. Replacing these inefficient units with new, more efficient refrigerators can realize substantial energy and cost savings. In many cases, it is cost-effective to replace older refrigerators before scheduled replacement because of the electricity cost savings.

The most common size of refrigerators in public housing is the 14- to 15-cubic-foot range. In that range, the most efficient refrigerator available today uses 372 kWh per year. This automatic-defrost model is ENERGY STAR® qualified because it is 15 percent more efficient than federal standards require. By contrast, the average refrigerator in that size purchased before 1991 uses around 1,100 kWh, with older units using more than 1,500 kWh per year.

This ECM recommends Energy Star refrigerators at the property. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

ECM: Replace Incandescent Lighting with Compact Fluorescent Lamps in Dwelling Units, common areas, and unit entry

Standard incandescent light bulbs, typically used in public housing dwelling units, use three to four times more electricity than fluorescent lamps. Replacing incandescent bulbs with fluorescent lamps will save as much as 75 percent of the electricity costs per lamp. In addition, because fluorescent lamps last longer than incandescent bulbs, the PHA saves on replacement and maintenance costs. The most appropriate type of fluorescent lighting for dwelling units is a compact fluorescent lamp (CFL). Advances in technology over the past few years have brought great improvements to CFLs in terms of light quality and appearance, and CFLs now come in a variety of shapes and sizes.

Although the initial cost of CFLs is high relative to incandescent lamps, the energy savings and reduced time and expense from lamp replacement make CFLs a cost effective energy conservation measure for many applications. Because the energy savings from a CFL depends on the number of hours the lamp is on, CFLs should be installed in areas with the heaviest use, such as the kitchen, bathroom, and hallways. There is a fair amount of variation in the light output (lumens) per watt of CFLs. To save on energy costs first choose the bulb with the light output you need, then choose the one with the lowest watts. The **ENERGY STAR lumen chart** will help you determine the lumens you need.

This ECM recommends replacing the incandescent fixtures at the property. Replacements should include compact fluorescent bulbs. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

ECM: Install Programmable Thermostats

Thermostats regulate temperature in a dwelling unit by controlling the heating system. A programmable thermostat is a special type of wall-mounted thermostat that automatically lowers the temperature setting at night, raising it back to the daytime setting in the morning. In addition to lowering the temperature at night, temperature-limiting programmable thermostats limit daytime temperature to a pre-determined setting (generally 72 degrees in family housing and 75 degrees in housing for the elderly).

Resident energy education is crucial when replacing non-programmable thermostats with temperature limiting programmable thermostats. At the time of installation, residents should be informed about why the thermostats were selected and how they operate. In buildings where heat had been unlimited, residents may find the lower temperatures uncomfortable at first. A resident education program should stress the importance of keeping windows closed and should include information about how to dress appropriately at home in the winter.

This ECM recommends replacing the standard thermostats with programmable thermostats at the office building. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

ECM: Replace Inefficient PTHP/PTAC units

Due to age or lack of proper maintenance, or both, older PTAC and PTHP units may not operate as efficiently as they did when they were new. In addition, technological developments have produced great advances in air-conditioning efficiency, making many older air-conditioning systems obsolete. Replacing older air-conditioning units can generate substantial electricity and cost savings for the housing authority.

This ECM recommends replacing the 10 SEER condensing units with 16 SEER condensing units at the property. This ECM is for consideration since the payback is greater than the useful life. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

5.3. ENERGY CONSERVATION MEASURES CONSIDERED

The table below is a summary of Energy Conservation Measures considered as part of EMG's review of the energy use at the property. The review of the property was not limited to the below list of ECMs; however, these are those that typically have a quantifiable payback or can be documented. The actual ECM calculations can be found in Appendix D to this report.

	Item	Recommend	Already exists	Payback Period > EUL	Infeasible	Comment (req for all infeasible)
Architectural/Building Envelope ECMs						
1	Install Replacement Windows	✓				
2	Install Window Sun Shades: South-facing windows				✓	No air-conditioning at property
3	Install Window Sun Shades: East and West-facing windows			✓		
4	Install Roof Insulation: R10					
5	Install Roof Insulation: R20		✓			
6	Install Wall Insulation		✓			
7	Control Air Leakage		✓			
Space Heating and Cooling ECMs						
8	Install Vent Dampers		✓			No boiler
9	Install Energy Management Systems (EMS)					Only works on central system
10	Convert to Electronic Ignition		✓			
11	Install Boiler Controls	✓	✓			
12	Replace Inefficient Heating Plant	✓	✓			
13	Install Programmable/Setback Thermostats	✓				
14	Insulate Hot Water or Steam Pipes	✓				
15	Seal and Insulate Ducts					No ducts
16	Install Geothermal Heat Pumps				✓	No water source heat pumps
17	Replace Inefficient Air Conditioners/fan coils					No Air-conditioning – tenant provided only
18	Install Swamp Coolers					Not Applicable for this part of the country.
Domestic Water & Heating Systems ECMs						
19	Install Water-efficient Showerheads and Faucet Aerators	✓	✓			Already exists in kitchen
20	Insulate Hot Water Tanks		✓			
21	Install Hot Water (DHW) Off-Peak Controls					No central system
22	Replace Inefficient Water Heaters					Indirect fired tanks
Lighting System ECMs						
23	Replace Older Fluorescent Lamps with Energy-Saving Lamps in Apartments	✓				
24	Install Electronic Ballasts in Building	✓				
25	Install Lighting Controls in Building	✓				
26	Convert Exterior Lighting Fixtures	✓				
27	Install Photo-Controls for Exterior Lighting		✓			

Item		Recommend	Already exists	Payback Period > EUL	Infeasible	Comment (req for all infeasible)
Miscellaneous ECMs						
28	Upgrade or Replace inefficient Motors					None at property
29	Install Water-Saving Toilets		✓			
30	Convert Water Supply Pumps					None at property
31	Install Check Metering or Individual Metering		✓			
Additional ECMs to Consider						
32	Convert Hot Water Heater System to Solar					Too much shade
33	Install Soil Moisture Sensors					
34	Install Direct Use Geothermal System for Heating and Hot Water				✓	
35	Install Occupational Sensors for Interior Lighting	✓				
36	LED Exit Signs	✓				Common area only

6. OPERATIONS AND MAINTENANCE

6.1. RESIDENT EDUCATION

A significant portion of each unit's energy consumption is also due to tenant-owned electronics and appliances. The property management should consider working with the utility providers (electricity, water, gas) to educate tenants on saving energy. Tenant behavior change could ultimately account for on average 5% to 8% energy savings per unit. Likewise, management should consider preparation of Operations and Maintenance Manuals for the maintenance staff, regarding HVAC systems, Electrical systems and Plumbing systems to ensure proper operation, future maintenance, and appropriate repair. The Green O&M plan should address the following points:

- A description of maintenance practices that use a materially lower use of chemicals thought to be harmful to humans and where practicable, that use more recycling (including construction debris removal). Should the Owner decide to proceed with the Green Initiative, any pending construction and maintenance activities are required to subscribe to construction waste minimization practices. This includes construction waste management, segregation, and the promotion of recycling and reuse. The Owner/Contractor should consider the donation of salvageable equipment/materials to non-profit entities for reuse. The future O&M plan is required to have a detailed section regarding green waste minimization practices. It is important to note that waste minimization typically saves money, as it reduces tipping charges and disposal costs.
- Specification of green cleaning products and materials that are biodegradable and contain low or no volatile organic compounds.
- Include a Resident Involvement, Outreach, and Incentive Plan, featuring Green Training which is applicable to the recommended rehabilitation items.(e.g. programmable thermostats, etc.).
- An Integrated Pest Management Plan (IPM) is to be adopted, to include periodic interior and exterior inspections and best management practices for pest control.
- Operations and maintenance inspection checklists for routine inspections by management/maintenance staff involving landscaping, building envelope penetrations, dumpster location cleanliness, litter control, and water leaks.
- Operations and maintenance requirements for routine cleaning of walk-off matting, common area recycling bins, and other Green Components warranting daily/weekly upkeep to prevent pest, odor and allergen build-up.
- Specify green landscaping methods, to include waste minimization practices (mulching and composting of yard waste), and fertilizer treatment schedules (where fertilizers are used, they should be applied in several smaller applications in lieu of one heavy application).
- Indoor Environmental Quality (IEQ) testing protocols are to be established, including routine schedules for monitoring of resident comfort (e.g. temperature and relative humidity are significant indicators of indoor air quality and for avoiding mold problems), as well as protocols for reactive testing (e.g. specialty testing to occupancy complaints).
- Energy and Water Usage Monitoring. Management is required to establish a tracking mechanism for utility consumption in order to benchmark the effects of the Green improvements.

6.2. OPERATIONS AND MAINTENANCE RECOMMENDATIONS

The following general operations and maintenance recommendations should be continued or implemented.

Building Envelope:

1. Caulking and weather stripping is functional and effective.
2. Holes are patched in the building envelope.
3. Interior vestibule doors are closed.

Heating and Cooling:

1. The burners are clean and fuel/air ratios are optimized.
2. Heat exchange surfaces of furnaces are clean and free of scale.
3. Temperature settings are reduced in unoccupied areas and set points are seasonally adjusted.
4. Control valves and dampers are fully functional.
5. Equipment is inspected for worn or damaged parts.
6. Air dampers are operating correctly.
7. Heating is uniform throughout the designated areas.
8. Evaporator and condenser coils in AC equipment are clean.
9. Air filters are clean and replaced as needed.

Domestic Hot Water:

1. Domestic hot water heater temperature is set to the minimum temperature required.
2. Tank-type water heaters are flushed as required.

Lighting:

1. Over-lit areas are managed by bi-level switching or photocell controls.
2. Only energy efficient replacement lamps are used and in-stock.
3. Lighting fixture reflective surfaces and translucent covers are clean.
4. Walls are clean and bright.
5. Timers and/or photocells are operating correctly on exterior lighting.

Tenant areas:

1. Refrigerator and freezer doors close and seal correctly.
2. Kitchen exhaust fans are only used when needed.
3. Office/computer equipment is either in the "sleep" or off mode when not used.
4. All other recommended equipment specific preventive maintenance actions are conducted,
5. Usage demands on the building/equipment have not changed significantly since the original building commissioning or the most recent retro-commissioning.
6. Recommend tenants use Energy Star rated computers and copiers.

Equipment Replacement:

1. All equipment replacements are not over/undersized for the particular application.
2. All equipment replacements should be energy conserving devices.

APPENDICES

APPENDIX A: Photographic Record
APPENDIX B: Site Plan
APPENDIX C: Energy Audit Calculations
APPENDIX D: Manual J Calculations
APPENDIX E: Supporting Documentation
APPENDIX F: EMG Accessibility Checklist
APPENDIX G: Pre-Survey Questionnaires
APPENDIX H: Resumes and Certifications

APPENDIX A:
PHOTOGRAPHIC RECORD

EMG
ENGINEERING PEACE OF MIND

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-005.306 **Project Name: Mahwah Public Housing**

Photo #1:	Entrance drive

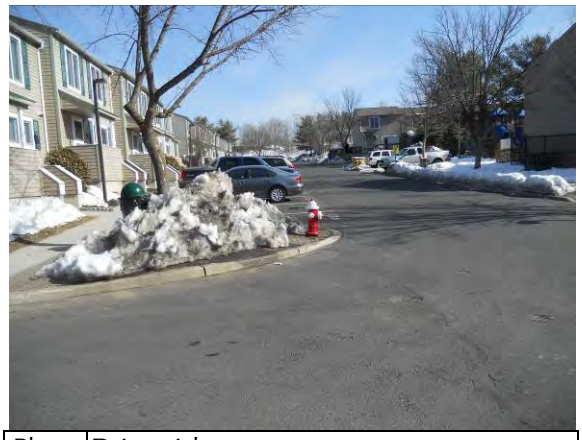


Photo #2:	Drive aisle

Photo #3:	Front and left side elevation

Photo #4:	Rear and right side elevation

Photo #5:	Concrete slab rear porch

Photo #6:	Damaged siding under sliding door

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Project No.: 107534.13R-005.306 **Project Name: Mahwah Public Housing**

Photo #7:	Locked gate at gas meters

Photo #8:	Gas meters

Photo #9:	Gated electric meter area

Photo #10:	Raised rear wood deck

Photo #11:	Tenant kitchen

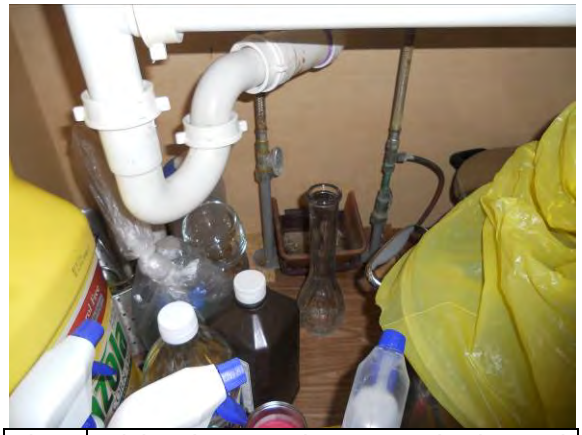

Photo #12:	Polybutylene supply piping at kitchen sink

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EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-005.306 **Project Name: Mahwah Public Housing**

Photo #13:	Half bathroom

Photo #14:	Dust filled exhaust fan in bathroom

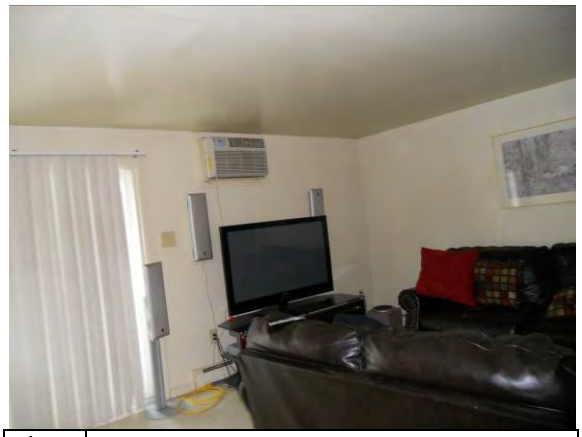

Photo #15:	Living room

Photo #16:	Storage tank for domestic water

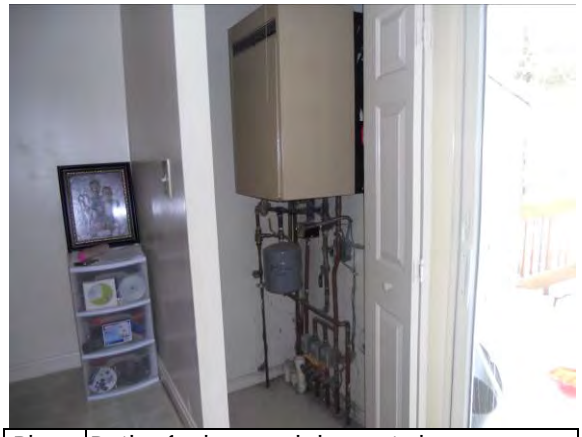

Photo #17:	Boiler for heat and domestic hot water

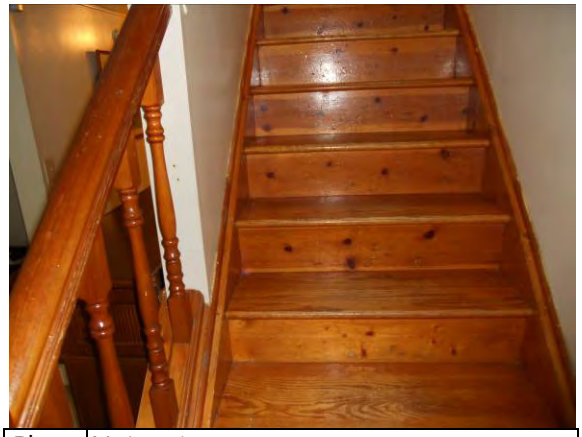

Photo #18:	Unit stairs

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EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-005.306 **Project Name: Mahwah Public Housing**

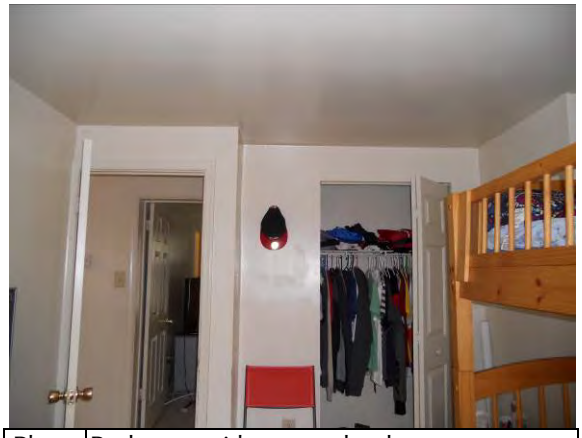

Photo #19:	Bedroom with no smoke detector

Photo #20:	Parking overview

Photo #21:	Damaged siding and loose window gasket

Photo #22:	Entrance to unit

Photo #23:	Newer domestic water storage tank

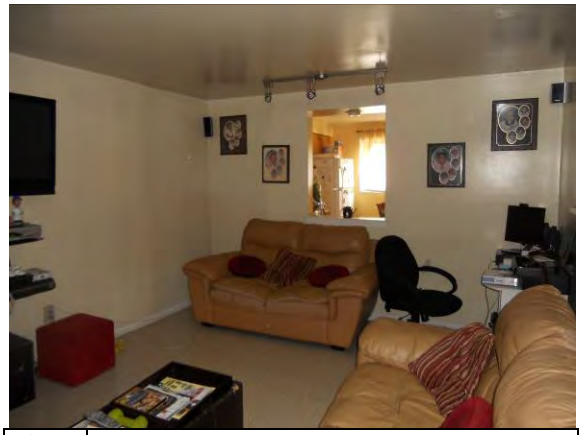

Photo #24:	Living room

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EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-005.306 **Project Name: Mahwah Public Housing**

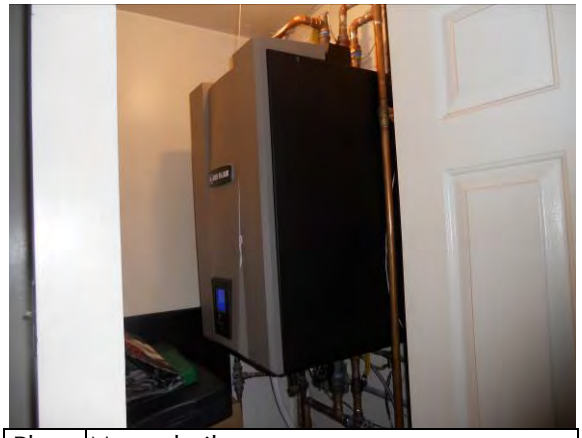

Photo #25:	Newer boiler

Photo #26:	Unit full bathroom

Photo #27:	Unit bathroom with non-GFCI test type receptacle

Photo #28:	Retaining wall and exterior stairs along the 700 units

Photo #29:	ADA parking for unit 605

Photo #30:	Rear patio for ADA unit 605

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ENGINEERING PEACE OF MIND

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-005.306 **Project Name: Mahwah Public Housing**

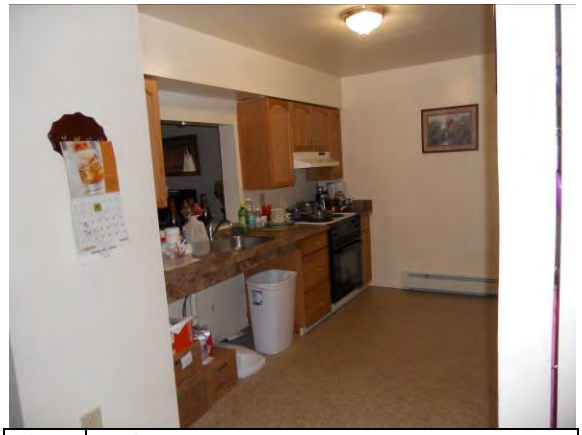

Photo #31:	Kitchen in ADA unit

Photo #32:	Non-insulated drain pipe in kitchen of ADA unit

Photo #33:	Domestic water storage tank in ADA unit with boiler in background

Photo #34:	Crawl space with active leak under unit 605

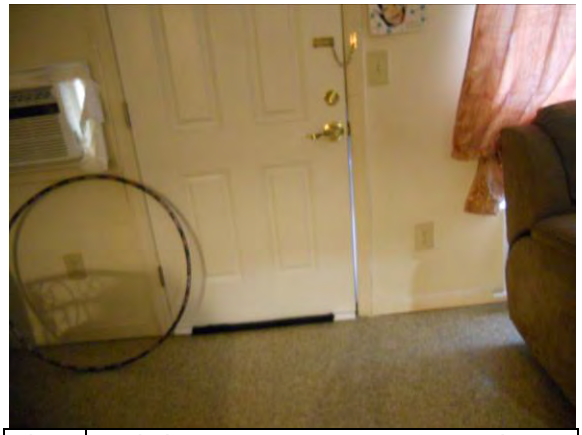

Photo #35:	Daylight seen at perimeter of entry door

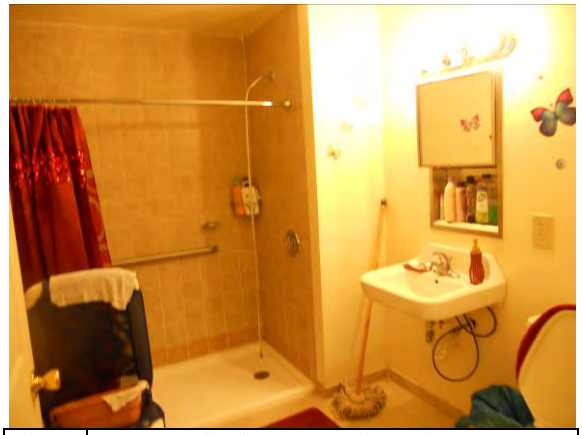

Photo #36:	ADA unit bathroom with no drain pipe insulation or hand-held shower mount

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EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-005.306 **Project Name: Mahwah Public Housing**

Photo #37:	No drain pipe insulation or rear grab bar at toilet in ADA unit

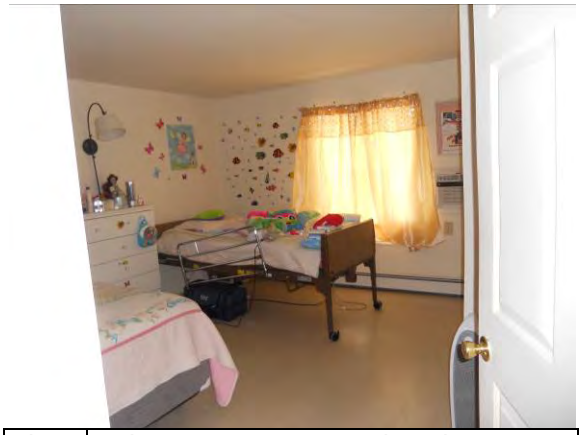


Photo #38:	Bedroom in ADA unit without lever handle

Photo #39:	Damaged flooring near tenant installed washing machine

Photo #40:	Window sash not sitting flush in frame

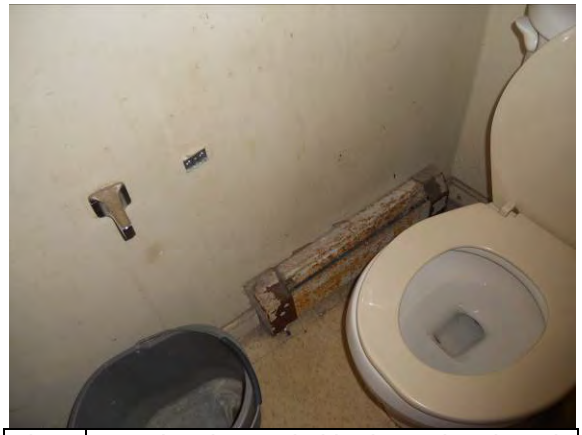


Photo #41:	Rusted and corroded hydronic baseboard heater

Photo #42:	Attic framing

EMG
ENGINEERING PEACE OF MIND

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-005.306 **Project Name: Mahwah Public Housing**

Photo #43:	Community center/rental office and ADA parking

Photo #44:	Right and rear elevations of community center/rental office

Photo #45:	Storage shed near community center/rental office

Photo #46:	Entrance lobby at community center/rental office

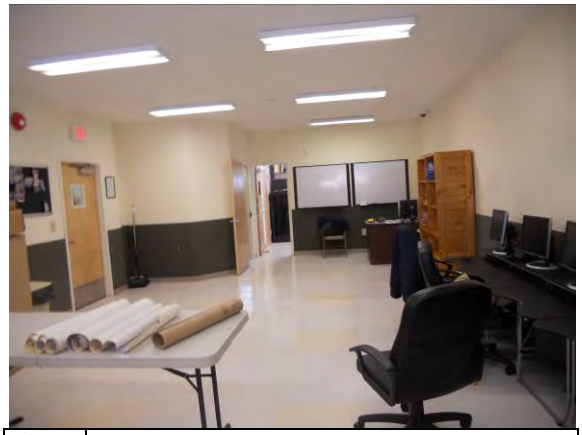


Photo #47:	Community room

Photo #48:	Community room kitchen

EMG
ENGINEERING PEACE OF MIND

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-005.306 **Project Name: Mahwah Public Housing**

Photo #49:	Community center/rental office common area laundry dryers

Photo #50:	Community center/rental office common area laundry washers

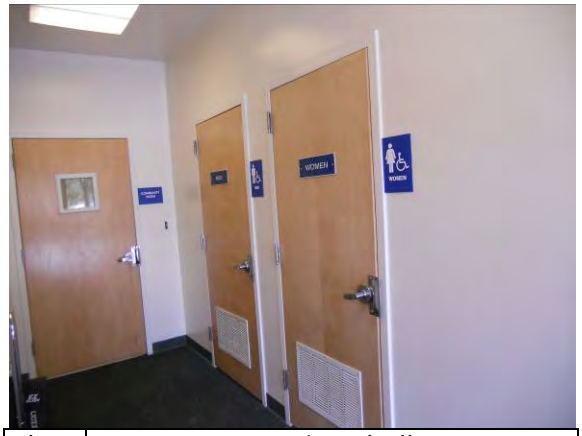


Photo #51:	Community center/rental office main lobby with common area restrooms

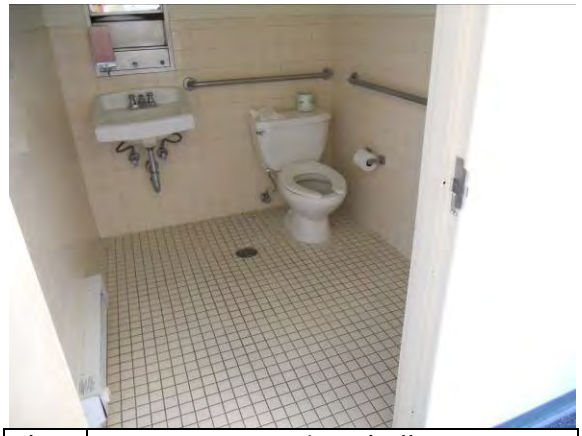


Photo #52:	Community center/rental office common area restroom

Photo #53:	Basketball court adjacent to community center/rental office

Photo #54:	Retaining wall and railing along basketball court

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-005.306 **Project Name: Mahwah Public Housing**

Photo #55:	Playground and brick pavers between the 600 Mahwah and 300 Ramsey units

Photo #56:	Playground equipment between the 600 Mahwah and 300 Ramsey units

Photo #57:	Fire hydrant and sunken brick pavers

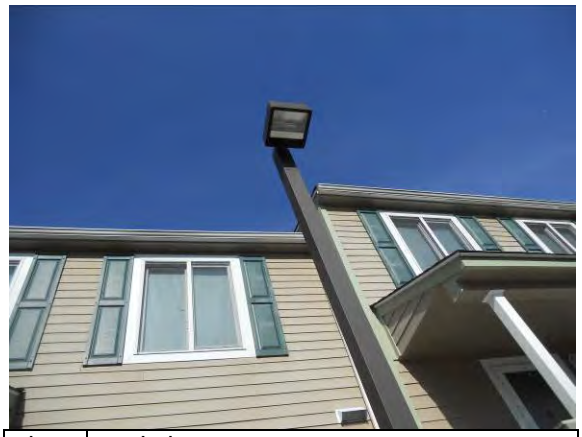


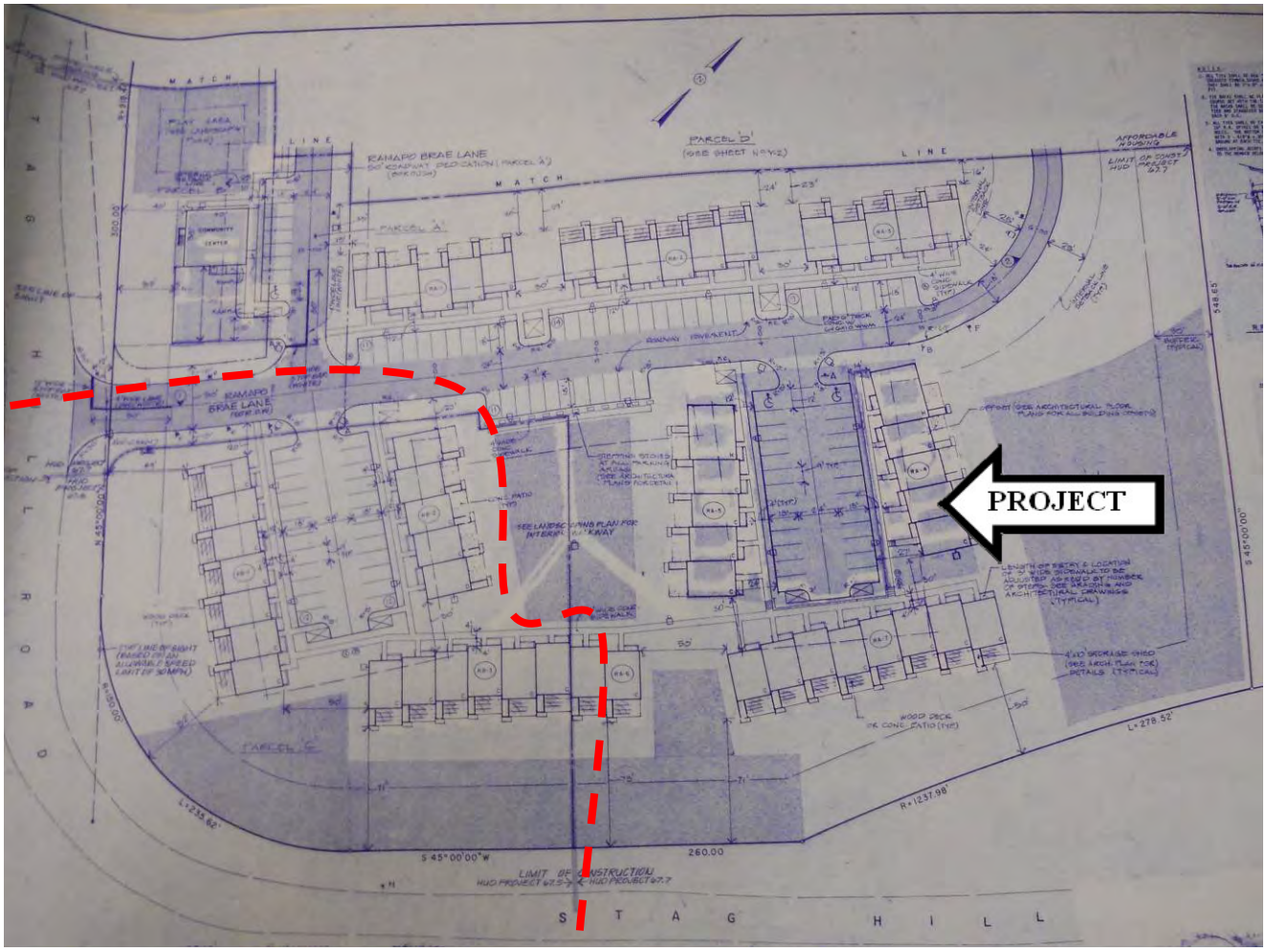
Photo #58:	Site lighting

Photo #59:	Dumpster and encloser

Photo #60:	Asphalt sidewalk with isolated heaving from tree roots

APPENDIX B:
SITE PLAN

Site Plan



EMG	**Source:** **Site provided**	**Project Number:** **107534.13R-005.306**
	The north arrow indicator is an approximation of 0° North.	**Project Name:** **Mahwah Public Housing**
		On-Site Date: **March 5, 2014**

APPENDIX C:
ENERGY AUDIT CALCULATIONS

Energy Conservation Measure
Replace Older Refrigerators with Energy Star Rated Refrigerators

Step 1a Obtain total cost of replacing the older refrigerators with Energy Star rated refrigerators:

3	Units	x	$435	each	=	$1,305 (Green Cost)

Step 1b Obtain total cost of replacing the older refrigerators with traditional refrigerators:

3	Units	x	$400	each	=	$1,200 (Traditional Cost)

Step 2 Refrigerator and Utility Information:

a	Total number of refrigerators to be replaced	3	
b	Useful Life refrigerators:	15	
c	Average age of existing refrigerators:	13	
d	Remaining Life of existing refrigerators:	2	
e	Cost of electricity:	0.165950502	$/kWh

Step 3 Existing Refrigerator Model: *GE/GTS18EBMBRWW*

Approximate annual energy use of each existing refrigerator: 555.00 kWh/yr

Step 4 Traditional Refrigerator Model: *Frigidaire FFTR15*

Approximate annual energy use of each traditional refrigerator replacement: 443.00 kWh/yr

Step 5 Green Refrigerator Model: *Frigidaire LFHT15 (Energy Star)*

Approximate annual energy use of each old green refrigerator replacement: 355.00 kWh/yr

Step 6 Calculate Annual Savings vs. Existing Refrigerators:

Energy Savings per Unit:	555	-	355	=	200	kWh/yr
Total Energy Savings	3	x	200	=	600	kWh/yr
Total Cost Savings:	600	x	0.17	=	$99.57	$/yr

Step 7 Calculate Annual Savings vs. Traditional Refrigerators:

Energy Savings per Unit:	443	-	355	=	88	kWh/yr
Total Energy Savings	3	x	88	=	264	kWh/yr
Total Cost Savings:	264	x	0.17	=	$43.81	$/yr

Simple Payback Period	$1,305	/	$100	=	**13.1**	years

Energy Conservation Measure
Replace Incandescent Lighting with Energy Star Light Fixtures in Apartments

This analysis is for replacment of standard incandescent light fixtures with Energy Star fixtures in the apartments. Average annual usage and 15 Watt CFL replacement bulbs are assumed.

Step 1	Cost Information								
	Cost of installingEnergy Star fixtures (Green)					6825.00	$		
	Cost of installing Incandescent (Traditional)					4725.00	$		
Step 2	Transfer the following information from the Survey:								
4-13	**a** Number of dwelling units:					35			
	b Total number of light fixtures to be replaced:					105			
	c Average number of hours/day lights are in use:					4			
5-9	**d** Cost of electricity:					$0.17	$/kWh		
Step 3	Lighting Energy Consumption								
	Existing/Traditional Consumption (60 Watt Incandescent)								
		0.120	x	105	x	1460	=	18396	kWh/yr
		kW/fixture		Fixtures		hrs/year			
	Green Consumption (13 Watt CFL)								
		0.045	x	105	x	1460	=	6899	kWh/yr
		kW/fixture		Fixtures		hrs/year			
Step 4	Estimate annual energy savings vs. Traditional:								
				2a		3			
		18396	-	6899	=	11498	kWh/yr		
Step 5	Calcualte annual cost savings vs. Traditional:								
				4		2b			
	Cost Savings	11497.50	x	0.17	=	1908.02	$/yr		
	Cost Differential	6825.00	-	4725.00	=	2100.00	$/yr		
Step 6	Calculate payback period:								
				1		5			
	Simple Payback Period	6825.00	/	1908.02	=	**3.58**	yrs		

Energy Conservation Measure
Replace Fluorescent Fixtures in Common Areas with T-8 Bulbs & Electronic Ballasts

This analysis is for replacment of the T-12 fluorescent lighting with T-8 Lamps and Electronic Ballasts in the common areas. An average annual usage and standard replacement bulb size are assumed.

Step 1 Cost Information

Cost of Replacing Fixtures w/ T-8 & Electronic Ballast	8580.00	$
Cost of Replacing Fixtures w/ T-12 & Electronic Ballast	7150.00	$

Step 2 Transfer the following information from the Survey:

b	Total number of light fixtures to be replaced:	110	
c	Existing Watts per bulb	40	
d	Number of linear bulbs per fixture	2	
e	Average number of hours/day bulbs are in use:	12	
f	Cost of electricity:	$0.17	$/kWh

Step 3 Lighting Energy Consumption

Traditional Consumption *T-12 Fluorescent - 40 Watt*

0.040	x	220	x	4380	=	38544	kWh/yr
kW/bulb		# of bulbs		hrs/year			

Traditional Consumption *T-12 Fluorescent - 34 Watt*

0.034	x	220	x	4380	=	32762	kWh/yr
kW/bulb		# of bulbs		hrs/year			

Green Consumption *T-8 Fluorescent - 28 Watt*

0.028	x	220	x	4380	=	26981	kWh/yr
kW/bulb		# of bulbs		hrs/year			

Step 4 Estimate annual energy savings vs. Traditional:

2a		3			
32762	-	26981	=	5782	kWh/yr

Step 5 Calcualte annual cost savings vs. Traditional:

	4		2b			
Cost Savings	5781.60	x	0.17	=	959.46	$/yr
Cost Differential	8580.00	-	7150.00	=	1430.00	$/yr

Step 6 Calculate payback period:

	1		5			
Simple Payback Period	8580.00	/	959.46	=	**8.94**	yrs

Energy Conservation Measure
Replace Incandescent Fixtures at Apartment Entry Lights with LED Wall Packs

This analysis is for replacment of the incandescent light bulbs at the apartment entrances with LED wall packs. The average annual usage and existing bulb size are assumed.

Step 1	Cost Information								
	Cost of installing LEDs (Green)						2275.00	$	
	Cost of installing Incandescent (Traditional)						1050.00	$	
Step 2	Transfer the following information from the Survey:								
4-13	**a** Number of apartment entry lgihts						35		
	b Total number of light bulbs to be replaced:						35		
	c Average number of hours/day bulbs are in use:						12		
5-9	**d** Cost of electricity:						$0.17	$/kWh	
Step 3	Lighting Energy Consumption								
	Existing/Traditional Consumption (Incandescent)								
		0.100	x	35	x	4380	=	15330	kWh/yr
		kW/bulb		# of bulbs		hrs/year			
	Green Consumption (5 Watt LED)								
		0.005	x	35	x	4380	=	767	kWh/yr
		kW/bulb		# of bulbs		hrs/year			
Step 4	Estimate annual energy savings vs. Traditional:								
				2a		3			
				15330	-	767	=	14564	kWh/yr
Step 5	Calcualte annual cost savings vs. Traditional:								
				4		2b			
	Cost Savings			14563.50	x	0.17	=	2416.82	$/yr
	Cost Differential			2275.00	-	1050.00	=	1225.00	$/yr
Step 6	Calculate payback period:								
	Simple Payback Period			2275.00	/	2416.82	=	**0.94**	yrs

Energy Conservation Measure
Replace Older PTAC Units with PTHP Units

Step 1 Obtain total cost of replacing existing air conditioners with efficient units:

3	PTAC Units	x	$1,030	per unit	$3,090	$

Step 2 Transfer the following information from the Survey:

EER rating of existing PTAC units:	11.6	EER
Cooling capacity of existing PTAC units:	7100	Btu/hr
Heating capacity of existing PTAC units:	4	kW
Number of existing AC units:	3	
Cost of electricity:	0.165950502	$/kWh

Step 3

Annual cooling hours	1007	hours
Annual heating equipment hours	1170	hours
Heat Pump Heating Season Time (%)	33%	

Step 4

Existing energy efficiency rating (EER):					11.6	
Replacement unit EER					11.7	
Replacement unit coefficienct of Performance (COP):					3.4	
	kW		COP			
Heat Pump Input Power	4	/	3.4	=	1.18	kW

Step 5 Calculate existing energy use per PTAC:

	Hours		kBtu		EER			
Cooling (DX)	1007	x	7.10	/	11.6	=	616	kWh
	Hours		kW					
Heating (Resistance)	1170	x	4.00			=	4680	kWh
Total							5296	kWh

Step 6 Calculate energy use per replacement PTHP:

	Hours		kBtu		EER			
Cooling (Heat Pump)	1007	x	7.10	/	11.7	=	611	kWh
	Hours		%		kW			
Heating (Heat Pump)	1170	x	0.33	x	1.2		459	kWh
	Hours		%		kW			
Heating (Resistance)	1170	x	0.67	x	4.0		3120	kWh
Total							4190	kWh

Step 7 Estimate annual energy savings:

5		6		2c			
5296	-	4190	x	3.00	=	3319	kWh/yr

Step 8 Calculate annual cost savings:

7		2d			
3319	x	0.17	=	551	$/yr

Step 9 Calculate payback period:

1		8			
3090.00	/	550.85	=	**5.61**	yrs

Energy Conservation Measure
Install Setback Thermostats

Step 1	Obtain total cost of installing night setback thermostats					
	35	Thermostats x	$85	per unit		$2,975
Step 2	Transfer the following information from the Survey:					
4-8	**a** Heating degree-day zone:					5122.50
5-14	**b** Annual heating fuel consumption:				Gas:	15050
					Electric:	0
5-9	**c** Cost of heating fuel:				Gas:	1.04
					Electric:	0.165950502
Step 3	Obtain the following savings factors from Table 1:					
Table 1	Savings factor:					.072
Step 4	Estimate annual energy savings:					
			3		2b	
		Gas:	.072	x	15049.96	= 1083.596976
		Electric:	.072	x	0.00	= 0
Step 5	Calculate annual cost savings:					
			4		2c	
		Gas:	1083.60	x	1.04	= $1,128.70
		Electric:	0.00	x	0.17	= $0.00
Step 6	Calculate payback period:					
			1		5	
		Gas:	2975.00	/	1128.70	= **2.64**
		Electric:	2975.00	/	0.00	= **#DIV/0!**

APPENDIX D:
MANUAL J CALCULATIONS

Apartment Load Sizing: **Mahwah Public Housing**
Heat Gain Calculations **2-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 1	Calculated total tonnage for cooling equipment:		1.0	Tons
			12519	Btu/hr
Step 2	Heat gain from Windows on North Side			
a	Height of Window		4.83	ft.
b	Width of Window		3.83	ft.
c	Number of windows on north side		2	
d	Indoor Design Temperature		74	F
e	Outdoor Design Temperature		95	F
f	U-Value for Window		0.50	
g	Heat gain, Q = (2a x 2b x 2c) x 2f x (2e- 2d)		388	BTUH
Step 3	Heat gain from Exterior Doors on North Side			
a	Height of Exterior Door		7	ft.
b	Width of Exterior Door		6	ft.
c	Number of exterior doors on north side		1	
d	Indoor Design Temperature		74	F
e	Outdoor Design Temperature		95	F
f	U-Value for Exterior Door		0.10	
g	Heat gain, Q = (3a x 3b x 3c) x 3f x (3e- 3d)		88	BTUH
Step 4	Heat gain from North Wall			
a	Length of North wall		24.5	ft.
b	Height of North wall		9.0	ft.
c	Indoor Design Temperature		74	F
d	Outdoor Design Temperature		95	F
e	U-Value for North wall		0.071	
f	Heat gain, Q = ((4ax4b)-(2a*2b*2c)-(3a*3b*3c))x 4e x (4d- 4c)		212	BTUH
Step 5	Heat gain from Windows on South Side			
a	Height of Window		4.83	ft.
b	Width of Window		3.83	ft.
c	Number of windows on south side		1	
d	Indoor Design Temperature		74	F
e	Outdoor Design Temperature		95	F
f	U-Value for Window		0.50	
g	SHGC, Solar Heat Gain Coefficient		0.4	
h	Heat gain, Q = ((5a x 5b x 5c) x 5f x (5e- 5d)) + (5ax5bx5cx5gx125)		1,119	BTUH
Step 6	Heat gain from Exterior Doors on South Side			
a	Height of Exterior Door		7	ft.
b	Width of Exterior Door		3	ft.
c	Number of exterior doors on south side		1	
d	Indoor Design Temperature		74	F
e	Outdoor Design Temperature		95	F
f	U-Value for Exterior Doors		0.10	
g	Heat gain, Q = (6a x 6b x 6c) x 6f x (6e- 6d+10)		65	BTUH

Apartment Load Sizing: **Mahwah Public Housing**
Heat Gain Calculations **2-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 7	Heat gain from South Wall			
	a	Length of South wall	24.5	ft.
	b	Height of South wall	9.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for South wall	0.071	
	f	Heat gain, Q = ((7ax7b)-(5a*5b*5c)-(6a*6b*6c))x 7e x (7d- 7c+10)	401	BTUH
Step 8	Heat gain from Windows on East Side			
	a	Height of Window	4.83	ft.
	b	Width of Window	3.83	ft.
	c	Number of windows on east side (1 window + 1 set of french doors)	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	Heat gain, Q = (8a x 8b x 8c) x 8f x (8e- 8d)	0	BTUH
Step 9	Heat gain from Exterior Doors on East Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on east side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat gain, Q = (9a x 9b x 9c) x 9f x (9e- 9d)	0	BTUH
Step 10	Heat gain from East Wall			
	a	Length of East wall	24.5	ft.
	b	Height of East wall	9.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for East wall	0.071	
	f	Heat gain, Q = ((10ax10b)-(8a*8b*8c)-(9a*9b*9c))x 10e x (10d- 10c)	331	BTUH
Step 11	Heat gain from Windows on West Side			
	a	Height of Window	4.83	ft.
	b	Width of Window	3.83	ft.
	c	Number of windows on west side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	SHGC, Solar Heat Gain Coefficient	0.4	
	h	Heat gain, Q = ((11a x 11b x 11c)x11f x(11e- 11d))+(11ax11bx11cx11gx125)	0	BTUH

Apartment Load Sizing: **Mahwah Public Housing**
Heat Gain Calculations **2-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 12	Heat gain from Exterior Doors on West Side			
a	Height of Exterior Door	7	ft.	
b	Width of Exterior Door	3	ft.	
c	Number of exterior doors on west side	0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Exterior Doors	0.10		
g	Heat gain, Q = (12a x 12b x 12c) x 12f x (12e- 12d+10)	0	BTUH	
Step 13	Heat gain from West Wall			
a	Length of West wall	24.5	ft.	
b	Height of West wall	9.0	ft.	
c	Indoor Design Temperature	74	F	
d	Outdoor Design Temperature	74	F	
e	U-Value for West wall	0.071		
f	Heat gain, Q = ((13ax13b)-(11a*11b*11c)-(12a*12b*12c))x13ex(13d- 13c+10)	0	BTUH	
Step 14	Heat gain from Roof			
a	Length of Roof	24.5	ft.	
b	Width of Roof	24.5	ft.	
c	Slope Factor for Roof (1.0 for flat roofs, 1.20 for sloped roofs)	1.20		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Roof	0.067		
g	Heat gain, Q = (14a x 14b x 14c) x 14f x (14e- 14d + 30)	2,449	BTUH	
Step 15	Heat gain from Ground Floor			
a	Length of ground floor	24.5	ft.	
b	Width of ground floor	24.5	ft.	
c	Indoor Design Temperature	74	F	
d	Outdoor Design Temperature	75	F	
e	U-Value for ground floor	0.000		
f	Heat gain, Q = (15a x 15b) x 15e x (15d- 15c)	0	BTUH	
Step 16	Heat gain from Infiltration			
a	Length of Building or Unit	24.5	ft.	
b	Width of Building or Unit	24.5	ft.	
c	Height of Building or Unit	9.0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	ACH, Air Change Per Hour	1.0		
g	Enthalpy, H	10.0		
h	Heat gain, Q = ((16a x 16b x 16c) / 60) x 16f x 4.5 * 16g	4,052	BTUH	
Step 17	Heat gain from electrical heat			
a	Kilowatt of continuous power (per hour)	1.0	kW	
b	Heat gain, Q = 3414 x 17a	3,414	BTUH	

Apartment Load Sizing: **Mahwah Public Housing**
Heat Loss Calculations **2-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 1	Calculated total BTUH for heating equipment:			
			31356	BTUH
			9.2	kW
Step 2	Heat loss from Windows on North Side			
	a	Height of Window	4.8	ft.
	b	Width of Window	3.8	ft.
	c	Number of windows on north side	1	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (2a x 2b x 2c) x 2f x (2d- 2e)	703	BTUH
Step 3	Heat loss from Exterior Doors on North Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	6.0	ft.
	c	Number of exterior doors on north side	1	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Door	0.10	
	g	Heat Loss, Q = (3a x 3b x 3c) x 3f x (3d- 3e)	319	BTUH
Step 4	Heat loss from North Wall			
	a	Length of North wall	24.5	ft.
	b	Height of North wall	9.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for North wall	0.071	
	f	Heat Loss, Q = ((4ax4b)-(2a*2b*2c)-(3a*3b*3c))x 4e x (4c- 4d)	869	BTUH
Step 5	Heat loss from Windows on South Side			
	a	Height of Window	4.8	ft.
	b	Width of Window	3.8	ft.
	c	Number of windows on south side	2	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (5a x 5b x 5c) x 5f x (5d- 5e)	1,406	BTUH
Step 6	Heat loss from Exterior Doors on South Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on south side	1	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (6a x 6b x 6c) x 6f x (6d- 6e)	160	BTUH

Apartment Load Sizing: **Mahwah Public Housing**
Heat Loss Calculations **2-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 7	Heat loss from South Wall			
	a	Length of South wall	24.5	ft.
	b	Height of South wall	9.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for South wall	0.071	
	f	Heat Loss, Q = ((7ax7b)-(5a*5b*5c)-(6a*6b*6c))x 7e x (7c- 7d)	882	BTUH
Step 8	Heat loss from Windows on East Side			
	a	Height of Window	4.8	ft.
	b	Width of Window	3.8	ft.
	c	Number of windows on east side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (8a x 8b x 8c) x 8f x (8d- 8e)	0	BTUH
Step 9	Heat loss from Exterior Doors on East Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on east side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (9a x 9b x 9c) x 9f x (9d- 9e)	0	BTUH
Step 10	Heat loss from East Wall			
	a	Length of East wall	24.5	ft.
	b	Height of East wall	9.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for East wall	0.071	
	f	Heat Loss, Q = ((10ax10b)-(8a*8b*8c)-(9a*9b*9c))x 10e x (10c- 10d)	1,197	BTUH
Step 11	Heat loss from Windows on West Side			
	a	Height of Window	4.8	ft.
	b	Width of Window	3.8	ft.
	c	Number of windows on west side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (11a x 11b x 11c) x 11f x (11d- 11e)	0	BTUH

Apartment Load Sizing: **Mahwah Public Housing**
Heat Loss Calculations **2-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 12	Heat loss from Exterior Doors on West Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on west side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (12a x 12b x 12c) x 12f x (12d- 12e)	0	BTUH
Step 13	Heat loss from West Wall			
	a	Length of West wall	24.5	ft.
	b	Height of West wall	9.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	76	F
	e	U-Value for West wall	0.071	
	f	Heat Loss, Q = ((13ax13b)-(11a*11b*11c)-(12a*12b*12c))x 13e x (13c- 13d)	0	BTUH
Step 14	Heat loss from Roof			
	a	Length of Roof	24.5	ft.
	b	Width of Roof	24.5	ft.
	c	Slope Factor for Roof (1.0 for flat roofs, 1.20 for sloped roofs)	1.20	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Roof	0.067	
	g	Heat Loss, Q = (14a x 14b x 14c) x 14f x (14d- 14e)	3,650	BTUH
Step 15	Heat loss from Ground Floor			
	a	Length of ground floor	24.5	ft.
	b	Width of ground floor	24.5	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	68	F
	e	U-Value for ground floor	0.000	
	f	Heat Loss, Q = (15a x 15b) x 15e x (15c- 15d)	0	BTUH
Step 16	Heat loss from Infiltration			
	a	Length of Building or Unit	24.5	ft.
	b	Width of Building or Unit	24.5	ft.
	c	Height of Building or Unit	9.0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	ACH, Air Change Per Hour	3.0	
	g	Heat Loss, Q = ((16a x 16b x 16c) / 60) x 16f x 1.08 * (16d- 16e)	22,171	BTUH

Apartment Load Sizing: **Mahwah Public Housing**
Heat Gain Calculations **3-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 1	Calculated total tonnage for cooling equipment:		1.6	Tons
			19633	Btu/hr
Step 2	Heat gain from Windows on North Side			
a	Height of Window		4.83	ft.
b	Width of Window		3.83	ft.
c	Number of windows on north side		2	
d	Indoor Design Temperature		74	F
e	Outdoor Design Temperature		95	F
f	U-Value for Window		0.50	
g	Heat gain, Q = (2a x 2b x 2c) x 2f x (2e- 2d)		388	BTUH
Step 3	Heat gain from Exterior Doors on North Side			
a	Height of Exterior Door		7	ft.
b	Width of Exterior Door		6	ft.
c	Number of exterior doors on north side		1	
d	Indoor Design Temperature		74	F
e	Outdoor Design Temperature		95	F
f	U-Value for Exterior Door		0.10	
g	Heat gain, Q = (3a x 3b x 3c) x 3f x (3e- 3d)		88	BTUH
Step 4	Heat gain from North Wall			
a	Length of North wall		20.0	ft.
b	Height of North wall		17.0	ft.
c	Indoor Design Temperature		74	F
d	Outdoor Design Temperature		95	F
e	U-Value for North wall		0.071	
f	Heat gain, Q = ((4ax4b)-(2a*2b*2c)-(3a*3b*3c))x 4e x (4d- 4c)		392	BTUH
Step 5	Heat gain from Windows on South Side			
a	Height of Window		4.83	ft.
b	Width of Window		3.83	ft.
c	Number of windows on south side		3	
d	Indoor Design Temperature		74	F
e	Outdoor Design Temperature		95	F
f	U-Value for Window		0.50	
g	SHGC, Solar Heat Gain Coefficient		0.6	
h	Heat gain, Q = ((5a x 5b x 5c) x 5f x (5e- 5d)) + (5ax5bx5cx5gx125)		4,745	BTUH
Step 6	Heat gain from Exterior Doors on South Side			
a	Height of Exterior Door		7	ft.
b	Width of Exterior Door		3	ft.
c	Number of exterior doors on south side		1	
d	Indoor Design Temperature		74	F
e	Outdoor Design Temperature		95	F
f	U-Value for Exterior Doors		0.10	
g	Heat gain, Q = (6a x 6b x 6c) x 6f x (6e- 6d+10)		65	BTUH

Apartment Load Sizing: **Mahwah Public Housing**
Heat Gain Calculations **3-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 7	Heat gain from South Wall			
	a	Length of South wall	20.0	ft.
	b	Height of South wall	17.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for South wall	0.071	
	f	Heat gain, Q = ((7ax7b)-(5a*5b*5c)-(6a*6b*6c))x 7e x (7d- 7c+10)	583	BTUH
Step 8	Heat gain from Windows on East Side			
	a	Height of Window	4.83	ft.
	b	Width of Window	3.83	ft.
	c	Number of windows on east side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	Heat gain, Q = (8a x 8b x 8c) x 8f x (8e- 8d)	0	BTUH
Step 9	Heat gain from Exterior Doors on East Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on east side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat gain, Q = (9a x 9b x 9c) x 9f x (9e- 9d)	0	BTUH
Step 10	Heat gain from East Wall			
	a	Length of East wall	27.5	ft.
	b	Height of East wall	17.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	74	F
	e	U-Value for East wall	0.071	
	f	Heat gain, Q = ((10ax10b)-(8a*8b*8c)-(9a*9b*9c))x 10e x (10d- 10c)	0	BTUH
Step 11	Heat gain from Windows on West Side			
	a	Height of Window	4.83	ft.
	b	Width of Window	3.83	ft.
	c	Number of windows on west side (1 window + 1 set french doors)	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	SHGC, Solar Heat Gain Coefficient	0.0	
	h	Heat gain, Q = ((11a x 11b x 11c)x11f x(11e- 11d))+(11ax11bx11cx11gx125)	0	BTUH

Apartment Load Sizing: **Mahwah Public Housing**
Heat Gain Calculations **3-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 12	Heat gain from Exterior Doors on West Side			
a	Height of Exterior Door	7	ft.	
b	Width of Exterior Door	3	ft.	
c	Number of exterior doors on west side	0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Exterior Doors	0.10		
g	Heat gain, Q = (12a x 12b x 12c) x 12f x (12e- 12d+10)	0	BTUH	
Step 13	Heat gain from West Wall			
a	Length of West wall	27.5	ft.	
b	Height of West wall	17.0	ft.	
c	Indoor Design Temperature	74	F	
d	Outdoor Design Temperature	95	F	
e	U-Value for West wall	0.071		
f	Heat gain, Q = ((13ax13b)-(11a*11b*11c)-(12a*12b*12c))x13ex(13d- 13c+10)	701	BTUH	
Step 14	Heat gain from Roof			
a	Length of Roof	20.0	ft.	
b	Width of Roof	27.5	ft.	
c	Slope Factor for Roof (1.0 for flat roofs, 1.20 for sloped roofs)	1.20		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Roof	0.067		
g	Heat gain, Q = (14a x 14b x 14c) x 14f x (14e- 14d + 30)	2,244	BTUH	
Step 15	Heat gain from Ground Floor			
a	Length of ground floor	20.0	ft.	
b	Width of ground floor	27.5	ft.	
c	Indoor Design Temperature	74	F	
d	Outdoor Design Temperature	75	F	
e	U-Value for ground floor	0.000		
f	Heat gain, Q = (15a x 15b) x 15e x (15d- 15c)	0	BTUH	
Step 16	Heat gain from Infiltration			
a	Length of Building or Unit	20.0	ft.	
b	Width of Building or Unit	27.5	ft.	
c	Height of Building or Unit	17.0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	ACH, Air Change Per Hour	1.0		
g	Enthalpy, H	10.0		
h	Heat gain, Q = ((16a x 16b x 16c) / 60) x 16f x 4.5 * 16g	7,013	BTUH	
Step 17	Heat gain from electrical heat			
a	Kilowatt of continuous power (per hour)	1.0	kW	
b	Heat gain, Q = 3414 x 17a	3,414	BTUH	

Apartment Load Sizing: **Mahwah Public Housing**
Heat Loss Calculations **3-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 1	Calculated total BTUH for heating equipment:			
			51095	BTUH
			15.0	kW
Step 2	Heat loss from Windows on North Side			
	a	Height of Window	4.8	ft.
	b	Width of Window	3.8	ft.
	c	Number of windows on north side	3	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (2a x 2b x 2c) x 2f x (2d- 2e)	2,109	BTUH
Step 3	Heat loss from Exterior Doors on North Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	6.0	ft.
	c	Number of exterior doors on north side	1	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Door	0.10	
	g	Heat Loss, Q = (3a x 3b x 3c) x 3f x (3d- 3e)	319	BTUH
Step 4	Heat loss from North Wall			
	a	Length of North wall	20.0	ft.
	b	Height of North wall	17.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for North wall	0.071	
	f	Heat Loss, Q = ((4ax4b)-(2a*2b*2c)-(3a*3b*3c))x 4e x (4c- 4d)	1,316	BTUH
Step 5	Heat loss from Windows on South Side			
	a	Height of Window	4.8	ft.
	b	Width of Window	3.8	ft.
	c	Number of windows on south side	2	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (5a x 5b x 5c) x 5f x (5d- 5e)	1,406	BTUH
Step 6	Heat loss from Exterior Doors on South Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on south side	1	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (6a x 6b x 6c) x 6f x (6d- 6e)	160	BTUH

Apartment Load Sizing: **Mahwah Public Housing**
Heat Loss Calculations **3-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 7	Heat loss from South Wall			
	a	Length of South wall	20.0	ft.
	b	Height of South wall	17.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for South wall	0.071	
	f	Heat Loss, Q = ((7ax7b)-(5a*5b*5c)-(6a*6b*6c))x 7e x (7c- 7d)	1,531	BTUH
Step 8	Heat loss from Windows on East Side			
	a	Height of Window	4.8	ft.
	b	Width of Window	3.8	ft.
	c	Number of windows on east side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (8a x 8b x 8c) x 8f x (8d- 8e)	0	BTUH
Step 9	Heat loss from Exterior Doors on East Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on east side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (9a x 9b x 9c) x 9f x (9d- 9e)	0	BTUH
Step 10	Heat loss from East Wall			
	a	Length of East wall	27.5	ft.
	b	Height of East wall	17.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	76	F
	e	U-Value for East wall	0.071	
	f	Heat Loss, Q = ((10ax10b)-(8a*8b*8c)-(9a*9b*9c))x 10e x (10c- 10d)	0	BTUH
Step 11	Heat loss from Windows on West Side			
	a	Height of Window	4.8	ft.
	b	Width of Window	3.8	ft.
	c	Number of windows on west side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (11a x 11b x 11c) x 11f x (11d- 11e)	0	BTUH

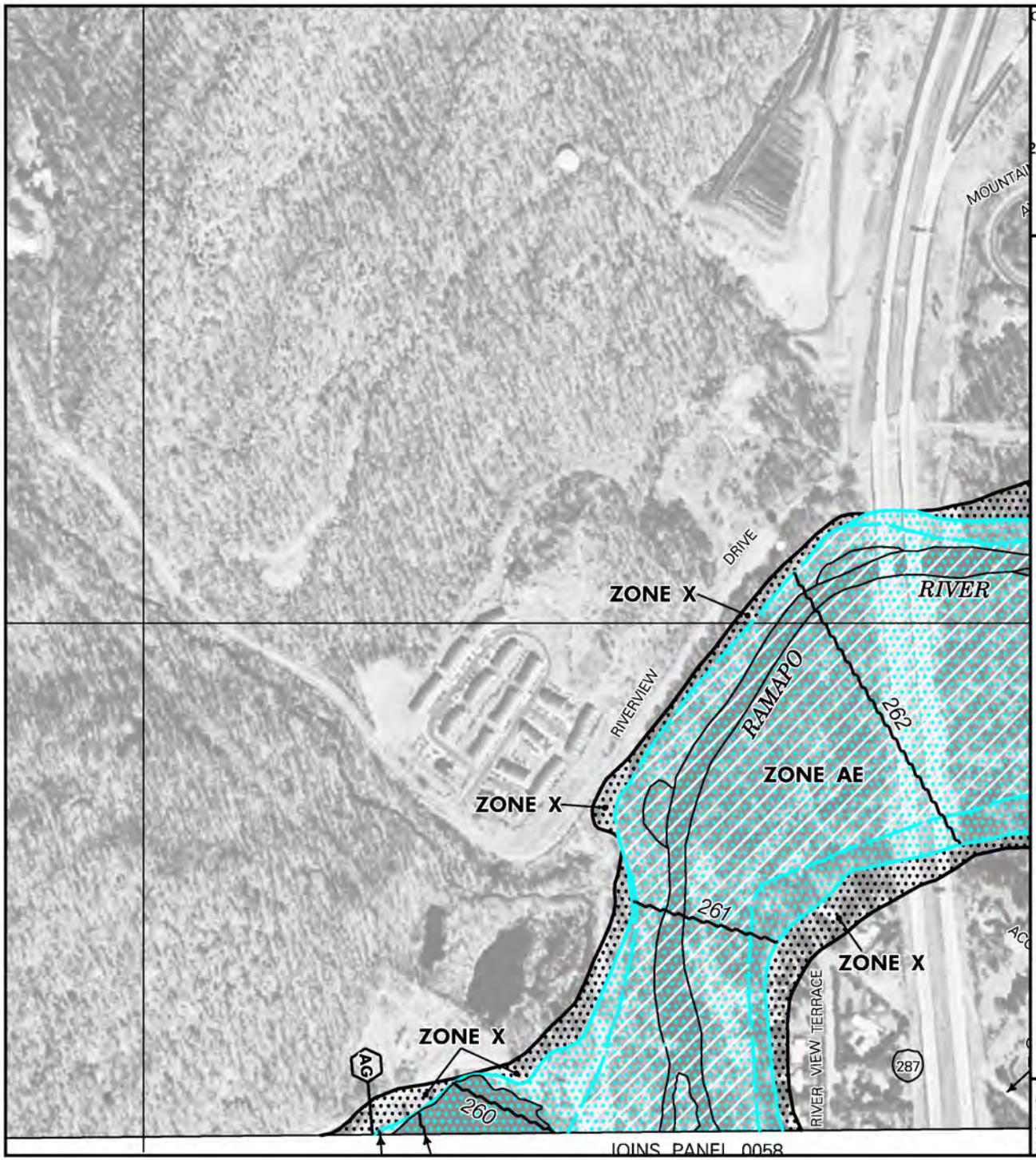
Apartment Load Sizing: **Mahwah Public Housing**
Heat Loss Calculations **3-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 12	Heat loss from Exterior Doors on West Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on west side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (12a x 12b x 12c) x 12f x (12d- 12e)	0	BTUH
Step 13	Heat loss from West Wall			
	a	Length of West wall	27.5	ft.
	b	Height of West wall	17.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for West wall	0.071	
	f	Heat Loss, Q = ((13ax13b)-(11a*11b*11c)-(12a*12b*12c))x 13e x (13c- 13d)	2,538	BTUH
Step 14	Heat loss from Roof			
	a	Length of Roof	20.0	ft.
	b	Width of Roof	27.5	ft.
	c	Slope Factor for Roof (1.0 for flat roofs, 1.20 for sloped roofs)	1.20	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Roof	0.067	
	g	Heat Loss, Q = (14a x 14b x 14c) x 14f x (14d- 14e)	3,344	BTUH
Step 15	Heat loss from Ground Floor			
	a	Length of ground floor	20.0	ft.
	b	Width of ground floor	27.5	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	68	F
	e	U-Value for ground floor	0.000	
	f	Heat Loss, Q = (15a x 15b) x 15e x (15c- 15d)	0	BTUH
Step 16	Heat loss from Infiltration			
	a	Length of Building or Unit	20.0	ft.
	b	Width of Building or Unit	27.5	ft.
	c	Height of Building or Unit	17.0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	ACH, Air Change Per Hour	3.0	
	g	Heat Loss, Q = ((16a x 16b x 16c) / 60) x 16f x 1.08 * (16d- 16e)	38,372	BTUH

APPENDIX E:
SUPPORTING DOCUMENTATION

onal Flood Insurance Program at 1–800–638–6620.



MAP SCALE 1" = 500'

250 0 500 1000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0056G

FIRM

FLOOD INSURANCE RATE MAP

BERGEN COUNTY,
NEW JERSEY
(ALL JURISDICTIONS)

PANEL 56 OF 332

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MAHWAH, TWP OF	340049	0056	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
34003C0056G

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

BUILDING DEPARTMENT FOIA

To: Daniel Mairella
Township of Mahwah Building Department of Planning and Zoning
Mahwah, New Jersey

Date: March 5, 2014
Phone #: 201.529.5757 x237
email: dmairella@mahwahtwp.org

Re: Mahwah Public Housing
1600 Ramapo Brae Lane
Mahwah, New Jersey 07430

EMG Project No: 107534.13R-005.306

Project Manager: Jill Orlov

Dear Daniel Mairella:

EMG is an engineering firm currently conducting a property condition survey of the above-referenced property. As part of the due-diligence process, we are submitting this letter through the Freedom of Information Act to obtain information specific to the property. We request your assistance by providing us with the following information concerning the site and buildings:

1. Date of last building department inspection ___/___/___
   mo. day year
2. Are there any OUTSTANDING building code violations? YES/ NO
   (circle one)
3. How often is the subject property inspected? annually, biennially, other
   (circle one)
4. Is the original Certificate of Occupancy or Permit on file? YES/ NO
   If such documents are on file, please fax them to the number noted below.

Responses may be faxed directly to our office, at (410) 785-6220, or mailed to our corporate offices:

EMG
Attn: Senior Engineering Consultant – Edward Beeghly
222 Schilling Circle, Suite 275
Hunt Valley, Maryland 21031

If **outstanding** violations are on file, please provide copies of the reports/citations. Please note the EMG Project Number and the Senior Engineering Consultant's name on all correspondence. If you need additional information to complete this request, please contact me at (800) 733-0660. Thank you for your prompt attention to this matter.

Sincerely,

Jill Orlov
Project Manager

PLANNING DEPARTMENT FOIA

To: Gary Montroy
Township of Mahwah Department of Planning and Zoning
Mahwah, New Jersey

Date: March 5, 2014
Phone #: 201.529.5757 x245
email: gmontroy@mahwahtwp.com

Re: Mahwah Public Housing
1600 Ramapo Brae Lane
Mahwah, New Jersey 07430

EMG Project No: 107534.13R-005.306

Project Manager: Jill Orlov

Dear Gary Montroy:

EMG is an engineering firm currently conducting a property condition survey of the above-referenced property. As part of the due-diligence process, we are submitting this letter through the Freedom of Information Act to obtain information specific to the property. We request your assistance by providing us with the following information concerning the site and buildings:

1. What is the zoning designation for the subject property? _____
   (Residential/Commercial/Industrial/Other)
   (circle one)
2. Are there any OUTSTANDING zoning code violations? YES/ NO
   (circle one)
3. Is the subject property, in general, a conforming use? YES/ NO
   (circle one)

Responses may be faxed directly to our office, at (410) 785-6220, or mailed to our corporate offices:

EMG
Attn: Senior Engineering Consultant – Edward Beeghly
222 Schilling Circle, Suite 275
Hunt Valley, Maryland 21031

If **outstanding** violations are on file, please provide copies of the reports/citations. Please note the EMG Project Number and the Senior Engineering Consultant's name on all correspondence. If you need additional information to complete this request, please contact me at (800) 733-0660. Thank you for your prompt attention to this matter.

Sincerely,

Jill Orlov

Project Manager

FIRE DEPARTMENT FOIA

To: Michael Roe
Mahwah Fire Department
Mahwah, New Jersey

Date: March 5, 2014
Phone #: 201.529.5757 x275
email: mroe@mahwahtwp.org

Re: Mahwah Public Housing
1600 Ramapo Brae Lane
Mahwah, New Jersey 07430

EMG Project No: 107534.13R-005.306

Project Manager: Jill Orlov

Dear Michael Roe:

EMG is an engineering firm currently conducting a property condition survey of the above-referenced property. As part of the due-diligence process, we are submitting this letter through the Freedom of Information Act to obtain information specific to the property. We request your assistance by providing us with the following information concerning the site and buildings:

1. Date of last fire department inspection ___/___/___
   mo. day year
2. Are there any OUTSTANDING fire code violations? YES/ NO
   (circle one)
3. How often is the subject property inspected? annually, biennially, other
   (circle one)

Responses may be faxed directly to our office, at (410) 785-6220, or mailed to our corporate offices:

EMG
Attn: Senior Engineering Consultant – Edward Beeghly
222 Schilling Circle, Suite 275
Hunt Valley, Maryland 21031

If **outstanding** violations are on file, please provide copies of the reports/citations. Please note the EMG Project Number and the Senior Engineering Consultant's name on all correspondence. If you need additional information to complete this request, please contact me at (800) 733-0660. Thank you for your prompt attention to this matter.

Sincerely,

Jill Orlov

Project Manager

APPENDIX F:
EMG ACCESSIBILITY CHECKLIST

EMG ACCESSIBIILITY CHECKLIST

Property Name: Mahwah Public Housing
Date: March 5, 2014
Project Number: 107534.13R-005.306

EMG Accessibility Checklist						
UFAS/ADA Accessibility						
	Building History	**Yes**	**No**	**N/A**	**Unk**	**Comments**
1.	Has the management previously completed an accessibility review?	√				
2.	Does an accessibility compliance plan exist for the property?		√			
3.	Has the plan been reviewed/approved by outside agencies (engineering firms, building department, other agencies)?	√				
4.	Have any accessibility related complaints been received in the past?		√			
5.	Is the property Section 504 compliant?		√			No A/V
	Building Access	**Yes**	**No**	**N/A**	**Comments**	
1.	Are there an adequate number (per regulation) of wheelchair accessible parking spaces available at the rental office (96″ wide/60″ aisle)	√				
2.	Is there at least one wheelchair accessible van parking space (96″ wide/96″ aisle) for every 8 standard accessible spaces?		√		No Van parking	
3.	Are accessible parking spaces located on the shortest accessible route of travel from an accessible building entrance?	√				
4.	Does signage exist directing you to wheelchair accessible parking and an accessible building entrance?			√		
5.	Is there a ramp from the parking to an accessible building entrance (1:12 slope or less)	√				
6.	If the main entrance is inaccessible, are there alternate accessible entrances?			√		
7.	Is the accessible entrance doorway at least 32″ wide?	√				

EMG Accessibility Checklist					
	Building Access	**Yes**	**No**	**N/A**	**Comments**
8.	Is the door handle easy to open? (lever/push type knob, no twisting required, no higher than 48″ above floor)	√			
9.	Are entry doors other than revolving doors available?	√			
	Rental office	**Yes**	**No**	**N/A**	**Comments**
1.	Is the entry door to the rental office 3'wide with no step or threshold over ½″ tall?	√			
2.	Is there a counter or table at 30″ high for wheelchair access to fill out a rental application?	√			
3.	Is there clearance behind the counter for an employee in a wheelchair?	√			
	Building Corridors and Elevators	**Yes**	**No**	**N/A**	**Comments**
1.	Is the path of travel free of obstructions and wide enough for a wheelchair (at least 60″ wide)?	√			
2.	Are floor surfaces firm, stable and slip resistant (carpets wheelchair friendly)?	√			
3.	Do obstacles (phones, fountains, etc.) protrude no more than 4″ into walkways or corridor?	√			
4.	Are elevators controls low enough to be reached from a wheelchair (48″ front approach/54″ side approach)?			√	
5.	Are there raised elevator markings in Braille and standard alphabet for the blind?			√	
6.	Are there audible signals inside cars indicating floor changes?			√	
7.	Do elevator lobbies have visual and audible indicators of the cars arrival?			√	
8.	Does the elevator interior provide sufficient wheelchair turning area (51″ x 68″ minimum)?			√	
9.	Is at least one wheelchair accessible public phone available?			√	
10	Are wheelchair accessible facilities (restrooms, exits, etc.) identified with signage?	√			

EMG Accessibility Checklist					
	Common Area Restrooms	**Yes**	**No**	**N/A**	**Comments**
1.	Are common area public restrooms located on an accessible route?	√			
2.	Are pull handles push/pull or lever type?	√			
3.	Are access doors wheelchair accessible (at least 32″ wide)?	√			
4.	Are public restrooms large enough for wheelchair turnaround (60″ turning diameter)?	√			
5.	Are stall doors wheelchair accessible (at least 32″ wide)?			√	
6.	If stalls are too narrow can the toilet room be converted to a single occupant toilet room?			√	
7.	Are grab bars provided in toilet stalls (33″-36″ above floor)?	√			
8.	Do sinks provide clearance for a wheelchair to roll under (29″ clearance)?	√			
9.	Are sink handles operable with one hand without grasping, pinching or twisting?	√			
10.	Are exposed pipes under sink sufficiently insulated against contact?		√		
11.	Are soap dispensers, towel, etc. reachable (48″ from floor for frontal approach, 54″ for side approach)?	√			
12.	Is the base of the mirror no more than 40″ off floor?		√		
	Common Area Kitchen	**Yes**	**No**	**N/A**	**Comments**
1.	In a "U"-shaped kitchen is there 60″ clear floor space width?	√			
2.	In a "U"-shaped kitchen with base cabinet removed from beneath sink, is there a minimum of 40″ width?		√		
3.	In an "L"-shaped kitchen, is there a 40″ width minimum maintained?	√			
4.	Are countertops a maximum of 24″ deep and 36″ high?	√			
5.	Knee space beneath cabinetry is 30″ wide and 27″ high.		√		
6.	Is insulation installed below sinks on piping?		√		
7.	Are adaptable units equipped with removable or retractable cabinetry fronts beneath sink or stove?		√		

EMG Accessibility Checklist					
	Common Area Laundry rooms	**Yes**	**No**	**N/A**	**Comments**
1.	Are the laundry rooms located on an accessible route?	√			
2.	Are the door handles push/pull or lever type?	√			
3.	Are the access doors wheelchair accessible (at least 32″ clear width)?	√			
4.	Are laundry rooms large enough for wheelchair turnaround (60″ turning diameter)?	√			
5.	Is there a front load washing machine	√			
6.	If clothes folding tables are provided is one section at 32″ high with a clear area below the table?	√			
Fair Housing Accessibility/Section 504					
	Access to Unit	**Yes**	**No**	**N/A**	**Comments**
1.	Property management reports that the number of units currently accessible and those adaptable meet FHA requirements of all ground floor units or 100% for a high rise.	√			
2.	Are 5% of the units fully accessible to those individuals with mobility impairments and 2% of units accessible to those individuals with audio/visual impairments?	√	√		No A/V
3.	Are there any barriers or structural restrictions preventing access to the building?		√		
4.	Are the accessible units on an accessible route?	√			
5.	Is the apartment entry corridor 36″ wide, door 32″ wide (frame to frame), threshold height less than ½″, and appropriate door hardware present?	√			
	Unit Living Space	**Yes**	**No**	**N/A**	**Comments**
1.	Is there access throughout unit?	√			
2.	Are electrical outlets 15″ minimum above floor minimum?	√			
3.	Are environmental controls and switches 48″ maximum above floor or lower?	√			
	Unit Bathroom	**Yes**	**No**	**N/A**	**Comments**
1.	Is entry door at least 32″ wide frame-to-frame?	√			
2.	Are switches and outlets in accessible locations?	√			

EMG Accessibility Checklist					
	Unit Bathroom	**Yes**	**No**	**N/A**	**Comments**
3.	Are bathroom walls around the toilet and tub/shower reinforced?	√			
4.	Is there a 30″ x 48″ clear floor space outside of door swing area?	√			
5.	Is there a 56″ x 48″ clear floor space in front of toilet (48″ out from wall toilet is hung against)?	√			
6.	Is there a 30″ x 48″ clear floor space in front of lavatories (30″ deep from front of counter)?	√			
7.	Is there a 30″ x 48″ clear floor space in front of tub/shower (30″ out from tub/shower)?	√			
8.	Is vanity a maximum of 24″ deep and 36″ high?	√			
9.	Knee space beneath sink is 30″ wide and 27″ high.	√			
10.	Is shower stall 36″x 42″ minimum with small lip?	√			
11.	Is insulation installed below sinks on piping?		√		
	Unit Kitchen	**Yes**	**No**	**N/A**	**Comments**
1.	In a "U"-shaped kitchen is there 60″ clear floor space width?	√			
2.	In a "U"-shaped kitchen with base cabinet removed from beneath sink, is there a minimum of 40″ width?	√			
3.	In an "L"-shaped kitchen, is there a 40″ width minimum maintained?	√			
4.	Are countertops a maximum of 24″ deep and 36″ high?	√			
5.	Knee space beneath cabinetry is 30″ wide and 27″ high.	√			
6.	Is insulation installed below sinks on piping?		√		Required in adaptable unit regardless of occupancy.
7.	Are adaptable units equipped with removable or retractable cabinetry fronts beneath sink or stove?			√	

It is understood by the Client that the limited observation described herein does not comprise a full ADA Compliance Survey, and that such a survey is beyond the scope of EMG's Physical Condition Assessment. Only a representative sample of areas was observed and, other than as shown on the accessibility checklist, actual measurements were not taken to verify compliance.

ADAAG CRITERIA

Total Parking in Lot	Required Minimum Number of Accessible Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2% of total
1001 and over	20 plus 1 for each 100 over 1000

For further information or a copy of the Americans with Disabilities Act Accessibility Guidelines contact 1-800-949-4ADA

APPENDIX G:
PRE-SURVEY QUESTIONNAIRES

PROPERTY CONDITION ASSESSMENT: PRE-SURVEY QUESTIONNAIRE

This questionnaire must be completed by the property owner, the owner's designated representative, or someone knowledgeable about the subject property. ***The completed form must be presented to EMG's Field Observer on the day of the site visit***. If the form is not completed, EMG's Project Manager will require ***additional time*** during the on-site visit with such a knowledgeable person in order to complete the questionnaire. During the site visit, EMG's Field Observer may ask for details associated with selected questions. This questionnaire will be utilized as an exhibit in EMG's final Property Condition Report.

Name of person completing questionnaire: Vincent M. Bufis

Association with property: Property Manager

Length of association with property: 2 Years – September 2011

Date Completed: January 21, 2014

Phone Number: 201 206 9413

Property Name: Mahwah Public Housing

EMG Project Number:

Directions: Please answer all questions to the best of your knowledge and in good faith. Please provide additional details in the Comments column, of add backup documentation for any *Yes* responses.

	INSPECTIONS	DATE LAST INSPECTED	LIST ANY OUTSTANDING REPAIRS REQUIRED
1	Elevators	N/A	
2	HVAC, Mechanical, Electric, Plumbing	1/14/14 & 1/23/14	
3	Life-Safety/Fire	1/21/14	
4	Roofs	10/2013 (NEW)	
	QUESTION		**RESPONSE**
5	List any major capital improvement within the last three years.		Roof replacement on all 10 buildings and sheds.
6	List any major capital expenditures planned for the next year.		
7	What is the age of the roof(s)?		Less than 1 year old
8	What building systems (HVAC, roof, interior/exterior finishes, paving, etc.) are the responsibilities of the tenant to maintain and replace?		None of the building systems are the responsibility of the tenants to maintain and replace. They must pay their electric and gas bill, keep their apartments in a neat manner, and, if they so choose, have up their cable installed and maintained.

Mark the column corresponding to the appropriate response. Please provide additional details in the Comments column, or backup documentation for any *Yes* responses. (**NA** indicates *"Not Applicable"*, **Unk** indicates *"Unknown"*)

	QUESTION	RESPONSE				COMMENTS
		Y	N	Unk	NA	
9	Are there any unresolved building, fire, or zoning code issues?		x			
10	Are there any "down" or unusable units?		x			
11	Are there any problems with erosion, stormwater drainage or areas of paving that do not drain?		x			
12	Is the property served by a private water well?		x			
13	Is the property served by a private septic system or other waste treatment systems?		x			
14	Are there any problems with foundations or structures?		x			
15	Is there any water infiltration in basements or crawl spaces?		x			
16	Are there any wall, or window leaks?		x			
17	Are there any roof leaks?		x			
18	Is the roofing covered by a warranty or bond?	x				
19	Are there any poorly insulated areas?		x			
20	Is Fire Retardant Treated (FRT) plywood used?			x		
21	Is exterior insulation and finish system (EIFS) or a synthetic stucco finish used?		x			
22	Are there any problems with the utilities, such as inadequate capacities?		x			
23	Are there any problems with the landscape irrigation systems?	x				The sprinkler system needs repairs.
24	Has a termite/wood boring insect inspection been performed within the last year?			x		
25	Do any of the HVAC systems use R-11, 12, or 22 refrigerants?			x		

Mark the column corresponding to the appropriate response. Please provide additional details in the Comments column, or backup documentation for any *Yes* responses. (**NA** indicates "*Not Applicable*", **Unk** indicates "*Unknown*")						
QUESTION		**RESPONSE**				**COMMENTS**
		Y	N	Unk	NA	
26	Has any part of the property ever contained visible suspect mold growth?	X				During our inspections a couple of the bathrooms start to early process of mold growth, because the tenant does not utilize the exhaust fan properly. We address this issue immediately, and are going to be installing a new switch that activates the light and exhaust fan together.
27	Is there a mold Operations and Maintenance Plan?		X			
28	Have there been indoor air quality or mold related complaints from tenants?		X			
29	Is polybutylene piping used?	x				The water to the second floor and in the crawl space is carried through polybutylene piping.
30	Are there any plumbing leaks or water pressure problems?		x			
31	Are there any leaks or pressure problems with natural gas service?		x			
32	Does any part of the electrical system use aluminum wiring?		x			
33	Do Residential units have a less than 60-Amp service?		x			
34	Do Commercial units have less than 200-Amp service?		x			
35	Are there any recalled fire sprinkler heads (Star, GEM, Central, Omega)?		x			
36	Is there any pending litigation concerning the property?		x			
37	Has the management previously completed an ADA review?			x		
38	Have any ADA improvements been made to the property?		x			
39	Does a Barrier Removal Plan exist for the property?		x			
40	Has the Barrier Removal Plan been approved by an arms-length third party?		x			
41	Has building ownership or management received any ADA related complaints?		x			
42	Does elevator equipment require upgrades to meet ADA standards?				x	

Mark the column corresponding to the appropriate response. Please provide additional details in the Comments column, or backup documentation for any *Yes* responses. (**NA** indicates *"Not Applicable"*, **Unk** indicates *"Unknown"*)						
QUESTION		**RESPONSE**				**COMMENTS**
		Y	N	Unk	NA	
43	Are there any problems with exterior lighting?		x			
44	Are there any other significant issues/hazards with the property?		x			
45	Are there any unresolved construction defects at the property?		x			

Vincent M. Bufis

Signature of person Interviewed or completing form

January 28, 2014

Date

ENERGY AUDIT : PRE-SURVEY QUESTIONNAIRE

This questionnaire must be completed by the property owner, management point of contact or other person knowledgeable about the subject property.

The completed form must be presented to EMG's Field Observer on or before the site visit.

If the form is not completed, EMG's Project Manager will require additional time during the on-site visit in order to complete the questionnaire. During the site visit, EMG's Field Observer may ask for details associated with selected questions. This questionnaire will be utilized as an exhibit in EMG's final report.

Housing Authority: Bergen County	Address: 1 Bergen County Plaza, 2nd Floor Hackensack, NJ 07601
Owner, if other than Authority:	Address:
Name of Subject Site: Mahwah Public Housing	Residential Buildings: 9 Common Buildings: 1 Other Buildings:
Address: 1600 Ramapo Brae Lane	City, State, Zip: Mahwah, NJ 07430

Building Manager: Vincent M. Bufis	Phone (201) 206-9413
Maintenance Manage: Vincent M. Bufis	Phone (201) 206-9413
Energy Management Coordinator	Phone

Building Description (circle all that apply)

Masonry – (Wood framed) – Steel framed – Curtain wall

Detached – (Townhouse) – Low-rise – Mid-rise – High-rise

Basement – (Crawl Space) – (Attic) – Flat Roof – (Slope Roof)

Number of:

___ Efficiencies ____ One BR __2__ Two BR

__52__ Three BR ___ Four BR ____ Five BR ____ Six BR ____ SRO

Date of original completion: 1989_____

Dates of significant renovations: 2013 _____

Describe: Roof replacement all buildings

Other uses on this site

___ Rental Office

___ Community Service Offices

_x__ Common Laundry

___ Common Meeting-Activity

___ Common Kitchen
Residential or Commercial

___ Daycare

___ Training Education

___ Gym Fitness Recreation

_x__ Maintenance Storage

_x_ Other, Specify: 2 sheds, park, basketball court

Anticipated Modifications or Changes In Use in the next 15 yrs: Playground renovation, basketball court upgrade/modification

Have there been previous Energy Audits or Retrofit Programs? __Yes __No

Date _____

Agency _____

Scope _____

Are related Energy Audit or Retrofit documents available?

Any additional Energy Investment Programs? _____

Does the Institution Have an ongoing energy management program? ___Yes ___No

Utilities			
	Utility Supplier to the Site	Master Metered	Tenant Metered
Electric	Rockland Electric		X
Natural/LP Gas	PSE&G		X
Fuel Oil			
Other _____			
Domestic Water	Mahwah Water	X	
Sewer			

- Utility data is required for the most recent available 12 month period. EMG can provide you with Excel form to assist you in supplying this data. Request this form from your Program Manager.
- Tenant paid data is required for best evaluation results. At minimum a representative sample of actual tenant consumption and cost is required for the 12 month period.

Tenant Utility Cost Paid By		
	Landlord or Housing Authority	Tenant
Heating		X
Cooling		X
Domestic Hot Water	X	
Water Supply	X	
Sewer	X	

Unk = Unknown, NA = Not Applicable	Yes	No	Unk	NA	Comments
1. Does the boiler or furnaces seem to be oversized for the property (i.e. – cycles on and off often)?		x			
2. Do any of the gas fired boilers, furnaces, or water heaters have vent or flue dampers?		x			
3. Does the boiler have outdoor reset controls?		x			
4. Does the County pay for the tenant gas or oil consumption?		x			
5. Are low-flow faucet aerators and shower heads installed on all or most faucets and showers?	x				
6. Are the water closets low-flow (1.6 gpf)?			x		
7. Are the motors used for the elevators high-efficiency motors?				x	

Unk = Unknown, NA = Not Applicable	Yes	No	Unk	NA	Comments
8. Are the motors used for the ventilation systems (i.e. - air handlers, fan coils, etc.) high-efficiency motors?				x	
9. Are the motors used for the hydronic heating system (i.e. -- pumps) high-efficiency motors?			x		
10. Are the motors used for the hydronic cooling system (i.e. – pumps, chillers, cooling tower fan) high-efficiency motors?				x	
11. Is there any uninsulated heating water, chilled water, or domestic hot water piping in unconditioned spaces such as mechanical rooms, basements, or storage areas?	x				
12. Is a booster pump required to maintain water pressure at the property?		x			
13. Are laundry room washing machines fixed to cold rinse only?		x			
14. Are there any wall or window leaks?		x			
15. Are there any poorly insulated areas?		x			
16. Do the utilities (electric, gas, sewer, water) provide adequate service?	x				
17. Are HVAC systems at the property inspected and maintained, at a minimum, annually?	x				
18. Is the HVAC equipment more than ten years old?	x				Each unit has their own wall hung boiler, storage tank, and wall sleeves for the tenant's provided air conditioners. Some of the items are over 10 yrs old.
19. Are the water heaters/boilers more than ten years old?	x				See above
20. Are the any leaks or pressure problems with natural gas service?		x			
21. Is the electrical service adequate?	x				
22. Are there any emergency electrical generators?		x			
23. Are there any large UPS battery systems?	x				For the community building there is an fire alarm panel that has battery backup

Unk = Unknown, NA = Not Applicable	Yes	No	Unk	NA	Comments
24. Are there any vacant buildings or significant building areas?		x			
25. Is there anything else that EMG should know about when assessing this property? If so, what?		x			

APPENDIX H:
RESUMES AND CERTIFICATIONS

EDWARD BEEGHLY

Quality Assurance Manager

Education

- Pursuing Masters of Engineering in Project Management – UMD College Park
- Ohio Northern University; Bachelor of Science, Civil Engineering, May 1995
- Valley Forge Military College; Associate Degree in Business, May 1991

Project Experience

- ***Charlottesville Department of Public Works, Charlottesville, NC –*** Mr. Beeghly, as the Program Manager on this project, which includes the assessment of eight sites encompassing over 161,000 SF. Projects under this contract include office buildings, a county health center, a fire station, an historic center and an opera house. EMG was responsible for assisting the DPW in developing their capital facilities plan for major rehabilitation projects at these buildings. EMG performed ADA assessments, facility assessments, and completed cost estimates per the RS Means model, adjusted to the location of the projects. Mr. Beeghly was responsible for management of the assessment teams and technical review of deliverables.
- ***Atlanta Housing Authority, Atlanta, GA –*** Mr. Beeghly is serving as the Program Manager for this ADA and Section 504 Assessment. He is responsible for managing the EMG team, as well as technical oversight and facilitating communication between EMG and AHA. Mr. Beeghly's knowledge of multifamily housing will lead the team to provide ADA assessments. EMG will provide AHA with design solutions to bring each facility in compliance with UFAS, and HUD Section 504 standards.
- ***MDSHA District 3, Greenbelt, MD (Chief of Engineering Systems) –*** Mr. Beeghly served as the Chief of Engineering. During this time he managed a staff of seven, including four project managers, two engineering technicians, and one administrative assistant. Their projects included 10 consulting contracts valued at $12 million dollars. Additionally, he served as Program Manager for District 3's (Suburban Washington D.C.) system preservation programs. He was fiscally responsible for multiple programs valued upwards to $90 million dollars. He tracked asset management performance goals, program budget, network condition, and public commitments in determining individual project scope and program priority.

Industry Tenure

- A/E: 1995
- EMG: October, 2006

Related Experience

Industry Experience

- Government
- Office
- Industrial
- Affordable/Multi-family Housing
- Healthcare
- Retail
- Hospitality

Active Licenses/Registration

- Engineer in Training – Maryland

Special Skills & Training

- Dean L. H Archer Senior Design Award (Ohio Northern University)
- Geometric Design
- Highway Materials
- Pavement Design
- Project Management

Memberships

- Association of State Highway Engineers

SOLOMON ROSENBAUM

Technical Report Reviewer

Education

- B.S., Mechanical Engineering, Columbia University, 2000
- M.S., Mechanical Engineering, Columbia University, 2002

Project Experience

- ***N. Carolina school district –*** As a Sr. Project Engineer, Mr. Rosenbaum analyzed historical electrical and gas usage data for 140 schools in the district. After prioritizing the schools based on several usage factors, Mr. Rosenbaum began an audit program that would review all schools individually over a 3 year period. Mr. Rosenbaum's audits have led to several energy conservation measures that have helped the district reach its energy reduction goals.
- **Washington D.C., Federal archive facility** – As construction/project manager, Mr. Rosenbaum oversaw an $8.6 energy project in a 2 million ft² facility. The project included the construction of an addition to the building to house a new cooling plant. Further lighting and HVAC energy reduction measures were taken in the interior of the building.
- **Virginia, military base** – During the development phase, Mr. Rosenbaum was responsible for the design of new heating systems in several buildings and the layout of 10 miles of new gas piping on the base. During the construction phase, Mr. Rosenbaum assisted in the construction management and performed commissioning & verification at the completion of each installation.

Industry Tenure

- A/E: 2002
- EMG: 2010

Related Experience

- HVAC system design and specification
- Control system sequence of operations
- Lighting & occupancy sensor design
- Project development & savings analysis
- Construction & project management
- Commissioning, measurement & verification

Industry Experience

- Government Facilities
- Military Facilities
- Office
- Industrial
- Housing/Multi-family
- K-12
- Higher Education
- Research centers

Active Licenses/Registration

- Licensed P.E. in MD

Regional Location

- Baltimore, MD

JILL E. ORLOV

Technical Report Reviewer

Education

- Master of Architecture - University of Pennsylvania
- Bachelor of Science, Architecture - University of Virginia

Project Experience

- ***Hotel Property; Pittsburgh, PA –*** As Project Manager, Ms. Orlov performed a Property Condition Assessment of this 132 unit, six-story hotel property. She reviewed the condition of the building structure and systems and developed a thorough report, delivered on time and on budget.
- ***Nursing Home; Charleston, SC –*** Ms. Orlov completed a Property Condition Assessment of this 89,900 square feet building consisting of 148 units. Her findings included information on existing building conditions, site improvements, mechanical and electrical systems and code accessibility information.
- ***Office Building; Richmond, VA –*** Ms. Orlov completed a Property Condition Assessment on this 31,000 square feet, two and three story office building located in Richmond. She conducted interviews with the property manager and maintenance staff. Findings included information on existing building conditions, site improvements, mechanical and electrical systems and code and accessibility information.
- ***Higher Education Stadium; Fairfax, VA –*** Ms. Orlov completed a Property Condition Assessment on this 162,221 square feet, three story sports arena building located in Fairfax. Findings included information on existing building conditions, site improvements, mechanical and electrical systems and code and accessibility information. The client found her structural and roof observations critical to their final business decision. This project was a part of a large portfolio of projects EMG completed for our client.
- ***Accessibility Study of Office Building –*** New Orleans, Louisiana – Ms. Orlov completed a detailed handicapped accessibility study of a large hotel conference center.
- ***Multi-Family; Northeast –*** Ms. Orlov performed Property Condition Assessments on a large scale multi-family property converted from an historic mill complex. The site comprised a variety of past use buildings which had undergone major gut renovations.

Industry Tenure

- A/E: 1991 - 2004
- EMG: July, 2004 to present
- Commercial Real Estate Due Diligence: 2004

Industry Experience

- Government Facilities; 2004
- Office; 2004
- Industrial/Warehouse Facilities; 2004
- Housing/Multi-family; 2004
- Affordable Housing/HUD; 2004
- K-12; 2004
- Higher Education; 2004
- Hospitality; 2004
- Healthcare/Senior Living; 2004
- Retail; 2004
- Level 1 Energy Audit; 2004
- Level 3 ADA Audit; 2013

Active Licenses/Registration

- Architectural, Maryland
- Architectural, Pennsylvania - pending

Special Skills & Training

- AUTOCAD, 2000

Regional Location

- Baltimore, Maryland

KEVIN M. LANTRY, CEM

Lead Project Manager

Education

- Bachelor of Science, Mechanical Engineering - Purdue University School of Mechanical Engineering, 2003.

Project Experience

- ***Indianapolis Housing Agency, Indianapolis, IN –*** Lead Project Manager. Completed Physical Needs Assessments and Energy Assessments at 11 multifamily and senior living properties in the City of Indianapolis. Provided subsequent comprehensive update assessments for Tax Credit Rehabilitation purposes. Reports included life/safety concerns, deferred maintenance, capital planning, and ADA issues. Compiled capital plan into EMG's AssetCALC database software for client use.
- ***Ann Arbor Housing Commission, Ann Arbor, MI –*** Lead Project Manager. Completed Physical Needs Assessments and Energy Audits at 17 multifamily and senior living properties in the City of Ann Arbor. Compiled PNA Reports along with energy benchmarking, conservation measures, and financial calculations.
- ***Housing Authority of the City of Paterson; Paterson, NJ –*** Project Manager. Completed Energy Audits at office, residential, and recreational properties owned and operated by the Housing Authority of Paterson. Energy Audits included physical assessment, plan review, utility consumption analysis, and energy conservation recommendations.
- ***Mark to Market Green PCAs; Various Locations –*** Project Manager. Completed multiple Mark to Market Green PCAs per Housing and Urban Development (HUD) protocol. Reports included standard mark to market assessments with energy audits including ECMs and recommendations for sustainability.
- ***Alan Bible Federal Building; Las Vegas, NV –*** Project Manager. Completed a Level IV Building Engineering Report (BER) for the US Government General Services Administration. Evaluated the mechanical, plumbing, and elevator systems as part of the assessment team sent by EMG to analyze all building components.
- ***First Energy Facility Assessments; Multiple Sites, PA*** - Project Manager. Performed facility assessments on over forty sites in central and eastern Pennsylvania. Evaluated district offices, regional headquarters and maintenance facilities. Compiled results into Facility Condition Reports and AssetCALC software.

Industry Tenure

- A/E: 2001
- EMG: 2004

Related Experience

- GSA Assessment Team

Industry Experience

- Industrial
- Commercial
- Multi-family Residential
- Affordable Housing
- Condition Assessment
- Energy Auditing

Active Licenses/Registration

- Engineer in Training (EIT) Indiana ET 31011662
- Association of Energy Engineers Certified Energy Manager CEM #16678

Special Skills & Training

- Certified Multifamily Building Analyst by Building Performance Institute (BPI)
- Training Program for Energy Managers by the Association of Energy Engineers (AEE)
- AutoCAD
- VFA.Facility Certified
- Cross Trained for Environmental Assessments

Memberships

- ASHRAE
- U.S. Green Building Council

Regional Location

- Indianapolis, Indiana

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The Association of Energy Engineers

certifies that

Kevin M. Lantry

has completed the prescribed standards for certification,
has demonstrated a high level of competence and ethical fitness
for energy management, and is hereby granted the title of

CERTIFIED ENERGY MANAGER

Expiration Date:

December 31, 2014

CEM

16678

ASSOCIATION OF ENERGY ENGINEERS CORPORATE SEAL GEORGIA

CEM Board Chairman

CEM Director