Conditions Assessment, 15 May 2024

Hudson Public Library

Hudson, MA

Prepared by: Sorensen Partners | Architect + Planners, Inc., Westborough, MA
For: Hudson Public Library, Hudson, MA
Owner: Town of Hudson, MA

HUDSON
PUBLIC LIBRARY

SORENSEN
SORENSEN PARTNERS | ARCHITECTS + PLANNERS

Index & Introduction

Executive Summary

A. Planning Recommendation
B. Overview of Facility Critical Deficiencies
C. Alternative Sites

Narrative

1. Building & Site Description; Renovation Chronology
2. Floor Area & Current Uses; Space Metrics per Capita
3. Fire Protection, Fire Alarm & Fire Hazards
4. Structural Deficiencies
5. Parking
6. Entrances, Handicap-Accessibility Overview, and Lack of Handicap-Accessible Path-of-Travel
7. Elevator, Stairs & Interior Ramp
8. Additional Handicap-Accessibility Issues
9. Building Exterior Envelope: Energy Inefficiencies, Roofs, Downspouts, Windows & Facades
10. Hazardous Materials
11. Walls, Ceilings & Doors; Floors & Flooring
12. HVAC: Heating, Air Conditioning, & Lack of Ventilation Air
13. Plumbing, Bathrooms & Kitchens
14. Electrical & Lighting
15. Collections Shelving, Casework & Furniture

Appendices

A. 2024 Tripi Engineering Services, LLC, March 14, 2024: "Summary of Findings and Recommendations from Settlement Investigation, Geotechnical Investigation, and Review of Structural Capacity of the First Floor Framing to Support a New Rack Layout"
B. 2023 Geotechnical Engineering Report, Hudson Public Library, 1966 Addition Renovations, McPhail Associates, Christopher Miller, PE (MA License #56755) & Jonathan Patch, PE (MA License #47156)
C. 2023 Preliminary Foundation Engineering Report, Hudson Public Library, New Addition, McPhail Associates, Christopher Miller, PE (MA License #56755) & Jonathan Patch, PE (MA License #47156)

Format & Purpose of this Document

The goal of this Conditions Assessment is to document the status of Hudson Public Library building and site capital items. Deficiencies noted in the Assessment are items recommended for follow-up in future funding allocations to the Library. Conversely, portions of the building and site that are spatially and aesthetically commendable are recommended for protection and further enhancement. Severely deteriorated conditions are mentioned insofar as they should be considered and further studied by future architecture and engineering professionals in their designs to rehabilitate, demolish, and/or re-build portions of the Hudson Public Library.

Sorensen Partners | Architects + Planners, Inc., headed by a Massachusetts-licensed Architect (#50435), conducted this study pursuant to the terms of a contract between Sorensen Partners and Hudson Public Library. Hudson Public Library is being presented to the Massachusetts Board of Library Commissioners' 2023-2024 grant round for the Massachusetts Public Library

Construction Program (MPLCP) per MGL 605 CMR 6.00. Interviews by Sorensen Partners with the following individuals familiar with the building's history contributed to this assessment:

Ray Girard, Town of Hudson Director of Facilities, 2000-2022
Aileen Sanchez-Himez, Director, Hudson Public Library, 2019-Present
Trisha Desmond, Director, Hudson Public Library, 1990-2016
Matthew Tripi, Structural Engineer, Tripi Engineering
Tom Curley, Curley Plumbing & Heating (Town of Hudson Contract, Plumbing & Heating)
Michael Cardinale, Cardinale Electric (Town of Hudson Contract, Electrician)
Charlie MacGregor, BluSky/ReBuildEX (Contractor for Insurance Repairs from Burst Steam Pipes)

Sources Consulted

Sorensen Partners | Architects + Planners, Inc. (SP) consulted the documents listed in Appendices A, B, and C, and the following drawings and reports:

1. 1966 Addition to the Hudson Public Library – Architects Aldrich (MA License #764) & Staniunas (MA License #1059) (Hudson, MA)
2. 1988 Hudson Historical Commission. HUD.124 Hudson Public Library.
3. 1994 ADA Improvements to Hudson Public Library – Brown & Lindquist (MA License #3046) (Yarmouthport, MA); Charles Mello (Struct. Eng.); BE Lynch (Mech. Eng.); Shepherd (Elec. Eng.)
4. 2001 Hudson Public Library Renovation/Expansion of the Children's Room – Jackson Architects (Chicago, IL), RES Engineering (Hudson, MA)
5. 2010 Hudson Public Library (Window replacement project) – Glenn Davis Architects (MA License #7340) (Hudson, MA)

Executive Summary

/ A. PLANNING RECOMMENDATION

The 1966 Addition portion of the Hudson Public Library is not constructed on a suitable foundation system nor is the foundation built on suitable subgrade to the extent that would be designed and required by licensed structural engineers operating under the "Standard of Care" in the Commonwealth of Massachusetts. The 1966 Addition's structural drawings were designed and stamped by licensed Massachusetts architects and bear no structural engineer's stamp. Review of the existing conditions at the 1966 Addition portion of the building by Sorensen Partners (Architect), Tripi Engineering Services (Structural Engineer), and McPhail Associates (Geotechnical Engineer) demonstrates that the foundations have settled differentially, causing cracking of the façade and movement of sections of the building – at the north stair tower and at the expansion joint connecting to the Carnegie Building – by up to 2.5 inches. Sorensen Partners' field observations and interviews with tradespeople working at the building demonstrate that areas of the Ground Floor slab have settled up to 2 inches over 15 feet (along the north staff kitchen and bathroom area) and that the repeated bursting and cracking of heating steam pipes which are pinned to the building's structure is exacerbated by the differential settlement. Window surrounds throughout the 1966 Addition have hairline cracks emanating from the corners, indicating that caulk joints will continue to enlarge and prevent the window installation from being water-tight. The expense of retroactively supporting the 1966 Addition's foundation from below would be compounded by the further expense of upgrading the 1st Floor framing to support the load of physical collections, since this approximately 2,500 square-foot area was only designed as a "reading room."

For the 1966 Addition portion of the Hudson Public Library, rectifying the critical deficiencies and/or undertaking the facility improvements listed within this Conditions Assessment should be pursued on a short-term planning horizon, and in the case of professional judgment (including of Town or Commonwealth personnel, professional design consultants, and/or tradespeople performing work in the building) indicating a need to rectify critical deficiencies to protect the public health, safety and welfare in the short-term.

To the extent that improvements can be made to the landmarked 1904/1929 Carnegie Building in a rigidly-attached manner (such as would not be dislodged in the case of future construction on the site) with a flexible state-of-the-art system design that is capable of expansion to integrate with a future facility addition, those improvements should be undertaken as funding permits.

/ B. OVERVIEW OF FACILITY CRITICAL DEFICIENCIES

1. Program Space is Insufficient for Service Population (See Narrative, 2.)
The existing building contains approximately 15,569 gross square feet (GSF) of space within all floors – Basement, Ground Floor, 1st Floor, 2nd Floor, and Attic. Hudson's population is 20,095 per the 2020 census and is projected to increase to 21,299 by the 2050 census. Nationwide benchmarks show about 0.8 – 1.2 square foot per capita is the normative range for a service population. Hudson Public Library is presently providing 0.77 square feet per capita. A library sized for the 2050 projected service population would be between 17,039 and 25,559 gross square feet in size (see table below), yielding a space deficit of between 1,470 and 9,990 gross square feet.

2. Fire Sprinkler System is Not Present (See Narrative, 3.)
The building is not protected by a fire sprinkler system. A fire sprinkler system is a life-safety system of upmost importance to the health, safety, and welfare of building occupants and should be installed in the building as soon as possible.

3. Differential Structural Settlement of the 1966 Addition Foundations and Causally Related Problems (See Narrative, 4.)
Spread footings beneath portions of the 1966 Addition have settled differentially. The differential settlement has created a 2.5" gap at the joint between the Carnegie Building and the 1966 Addition; has resulted in cracking of the brick facade; and has either directly caused or complicated the cracking and bursting of steam pipes running in chases below the perimeter of the Ground Floor slab.

4. Bursting of Steam Heating Pipes and Resulting Water Damage (See Narrative, 4. & 12.)
Bursting and cracking of steam heating pipes have resulted in three shut-downs of sections of the Ground Floor Children's Room and the Staff Kitchen and Restroom – in 2003, 2021, and 2023; and one temporary area closure, in 2024. Each issue has resulted in water damage to carpets, wall finishes, and Library collections; and has required replacement of segments of cast iron steam heating pipes, followed by reconstruction of interiors. The bursting of the steam pipes is believed to be related to the differential settlement of the building foundations according to individuals interviewed.

5. Structural Design of 1st Floor (Main Floor) 1966 Addition Not Designed for Collections (See Narrative, 4. & 14.)
Structural Engineer Tripi Engineering has advised the Library that the number of books in the collections shelving area of the 1966 Addition 1st Floor must be decreased in order to reduce the weight of the book dead load, since the area was designed as a "reading room" and not as a collections area. Furthermore, Tripi advised the Library that book stacks cannot be rotated 90-degrees to improve sight lines from the circulation and reference desk, since the stacks currently span between floor joists, which is required in order for the floor to continue to support their weight.

6. Handicap-Accessible Path-of-Travel to the Building is Not Present (See Narrative, 6.)
The handicap-accessible entrance is located on the Ground Floor on the south side of the building; however, there is no handicap-accessible path-of-travel to this entrance from handicap-accessible parking in the lot behind the building and on the street in front of the building. The slope of the walkway located along the south side of the building is significantly greater than the permitted slope for a handicap-accessible ramp. Resolving this issue would require either an extensive switch-back ramp in Liberty Park or relocating the elevator to the front or rear of the building.

7. Elevator is not of Code-required Width for Accessibility, is Noisy, and has a History of Entrapping Passengers and Not Leveling Correctly (See Narrative, 7.)
The elevator, installed in 1994, is nearing the end of its expected useful life. It has a history of not leveling correctly, temporarily trapping individuals in the elevator shaft. The cab dimensions are undersized relative to current code. Furthermore, the operation of the elevator is noisy and disrupts the use of the McLellan Reading Room, a quite space for communal study and silent reading as well as an occasional event or program.

8. Cracking at Stair Tower and Associated Roof Gutters and Downspouts Resulting in Slip Hazards (See Narrative, 4., 6. & 9.)
The staff entrance/exit is located on the north side of the building abutting a stair tower added in the 1966 Addition. The stair tower has had cracking observed as early as 1990. The cracking of the stair tower has resulted in instability of the roof drainage on this portion of the building, and downspouts are not plumbed directly to underground drainage. Water accumulates at the base of the staircase causing slick ice in the winter, a slip hazard.

9. Energy Inefficiency and Failure of Areas of the Roof and Walls (See Narrative, 9. & 11.)
The roof of the 1966 Addition was last replaced in 1996 and is leaking in multiple locations. This roof is nearly 30 years old and should be replaced as soon as possible if the Library continues to provide services in this portion of the building. Energy efficiency of the roofs and walls are highly lacking. The roofs have only 1/3 of the code-required insulation levels (measured as "R-value," see tables below); and the walls have only 1/2 the code-required insulation levels. These deficiencies mean not only that utility costs are high for heating and air conditioning, but also that occupants are not likely to feel thermally comfortable while in the buildings, due to the cold surface materials surrounding them on the walls and ceilings.

10. Air Conditioning System is Marginally Functional (See Narrative, 12.)
Numerous components of the air conditioning system are in need of replacement. Occupants complain of thermal discomfort during summer months.

11. Boiler Requires Replacement; Replacement of Steam Heat Distribution with Hot Water is Recommended (See Narrative, 12.)
The boiler will require replacement in the next five years. Curley Plumbing & Heating, the Town's long-term service company, recommends replacing all of the steam heating distribution piping that has caused numerous leaks. Steam generated by the boiler is also converted to water to feed the front half of the heating supply locations in the building, which is an energy-inefficient system design. All piping and heating radiators should be hot water piping.

12. Lack of Ventilation Air (See Narrative, 12.)
The building lacks a ventilation air system for both the heating season and the cooling season. Fresh air ventilation is only introduced to the building during the opening and closing of the building's entrance doors. In order to provide code-required fresh

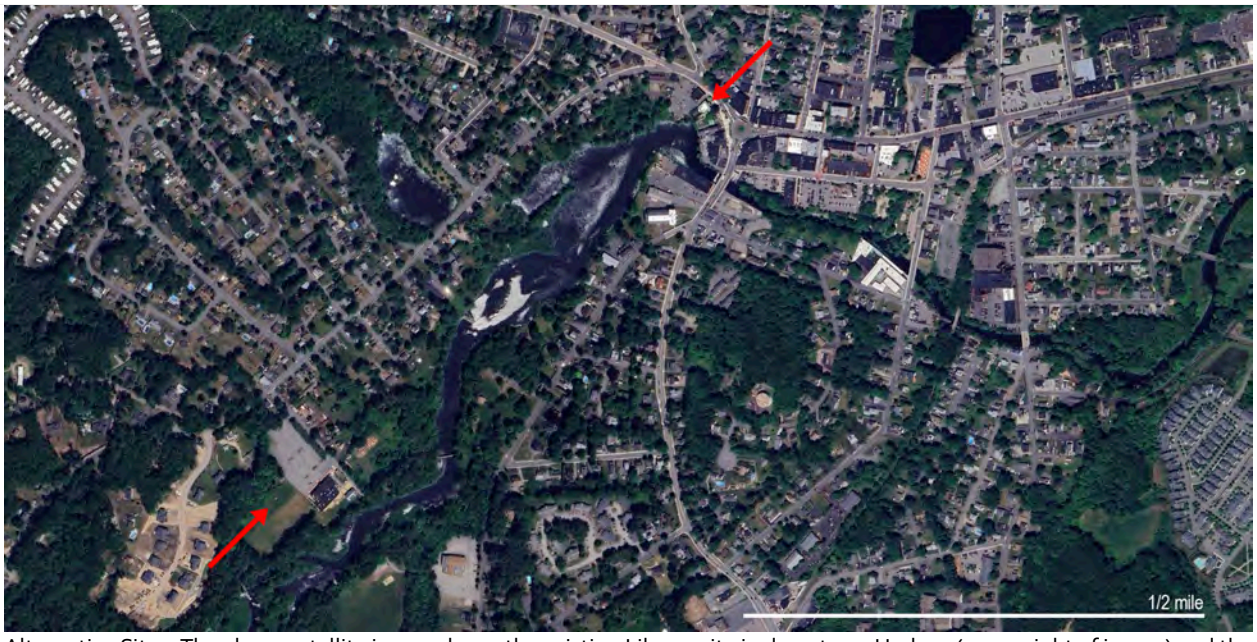
air ventilation to building occupants, mechanical outdoor air ventilation needs to be added to the building. Provision of fresh air ventilation has been linked to improved learning outcomes for school-age students. A rate of 5 cfm/person, or 0.12 cfm/ft² of outdoor air ventilation is required in the breathing zone (IMC 403.3.1.1. Minimum Ventilation Rates Table).

13. Bathroom Facilities' Distribution and Quality are Lacking; History of Sewage Backups (See Narrative, 13.)
The building contains four single-occupant toilet rooms: two below the stairs of the Carnegie Building, one in the Children's Room (handicap-accessible), and one in the staff area on the Ground Floor. While this quantity of toilet rooms is sufficient per code requirements for the current building size, the distribution (all located on the Ground Floor) of the toilets is problematic. Sewage backups are also frequent.

14. Electrical Power Supply is Maxed-out at Numerous Locations (See Narrative, 14.)
The staff kitchen, second floor Tavares Meeting Room, Director's Office, and IT areas near the reference desk are all maxed-out in terms of power supply that can be used without blowing a fuse. The Library has placed signs in these areas requesting that only one device or appliance be used at a time.

/ C. ALTERNATIVE SITES

The 1904/1929 Carnegie portion of the Library has sentimental value to many Hudson residents, and many Hudson residents appreciate the Library's downtown location, due in part to the downtown's recent renaissance. Hudson's 2014 Master Plan, prepared in 2014 by VHB, prioritizes protecting historic resources and safeguarding water resources and habitat. A rehabilitation of the 1904/1929 Carnegie portion of current Library, and an ecologically-sensitive site development, can address both of these goals. For this reason, and despite the difficulty of providing parking at the current site, keeping the 1904/1929 Carnegie Building and demolishing the failing 1966 Addition to build a larger purpose-built addition with integrated parking, utilizing the existing library property and the abutting Town-owned 0.37-acre property is a planning option considered in the Library's Strategic Plan. The Library's current location is in the C-1 Commercial - Varied Use zoning district. The Library is located on a 0.57-acre Town-owned parcel located at 2-4 Washington Street; this parcel includes the Library and Fire Station 1 buildings and the parking lot directly downslope of Fire Station 1. The Town also owns the abutting 0.37-acre public parking lot parcel located due west at 8 River Street. Future development (new construction) at this site would be subject to review under the Massachusetts Wetlands Protection Act (310 CMR 10.00).



Alternative Sites: The above satellite image shows the existing Library site in downtown Hudson (upper right of image) and the potentially developable land at the Portuguese Club property (lower left of image). Distance between the two sites is 0.65 miles as the crow flies, or 0.80 miles driving or walking.

A second planning option is to construct a new Library building at an alternative location in Town. Multiple locations were evaluated for ease of transportation access, available land of sufficient size for structure and parking, and proximity to downtown,

among other considerations. The Portuguese Club owns a 10.3 +/- acre site bordering the Assabet River and Port Street, located a 0.8-mile drive from the current site of the Hudson Public Library via River Street, an inter-town road with sidewalks on both sides. The site is comprised of two parcels, one located at 13 Port Street (4.66 acres), and an abutting parcel at 164 River Street (5.13 acres). The Portuguese Club's property borders two Town-owned parcels – a 2.52-acre conservation area at 10 Port Street used as the Hudson Community Garden, and a the riverfront Apsley Park, a 1.60-acre conservation area with dirt footpath from which a footbridge crosses the river to Wood Park, located along Park Street. Park Street is likewise an inter-town road leading into downtown Hudson with sidewalks on both sides. The Portuguese Club operates two function facilities and a chapel on the site and has an approximately 100,000-square foot parking lot which could be jointly used. The site's owners have expressed to the Library that they would consider a purchase and sale transaction for some or all of the property. There is approximately 40,000 – 60,000 square feet of developable land (currently wooded and used as a soccer field) on the site located southwest of the parking lot and banquet facility that could be used as a building site for a new building without violating zoning setbacks, frontage requirements, or building fire separation requirements, or the 200-ft riverfront setback requirement of the Massachusetts Wetlands Protection Act. The property has approximately 66 feet of frontage along Port Street. The FEMA 100-year flood zone encompasses the smaller of these two function facilities and lies approximately 15 ft southeast of the larger of the two facilities. The developable land includes two (2) upland areas characterized as *Bordering Vegetated Wetlands* (BVW), one of which encompasses a small seasonal pond; a BVW along the Assabet River, and the *Inner and Outer Riparian Zones* associated with the Assabet, according to the property owner's as-built survey. McPhail Associates' preliminary review of historical topographic maps appears to indicate "that the river may have traversed the Portuguese Club site at some point" and that "there is the possibility that there may be an organic layer underlying the fill material." This site is located in the SB Single Family zoning district. Future development (new construction) at this site would be subject to review under the Massachusetts Wetlands Protection Act (310 CMR 10.00).

Alternative Site: 40,000 – 60,000 square feet of vacant land southwest of the Portuguese Club parking lot and banquet facility

Narrative

/ 1. BUILDING & SITE DESCRIPTION; RENOVATION CHRONOLOGY

The Hudson Public Library, located at 3 Washington Street in downtown Hudson, MA, is a three-story approximately 15,000 square-foot structure measuring approximately 45 ft by 125 ft and facing the town's revitalized pedestrian-friendly retail and restaurant promenade. It consists of a 1904 historic Carnegie library and a 1966 addition that is structurally deficient. The front portion of the building, a 1904 Colonial Revival Carnegie library listed in the State Register of Historic Places (Inventory No. HUD.124), is a stone block structure with a timber-framed metal roof and is nestled between a historic fire station and Liberty Park, a popular public riverfront park. The 1904 Carnegie Building has a Main Floor (1st Floor) accessed from Washington Street up two short flights of stairs, and a Ground Floor and 2nd floor both accessed by a bifurcated staircase located directly inside the Washington Street entrance. Across Liberty Park lies St. Luke's Episcopal Church, likewise designed by Earl Aldrich but in the Queen Anne style.

Renovation Chronology:

- 2024 Repairs due to burst steam heating pipes at Ground Floor ceiling in front of elevator
- 2023 Major Repairs due to burst steam heating pipes at Ground Floor (30-ft length replaced from stage to stairwell), staff kitchen side, under floors, steam coming up walls then back through the ceiling – RJ Curley Plumbing (contractor) & BluSky (contractor)
- 2023 Mold and Mildew above Ground Floor staff kitchen and staff toilet remediated
- 2021 Major Repairs due to burst steam heating pipes at Ground Floor ceiling in front of elevator; affected area around the circulation desk and an adjacent collections area (scope included metal studs & track, insulation, plaster, and additional Carpenter Ant abatement of areas not previously accessible in 2012) – RebuildEX (contractor)
- 2021 Asbestos-containing Floor Tile ("VAT") removed throughout Ground Floor; cracks in concrete subfloor up to 1/2" wide were skim-coated; new carpet installed – RebuildEX (contractor)
- 2015 Repairs due to roof leak and pipe freeze water damage at the SE corner of the 2nd floor and attic of the Carnegie Building (plaster in 2 rooms, ceiling & stairs); the pipe enters the attic at the SE corner – RebuildEX (contractor)
- 2015 Elevator Repairs (invoice to Town account) – BBE Corporation. New rollers, new safety switch to coordinate with fire alarms, to prevent the cab from opening at the floor with the fire
- 2014 Roof Repairs at expansion joint between the 1966 Addition and the Carnegie Building (invoice to Town account) – Rockwell Roofing Inc. & RJ Curley Plumbing (contractors)
- 2014 Air Conditioning installed, Trane system, in Ground Floor NE corner (invoice to Town account) – Chaves Heating & AC (contractor)
- 2016 Window Replacement of a majority of the building's windows – Coulter Construction (contractor)
- 2012 Carpenter Ant abatement at Ground Floor in the Carnegie Building; removed plaster furring walls on old stone foundations to access the issue, replaced with sheetrock furring walls – *date approximate*
- 2012 Cooling Tower repaired (invoice to Town account) – RJ Curley Plumbing (contractor)
- 2012 New AC Condenser installed outside the back of the building to serve the portion of the Ground Floor in the 1966 Addition
- 2010 Re-roof of Carnegie Building with patina green-color PVC roof with PVC deco-ribs (imitation copper roof) – SOM Construction (contractor)
- 2003 Repairs due to burst steam pipe in the concrete pipe chase under the stage, north side Ground Floor of the 1966 Addition *date approximate*
- 2002 Replace book return bin at front side-wall of main entrance (not handicap-accessible)
- 2001 Major Interior Renovation of Children's Room (Ground Floor), converting civic room to Library program space; new casework, circulation desk, collections shelving, lighting, ceilings, carpeting; upgrades to heating registers and grills at Ground Floor; minor exterior work; and replacement of south-side Ground Floor doors.
- 2000 Masonry work at north stairwell to repair cracks due to stairwell pulling away from the building
- 1999 Front Doors of Carnegie Building replaced – Dovetail, Maynard (contractor) *date approximate*
- 1998 Re-roof: Installation of new roof on 1966 Addition – Rockwell Roofing Inc. (contractor)

- 1997 Bathroom renovation for two single-use bathrooms under the stairwell in the Carnegie Building
- 1996 Handicap-accessibility Upgrades: Elevator added (not code compliant); ramp added within Children's Room; exterior ramp upgraded along Liberty Park (not code compliant) – A.R. Rahimi (contractor)
- 1995 Ivy removed from Carnegie Building facade and perimeter beds – Town of Hudson (contractor) *date approximate*
- 1989 Railings replaced at main entrance stairs, with Historic Commission approval – Arrow Fence (contractor)
- 1988 Fire Alarm 5-zone system installed
- 1987 Book Return Bin added at front side-wall of main entrance (not handicap-accessible)
- 1966 Addition of 50 x 79-ft brick and frame addition (approx. 6,500 GSF), 24-ft high, including Civic Room (Ground Floor) – A. Cibelli & Sons Inc. (contractor)
- 1929 Addition of 2nd floor and pitched roof to the original Carnegie Building (for Historical Society Museum)
- 1904 Construction of the original Carnegie Building (1st floor and Ground Floor)

Hudson Public Library shares a 0.57-acre parcel ("2-4 Washington Street") with the Hudson Fire Department Station 1, both of which have street frontage. Public parking for the Library and other downtown occurs on the directly adjacent 0.37-acre parcel ("8 River Street"). Driveway access to the rear parking lot is via an easement on the adjacent privately-owned property at 14 River Street and via a driveway located between the Library and the Fire Department.

Hudson Public Library (right); Fire Station (left); and Town public parking lot (foreground).

The Library is sited on land that slopes about 15 feet to the pedestrian walkway along the Assabet River, where the Library's 1966 Addition and boiler room abut a pedestrian path and public parking lot. The FEMA 100-year flood zone encompasses the walkway but not the building's footprint. Water ponds at this riverbank, where the river turns ninety degrees from southwest to southeast and passes over a dam and spillway at Washington Street. Properties abutting the 150-foot section of the Assabet River preceding the dam have built abutments and dike walls, and the Library property's southwest edge is likewise lined with a concrete retaining wall which appears to be in fair to poor condition. For parking information, see Narrative, 5.

The 1966 Addition, constructed of brick over concrete block with uninsulated exterior walls and minimally insulated roof, measures approximately 50 ft x 79 ft, reduced by an approximately 35 ft x 20 ft section where the stair and elevator towers wrap the footprint of the Carnegie Building on the north and south side, respectively. The building was constructed on conventional concrete spread footings, which have settled differentially lower on the down-slope portion of the building, as evidenced by cracking in the building's brick facade and leaning of interior book stacks. The rate differential settlement is under observation by Tripi Engineering. The construction drawings for the building's structural, mechanical, plumbing, and electrical systems were designed by two licensed architects (design by a licensed structural engineer was omitted). The Main Floor (1st Floor) was designed for live loads corresponding to a reading room, which highly limits the number of physical collections that can be accessed in this area; due to recommendation by Tripi, the Library has weeded the stacks significantly. Tripi has advised the Library that the book stacks must be oriented perpendicular to the wood floor joists as they are now, and thus the flexibility of changing book stack direction to promote visibility throughout the Main Floor (1st Floor) is not available. Vinyl asbestos tile is among the finish materials present in the 1966 addition.

The building has two public-serving entrances: the historic entrance accessed from Washington Street, which leads to the Main Floor (1st Floor) adult area, teen space, and TEC Lab; and the handicap-accessible entrance accessed via a non-code compliant ramp that runs downhill along Liberty Park to the Ground Floor children's spaces. A hydraulic passenger elevator, installed in

1994, is located directly inside the Ground Floor entrance and services the three floors of the building; a ramp inside the Ground Floor children's spaces was also added at this time.

The Library site slopes about 15 feet down from street level to the pedestrian walkway along the Assabet River.

/ 2. FLOOR AREA & CURRENT USES; SPACE METRICS PER CAPITA

The existing building contains approximately 15,569 gross square feet (GSF) of space within all floors – Basement, Ground Floor, 1st Floor, 2nd Floor, and Attic. Hudson's population is 20,095 per the 2020 census and is projected to increase to 21,299 by the 2050 census. Nationwide benchmarks show about 0.8 – 1.2 square foot per capita is the normative range for a service population. Hudson Public Library is presently providing 0.77 square feet per capita. A library sized for the 2050 projected service population would be between 17,039 and 25,559 gross square feet in size (see table below), yielding a space deficit of between 1,470 and 9,990 gross square feet.

Hudson Public Library Floor Area *(estimated – square feet)*

Floor Level	Program	Gross (GSF)	Net (NSF)
Attic	Storage (Unconditioned), Air Conditioning Equipment	1,100	1,045
2nd Floor	Quiet Study, Meeting, Staff	3,090	2,936
1st Floor (Main Floor)	Adult Collections, Reference, Circulation, Teens, Staff	5,312	5,046
Ground Floor	Childrens Room, Childrens Circulation, Staff, Toilets	5,312	5,046
B	Boiler & Air Conditioning Equipment	750	713
Subtotal	**Carnegie Building Footprint only**	**10,370**	9,852
Total	**All Floors**	**15,569**	14,786

Hudson Public Library Floor Area Space Deficit

(Compared to U.S.-wide normative range for a service population)	
Hudson Population 21,299 (2050 census) X 0.8 multiple	17,039
Hudson Population 21,299 (2050 census) X 1.0 multiple	**21,299**
Hudson Population projection 21,299 (2050 census) X 1.2 multiple	25,559
Space Deficit (low end of range)	1,470
Space Deficit (high end of range)	9,990

The 1st Floor, also referred to as the Main Floor, has the main circulation desk, the adult collections including audiovisual formats, large print, and Portuguese and Spanish materials, reference help, IT help, public computers and printer, photocopier, microfilm machine, collections shelving, the teen area, circulation workroom, and director's office.

The 2nd Floor includes the McLellan Room, a reading room with capacity for twenty (20) people), which is otherwise used as a communal quiet study and an occasional event or program space; the Tavares Room, a meeting room for 6-8 people; and an L-shaped office suite for technical services and the assistant director's office space, as well as the access door to the attic which is

accessible via the Tavares Meeting Room. The lower portion of the attic, used for storage, is located on the 2nd Floor but is not climate-controlled nor does it have direct staff elevator access.

The Ground Floor, also referred to as the Children's Room, has the children's circulation desk, children's collections and play areas, grade-school collections, an Educators & Caregivers collection, and children's Portuguese and Spanish language collections.

/ 3. FIRE PROTECTION, FIRE ALARM & FIRE HAZARDS

/ FIRE PROTECTION

The building is not protected by a fire sprinkler system. A fire sprinkler system is a life-safety system of upmost importance to the health, safety, and welfare of building occupants and should be installed in the building as soon as possible. Since the Hudson Public Library is over 7,500 gross square feet in floor area, a "major" alteration of the existing building would trigger a code requirement for installation of a new automatic fire sprinkler system throughout.

/ FIRE ALARM

The building has a 5-zone fire alarm system designed in 1988 by Architect John A. Murphy Associates of Hingham (MA #02043). There are no known violations in the system; however, it is not designed to current Fire Alarm code requirements. The Fire Alarm indicator panel is located inside the door of the staff entrance on the north side of the building. This door is closest in proximity to the adjacent Fire Department building. The Simplex Fire Alarm control panel is located in the boiler room in the basement, below the 1966 Addition.

The fire alarm zones are as follows:

- Zone 1: Boiler Room
- Zone 2: Ground Floor (re-wired in 2001 renovation)
- Zone 3: First Floor
- Zone 4: 2nd Floor
- Zone 5: Attic
- Zone 6: Location not identified (added in 2001 renovation)

Fire Alarm indicator panel is located inside the door of the staff entrance on the north side of the building.

Simplex Fire Alarm control panel is located in the boiler room in the basement, below the 1966 Addition.

/ FIRE HAZARDS

Some areas within the library have a higher fire hazard classification and thus present a greater risk being unsprinklered. Within a short-term planning horizon, further analysis by a licensed fire protection designer should be undertaken to assess fire hazard risks throughout the Hudson Public Library and advise on any short-term changes that should be made to reduce risks.

Under NFPA 13, libraries are considered a Light Hazard (LH) occupancy, while large library stack rooms are required to be protected as an Ordinary Hazard (OH) occupancy. The majority of the library's book stack collections areas meet the definition of Ordinary Hazard (Group 1), with stockpiles of combustibles not exceeding 8 ft, and a moderate quantity of combustibles.

Storage areas within the library, including the attic of the Carnegie Building, the craft room (former stage) on the Ground Floor, and the circulation workroom on the 1st Floor, should be assessed for any stockpiles of flammable materials greater than 8 feet in height.

The attic of the Carnegie Building is a potential fire hazard area due to the exposed spray foam applied to the underside of the roof. Spray foam insulation typically contains fire retardant materials, but is nonetheless combustible.

The boiler room is a fire hazard area due to the presence of the boiler and adjacent oil tank. Design drawings indicate that this room is separated from the Ground Floor by a reinforced concrete floor slab, providing a degree of fire protection. However, the door to the boiler room does not seat correctly in its frame and should be replaced by a fire-rated door and frame assembly.

Any areas with combustible materials stacked higher than 8 feet, such as the circulation work room on the 1st Floor, should be assessed for fire risk.

Combustible materials higher than 8 ft and combustible spray foam insulation on the inside of Attic roof.

/ 4. STRUCTURAL DEFICIENCIES

Spread footings on uncontrolled fill have settled differentially, resulting in apparent movement of portions of the 1966 Addition both down-slope towards the west and towards the north. The differential settlement has created a 2.5" gap at the joint between the Carnegie Building and the 1966 Addition; has resulted in cracking of the brick facade; and has either directly caused or complicated the cracking and bursting of steam pipes running in chases below the perimeter of the Ground Floor slab.

The 1966 Addition portion of the Hudson Public Library is not constructed on a suitable foundation system nor is the foundation built on suitable subgrade to the extent that would be designed and required by licensed structural engineers operating under the "Standard of Care" in the Commonwealth of Massachusetts. The 1966 Addition's structural drawings were designed and stamped by licensed Massachusetts architects and bear no structural engineer's stamp. Review of the existing conditions at the 1966 Addition portion of the building by Sorensen Partners (Architect), Tripi Engineering Services (Structural Engineer), and McPhail Associates (Geotechnical Engineer) demonstrates that the foundations have settled differentially, causing cracking of the façade and movement of sections of the building – at the north stair tower and at the expansion joint connecting to the Carnegie Building – by up to 2.5 inches. McPhail's observations are as follows, and are further discussed in ***Appendix B***:

> The observed settlement of the existing 1966 addition is considered to be the result of the existing spread footings bearing on an 'uncontrolled' fill material which, at some explorations, was observed to be underlain by a highly compressible organic deposit. ... differential settlement appears to have occurred where the footing support transitions from a thin layer of fill overlying bedrock to a greater thickness of uncontrolled fill. ...it is recommended that supplemental foundation support be provided. (McPhail, 1966 Addition Renovations, 2023, 6-7)

Sorensen Partners' field observations and interviews with tradespeople working at the building demonstrate that areas of the Ground Floor slab have settled up to 2 inches over 15 feet (along the north staff kitchen and bathroom area) and that the repeated bursting and cracking of heating steam pipes which are pinned to the building's structure is exacerbated by the differential settlement. Window surrounds throughout the 1966 Addition have hairline cracks emanating from the corners, indicating that caulk joints will continue to enlarge and prevent the window installation from being water-tight. The expense of retroactively supporting the 1966 Addition's foundation from below would be compounded by the further expense of upgrading the 1st Floor framing to support the load of physical collections, since this approximately 2,500 square-foot area was only designed as a "reading room." (The 1st Floor framing diaphragm at the 1966 Addition is understood to have been designed for an approximate 60 pound per square foot live load for a library reading room, rather than a 150 pound per square foot live load for a library book stack room. Please refer to Tripi Engineering's memo in ***Appendix A***.)

Structural Engineer Tripi Engineering notes that today a new building on a site with similar soil conditions to the existing 1966 Addition site would be built with a deep foundation system (e.g., drilled micropiles, as specified by a geotechnical engineer) and/or some ground improvement. Please refer to ***Appendix C***, a geotechnical report by McPhail for structural design requirements for a theoretical new addition at the site.

Geotechnical Engineer McPhail's study of foundation design for a new structure in the vicinity of the existing 1966 Addition states "...where glacial till and/or bedrock was observed to vary from depths of approximately 13.5 feet or greater in the explorations, pile foundations will be required..." (McPhail, New Addition, 2023, 7) This commentary implies that pile foundations are a structurally recommended design for the existing conditions; whereas spread footings over uncontrolled fill – the design of the existing 1966 Addition – is not a correctly engineered design.

Town personnel have observed the cracking of materials (including interior walls and facades) in the north stairwell since 1990. A mason who was hired to repair this stairwell in 2000 commented that the staircase was pulling away from the main building. Following the mason's work to fill in the cracks, the cracks re-appeared. Multiple rounds of patching masonry cracks and repairing interior finishes have occurred in this stairwell.

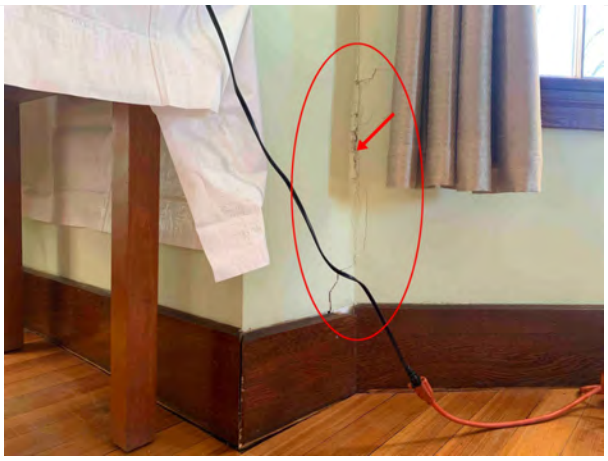
The Ground Floor concrete floor slab's deteriorated condition was observed in 2021 when the asbestos-containing flooring was removed throughout the 1966 Addition area in order to replace flooring due to burst steam heating pipes flooding the area. Many cracks were found throughout the floor, some ½ inch wide. In some areas, sections of the floor slab were found to be lifted higher than adjacent areas. The flooring subcontractor applied a concrete skim coat before installing new carpeting throughout this area. However, the underlying floor remains deteriorated and any future re-flooring of this area would have to include a new round of skim-coating. Since a structural engineer was not consulted when the ½ inch wide cracks were found, a correct grouted repair of the floor area was not performed, and thus the Ground Floor concrete slab is understood to be questionably sound.

Structural Engineer Tripi Engineering summarizes that the foundation of the 1966 Addition was not designed and built for the soil conditions present on site. Differential settlement has occurred, evidenced by the continued opening of the cracks in the building's façade. Tripi has been monitoring the cracks since summer 2023 and notes that while the overall trend is likely for the cracks to continue to increase in size, there is also seasonal change in the cracks' dimensions due to thermal and moisture cycling. Presently, while the building does not have a "clean bill of health," there is not an imminent danger to public health,

safety, and welfare directly due to structural failure. Tripi comments that in order to assess whether the building will be structurally safe in the future, the rate of building movement must be determined (through collection of additional longitudinal data). Tripi's recommendation is to continue monitoring and to continue to make probe openings/observations at the junction between the 1966 Addition and the Carnegie Building. According to Tripi, most of the connections are presently bearing and there is sufficient bearing length left; however, some connections and conditions are better than others. Please refer to ***Appendix A*** for Tripi's summary memo regarding the Library's structural deficiencies.

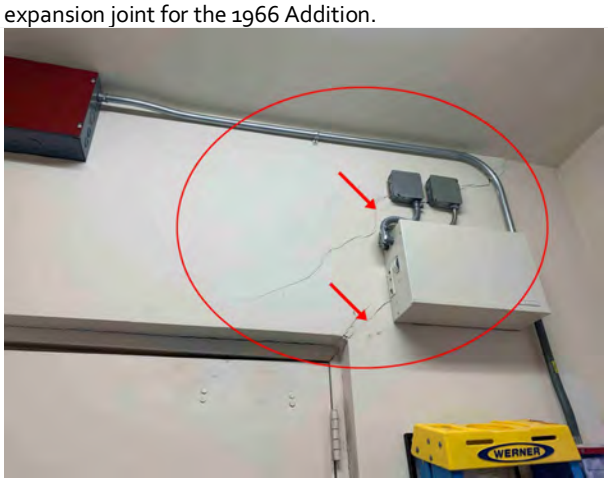
The Carnegie Building (1904) is a masonry bearing wall building (presumably 3-wythe brick) with an unknown floor framing system (possibly heavy timber). The roof of the 1929 Addition to the Carnegie Building is timber-framed and conventionally wood-framed. Partition walls within this portion of the building are likely to be wood stud walls. The Carnegie Building appears to be built predominantly on bedrock and suitable soils and does not show evidence of differential settlement. The foundation is a fieldstone foundation that is presumed to increase in width towards the exterior side of the building and that is presumed to be located below frost depth.

The 1966 Addition is a steel-framed building with infill masonry exterior walls (a single-wythe brick façade over concrete masonry units). The 1st Floor and Roof diaphragms consist of steel beams oriented north-south, bearing on steel columns located within the exterior walls; 2X12 wood joists bear on the steel beams and form the floor framing. The roof 2X12 framing is noted to have been pitched to drain. The building is supported on conventional spread concrete footings. The Ground Floor is a concrete slab on grade. The northeast corner of the 1966 Addition is bearing partially on bedrock. The remainder of the 1966 Addition appears to have been constructed on poorly compacted fill.



Cracking plaster indicates uneven settlement at the expansion joint for the 1966 Addition.

Cracking sheetrock wall at the rear of the 1st Floor. Cracking indicates uneven settlement of brick wall and foundations.



Cracking wall at the staff kitchen door leading to the boiler room, at the rear of the Ground Floor. Cracking indicates uneven settlement of brick wall and foundations.

Cracking sheetrock wall at the rear of the 1st Floor. Cracking indicates uneven settlement of brick wall and foundations.

Cracks along 1966 addition side facing Liberty Park.


Cracks along 1966 addition side facing Town parking lot.

/ 5. PARKING

Patrons use the Town-owned parking lot adjacent to the Library and the Town-owned South Street parking lot, in addition to on-street parking, which is ample and free in downtown Hudson, with a 2-hour time limit.

The Town-owned parking lot adjacent to the Library (located behind the fire station) has (7) Library staff spaces; (27) 2-hr spaces; (2) handicapped 2-hr spaces lacking an unloading zone; and (8) spaces with no time limit. Staff enter the Library through a door on the north side of the building that suffers from a ponding water issue at the bottom landing, a slip hazard that should be addressed in the near term to protect the public health, safety, and welfare.

On-street parking directly in front of and on the same side of the street as the Library includes (2) handicapped 2-hr spaces lacking a curb-cut or unloading zone; and (4) 2-hr spaces. There is a ponding water issue that occurs during rain events near the crosswalk directly in front of the library due to an overflowing street drain, which freezes over in the winter causing a slip hazard; this issue should be addressed in the short-term planning horizon in order to safeguard the public health, safety and welfare.

On-street parking lines both sides of the street throughout most of the downtown, including Washington Street, Central Street, Felton Street, and Main Street, which all meet at "Wood Square," the center of downtown Hudson, which is a former trolley roundabout located about 150 feet from the front of the library.

The Town-owned South Street parking lot, located 0.2 miles from the Library, has approximately (135) 2-hr spaces; and (2) handicapped 2-hr spaces with an unloading zone and curb cut leading to a sidewalk.

The Town of Hudson is actively considering ways to increase and improve parking downtown. According to Kristina Johnson, AICP, Hudson's Director of Planning and Community Development, "Hudson did a 2014 downtown parking study that was just updated. The 2-hr time limit on parking is the biggest issue for people visiting downtown, many of whom are 'trip chaining' and want to spend longer than two hours. The Hudson committee involved with regulatory changes unanimously supports changing the Town-wide time limit on parking to a 3-hr time limit. The Town is also considering long-term changes to parking supply by developing parking at two locations that are currently privately owned – 32 Washington Street (0.1 mi from the Library) & the 'old McDonalds site' – as well as converting the South Street Skate Park into parking, and re-locating the skate park function to other town-owned land."

Hudson's zoning bylaws require one (1) parking space for each four (4) seats for buildings in the Commercial C-1 district (7.1.5.6). However, in the Northeast, many libraries located in historic downtowns rely only on public or street parking, and the

parking availability for the Library should be addressed diligently through continued communication with the Town's Director of Planning and Community Development. It is recommended that the Library appoint a representative to participate in any meetings held by Planning and Community Development to address parking needs throughout downtown Hudson.

A more serious issue than parking availability is the lack of safe and handicap-accessible paths-of-travel from parking spaces to the interior of the building. Two specific safety hazards due to ponding water have been identified in this section. Please refer to the following section for a discussion of the lack of handicap-accessible paths-of-travel to the building.

Water ponds at the crosswalk in front of the Library during storm events, causing an icy puddle, a potential slip hazard, in winter.

Two dedicated handicap-accessible parking spaces are located directly in front of the Library; however, they do not have a striped unloading zone leading to a curb cut to access the sidewalk, and they are therefore not code-compliant.

Staff parking is located on the north side of the building along a steeply-sloped parking lot.

Slip hazard due to unplumbed downspout at staff entrance exterior stairs bottom landing.

/ 6. ENTRANCES, ACCESSIBILITY, AND LACK OF HANDICAP-ACCESSIBLE PATH-OF-TRAVEL

/ ENTRANCES

The main entrance to the Library, symmetrically centered on the façade of the Carnegie Building, fronts directly onto Washington Street, which is a part of Hudson's walkable downtown area. This historic entrance is accessible only to able-bodied patrons, as it includes two short flights of stairs to reach the 1st Floor with landings and handrails that do not meet current code. The interior landing at the entrance doors leads immediately to either the second short flight of stairs leading to the 1st Floor, or to a

bifurcated staircase that provides access down to the Ground Floor or up to the 2nd Floor. *See Narrative, 7 for additional information about stairs.* The front doors were replaced in 1999.

The staff entrance, located on the north side of the building, doubles as the exit from the emergency egress stair connecting all three floors of the building. Due to the differential settlement of this stair tower, the door can be difficult to open and there is a ponding water issue at the bottom landing. Handrails and stair treads and risers also do not meet current code at this entrance/exit.

Main entry stairs and handrails are not handicap-accessible. Landings at the front doors are not code-compliant.

Staff entrance doubles as the exit from the emergency egress stair that connects all three floors of the Library.

Ground Floor entrance on the south side of the building (designed as the handicap-accessible entrance but not code-compliant) leads to the Children's Room.

Children's Room second entrance at former civic meeting room; this redundant entrance is also located on the south side of the building.

The designated handicap-accessible entrance is the uphill entrance on the south side of the building abutting Liberty Park, leading to the Ground Floor Children's Room. This entrance does not comply with current Massachusetts accessibility code which requires an equitable entrance experience for all visitors, including disabled visitors. The ergonomics of using this entrance

are compromised by a column that is located directly inside the building close to the entrance doors that makes it difficult to navigate around the column to reach the rest of the Children's Room and the nearby elevator.

The second down-slope entrance on the south side of the building was designed for the use of the Ground Floor within the footprint of the 1966 Addition as a civic meeting room. This second entrance is now redundant. Both sets of doors were replaced during the 2001 Children's Room renovation.

/ HANDICAP-ACCESSIBILITY OVERVIEW

A handicap-accessibility upgrade was conducted on the building in 1996, leading to the construction of the exterior ramp on the south side of the building, the interior ramp bridging the three-step difference in height between the former civic meeting room and the remainder of the Children's Room, and the elevator. There is one handicap-accessible bathroom on the Ground Floor. The elevator allows patrons to use all three floors of the building, but the emergency exit stair does not have space for emergency rescue assistance for the handicapped at the top landing. The majority of the handicap-accessible features of the building are not dimensionally and materially compliant with current code and are also not equally distributed throughout the building, as current code requires. *See Narrative 7., 8., and 13.*

A handicap-accessibility upgrade for the entire building would be triggered if a major renovation were to occur that involved expenditure of 30% or more of the full and fair cash value of the building over any 3-year period (521 CMR). Such an upgrade would include parking and unloading; the interior and exterior accessible route; examination of providing accessibility at the Carnegie Building main entry or providing another "main entry" that is fully accessible; modifying handrails, guardrails, and stairs; modifying maneuvering clearances, hardware, and signaling at the elevator; correcting issues with floor surfaces and level changes; providing adequate accessible toilet rooms and drinking fountains; and correcting issues with device and switch heights throughout the building.

/ LACK OF HANDICAP-ACCESSIBLE PATH-OF-TRAVEL

The handicap-accessible entrance is located on the Ground Floor on the south side of the building; however, there is no handicap-accessible path-of-travel to this entrance from handicap-accessible parking in the lot behind the building and on the street in front of the building. The slope of the walkway located along the south side of the building is significantly greater than the permitted slope for a handicap-accessible ramp. Resolving this issue would require either an extensive switch-back ramp in Liberty Park or relocating the elevator to the front or rear of the building.

Ramp on the south side of the building designed as the handicap-accessible path of travel has too steep a slope to comply with code.

Uphill view of the non-code-compliant ramp on the south side of the building.

A further deficiency is that the Town-owned parking lot adjacent to the building does not have direct access to the elevator. The elevator location, which was chosen in 1996 during a building-wide accessibility upgrade project, appears to have been selected due to its central location in the building near both the Original Building and the 1966 Addition. The south side of the building appears to have been chosen since the selected location displaced two program spaces rather than the emergency egress stairwell located on the north side of the building. When the elevator is replaced, a location should be identified that is directly accessible via a short handicap-accessible path-of travel to the code-required number of handicap-accessible parking spaces –

and ideally to more parking spaces as well, since members of the general population also appreciate the nagivability of a handicap-accessible route.

The Ground Floor entrance doors are the closest entry point for patrons accessing the Library from the adjacent Town-owned parking lot. However, the riverfront concrete walkway has a cross-slope that is greater than 2% and then slopes steeply upward at a 6-degree or more slope to intersect with the ramp infrastructure at the two south-side doors.

A code-compliant ramp requires a maximum 1:12 slope (4.8-degrees). The existing ramp on the south side of the building has a 5.3-degree slope and is excessively long relative to the location of the handicap-accessible parking spaces on Main Street. Furthermore, the existing ramp has handrails only on one side; whereas, code requires handrails on both sides of the ramp.

View of the uneven walking surface of the pedestrian walkway from the adjacent public parking lot, which leads to the bottom of Liberty Park, approximately 8 feet below the handicap-accessible entrance to the building.

View from north of the cracked and uneven sidewalk used to access the Library from the adjacent public parking lot.

/ 7. ELEVATOR, STAIRS & INTERIOR RAMP

/ ELEVATOR

The elevator, installed in 1994, is nearing the end of its expected useful life. It has a history of not leveling correctly, temporarily trapping individuals in the elevator shaft. The cab dimensions are undersized relative to current code. Furthermore, the operation of the elevator is noisy and disrupts the use of the McLellan Reading Room, a quite space for communal study and silent reading as well as an occasional event or program.

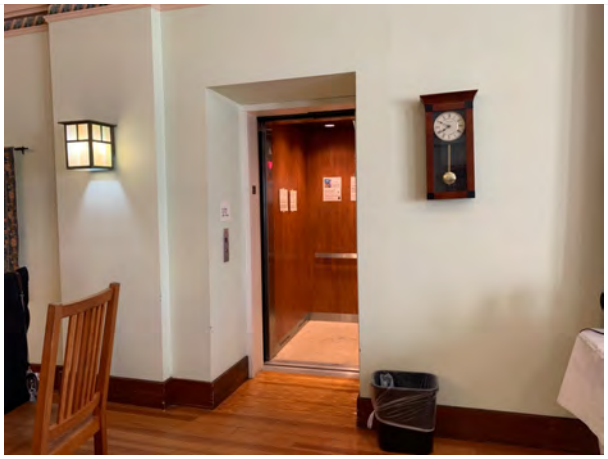
The Library's 1600-pound 120-fpm hydraulic passenger elevator, installed in 1996, is located directly inside the Ground Floor entrance and services the three floors of the building. Repairs were performed in 2015 to address issues including persistent jerking and shaking during operation; the cab failing to self-level at the demanded floor; and the cab stopping between floors, requiring manual operation and rescue. The elevator has been inspected annually and has up-to-date inspections. Note that the expected life for a hydraulic elevator is 20-30 years, and this elevator is now 30 years old.

The elevator's interior dimensions are 50"X54", smaller than the 54"X68" minimum required per Massachusetts handicap-accessibility code (521 CMR 28). As described in *Narrative, 6.*, the elevator's location within the building is reasonably good and central but it does not have direct access to handicap-accessible parking outside the building. From a programming perspective, the noisy elevator disturbs programs, meetings and quiet study when it opens onto the 2nd Floor.

Replacement of the elevator should be studied in the near-term planning horizon in order to safeguard the public health, safety, and welfare. Individuals trapped inside an elevator cab who may have medical conditions could be in imminent danger due to

their inability to access medical attention. Furthermore, individuals in the elevator during a fire event could also be trapped and unable to escape. The risk of these situations occurring can only be forestalled by providing fully-functional equipment.

A major renovation of the existing building would trigger the requirement to bring the elevator up to current code for size, door and threshold requirements, call buttons and signaling. A new Medical Emergency Elevator sized to accommodate a gurney would be required if a new addition were built at the site (CMR 524 MA Elevator Regulations).



Elevator entrance opens directly into the quiet study room on the 2nd Floor.

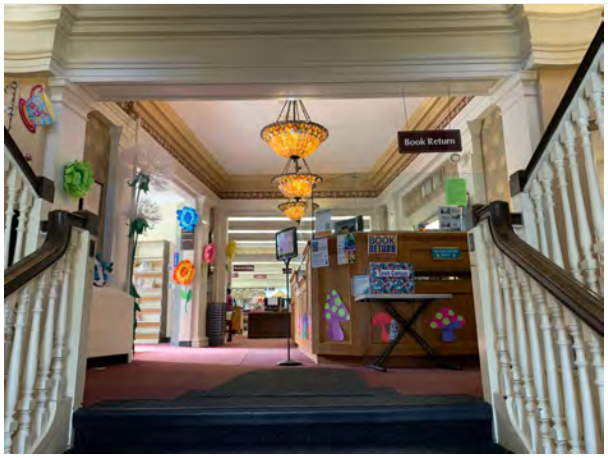
Elevator entrance on the 1st Floor opens into the adult services area.

/ STAIRS & INTERIOR RAMP

The building has three interior staircases and one interior ramp. The interior ramp makes the lower level of the Children's Room handicap-accessible but is a space inefficiency that is a remnant of the area's former use as a civic meeting room, set three steps lower than the rest of the Children's Room. This ramp and the three-step flight of stairs adjacent to it in the Children's Room are code compliant.

The historic front bifurcating staircase that connects the three floors of the building and the bathrooms is not code compliant in terms of the height of guardrails and the design of the integral guardrail-handrail, which is no longer permitted by code. The flight of stairs leading to the downstairs bathrooms below the Ground Floor lacks code compliant handrails on both sides of the stair.

The north egress stair, designed in 1966, has integral handrail-guardrails that are not of compliant height and do not have a separate grippable handrail. Furthermore, stanchions are placed too far apart.



Inside the main entrance, climbing an additional set of stairs is necessary in order to reach the 1st Floor.

Historic stairs to the bathrooms below the Ground Floor do not have compliant handrails.

The staircase to the boiler room presents the most pressing safety hazard, since there is insufficient headroom, posing a risk of injury to personnel using this staircase. Handrails are also lacking on both sides of the staircase. Handrails should be installed at this location and additional caution markings should be placed both on the stairs and the soffit above to warn personnel of the headroom issue.

Handrails and guardrails in the egress stair tower do not meet current code.

Historic stairs at the front of the Carnegie Building have non-code-compliant guardrails and handrails.

The staircase to the boiler room in the basement has no cod-required handrails; and has insufficient headroom, which is a code violation and a safety hazard for technicians and Town personnel.

The Children's Room has an unnecessary flight of stairs that resulted in a need to add a ramp to provide handicap accessibility. The change in level is a historic condition based on the space's prior use as a civic meeting room.

/ 8. ADDITIONAL HANDICAP-ACCESSIBILITY ISSUES

There are four additional handicap-accessibility issues worth noting, as follows:

1. The vestibule of the lower Children's Room entrance, which is used as a coat room, is not handicap-accessible; therefore, coat and stroller storage program space is not bead66 ing provided to persons with disabilities.
2. The fort, a reading space in the Children's Room, has a low entrance that is appealing to children; however, due to its smaller than normal height and width, this opening is not accessible to adult caregivers and persons with disabilities. A second adult-height door could be added at the back or side of this feature.
3. The book drop, which is located at the building's main entrance facing Washington Street, is located up a flight of two stairs, and is therefore not accessible to persons with disabilities. Given that returning books using a book drop is a basic programming element of a public library, rectifying this issue by locating a book drop in a place accessible to persons with disabilities in the short-term planning horizon is recommended. Staff access to the book drop is via a landing of the front staircase and is not handicap-accessible.
4. Ground floor clearances to access the elevator are problematic. Book stacks were located in close proximity to the elevator during the 2001 Children's Room renovation, and navigation around these stacks is challenging, especially with larger wheelchairs. This issue could be addressed by re-design of the book stacks, with some loss of collections shelving. In addition, there is a column located directly beyond the inside landing at the handicap-accessible entrance doors. Navigating around this column is problematic, but is not solved without moving the entrance doors, which would require an exterior renovation.

1. The vestibule of the second Children's Room entrance (the former civic meeting room entrance) is used as a coat room and for stroller parking, but it is not handicap-accessible.

2.The fort in the Children's Room is not accessible to adult caregivers or persons with disabilities.

3. The book drop, located up a set of two stairs at the front entrance, is not handicap-accessible.

4. Clearances around the elevator on the Ground Floor are very tight, making access difficult.

/ 9. BUILDING EXTERIOR ENVELOPE; ENERGY INEFFICIENCIES, ROOFS, WINDOWS & FACADES

/ ENERGY INEFFICIENCIES

Energy efficiency of the roofs and walls are highly lacking. The roofs have only 1/3 of the code-required insulation levels (measured as "R-value," see tables below); and the walls have only 1/2 the code-required insulation levels. These deficiencies mean not only that utility costs are high for heating and air conditioning, but also that occupants are not likely to feel thermally comfortable while in the buildings, due to the cold surface materials surrounding them on the walls and ceilings.

Hudson Public Library Envelope R-values *(estimated)*

*ci = "continuous insulation"; code requirements are based on the 2021 IECC

WALL – Carnegie Building	
Wall Component	R-Value
Ext Air Film	0.17
Brick	0.80
Air Gap 1/2"	1.00
Brick	0.80
Air Gap 1/2"	1.00
Brick	0.80
3/4" WD x 75%	0.94
3/4" Plaster	0.56
Int Air Film	0.68
Total R-value	**6.75**
Code Req'd R-value (ci)*	**11.40**
R-value Deficit (% of Req'd)	41%

WALL – 1966 Addition	
Wall Component	R-Value
Ext Air Film	0.17
Brick	0.80
Air Gap 3/8"	0.68
8" Concrete Block	1.11
2X Strapping x 75%	0.94
5/8" GWB	0.56
Int Air Film	0.68
Total R-Value	**4.94**
Code Req'd R-value (ci)*	**11.40**
R-value Deficit (% of Req'd)	57%

ROOF – Carnegie Building	
Roof Component	R-Value
Ext Air Film	0.17
PVC Roof	0.10
1 1/4" PLWD	1.25
2X8 WD Joist	0.12
4" Open Cell Spray Foam	15.00
Int Air Film	0.68
2x4 Batt Insul. (floor)	12.00
Total R-value	**17.32**
Code Req'd R-value (Attic)*	**49.00**
R-value Deficit (% of Req'd)	65%

ROOF – 1966 Addition	
Roof Component	R-Value
Ext Air Film	0.17
PVC Roof	0.10
1" Rigid Insulation	5.00
5/8" PLWD	0.63
2x12 WD Joist	0.12
1X Strapping x 75%	0.94
3/4" Plaster	0.56
Int Air Film	0.68
Total R-value	**8.19**
Code Req'd R-value (ci)*	**30.00**
R-value Deficit (% of Req'd)	73%

/ ROOF – 1966 ADDITION

The roof of the 1966 Addition was last replaced in 1996 and is leaking in multiple locations. This roof is nearly 30 years old and should be replaced as soon as possible if the Library continues to provide services in this portion of the building. Typical roofing warranties for membrane roofs are 20 years, and municipal buildings should be on a cycle of roof replacement roughly commensurate with this timeline in order to prevent leaks, damage to interior contents, damage to wall and ceiling surface materials, and potential mold buildup in ceiling cavities and walls.

The roof of the 1966 Addition does not meet current code for amount of insulation nor number of roof drains required. A second roof drain is required by current code for a roof of this square footage. This rooftop is used as the location for two air conditioning condensers, which should be removed and reinstalled with correct curbs, flashing, and weight-spreading supports.

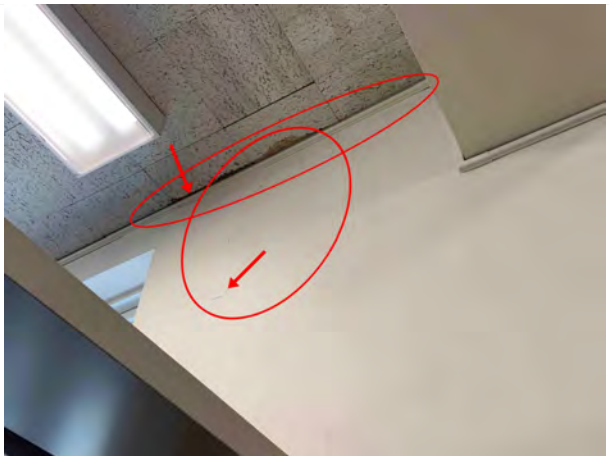
The wood fascias of both the Carnegie Building and the 1966 Addition have numerous areas of peeling paint, indicating rotted wood behind. Replacement of exterior wood trim is recommend to keep moisture out of the exterior walls and ceilings.

The roof of the 1966 Addition has a single roof drain, which does not meet current code (2 drains are required for a roof of this area).

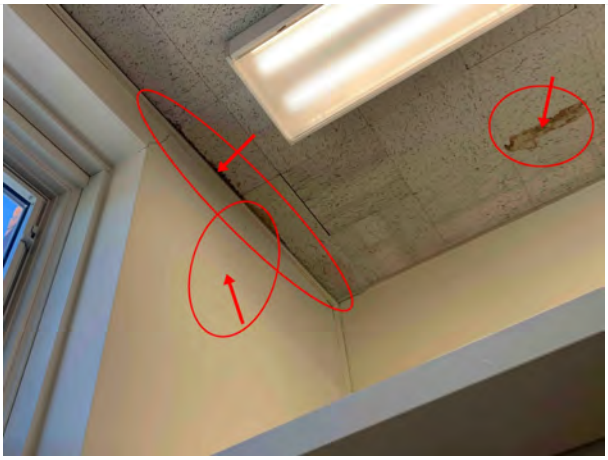
As can be seen in the images below, the interior of the 1st Floor within the 1966 Addition portion of the building is suffering damage to interior wall and ceiling finishes and has active leaks during rain events in the following locations reported by Library staff: near the reference area; behind the wall by the photocopier; near the checkers and scavenger hunt tables; and near the soffit by the column. The possibility also exists that mold buildup has occurred in the ceiling cavity of the 1966 Addition roof. Exterior views of this roof show that the wood fascia board has peeling paint and exposed wood areas, likely indicating rotted surfaces below. The wood fascia and flashing over it protect the top joint of the wall where it meets the roof and need to be covered in order to prevent water from entering the building. The recommendation to replace this roof as soon as possible includes replacement of the associated flashings and wood fascia.

Evidence of roof leak in the ceiling of the 1st Floor, 1966 Addition.

Evidence of roof leaks in the ceiling of the 1st Floor, 1966 Addition.



Evidence of roof leaks in the ceiling of the 1st Floor, 1966 Addition; these leaks have also affected the top of the wall, causing bubbling of the sheetrock.



Evidence of roof leaks in the ceiling of the 1st Floor, 1966 Addition; these leaks have also affected the top of the wall, causing bubbling of the sheetrock.

/ ROOF – NORTH EXIT STAIR TOWER

The staff entrance/exit is located on the north side of the building abutting a stair tower added in the 1966 Addition. The stair tower has had cracking observed as early as 1990. The cracking of the stair tower has resulted in instability of the roof drainage on this portion of the building, and downspouts are not plumbed directly to underground drainage. Water accumulates at the base of the staircase causing slick ice in the winter, a slip hazard.

/ ROOF – CARNEGIE BUILDING

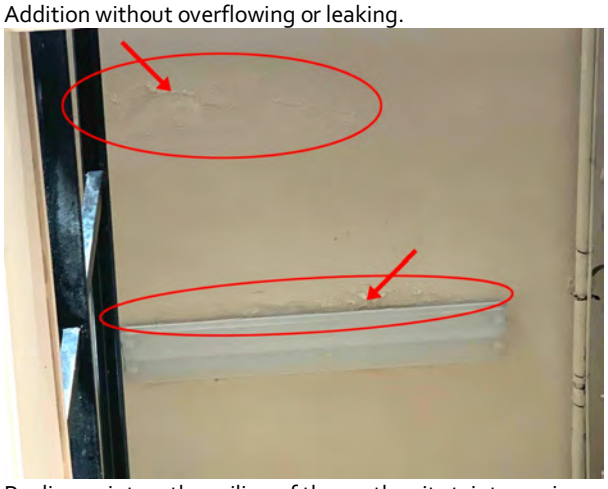
The Carnegie Building's 1929 addition (2nd Floor and Attic) is understood to have formerly been roofed in the original copper roofing, with a 5-ply tar-and-gravel built-up-roof installed in 1966. This building was re-roofed in 2010 with a glue-down patina-green-color PVC roof with matching welded-on PVC deco-ribs intended to look like metal roofing. The PVC roofing was installed

over the flat roof section a the top of the building as well as the sloped areas, with matching flashing. This roof is understood to be under a standard 20-year warranty with SOM Construction that expires in 2030. In the short-term planning horizon, Town personnel should survey the roof to determine if there are any leaks or deficiencies in the roof that should be addressed while it is still under warranty. The most recent roof repairs have been in 2014 and 2016 (refer to Renovation Chronology).

Several downspouts and roof drains from this roof enter the upper walls of the building with through-wall and through-ceiling penetrations and piping that are incompletely designed; this improper roof drainage has resulted in persistent condensation onf the surface of internal drain pipes and some leaks that are still occasionally active. The entire roof, including the roof drainage system, should be re-examined to ensure all roof runoff is directed to gutters properly plumbed to downspouts and interior drainpipes with integrity from rooftop to sewer. The canopy at the main entrance should be included in this examination and repair project, since a sign warning of possible snow and ice falling is located at the front door.

Downspouts from the Carnegie Building roof are not correctly plumbed to drain onto the roof of the 1966 Addition without overflowing or leaking.

The roof of the Carnegie Building is a patina green-colored PVC membrane installed in 2010; deco-ribs added to the pitched areas make it look like a metal roof.



Peeling paint on the ceiling of the north exit stair tower is evidence of current roof leaks.

Four inches of spray foam were added to the underside of the Carnegie Building roof in 2022.

/ DOWNSPOUTS

The 1966 Addition roof appears to be designed with an internal roof drain passing through the building to storm drainage. In contrast, the Carnegie Building, the north exit stair tower, and the south elevator tower have roof with gutters and downspouts. The majority of the gutter-to-downspout connections appear to be in poor condition and should be checked as soon as possible by SOM Construction, the contractor for the Carnegie Building roof, which is likely still under its 20-year warranty until 2030.

The single downspout on the rear north side of the building that delivers water to the storm drainage system is highly problematic. This downspout is likely undersized for the quantity of water being delivered to it, and it is not plumbed to storm

drainage. Its overflow results in sheeting and ponding frozen water across the parking lot and at the bottom stair landing of the staff entrance (which doubles as the egress stair exit). This is a slip hazard that should be addressed immediately in order to safeguard the public health, safety, and welfare.

Staff entrance. Image shows downspout is not plumbed to subsurface drainage, leading to a slip hazard due to ponding water at stair bottom landing.

Some downspouts are correctly plumbed to storm piping such as this downspout on the south side of the building.

/ WINDOWS

The majority of the windows and storefront (excluding doors) was replaced in 2010 in a window replacement project by Davis Architects.

Aluminum windows installed in 2010 at the 1966 Addition.

Aluminum storefront installed in 2010 at the 1966 Addition.


Active leak at Children's room Ground Floor rear window.

Window and storefront installed in 2010 in the 1966 Addition are aluminum windows and storefront with insulated aluminum spandrel panels with insulated glazing units (IGUs) and chain-operated shades. Due to the differential settlement of the foundations, window surrounds throughout the 1966 Addition have hairline cracks emanating from the corners, indicating that caulk joints will continue to enlarge and prevent the window installation from being water-tight.


Typical interior view of a 2010-installed aluminum replacement window in the 1966 Addition.


Typical interior view of a 2010-installed wood-wrapped replacement window in the Carnegie Building.

Windows installed in 2010 in the Carnegie Building are wood-wrapped divided-lite replacement windows with insulated glazing units (IGUs) and chain-operated shades. Replacement windows installed in 2010 in the Carnegie Building include painted wood panels (rather than durable factory-coated aluminum, the standard for commercial buildings), which is a maintenance concern. Chain-operated shades are no longer permitted by current code due to the possibility of strangulation from the chains. The Library should assess this risk and act accordingly to reduce or eliminate the risk based on its level of caution regarding this topic.

All windows have operable lower sashes which is a code requirement in order to provide natural ventilation, since the building is not mechanically ventilated. However, it is likely that windows are rarely opened either in the winter (due to cold temperatures) or in the summer (in the interest of maintaining the cool temperatures of air-conditioned air). *See Narrative, 12. for a discussion of the lack of mechanical ventilation air in the building.*

Replacement windows installed in 2010 in the Carnegie Building include painted wood panels, a maintenance concern, rather than durable factory-coated aluminum.

Windows in the Carnegie Building installed in 2010 are wood-wrapped divided-lite replacement windows with insulated glazing units (IGUs) with chain-operated shades.

/ FAÇADES

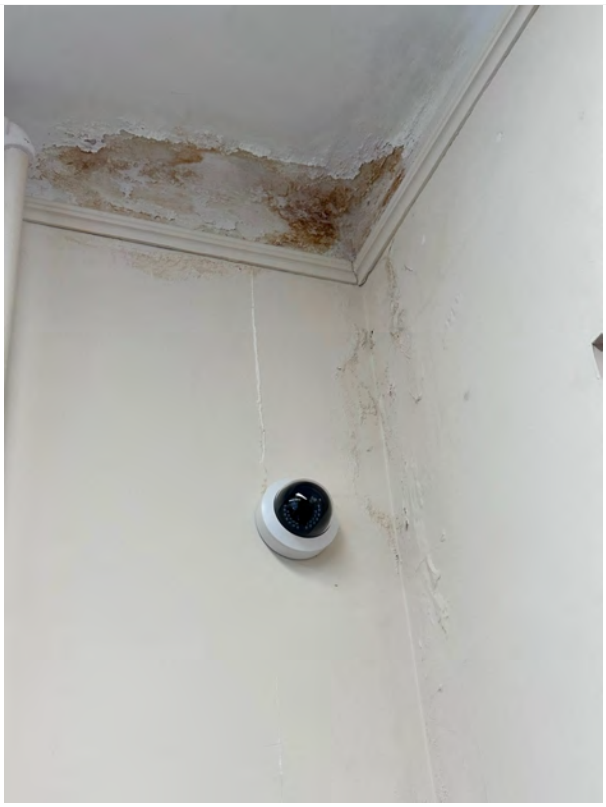
The building's facades are predominantly brick with the exception of a small section of exposed fieldstone foundation at the Carnegie Building. Town personnel protected the fieldstone against leaks occurring along the Liberty Park side by the addition of a concrete parge-coat. The Carnegie Building's facades are presumed to be triple-wythe brick; whereas, the facades of the 1966 Addition are single-wythe brick over concrete masonry unit backup wall. Neither façade type has insulation within the wall cavity.

Library view from the north, with fire station in right foreground.

The interior side of the façade walls are presumed to be predominantly plaster over lath in the Carnegie Building and rock lath (similar to sheetrock but capable of accepting a wet finish) and plaster over 1X3 wood strapping in the 1966 Addition. Headers, sills, and belt-course are cast concrete at the 1966 Addition; whereas the roof fascia is wood. At the Carnegie Building, headers, sills, and belt-courses are understood to be limestone; whereas the roof fascia (a complex stepped parapet and fascia) is understood to be wood. Actual materials will need to be confirmed when restoration work occurs. Locations where water intrusion through the facades is affecting interior spaces is discussed in Narrative, 9.

As soon as possible, wood and/or cast stone fascias at the roof line should be examined for rot, loose and unpainted boards; and in the case of stone or cast concrete pieces, gaps in caulk joints. The upper walls in the 2nd Floor of the Carnegie Building and the 1st Floor of the 1966 Addition show signs of water intrusion at this location. The integrity of the building's facades relies on the durability and water-tightness of these cap materials. The canopy at the main entrance should be included in this fascia examination and repair project, since a sign warning of possible snow and ice falling is located at the front door.

The Carnegie Building was covered in ivy until 1995 when it was removed by Town personnel. Neither the prior presence nor the removal of the ivy appears to have caused the mortar joints in the brick to be degraded beyond normal expected wear. However, some sections of the façade, such as at the main entrance, appear to have been re-pointed with a bright white mortar that has gaps. In a major restoration of the building, the entire façade should be systematically examined for locations where brick repointing is required. Miscellaneous cast concrete items like the pillars and wood items like display cases mounted to the façade should be scraped and re-painted in order to protect the underlying materials.



The brick walls of the southeast corner of the Carnegie Building's 1st Floor (teen space) have a persistent leak, causing peeling plaster at the interior.

The brick walls of the southeast corner of the Carnegie Building's 2nd Floor (technical services offices) have a persistent leak, causing peeling plaster at the interior.

The façade of the 1966 Addition is composed of bricks of lower quality, slightly longer dimensions, and deeper red color than the Carnegie Building. Many of the bricks have pock-marks and cracks that may have been present even when they were installed. Due to the differential settlement of the foundations, cracks have opened in the mortar joints throughout the facades, allowing water to intrude into the building's exterior walls. The presence of water within these walls will propagate continued stress during seasonal freeze-thaw cycles, further degrading the facades. If a decision is made to keep the 1966 Addition for a long-term planning horizon, the open mortar joints should be repointed.

Typical brick façade condition at the Carnegie Building.


Typical brick façade condition at the 1966 Addition.

The brick of the elevator tower on the south side of the building, added in 1996, is a third, darker color brick.

There is evidence of some efflorescence (seen as white patchy areas over the red brick) throughout all the building's facades, due to soluble salts coming to the surface during temperature changes. The efflorescence is evidence that moisture has been allowed to enter behind the facades due to inadequate and compromised roof and roof edge flashings, gutters, and fascias. There are various methods for removing efflorescence which could be employed on the Carnegie Portion of the building if a major renovation of that building occurs.


Library's brick facade covered in vines; date of photograph unknown. Image appears in form "HUD.124," recorded in 1988 and noted "very overgrown with ivy." The ivy was removed in approximately 1995.


Mortar is in poor condition due to cracking at the facades of the 1966 Addition.

/ 10. HAZARDOUS MATERIALS

Systematic hazardous materials testing has not been performed on the building. The architectural drawings for the 1966 Addition show over 50% of the Ground Floor and 1st Floor flooring was scheduled as "VAT" (vinyl asbestos tile). On the 1st Floor VAT is listed as being present in the main collections area (reading room), the exit stair, and the circulation desk workroom. If these surfaces are exposed to view rather than covered by carpet, they should be tested for the presence of asbestos. Any crumbling or deteriorating VAT surfaces should be replaced immediately. On the Ground Floor, VAT was tested and removed during the 2021 renovation following the steam pipe burst in front of the elevator. The VAT was removed down to concrete subfloor, which was then skim-coated prior to the installation of new carpet.

Should the boiler room be renovated or demolished, hazardous materials testing in this area should precede any work, since asbestos-containing insulation materials may have been used when the room was built in 1966.

Mold and mildew are suspected hazardous materials throughout the ceiling and walls of the Ground Floor wherever steam pipes are running. The cast iron steam pipes are highly subject to pinhole leaks, which could cause condensation collecting in wall and ceiling spaces as occurred in the remediation of the 2023 steam pipe burst over the staff kitchen and bathroom. Whenever ceilings or wall cavities are being renovated on the Ground Floor, or in any steam pipe chases throughout the building, contractors should wear appropriate personal protective equipment (PPE).

Carpenter ants were found to be prevalent along the sub-grade fieldstone foundation walls on the Ground Floor of the Carnegie Building, living behind plaster walls. The plaster walls were removed in an abatement project in 2012, and the carpenter ants were abated, and the plaster walls presumably replaced with sheetrock. There is a possibility that carpenter ants could return to this location. The Library does have pest abatement done annually, and this contract should be sure to include checking for carpenter ants.

/ 11. WALLS, CEILINGS & DOORS; FLOORS & FLOORING

/ WALLS

In general, interior walls, ceilings and doors are in serviceable condition. Wall surfaces consist of many materials, from plaster over rock lath to standard sheetrock. Some walls in the renovated areas of the building have only a single coat of paint. Other locations have multiple coats of paint. Partition walls in the Carnegie Building are presumed to be wood stud, comprised of wood studs of smaller dimension than contemporary wood studs. Partition walls in the 1966 Addition are wood stud. Partition and knee walls from the 2001 Children's Room renovation are metal stud with sheetrock.

The interior sides of exterior walls have water intrusion problems as noted in the above section Narrative, 9. Damp walls should be tested for the possible presence of mold so that Library visitors' respiratory health is safeguarded. Damp and/or moldy wall finishes should be removed and replaced with new non-moldy dry wall surfaces. This work should be undertaken on a short-term planning horizon, in order to protect occupant health, safety and welfare.

One location where the room's walls are not code-compliant is the former stage in the Children's Room, primarily used as a craft activities room. Part of the stage is used by hired performers for children's programs. This room does not have a full-height enclosure wall on the side facing the Children's Room. There is an approximately 18-inch dropoff located at the edge of the stage, protected by a temporary partition that is not designed to the fall-protection structural standards of a guardrail. A full-height wall should be built at this location to enclose the room; or, if a temporary solution is preferred, a stable pipe-rail guardrail a minimum of 42-inches high should be installed on the room side of the temporary wall to serve as fall protection; stanchions should be spaced no more than 4-inches apart.

The craft room has an 18-inch drop-off to the floor below that lacks engineered fall protection.

View of the temporary wall enclosing the former stage from the Children's Room side.

/ CEILINGS

Ceiling tiles and soffit features throughout the Ground Floor were replaced in the 2001 Children's Room renovation are mostly in good condition. The ceilings of this floor were designed to provide a demarcation of programs and still maintain a contemporary look. The exception to the good quality of these ceilings is locations where steam pipes have burst, such as at the elevator soffit

in 2024, 2021 and 2014, or where steam pipes have leaked steam up through the exterior walls into the ceiling cavity, such as at the staff kitchen and bathroom in 2023.

When repair work was done in 2023 in the ceilings of the staff kitchen and toilet room, the bathroom exhaust fan was found to have been rotting out due to excess moisture in the ceiling. Mold and mildew was found in the ceiling tiles in the area of these steam pipe leaks and was remediated.

Ceiling tiles in the 1st Floor of the 1966 Addition are glue-on acoustical tiles located in close proximity to the leaking roof above. Many of these tiles are discolored and some are dislodged due to the roof leaks. A random check of ceiling tiles should be performed throughout this ceiling to determine if mold and mildew are present. If found to be present, the entire ceiling should be removed and a new ceiling installed. Roof joists should also be checked for the presence of mold, mildew, and rot.

/ DOORS

Wood exterior doors at the main entrance were replaced in 1999 by Dovetail, a carpentry shop in Maynard. The aluminum storefront doors at the Children's Room were replaced in the 2001 Children's Room renovation. The hollow metal door and frame at the staff entrance (also the emergency egress stair exit) should be replaced as soon as feasible, as a matter of public health, safety, and welfare since this door is reported to be hard to open and shut. Masonry work may need to precede this door replacement in order to create a rectilinear rough opening.

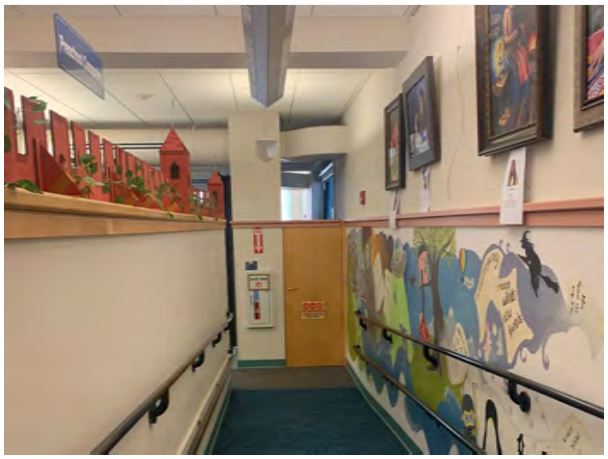
Doors on the 2nd Floor are decorative simulated divided lite doors with knob hardware. While these doors are not generally of a grade suitable for commercial use, they are presently performing without issue. The hardware on the doors should be changed to lever hardware so that these spaces are correctly accessible to persons with disabilities. Interior doors throughout the Ground Floor and 1st Floor predominantly enclose staff offices and are mostly of hollow core wood doors with knob hardware. All knob hardware should be replaced with handicap-accessible lever hardware so that staff offices are "visitable" by persons with disabilities, and/or can be used by staff with disabilities.

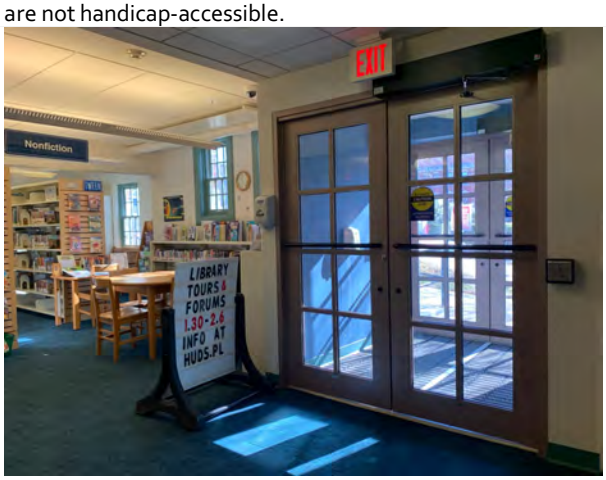
Doors on the 2nd Floor are predominantly decorative divided-lite doors with knob hardware.

The public access door to the former civic meeting room stage, which is primarily used as a craft activities room, is not of code-compliant size. This room should be properly enclosed with bounding walls and should not be accessed via non-code-compliant doors, since fire egress is required to occur through doors and openings meeting egress code requirements.

The hollow metal door to the boiler room is rusted and is typically left in the open position. This door should be replaced as soon as possible with a fire-rated hollow metal door and frame in order to safely enclose the fire hazard area of the boiler room. The rough opening of the wall surrounding this room will likely need repair in order to install the new hollow metal frame.

Interior doors on the 1st and 2nd Floor have round knobs that are not handicap-accessible.


The craft room is accessed via this non-code-compliant door at the bottom landing of the ramp in the Children's Room.



Aluminum doors with push-button handicap-accessible hardware were installed at the Children's Room south side entrance in 2001.

The exterior wall at the boiler room top stair landing is crumbling due to uneven settlement and water intrusion. The boiler room door (foreground) is rusted.

/ FLOORS & FLOORING

Over fifty percent of the flooring installed in the 1966 Addition was VAT (vinyl asbestos tile). The VAT was removed in the Children's Room when new carpet was installed in 2021, following the steam pipe leak that flooded the area. As discussed in Narrative, 4., the concrete floor slab under this area had cracks up to ½" hand had to be skim-coated in order to lay down new carpet. VAT remains in the floor landings of the egress stair tower and presumably underneath the carpeting of the 1st Floor 1966 Addition area, as it is noted as such in the drawings' finish schedule. Remaining VAT should be monitored for friability (fragmentation into small pieces that can be inhaled).

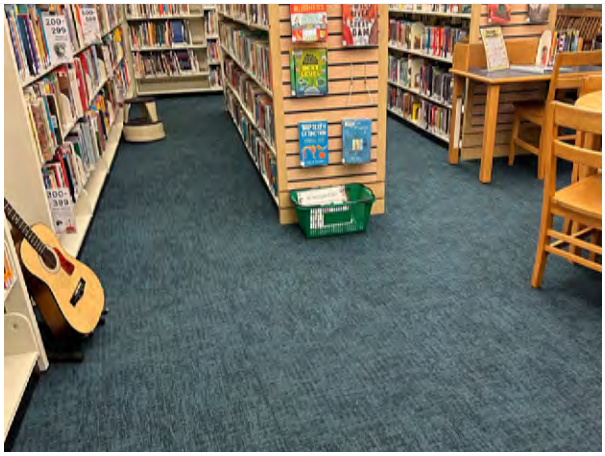
Carpeting in the 1st Floor is pilled and bare. Replacement is recommended. At time of replacement, VAT may or may not require abatement, depending on whether it is determined to be stable or friable.

Carpeting and flooring on the Ground Floor is generally in good condition and was replaced in 2021, following abatement of asbestos floor tiles, with quick ship carpet tiles due to supply chain delays driven by the Covid pandemic.

Framed flooring for the Ground Floor stairs, ramp, and stage is visible via various access panels. The framed flooring for the stage was all replaced during two different steam pipe leaks in this area.

Within the 1966 Addition portion of the building, flooring is not level. On the 1st Floor, the floor joists have settled between the steel beams, leading to a wave pattern that has affected the verticality of the collections shelving above. On the Ground Floor, the differential settlement of the footings resulted in a 2" pitch over 10 feet towards the north side of the building that was noticed

by the rehab contractor doing the 2023 renovation of the staff kitchen and toilet room. The carpenters left the slanted floor and made up the 2" in a sloping toe-kick for the cabinets.



New carpet tiles were installed in the Children's Room following abatement of asbestos tile flooring in 2021.

Carpeting in the 1st Floor 1966 Addition is pilled and bare; replacement is recommended

/ 12. HVAC

/ HEATING

Bursting and cracking of steam heating pipes have resulted in three shut-downs of sections of the Ground Floor Children's Room and the Staff Kitchen and Restroom – in 2003, 2021, and 2023; and one temporary area closure, in 2024. Each issue has resulted in water damage to carpets, wall finishes, and Library collections; and has required replacement of segments of cast iron steam heating pipes, followed by reconstruction of interiors. The bursting of the steam pipes is believed to be related to the differential settlement of the building foundations according to individuals interviewed.

The boiler will require replacement in the next five years. Curley Plumbing & Heating, the Town's long-term service company, recommends replacing all of the steam heating distribution piping that has caused numerous leaks. Steam generated by the boiler is also converted to water to feed the front half of the heating supply locations in the building, which is an energy-inefficient system design. All piping and heating radiators should be hot water piping.

Boiler installed in 2005.

Oil tank, cooling tower, and an air handling unit are located in a fenced-in area adjacent to the boiler room.

The Library is heated by an oil-fired boiler (Weil-McLain Model 80, #1080 9.6 GPD input, 1110 MBH output) that was last replaced in 2005 by Curley Plumbing & Heating. The boiler room is located below the Ground Floor at the far west down-slope side of the site. The oil tank is located in the wood-sided shed attached to the building. Based on a 10-20 year expected useful

life for a boiler, the boiler is expected to require replacement in the upcoming 5-year time horizon. The boiler is an old-style steam boiler feeding the 1966 Addition and the Ground Floor of the Carnegie Building – with an exchange heater that converts some of the steam to hot water to heat the 1st and 2nd Floors of the Carnegie Building. One radiator, a UniVent heater on the 2nd Floor in the McLellan Room, is intermittently functional and has been looked at many times. Old-style steam boiler systems tend to have high maintenance requirements, with frequent pinholes and leaks. Note that prior to the 1966 Addition, the Library got heat from the Fire Station, likely via underground hot water pipes, which are understood to have been abandoned in place.

Occupants report that loud banging can be heard when the heating system is operating. Occupants find that the Children's Room (Ground Floor) and Main Level (1st Floor) are too hot in winter, while the 2nd floor is reasonably warm in winter, despite malfunctions of the UniVent heater. The wintertime warmth of the McLellan Room may be due to heat rising from downstairs into a space with reasonably good roof and attic insulation, and due to occasional solar radiation from the west-facing windows.

Extensive plumbing pipe replacement occurred for sinks and toilets during repair from the April 2023 steam pipe leaks. This was due to condensation filling wall and ceiling cavities and causing corrosion on plumbing piping.

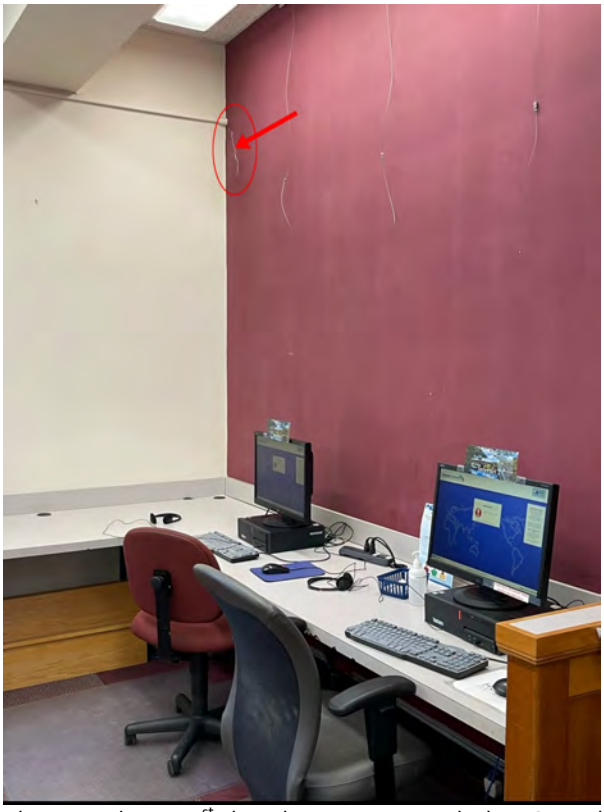
The contractor who replaced the cabinets in the staff kitchen due to the April 2023 steam pipe leaks found that the floor slopes 2 inches over 15 feet (due to uneven settlement of the building foundation).

The steam pipe cracking/bursting in 2003 and 2023 occurred under the stage on the north side of the Ground Floor. The steam pipes are located in a concrete pipe chase under the concrete floor slab. A wood-framed stage floor is located on top of the pipe chases. Both times the break occurred in this area, the stage floor joists had to be removed and then replaced. The work in 2023 required replacement of thirty (30) feet of 3-inch diameter old cast iron steam pipe with new steel pipe. The contractor attempted to chase the rot as far as they could. The pipe had been leaking in multiple locations, causing steam to travel up the walls into the ceiling cavity above the staff kitchen and toilet room, causing a mold and mildew problem. Steam also traveled further up the walls above the staff kitchen to the 1st Floor where it caused plaster to separate from the wall surface above the public access computers. A complete renovation of the staff kitchen and bathroom resulted from this issue.

Steam pipe leaks at the Ground Floor concrete floor chase, resulting in steam buildup, mold and mildew in the staff area ceiling in April 2023.

Steam pipe leaks at the Ground Floor staff area in April 2023 – resulting in showing condensation on plywood subfloor of staff area ceiling.

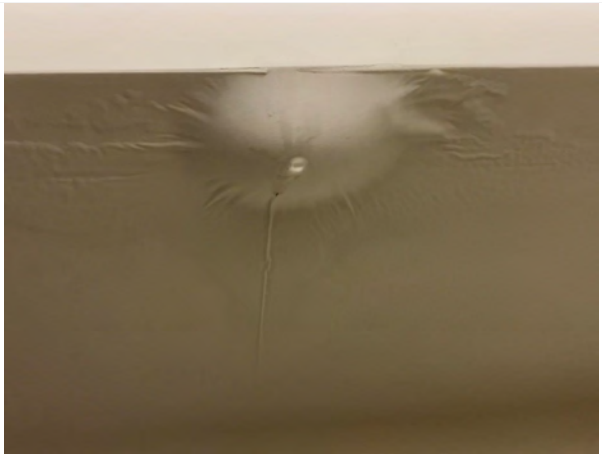
Mold was found on surfaces in the staff kitchen and restroom due to steam pipe leaks.



Plaster cracking at 1st Floor due to steam pipe leak at Ground Floor.

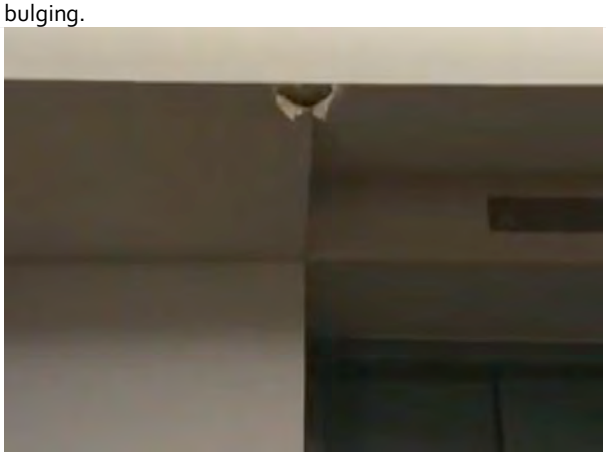
The steam pipe cracking/bursting in 2021 and 2024 occurred in the ceiling of the south side of the Ground floor, where the steam pipes are hung in a soffit along the perimeter of the building. In both cases the cracking/bursting occurred in the soffit located directly in front of the elevator. A complete renovation of the area in front of the circulation desk and an adjacent collections area resulted from the 2021 pipe burst.

Contractors and facilities personnel provided comment that the age of the steam pipes alone is not sufficient to explain the extent of cracks and leaks in the steam pipes. The uneven settlement of the concrete foundations, floor slabs, and pipe chases is suspected to have created stresses on the pipes and pipe joints that are hung by metal pipe hangers attached to building's structure.



Steam pipe leak at Ground Floor elevator soffit, February 2024 – showing one of three locations where the soffit was bulging.

Steam pipe leak at Ground Floor elevator soffit, February 2024.



Steam pipe leak at Ground Floor elevator soffit, Spring 2021.

Repairs to Children's Room after steam pipe leak at Ground Floor elevator soffit, Spring 2021. *Photo credit Ed Karvoski Jr., Community Advocate*

/ AIR CONDITIONING

Numerous components of the air conditioning system are in need of replacement. Occupants complain of thermal discomfort during summer months. The components of the air conditioning system are of varying ages and conditions; some are marginally functional. Staff have been advised to leave the air conditioning on once the system is turned on for the summer because turning the equipment on and off causes the equipment to work too hard. Air conditioning tuning and maintenance is a large recurring annual maintenance cost, on the order of $2,000 – $3,200 per year spend for Commercial Control Systems LLC of Blackstone, MA to perform maintenance; and an additional $2,500 +/- per year to Johnson Control. Despite the annual maintenance to tune the AC, the occupants do not report an experience of thermal comfort in the summer months. The Ground Floor Children's Room and the 1st Floor are often too hot during the summer, and the 2nd Floor is consistently too cold. Household fans are used to push the air conditioning from the 2nd Floor down to the 1st Floor.

The AC air handler for the 2nd Floor is located in the attic of the Carnegie Building.

The 10-ton AC air handler for the 1966 Addition portion of the 1st Floor is located in the boiler room.


Condensation observed on July 20, 2023 on the surface of the unjacketed Zone 3 ductwork in the boiler room.


Peeling paint on the ceiling of the McLellan Room.


Condensers for two of the building's AC units are located on the roof of the 1966 Addition.


The Library's oil tank, cooling tower, and a newer AC air handler and condenser are located within the chain-link fence and wood-sided shed at the rear of the building.

Peeling paint has been noted to be present on the ceiling of the McLellan Room, which may indicate that there is moisture migrating into this room from the attic above, possibly due to the moisture and temperature differential between the spaces.

The air conditioning zones are as follows; year of construction is underlined:

- Zone 1: 2012 Ground Floor, 1966 Addition (5-ton air handler and condenser outside the building in back, in fenced enclosure)
- Zone 2: 2014 Ground Floor, Carnegie Building (Trane air handler in the NE closet of the Ground Floor)
- Zone 3: 1966 1st Floor, 1966 Addition (10-ton air handler in the boiler room, cooling tower pre-chills water; cooling tower repaired in 2012)
- Zone 4: 2001 1st Floor front (5-ton air handler above circulation staff office ceiling, condenser on 1966 Addition roof)
- Zone 5: 1986 2nd Floor (air handler in the attic, condenser on the 1966 Addition roof) *date is approximate*

/ HVAC RADIATORS, DUCTWORK AND GRILLES

Heating radiators and air conditioning ductwork and grilles are in serviceable condition but should be cleaned regularly. Given its age, the air conditioning ductwork should be checked for mildew buildup and should be professionally cleaned. The Tavares Meeting Room is consistently too cold for comfortable occupancy during the winter.


Heat is delivered through steam radiators below the windows of the 1st Floor 1966 Addition; air conditioning is delivered through grilles in the two rear corners of the room.

Heat is delivered through hot water radiators throughout the 1st and 2nd Floors of the Carnegie Building.


A UniVent forced air heater serves the McLellan Room. However this unit works intermittently and should be replaced.

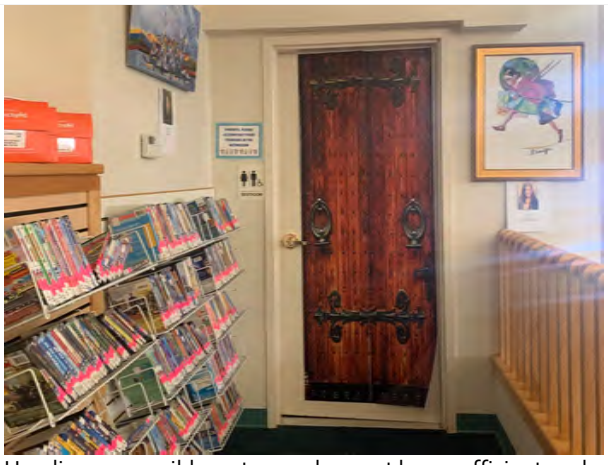

Air conditioning registers are located on the ceiling of the McLellan Room, directly below an AC unit. Too much cold air is delivered via the registers, and excess AC is directed to the circulation desk area below by conventional fans.

/ LACK OF VENTILATION AIR

The building lacks a ventilation air system for both the heating season and the cooling season. Fresh air ventilation is only introduced to the building during the opening and closing of the building's entrance doors. In order to provide code-required fresh air ventilation to building occupants, mechanical outdoor air ventilation needs to be added to the building. Provision of fresh air ventilation has been linked to improved learning outcomes for school-age students. A rate of 5 cfm/person, or 0.12 cfm/ft² of outdoor air ventilation is required in the breathing zone (IMC 403.3.1.1. Minimum Ventilation Rates Table). A new mechanical ventilation system should be designed by a licensed mechanical engineer.

/ 13. PLUMBING, BATHROOMS & KITCHENS

The building contains four single-occupant toilet rooms: two below the stairs of the Carnegie Building, one in the Children's Room (handicap-accessible), and one in the staff area on the Ground Floor. While this quantity of toilet rooms is sufficient per code requirements for the current building size, the distribution (all located on the Ground Floor) of the toilets is problematic. Sewage backups are also frequent.


Handicap-accessible restroom does not have sufficient push-side clearance at the entrance to the room and is therefore not code compliant.


The staff kitchen was renovated following an April 2023 steam pipe leak that destroyed the finishes in this area and the adjacent hallway and bathroom.

The Library has a total of eight (8) sinks: four in the four single-occupant toilet rooms; one in the staff kitchen on the Ground Floor; one in the staff circulation office on the 1st Floor; one in the custodian's sink closet located in the Children's Room handicap-accessible restroom; and one in the storage room at the northeast corner of the building. The toilets and sinks experience frequent sewage backup. The sewer main is located below Main Street, and the sewer pipe leaving the building has a sharp turn and a drop before it hits the main, which is a likely contributor to the backups. Curley Plumbing and Heating is frequently called to the building to address clogged toilets and sink drains, and has had to have the sewage line snaked from the building to the main.

The fixtures and finishes at all of the bathrooms are basic institutional fixtures with discoloration from rust and mildew. Based on the current square footage of the building, the three public-use and one staff toilet room provided meet the code requirement for plumbing fixtures (see calculation in italics below).

All of the building's plumbing fixtures are located on the Ground Floor, rather than distributed on the three floors, which detracts from ease of access by disabled patrons. The designated handicap-accessible bathroom does not have sufficient pull-side clearance at the door, and thus violates accessibility code. The floor tiles of this room are constantly saturated with water from below due to toilet overflows.

Toilet count requirements per current code – for Library's existing floor area:
The occupancy for the Library is calculated at an average of 66 square feet per occupant (A-3 use group) for approximately 13,028 NSF, reduced by approximately 30% (circulation areas), yielding 136 occupants, for whom 3 toilets (1 men's and 2 women's) are required. The occupancy of the Library is estimated to be 1/3 stack areas (100 square feet per occupant) and 2/3 reading rooms (50 square feet per occupant), averaging at 66 square feet per occupant. Code requires 1 toilet per 125 males and 1 toilet per 65 females.


A sink is located in a closet in the northeast corner of the Ground Floor.

Interior view of typical bathroom below staircase. Clearances are tight; sewage backups are frequent; and signs of rust are present.

Two of the single-stall toilet rooms are located under the staircase of the Carnegie Building.

Handicap-accessible restroom has water accumulation below the tile floor due to the toilet repeatedly overflowing.

/ 14. ELECTRICAL & LIGHTING

The staff kitchen, second floor Tavares Meeting Room, Director's Office, and IT areas near the reference desk are all maxed-out in terms of power supply that can be used without blowing a fuse. The Library has placed signs in these areas requesting that only one device or appliance be used at a time.

The building's electrical systems date to a mid-20th century installation of components in the Carnegie Building, and to components installed with the 1966 Addition. The building's lighting and electric power systems have been serviced by Cardinale Electric for the past eighteen years. All 400-Amp 3-phase electrical service enters the building from a transformer located at the NW corner, and the main electrical panels are located in the adjacent boiler room. The transformer serves the Library and the adjacent fire station. The building's electrical panels are dispersed throughout the building and are not located in dedicated utility rooms, making it possible for patrons to tamper with the fuses. Many rooms have insufficient electrical outlets and amperage available. The IT area on the 1st Floor, the staff kitchen, the Director's Office, the 2nd floor meeting room, and the TEC Lab (housing equipment such as a 3D printer) all regularly experience issues with greater demand for power than can be provided through the available outlets. Lights in the 1966 Addition 1st Floor do not have a switch, and instead are operated via the fuses on the adjacent electrical panel. The two Square D panels should be considered for near-term replacement due to their age.

Ease of access to outlets is a major issue, and to compensate for lack of outlets, various electrical power strips have been installed throughout the building, especially near the public computers on the 1st Floor, near the public computers in the Children's Room, and near seating areas in the McLellan Room, Tavares Meeting Room, and on the 1st Floor.

No aluminum wiring or knob-and-tube wiring has been encountered in any wiring reconfigurations done by Cardinale. Cardinale has encountered some BX cable (armored heavy-duty cable), which is permitted so long as it is not compromised. Water or moisture present in the air tends to deteriorate BX cable. This wiring is feeding the old outlets on the 1st Floor and is located above the drop ceiling on the Ground Floor.

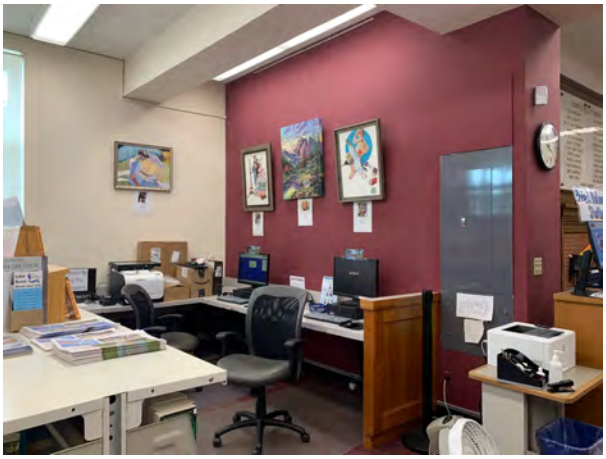
The building's electrical panels and zones are as follows:

- Boiler Room Panel – 100 Amps, serves boiler room area equipment
- Ground Floor Sub-Panel – (Challenger Panel) has circuits remaining
- Ground Floor Panel – 225 Amps – bus-bar panel (Square D) maxed out, some dead-ended wires, serves entire Children's Room plus bathrooms under front stairwell and front stairwell – *should be considered for change due to age*
- 1st Floor Panel – 225 Amps – for circulation desk (Square D) maxed out, no more circuits; this panel is used to turn the lights on in the 1966 Addition portion of the 1st Floor – *should be considered for change due to age*
- Attic Panel – 150 Amps – serves 2nd floor and Attic; circuits are overloaded, they may be drawing from original panel on the 1st Floor

The McLellan Room has updated lighting purpose-designed for the space; however lighting in other areas of the building is basic area lighting. One particularly problematic area is the lighting fixtures above the 1st Floor stacks which do not properly light the

stack aisles for adequate visibility and browsing access. Much of the building's lighting, including the 7 exterior light fixtures, has been changed over to LEDs except for lighting in the McLellan Room; the area over the stage on the Ground Floor which is still incandescent; and the Ground Floor, which is still predominantly T5 and 26-9 W TL fluorescent lights. The installation of LED lights has reduced the overall power draw of the building, and thus it may not be necessary to upgrade the 400-Amp service; however, the available amperage is not distributed to the various sub-panels in a way that meets localized needs for some of the highest power draws: copiers, back-up for UPS servers, and air conditioning equipment.

Most 1st and 2nd Floor lighting has been converted to LEDs. Image shows lights on the 1st Floor near the reference desk.


Electrical panel located in the IT area of the 1st Floor, used to turn the lights on and off on the 1st Floor, 1966 Addition side.


A data closet is located in a closet in the northeast corner of the Ground Floor.


Boiler room electrical panels and disconnect switch.

/ 15. COLLECTIONS SHELVING, CASEWORK & FURNITURE

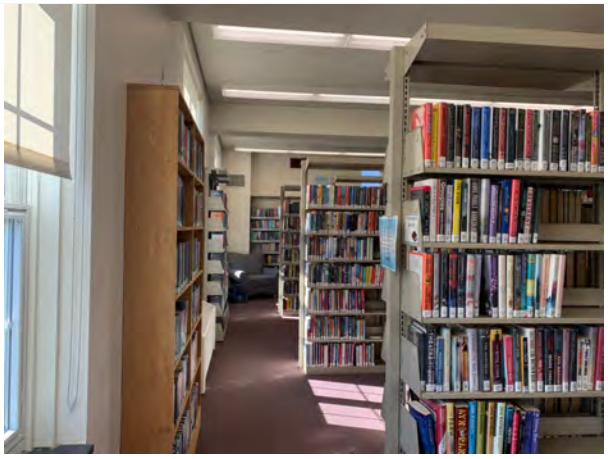
/ COLLECTIONS SHELVING

Structural Engineer Tripi Engineering has advised the Library that the number of books in the collections shelving area of the 1966 Addition 1st Floor must be decreased in order to reduce the weight of the book dead load, since the area was designed as a "reading room" and not as a collections area. Furthermore, Tripi advised the Library that book stacks cannot be rotated 90-degrees to improve sight lines from the circulation and reference desk, since the stacks currently span between floor joists, which is required in order for the floor to continue to support their weight.

End-cap casework on the 1st Floor is out-of-date and of multiple unmatched styles.

Rigid metal straps have been added on top of collections shelving on the 1st Floor for stability on the uneven floors.

The metal collections shelving (RoyalMetal Corp) on the 1st Floor is original to the 1966 Addition. Other 1st Floor shelving has been purchased incrementally and in some cases does not match within a room. The magazine racks in the 2nd Floor are coordinated with the room decor for that room. The collections shelving in the 1st Floor 1966 Addition area has been tied together with metal straps to prevent overturning due to the uneven settlement of the subfloor between beams. This shelving and its contents are a code violation since the floor was designed for the weight of a "reading room" and not a library "collections" area. The Library is receiving guidance from Tripi Engineering about reducing the weight of the shelving in this area and has further employed strategies to purchase more electronic resources with the collections budget and to purchase more popular books that will spend more time circulating rather than occupying space in collections shelving. Staff would like to be able to reorganize the 1st Floor in order to have better sight-lines between shelving from the circulation desk; however the existing collections shelving cannot be turned 90-degrees without structural upgrades to this floor diaphragm, including the walls and foundations that support it from below. *Please reference the Structural Engineer's Item 6., a. on page 4 of Appendix A.*



Metal shelving on the 1st Floor violates building code due to the weight of its contents; the floor diaphragm was designed for a "Reading Room" not a "Collections Room."

Ground Floor access to the elevator is constrained by nearby shelving which has been placed wherever space is available on the Ground Floor.

Collections shelving on the Ground Floor is coordinated with the design layout as the result of a coordinated major renovation done to the majority of this floor in 2001. The collections shelving in the vicinity of elevator doors impedes access by persons with disabilities, especially if those individuals use larger wheelchairs. Collections shelving is located in very close proximity to all sides of the circulation desk on the Ground Floor, which makes this area feel very crowded, especially due to the lack of windows in this area.

/ CASEWORK & FURNITURE – 1ST FLOOR

The casework and furniture on the 1st Floor – which contains the adult collections, reading, and IT area, as well as reference, the main circulation desk, and the teen area – is generally a mix of objects that have been acquired and installed over time to meet the program needs of these areas. These items are not designed for purpose nor are they coordinated floor-wide to create a unified design that is easy for visitors to understand and navigate. The Library does not have adequate storage space for its Library of Things Collection. Tutoring takes place at a variety of desks located throughout the 1st Floor without acoustic privacy either for the student and tutor, or for other Library occupants. Please note that these comments do not account for issues related to undersized, unsuitable, or inequitable program areas.

The Information Desk casework on the 1st Floor is not of durable quality and lacks space for parking book trucks.


Desks used for tutoring on the 1st Floor are conventional office desks.


1st Floor furniture is a mix of antique and contemporary items not purpose designed for their use or location.


Furniture in the teen area on the 1st Floor is uncoordinated and out-of-date.

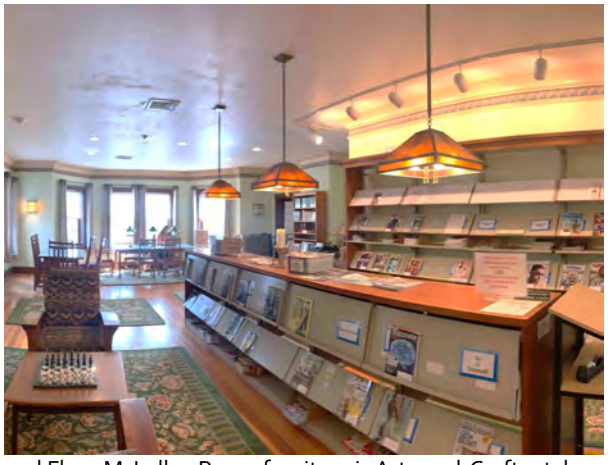
/ CASEWORK & FURNITURE – GROUND FLOOR & 2ND FLOOR

The casework and furniture in the Ground Floor Children's Room and in the 2nd Floor McLellan Room are generally coordinated in style and purpose for the uses of those two rooms, and are in serviceable condition. A notable exception to the organization of both spaces is that storage is lacking. A corner of the McLellan Room is used to store extra chairs, fans, and other items. The stage area of the Ground Floor is used for overflow storage of collections as well as arts-and-crafts supplies, and seasonal and

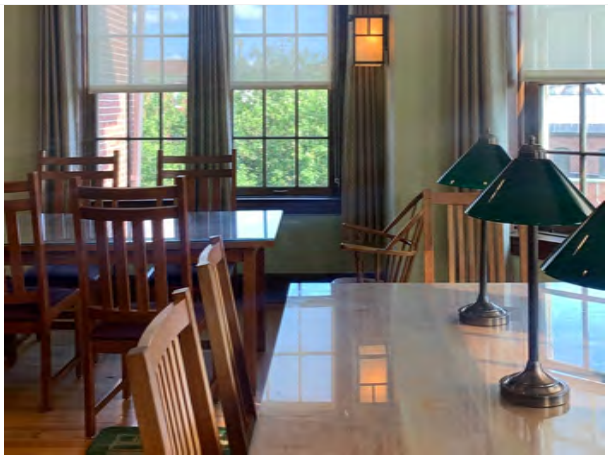
holiday books and audiovisual collections, and is crowded with tables and storage shelving. Both the Ground Floor and 2nd Floor programs could benefit from purpose-designed storage rooms that are separate from the programmed spaces. Please note that these comments do not account for issues related to undersized, unsuitable, or inequitable program areas.

The casework of the Children's Room circulation desk was updated in the 2001 renovation.

Casework and furniture in the Ground Floor Children's Room were updated in the 2001 renovation.



2nd Floor McLellan Room furniture is Arts-and-Crafts style.



Detail of McLellan Room furniture on the 2nd Floor.

END OF NARRATIVE.

Appendices

/ INDEX: Professional Studies, Documents, and Testing

Appendix A
2024 Tripi Engineering Services, LLC, March 14, 2024: "Summary of Findings and Recommendations from Settlement Investigation, Geotechnical Investigation, and Review of Structural Capacity of the First Floor Framing to Support a New Rack Layout"

Appendix B
2023 Geotechnical Engineering Report, Hudson Public Library, 1966 Addition Renovations, McPhail Associates, Christopher Miller, PE (MA License #56755) & Jonathan Patch, PE (MA License #47156)

Appendix C
2023 Preliminary Engineering Report, Hudson Public Library, New Addition, McPhail Associates, Christopher Miller, PE (MA License #56755) & Jonathan Patch, PE (MA License #47156)

Appendix A

Tripi Engineering Services, March 14, 2024, "Summary of Findings and Recommendations from Settlement Investigation, Geotechnical Investigation, and Review of Structural Capacity of the First Floor Framing to Support a New Rack Layout" (MA License #45212)

TRIPI ENGINEERING SERVICES, LLC
433 Main Street, Suite 4
Hudson, Massachusetts 01749
www.tripiengineering.com

March 14, 2024

Ms. Aileen Sanchez-Himes
Library Director
Hudson Public Library
78 Main Street
Hudson, MA 01749

Project: 220131.01 - Structural Engineering Consulting Services:
Hudson Library – 3 Washington Street, Hudson, MA

Subject: Summary of Findings and Recommendations from Settlement Investigation, Geotechnical Investigation, and Review of Structural Capacity of the First Floor Framing to Support a New Rack Layout

Dear Ms. Sanchez-Himes:

As requested, we are providing this summary of our investigation of movement / settlement of the circa 1966 Addition, related geotechnical investigation, and review of the structural capacity of the first-floor framing of the Addition.

Background

In 2017 / 2018, the Town of Hudson engaged Tripi Engineering Services, LLC of Hudson, MA, to investigate apparent movement / settlement of the 1966 "Addition" to the Hudson Public Library. Based upon available budget and timeline needed for measuring / monitoring the movement, the work was completed in phases:

1. Phase 1a (formerly called Phase 1) – Completed Spring / Summer of 2018. The work included document review, limited field observations, preliminary structural analysis and review of "load paths," establishment of settlement monitoring points and installation of visual "crack gauges," to establish a baseline for comparison to future measurements.
2. Phase 1b – Completed Spring of 2019 – The work included follow-up readings on the crack gauges and resurvey of the settlement points we installed during Phase 1a, to determine whether additional movement occurred.
3. Phase 1c – Completed Spring of 2022 (no work was requested nor could be scheduled during the COVID 19 Pandemic) – The work included limited / localized removal of building finish materials to allow firsthand observation of concealed structural elements at the junction between the original library building and the 1966 Addition. The objective of this effort was to confirm that existing structural elements and connections of the building's structural system are configured such that minor additional settlement will not likely result in catastrophic failure, which was confirmed.
4. Phase 2 – Fieldwork and Follow-Up Review / Analysis Completed in 2023 – The work included follow-up settlement investigation, as follows:
   a. Local excavation of "test pits" at the building exterior to allow direct observation of foundation / soil conditions at areas of apparent settlement, and soil borings to determine general site soil conditions.
   b. Continued monitoring of building settlement and precision monitoring of movement (crack widening) through the installation of remotely monitored electronic sensors.

   c. Preliminary review of potential methods for addressing the observed foundation conditions and building settlement.
5. Review of first-floor framing to support new stack layout - Fieldwork and Follow-Up Review / Analysis Completed in late 2022 / early 2023 – Separate from the movement / settlement investigation, we reviewed the first-floor framing of the Addition to determine its capacity to safely support an alternate rack layout.

List of Documents Generated to Date

The following is a list of Tripi Engineering and its Subconsultant's documents issued to date:

1. May 9, 2018 - Completion of Phase 1 Services - Structural Review of Observed Sagging Floors and Apparent Settlement at the Hudson Library - Town of Hudson, MA
2. April 15, 2019 - Completion of Phase 1b - Summary of Findings from Follow-Up Review and Related Recommendations
3. May 25, 2022 - Completion of Phase 1c Services – Summary of Findings from Follow-Up Review and Related Recommendations
4. August 14, 2023 – Geotechnical Engineering Report – Hudson Public Library – 1966 Addition Renovations
5. August 14, 2023 – Preliminary Foundation Engineering Report – Hudson Public Library – New Addition

Summary of Findings to Date

1. Our initial field observations and investigation revealed several symptoms of building movement / settlement of the 1966 Addition (e.g. sloped bed joints in exterior brick, visibly displaced surfaces), and "differential movement" between the Addition and the Original Building (e.g. significant diagonal / step cracks in the brick veneer, gaps at the junction between the buildings, and cracked interior finish materials).
2. Settlement surveys confirmed ongoing vertical movement, but only limited movement has occurred over the time period during which surveys were performed (i.e., the building continues to move, but appears to be moving at a slow rate).
3. Settlement surveys confirmed differential settlement between the Addition and Original buildings. Figure 1 is a plot of the settlement measured to date, showing significant settlement of the Addition and almost no settlement of the Original Building.
4. Investigation of the type / condition of the connections between structural elements at the junction between the Addition and Original Building (Figure 2) revealed that the connections are generally bearing-type connections, which can accommodate some additional movement without being overstressed, however, significant additional movement could lead to instabilities and related structural failure. One of the connections observed at the northwest stairwell should be supplemented / strengthened to safely accommodate the anticipated additional movement.
5. Geotechnical / subsurface investigation revealed that the portions of the Addition observed to have settled are generally founded on unsuitable soil, while the Original Building and other portions of the Addition appear to be founded on "rock ledge" and / or suitable soil.

Figure 3 shows an abrupt "drop off" of the rock ledge beneath a portion of the Addition that corresponds to the location of one of the most significant cracks in the brick veneer. A direct pathway can be observed (white arrows in Figure 3) from the edge of the ledge below grade to the crack in the building's exterior brick veneer.

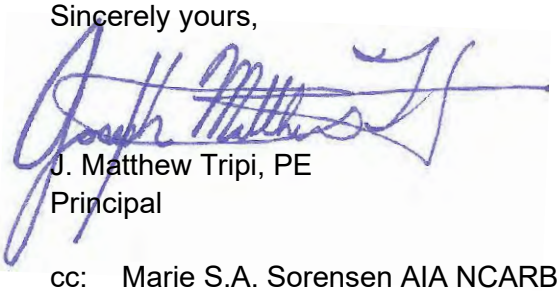
6. Potential options for providing supplemental support to stabilize the foundation and mitigate further movement explored to date include a) "pit underpinning" with concrete, b) installation of "drilled minipiles," and c) installation of "resistance piers." Each approach has pros and cons, and all three have potential limitations.
7. Review of data recorded to date by the recently installed precision electronic crack gauges and tilt-meter revealed that the cracks / gaps are widening, generally with decreasing ambient temperatures since the gauges were installed (August 2023). Figure 4 shows a movement plot (crack widening) based upon data from one of the gauges that was placed across the gap between the Addition and the Original Building. We anticipate that rising temperatures as spring / summer approach will result in the cracks / gaps narrowing some, however, a net increase in width is expected each year. Data is not yet available for a full-year cycle.
8. Structural review and analysis of the first-floor framing of the Addition:
    a. The floor system generally has adequate structural capacity to safely support a "live load" (i.e., weight of furniture, including storage racks, and building occupants) of approx. 60 pounds per square foot (psf) in addition to the "dead load" (i.e. weight) of the floor system itself. This 60psf live load corresponds to current building code requirements for "Reading Rooms" in Libraries, but not "Stack Rooms," which require a much higher floor load capacity of 150psf. Reviewing the original drawings for the Addition Building, this area of the First Floor Addition is designated as a "New General Reading Room," which suggests that the design live load would have been 60psf, consistent with what our analysis shows.
    b. The racks currently stored in this section of the Addition could result in the floor being overloaded under certain conditions, and further review should be performed. For the time being, we understand that the racks are being kept only partially loaded, to reduce the weight. Importantly, the current orientation of the racks (i.e. racks oriented parallel to Main Street at the front of the building), is structurally favorable, because it spreads the rack weight out over several of the floor framing members. Reorienting the racks perpendicular to their current layout would concentrate the loading over only a few members and would overload the floor.
    c. Relocating the racks to the floor below, portions of which have a concrete slab-on-grade floor (Figure 2), may be possible, but would require further investigation of the condition beneath the slab, as some voids have developed due to the building movement. It may be possible to inject polyurethane or grout to fill voids beneath the slab to address this concern, pending further review. The potential surcharge (lateral) loading on the wall of the Boiler Room from the additional weight of the stacks would also need to be reviewed.

Conclusions / Recommendations to Date

1. The Addition continues to move / settle, albeit at a slow rate.
2. The settlement appears to be caused by consolidation of unsuitable soils beneath the Addition.
3. The movement / settlement is expected to continue and will likely cause further distress in the building components, especially at the junction between the Addition and Original Buildings and the locations of subgrade transition between unsuitable soil and ledge.
4. The connections that we were able to observe at the junction between buildings are, in our opinion, safe for the time being, however, significant additional movement will result in unsafe conditions. One small area observed at the northwest stairwell should receive supplemental strengthening in the near term.
5. Continued monitoring is imperative, so that additional movement can be detected and appropriate actions taken before unsafe conditions develop.
6. Near-term and long-term library planning should include taking steps to:
   a. Address potential floor overloading at the Reading Room Area of the Addition which currently contains stacks. Perform additional investigation of the slab-on-grade at the floor below, and address subslab voids if / as required, if that area will contain racks.
   b. Provide supplemental support to the roof framing above the northwest stairwell, at the junction between the Addition and Original Building.
   c. Continue monitoring and periodically inspect connections between structural elements in areas of the building affected by the ongoing movement / settlement.
   d. Permanently address the building settlement / movement by performing foundation remediation of some type, or by removal and replacement of the Addition with a properly founded structure.

Please let me know if you have questions or would like to discuss further.

Sincerely yours,



J. Matthew Tripi, PE
Principal

cc: Marie S.A. Sorensen AIA NCARB LEED AP of
Sorensen Partners / Architects + Planners, Inc.
(Architect performing conditions assessment)

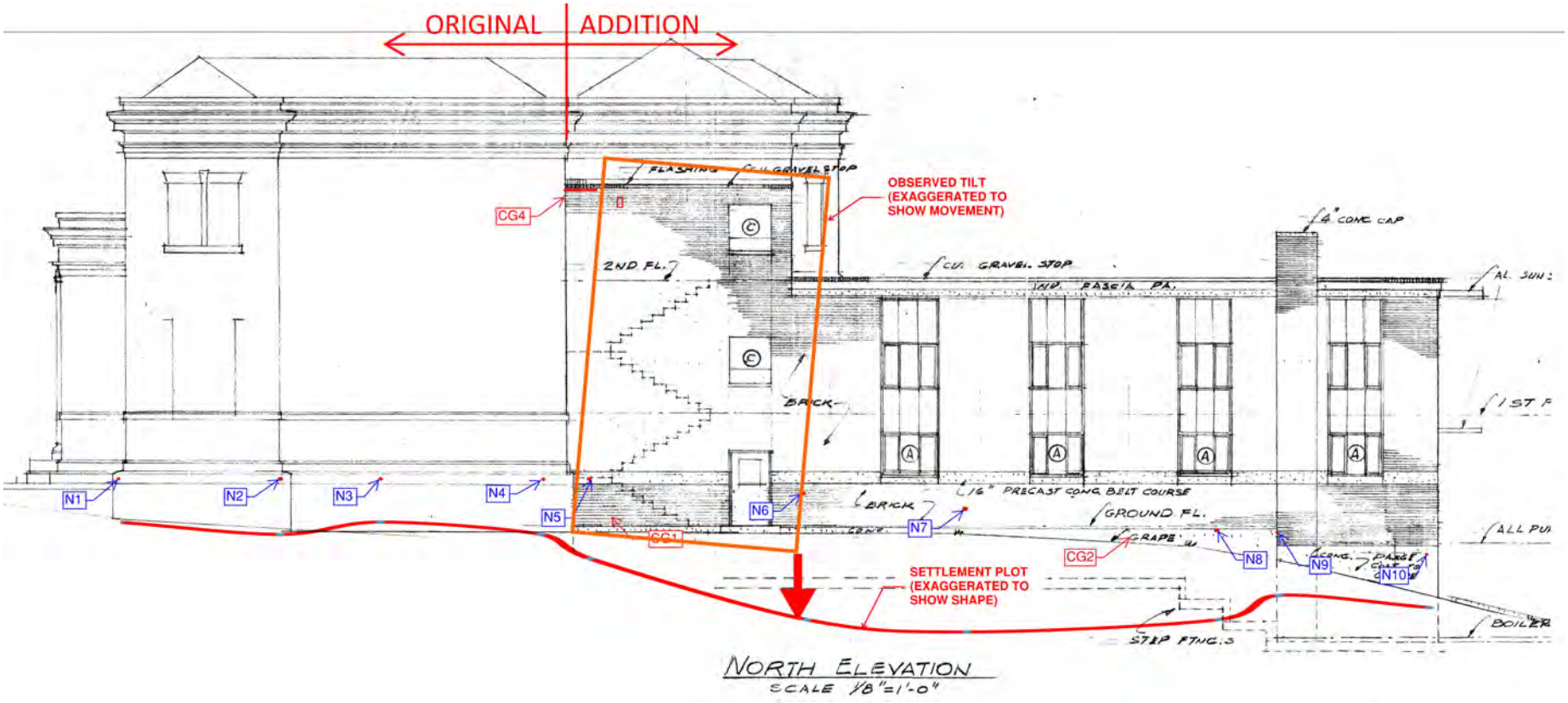


Figure 1 – Plot of observed building settlement.

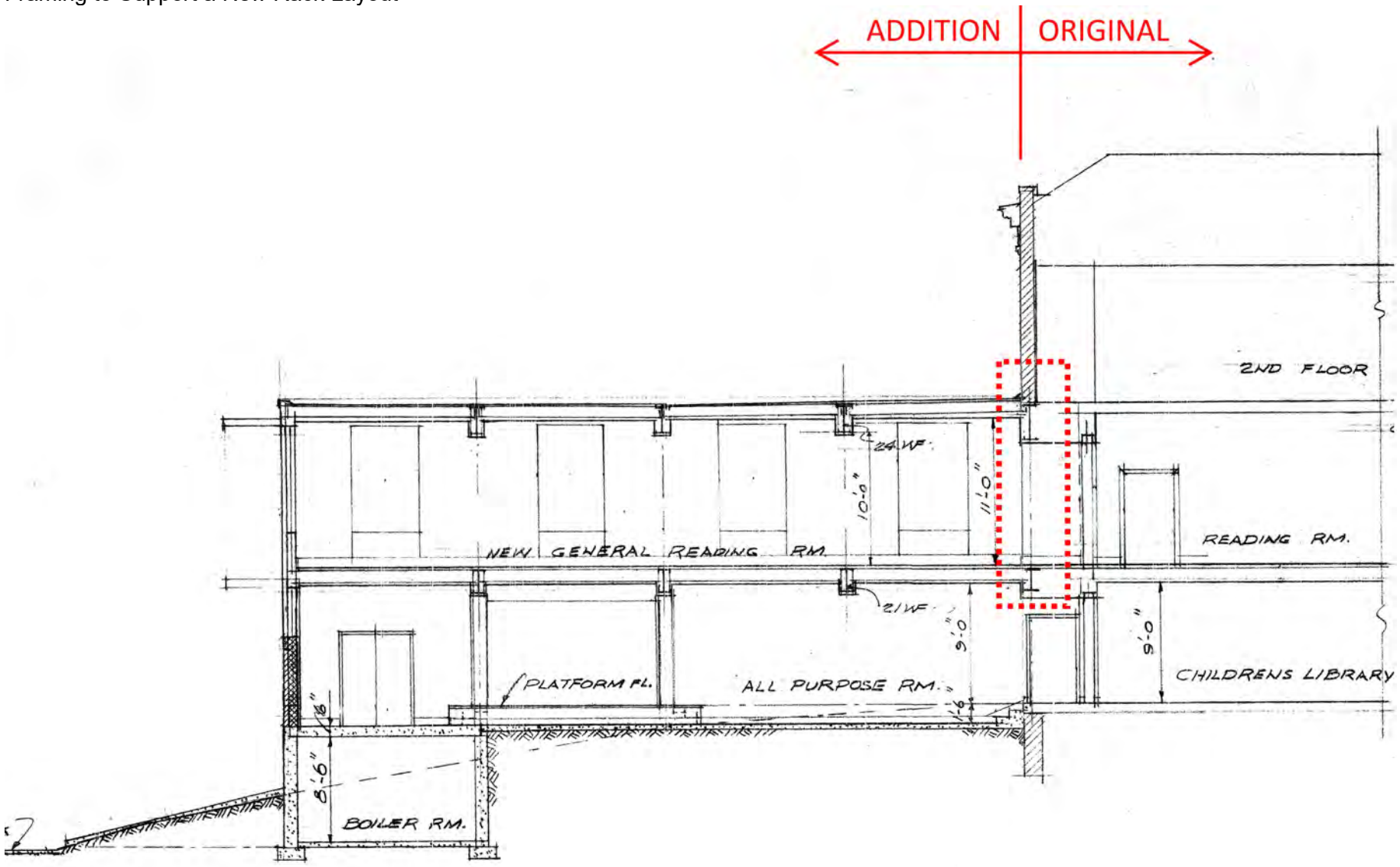


Figure 2 – Cross section of building showing "junction" between Addition and Original Building.

Figure 3 – Photograph from test pit on southeast side of Addition.

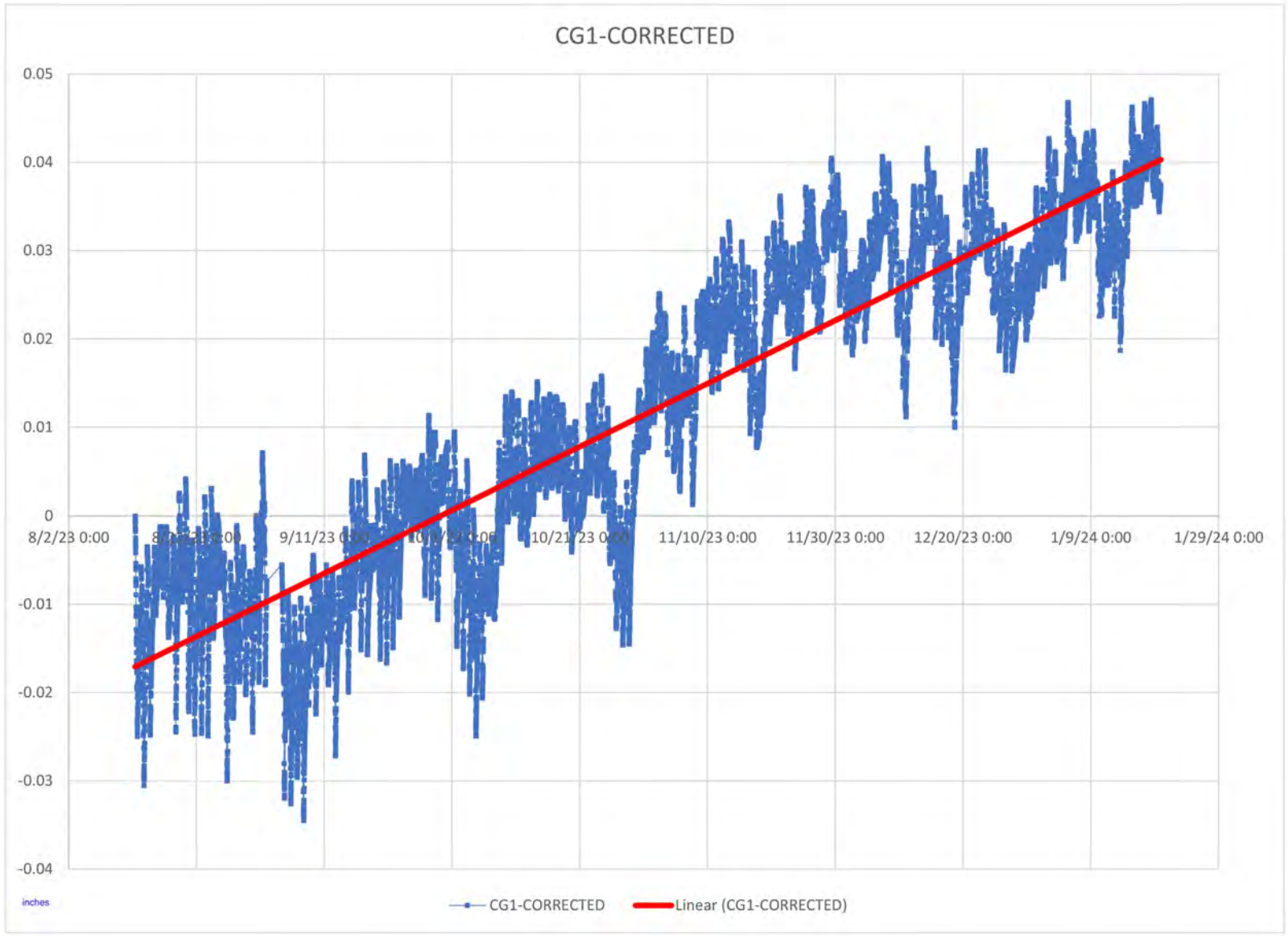


Figure 4 – Plot of movement data from crack gauge placed across gap between Addition and Original Building.

Appendix B

2023 Geotechnical Engineering Report, Hudson Public Library, 1966 Addition Renovations, McPhail Associates, Christopher Miller, PE (MA License #56755) & Jonathan Patch, PE (MA License #47156)

GEOTECHNICAL ENGINEERING REPORT

HUDSON PUBLIC LIBRARY – 1966 ADDITION RENOVATIONS

3 WASHINGTON STREET

HUDSON, MASSACHUSETTS

AUGUST 14, 2023

Prepared For:

Tripi Engineering Services, LLC
433 Main Street, Suite 4
Hudson, MA 01749

2269 Massachusetts Avenue
Cambridge, MA 02140
www.mcphailgeo.com
(617) 868-1420

PROJECT NO. 7641.2.T1

August 14, 2023

Tripi Engineering Services, LLC
433 Main Street, Suite 4
Hudson, MA 01749

Attention: J. Matthew Tripi, P.E.

Reference: Hudson Public Library – 1966 Addition Renovations
3 Washington Street; Hudson, Massachusetts
Geotechnical Engineering Report – Executive Summary

Enclosed is our Geotechnical Engineering Report for the above-referenced project. The following is an executive summary of the report.

The proposed renovations may include repairs to foundations supporting the 1966 addition, which is located at the rear of the original library building, for the purpose of providing supplemental foundation support to limit future differential settlement of the addition due to the differing bearing strata. Additionally, it is understood that the existing interior and exterior damage that has resulted from the differential settlement would be repaired as part of the project.

It is recommended that supplemental foundation support for the proposed renovations consist of one of the following options:

Option 1: Conventional underpinning of the existing foundations, utilizing an allowable bearing capacity of two (2) tons per square-foot.

Option 2: Drilled-in micropiles with pile caps and grade beams. For preliminary micropile design, a design pile capacity of 10 tons in compression and tension is recommended.

Option 3: Resistance piles. For preliminary resistance pile design, a compressive pile capacity of 8 tons is recommended.

Each of these systems would transfer the building loads below the uncontrolled fill and, if present, organics, into the underlying alluvial deposit, glacial till, and/or bedrock.

Other detailed geotechnical engineering recommendations and criteria for foundation design are documented in the report, as well as foundation construction considerations such as survey monitoring, dewatering, on-site reuse of excavated soil, and off-site removal of excess excavated soil. Furthermore, construction monitoring considerations are also presented herein.

GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERS
2269 Massachusetts Avenue
Cambridge, Massachusetts 02140
(617) 868-1420

We look forward to continued participation with the design team during the remainder of the project. Should you have any questions concerning the recommendations presented herein, please do not hesitate to call us.

Very truly yours,

McPHAIL ASSOCIATES, LLC

Christopher P. Miller, P.E.

Jonathan W. Patch, P.E.

N:\Working Documents\Reports\7641_HudsonPublicLibraryHudson_GER_081423.docx

CPM/hjb/jwp

GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERS
2269 Massachusetts Avenue
Cambridge, Massachusetts 02140
(617) 868-1420

CONTENTS:

FIGURES:

APPENDICES:

1.0 - INTRODUCTION

1.1 - GENERAL

This report presents the results of our subsurface exploration program and foundation design study for the proposed renovations to the existing Hudson Public Library located at 3 Washington Street in Hudson, Massachusetts. Refer to the Project Location Plan, **Figure 1**, for the general site locus.

The geotechnical engineering services were performed in accordance with our proposal for geotechnical engineering services dated February 8, 2023, and the subsequent authorization of Tripi Engineering Services, LLC. These services are subject to the limitations contained herein.

1.2 – PURPOSE AND SCOPE

The purpose of the subsurface exploration program and foundation design study was to document the subsurface soil and groundwater conditions at the site, to document the condition and configuration of the existing 1966 addition foundations, to assess the cause of the building settlement, and to provide geotechnical engineering recommendations for supplemental foundation design for the proposed foundation repairs.

Foundation design includes three options to address the settlement of the 1966 addition foundations and seismic design considerations in accordance with the provisions of the Ninth Edition of the Massachusetts State Building Code (Code). Foundation construction considerations relating to geotechnical aspects of the proposed construction are also presented herein.

1.3 – AVAILABLE INFORMATION

Information available to McPhail Associates, LLC (McPhail) included the following:

- A set of historic plans entitled "Addition to the Hudson Public Library; Main St.; Hudson, Mass." dated June 15, 1966, prepared by Earl V. Aldrich & Joseph P. Staniunas Associated Architects.
- A schematic architectural drawing entitled "Scheme 1 – Expansion Over Parking Lot Main Level Plan" dated May 20, 2022, prepared by DRA Architects.
- An undated satellite image of the subject site annotated with a cloud indicating the approximate area of a proposed addition.

1.4 – ELEVATION DATUM

An existing conditions plan with site elevations was unavailable at the time of this report. As such, the elevations cited herein are in feet and are referenced to a local datum which

assumes a rim elevation of 0.0 for the water valve located in the street, just off the sidewalk, in front of the building along Washington Street, which is indicated on **Figure 2**.

2.0 – SITE AND PROJECT DESCRIPTION

2.1 – EXISTING SITE CONDITIONS

Fronting onto Washington Street to the northeast, the existing two-story masonry library building, which occupies an approximately 5,600-square-foot plan area, is bounded by the Town of Hudson Fire Station and parking lot to the northwest, Liberty Park to the southeast, and the Assabet River to the southwest. For the purposes of this report, Washington Street is referred to herein as "north". The ground surface across the site slopes downward approximately 13 feet from Washington Street toward the south side of the 1966 building addition.

Based on our review of the Town of Hudson assessor's database, the original portion of the two-story masonry library building was constructed in 1905 and occupies an approximate 2,600-square-foot plan area and contains a "walk-out" below-grade level that is benched into the sloping site such that the northern portion is fully below-grade and the southern portion is at-grade. The rear (southern) portion of the library building was constructed in 1966 and occupies an approximate 3,000-square-foot plan area. Currently, a portion of the 1966 addition has reportedly settled, resulting in interior cracking and exterior cracking of the foundations and brick façade. As such, an evaluation is being performed to determine if the 1966 addition should be repaired or demolished and replaced. This report focuses on the geotechnical-related issues associated with the repair of the 1966 addition.

Based on survey information obtained by McPhail and our review of the above-referenced historic plans, the lowest-level slab of the original portion of the library is understood to be at about Elevation -5.2 and is about 1.5 feet higher than the 1966 addition lowest-level slab which is understood to be at approximately Elevation -6.7. Furthermore, the boiler room slab at the rear of the 1966 addition is understood to be at Elevation -15.7.

2.2 – PROPOSED RENOVATIONS

The proposed renovations may include repairs to the 1966 addition foundations to provide supplemental foundation support to limit future differential settlement of the addition. Additionally, it is understood that the interior and exterior damage that resulted from the differential settlement will be repaired as part of the project.

3.0 – SUBSURFACE EXPLORATIONS

The approximate location of the subsurface explorations is indicated on the enclosed Subsurface Exploration Plan, **Figure 2**. The following subsurface explorations were completed at the project site under contract to McPhail:

- Two (2) machine-excavated test pits (TP-1 to TP-2) completed on April 27, 2023, by T. D'Amato Excavating, were performed using a mini-excavator with a toothed bucket.
- Six (6) borings (B-1 to B-6) completed on April 26 and 27, 2023, by Carr-Dee Corp.

Exploration procedures and soil classification methods are contained in **Appendix A**.

The borings were drilled to depths ranging from 10 to 22 feet below the existing ground surface and were terminated within a natural glacial outwash deposit or a natural alluvial deposit, with the exception of B-1, which was terminated upon roller bit refusal within the fill layer indicative of possible bedrock. Boring logs are contained in **Appendix B**.

Test pits TP-1 and TP-2 were performed adjacent to the foundation of the 1966 addition. The test pits were excavated to depths of up to 7.9 feet below the existing ground surface. Logs of the test pits prepared by McPhail, and photographs, are contained in **Appendix C**.

Prior to performance of the recent subsurface explorations, a geophysical survey using electromagnetic (EM) and ground-penetrating radar (GPR) techniques was performed on April 24, 2023, by Atlantic GeoServices (AGS) under contract to McPhail to locate utilities in the vicinity of the proposed explorations. The geophysical survey results figure prepared by AGS is contained in **Appendix D**.

4.0 – SUBSURFACE CONDITIONS

4.1 – SOIL AND BEDROCK CONDITIONS

A detailed description of the subsurface conditions encountered in the explorations is documented on the logs contained in the Appendices as described above. Based on the explorations performed at the site, the following is a description of the generalized subsurface conditions across the site encountered from ground surface downward.

Generalized Subsurface Strata	***Approximate Thickness (Feet)***	***Top of Soil Strata (Elevation)***
Surface Treatment	0.2 to 1.0	Ground Surface (El. -6.3 to El. -13.5)
Fill Material	3.2 to 10.7	El. -7.3 to El. -13.7
Organic Deposit	Not Encountered to 5.0	El. -17.9 to El. -19.5 (Where Encountered)
Alluvial Deposit	Not Encountered and/or Not Fully Penetrated	El. -10.5 to El. -22.9 (Where Encountered)
Glacial Till Deposit	Not Encountered and/or Not Fully Penetrated	El. -27.0 (Where Encountered)
Bedrock	Not Encountered or Not Fully Penetrated	El. -9.7 (Where encountered)

Surface Treatments: Ground surface was covered either by topsoil or bituminous concrete pavement. The topsoil generally consists of a dark brown, silty sand with trace gravel.

Fill Material: The fill material generally consists of very loose to very dense, yellow-brown to black, silt and sand, varying to sand and gravel with trace silt, also containing varying amounts of mortar, brick, asphalt, wood, ash, and cinders. Furthermore, what is believed to be an approximate 1-foot thick concrete slab was augered through in boring B-5 from a depth of 5.4 to 6.4 feet below grade. Grain size distributions of samples of the fill material are presented in the enclosed **Figure 3**.

Organic Deposit: Within borings B-3 and B-4, the fill material was underlain by an organic deposit which consists of a very soft to firm, dark brown to black, organic silt with trace sand, varying to fibrous peat and organic silt with fine sand seams.

Alluvial Deposit: The alluvial deposit, which underlies the fill material and/or organic deposit, generally consists of loose to dense, orange-brown to gray, gravelly sand with trace to some silt varying to silt. Refer to **Figure 2** for the elevation of the top of the alluvial deposit at each exploration location, where encountered. Except for borings B-1 and B-3, the explorations were terminated within the alluvium.

Glacial Till Deposit: A glacial till deposit was encountered below the alluvial deposit in boring B-3 at a depth of 13.5 feet. The glacial till generally consists of a very dense, mottled orange-brown to gray-brown, silty sand and gravel, varying to gravelly silt and sand.

Bedrock: Bedrock was encountered below the fill material in test pit TP-1 and may have been encountered below the fill in boring B-1 based on the roller bit refusal. Generally, the glacial till deposit is anticipated to be underlain by bedrock.

4.2 – GROUNDWATER CONDITIONS

The groundwater level in the boreholes at the completion of drilling, with the exception of boring B-4, was observed to range from about Elevation -13.8 to Elevation -21, or between depths of 7 feet and 11 feet below ground surface. Within boring B-4, groundwater was observed at a depth of 4.5 feet below ground surface, corresponding to Elevation -17.9. The elevation of the water level in the Assabet River should be determined as part of a future topographic site survey.

It is anticipated that future groundwater levels across the site may vary from those reported herein due to the level of water in the Assabet River, factors such as normal seasonal changes, runoff particularly during or following periods of heavy precipitation, and alterations of existing drainage patterns.

4.3 – EXISTING FOUNDATION CONDITIONS

Based upon our review of the foundation plan contained in the above-referenced 1966 plans, which is included in **Appendix E** along with an elevation view and longitudinal section, the existing 1966 addition is supported on spread footing foundations. Specifically, the existing plan indicates that a 2-foot wide concrete footing at a minimum 4-foot depth below grade is located around the east, south and west sides, and interior columns are supported on 3-foot and 4-foot square concrete footings.

Based upon our review of the 1966 drawings and our site reconnaissance, the southern end of the 1966 addition, identified on the plans as "Boiler Room", has a lowest level slab 9 feet below the remainder of the addition at Elevation -15.7, with the remainder of the lowest-level slab at Elevation -6.7. The continuous footings around the boiler room are anticipated to be 12 inches thick with the bottom at about Elevation -17. The continuous perimeter footings on the west and east sides of the 1966 addition are anticipated to step up from south to north from approximately Elevation -17 to approximately Elevation -10.7.

Test pit explorations TP-1 and TP-2 were performed on the exterior of the east and west sides of the 1966 addition, respectively. The existing lowest-level slab of the addition in this area is understood to be at approximately Elevation -6.7. It is noted that foundation conditions may vary from those observed in the test pits. Groundwater was not observed within the completed test pits. Test pit logs and photographs are included in **Appendix C**.

Test pit TP-1 was performed adjacent to the exterior foundation wall and the children's section entrance and exposed the foundation of the 1966 addition and the main building. A cast-in-place concrete foundation wall was observed to extend down approximately 2.4 feet below ground surface for the children's section entrance area, bearing on approximately 0.3 feet of fill material that overlies bedrock. For the main building, a cast-in-place concrete foundation wall was observed to extend down approximately 3.4 feet below ground surface, bearing on a 0.3-foot-thick fill layer overlying bedrock. Approximately 8.5 feet south of the foundation wall for the children's section entrance, the cast-in-place foundation wall was observed to step down to approximately 3.8 feet below ground surface, continuing to bear

on a thin layer of fill material overlying bedrock. Approximately 10.5 feet south of the foundation wall for the children's section entrance, the bedrock surface was observed to drop off vertically and the footing was observed to bear on an undetermined amount of fill material. Within boring B-1, which was performed at the southeast corner of the 1966 addition, the fill material was observed to extend to a depth of 10 feet below grade which corresponds to Elevation -23, where the boring was terminated upon practical refusal with the roller bit which could be indicative of the bedrock surface. Based on boring B-1, bedrock is anticipated to be about 6 feet below the bottom of footing of the boiler room foundations, which are anticipated to be at about Elevation -17.

Test pit TP-2 was performed adjacent to the exterior foundation wall of the 1966 addition proximal to the connection with the original library building. A cast-in-place foundation wall was observed to extend down approximately 5.7 feet below ground surface which corresponds to approximately Elevation -12, bearing on fill material. Test pit TP-2 was terminated in the fill material at a depth of 7.9 feet below ground surface, which was about 2.2 feet below bottom of footing. Within boring B-2, which was performed to the south of test pit TP-2, the fill material was observed to extend to a depth of 11 feet to Elevation -20.6, where the boring encountered the natural alluvial deposit. Based on boring B-2, the surface of the natural alluvial deposit is approximately 8.6 feet below the bottom of footing based on information obtained from test pit TP-2.

5.0 – GEOTECHNICAL RECOMMENDATIONS

5.1 – PROBABLE CAUSE OF BUILDING SETTLEMENT

The observed settlement of the existing 1966 addition is considered to be the result of the existing spread footings bearing on an "uncontrolled" fill material which, at some explorations, was observed to be underlain by a highly compressible organic deposit. Based on our observations of soil samples obtained from the borings and test pits, portions of the fill contain organics, ash, cinders, and brick. Furthermore, the density of the fill as determined by the borings was observed to vary, with portions of the fill being loose. As such, the fill material below the existing 1966 addition foundations is considered to be "uncontrolled", meaning that it was likely not placed and compacted in a controlled manner, and such, would likely cause settlement of an overlying structure. Additionally, the weight of the existing uncontrolled fill and the load from the existing spread footings would cause the organics, if present below the footings, to compress which would contribute to more structure settlement. Furthermore, step cracking of the exposed brick foundation wall on the east side of the 1966 addition is located proximal to where the bedrock observed in test pit TP-1 was observed to drop off. As such, differential settlement appears to have occurred where the footing support transitions from a thin layer of fill overlying bedrock to a greater thickness of the uncontrolled fill.

5.2 – RECOMMENDATIONS FOR SUPPLEMENTAL FOUNDATION SUPPORT

It's possible that the existing structure may continue to settle over time even with no appreciable changes to the existing structure. As such, in order to minimize the potential for

future uncontrolled settlement, it is recommended that supplemental foundation support be provided.

Based on the subsurface conditions the following are three (3) options for supplemental foundation support:

Option 1: Conventional Pit Underpinning

This option would consist of the installation of conventional concrete underpinning pits below the continuous perimeter foundations and the interior boiler room foundation wall. The underpinning pits would extend down to the natural alluvial deposit or bedrock, to transfer the building load below the uncontrolled fill and, if present, organic deposit. Refer to Section 5.3 for additional information.

Option 2: Drilled-In Micropiles

This option would consist of the installation of drilled-in micropiles to transfer the load from the existing footings to the underlying alluvial deposit, glacial till, and/or bedrock deposit. The existing continuous footings would need to be analyzed to determine their ability to act as a grade beam and span unsupported between the micropile elements. Alternatively, new pile caps and grade beams could be constructed to re-support the structure and transition the load to the micropiles. Refer to Section 5.4 for additional information.

Option 3: Resistance Piles

This option would consist of the installation of resistance piles to transfer the load from the existing footings to the underlying alluvial deposit, glacial till, and/or bedrock deposit. The existing continuous footings would need to be analyzed to determine their ability to act as a grade beam and span unsupported between the resistance pile elements, which would be connected to the bottom of the existing continuous footings by means of steel brackets. Refer to Section 5.5 for additional information.

5.3 – OPTION 1: CONVENTIONAL PIT UNDERPINNING

This option would consist of underpinning the majority of the continuous foundation walls of the 1966 addition, with the exception of the northeastern portion of the perimeter wall of the addition, proximal to the children's section entrance, where the foundations were observed to bear on bedrock. Furthermore, underpinning of the existing foundations will be required to extend the bottom of the foundations such that they bear on the natural alluvial deposit or bedrock, whichever is higher. Based on the test pit and boring information, the maximum depth of underpinning is anticipated to be 8 feet below the bottom of the existing foundations. The feasibility of this approach will need to be discussed with specialty contractors due to the relatively high depth of the underpinning relative to what is normally performed. The actual extent of underpinning should be evaluated in the field utilizing supplemental test pits or as the existing bottom of footing elevations are exposed in excavations.

For this option, underpinning of the existing continuous foundations would consist of hand-excavated, timber lagged underpinning pits. The underpinning pits should be proportioned utilizing an allowable design net bearing pressure of two (2) tons per square foot bearing on either the alluvial deposit or bedrock. As indicated above, the existing continuous footings are anticipated to be 2 feet wide. In lieu of providing continuous underpinning along the full length of the foundations and for the anticipated 2-foot footing width, it may be possible to enlarge the bearing surface of the underpinning pit such that it is designed to support the load from an adjacent non-underpinned footing. The feasibility of this approach would require evaluation, by the project structural engineer, of the existing footing to determine if it could span.

The maximum width of each individual underpinning pit along the length of the foundation wall should not exceed four (4) feet and the minimum clear distance between simultaneously excavated pits should not be less than eight (8) feet. The Contractor should assess the condition of the existing foundations for themselves prior to beginning underpinning to determine if any stabilization of the existing foundations should be performed.

It is recommended that as soon as the bearing surface is exposed by means of a hand shovel, it be immediately covered with a minimum 3-inch thickness of compacted 3/4-inch crushed stone to prevent disturbance of the subgrade during subsequent forming operations. Dewatering by means of conventional sumping, or possibly wellpoints, will be required to lower the groundwater level below the bottom of the underpinning pits.

Concrete should be placed "in the dry" within each underpinning pit to a minimum of 3 inches below the bottom of the existing footings. After the concrete has sufficiently cured, the space between the concrete underpinning pit and bottom surface of the existing foundation should be dry-packed in accordance with proper underpinning practice.

Conventional pit underpinning is not anticipated to be feasible for the interior column footings, which are anticipated to be 3- and 4-foot square, due to their small size. Based on our review of the plans for the 1966 addition, the loading of the interior columns is unknown, however they may only extend to the ground-floor framing. Should the interior columns only extend to the ground-floor framing, it is anticipated that temporary shoring of the ground-floor framing by means of needle beams and timber cribbing may be feasible, to allow the existing footings to be removed temporarily. The existing footings could either be replaced with new footings at a lower elevation, bearing on the natural alluvial deposit or bedrock, or with drilled-in micropiles as described herein. The required temporary shoring loads would need to be determined by the project structural engineer prior to the preparation of the underpinning and shoring design.

The underpinning design should be prepared by a professional engineer registered in the Commonwealth of Massachusetts who is employed by the Contractor. The design submittals for underpinning should be submitted to the Architect for review by McPhail and the project structural engineer prior to the commencement of construction.

5.4 – OPTION 2: DRILLED-IN MICROPILES

Underpinning the existing building may be accomplished by use of drilled-in micropiles installed adjacent to the existing footing foundations, with new pile caps and grade beams, to transfer the building loads below the uncontrolled fill and, if present, organics, into the underlying alluvial deposit, glacial till, and/or bedrock. The connection of the drilled-in micropiles to the existing footings would need to be designed by the project structural engineer. The required compressive, tensile, and lateral pile loads would be a function of the pile spacing, which would be determined by the project structural engineer. For preliminary micropile design, a design pile capacity of 10 tons in compression and tension is recommended. Depending on the final pile design, a pile load test may be required.

5.5 – OPTION 3: RESISTANCE PILES

Underpinning the existing building may be accomplished by use of resistance piles installed adjacent to the existing footing foundations, to transfer the building loads below the uncontrolled fill and, if present, organics, into the underlying alluvial deposit, glacial till, and/or bedrock. Resistance piles are hydraulically-pushed into the soil with hydraulic cylinders by using the weight of the overlying structure as a reaction force. The existing structure must have sufficient weight to allow enough force to be applied to the pile to reach the natural alluvial deposit, glacial till or bedrock bearing strata. Each pile is installed individually, utilizing the maximum resistance of the structure as a reaction force. The connection of the resistance piles to the existing footings is typically provided by a steel bracket that would be attached to the bottom of the existing footing. The required compressive, tensile, and lateral pile loads would be a function of the pile spacing, which would be determined by the project structural engineer. For preliminary resistance pile design, a compressive pile capacity of 8 tons is recommended.

5.6 – SEISMIC DESIGN CONSIDERATIONS

For the purposes of determining parameters for structural seismic design, this site is considered to be a Site Class D as defined in Chapter 20 of American Society of Civil Engineers (ASCE) Standard 7-10 "Minimum Design Loads for Buildings and Other Structures". Further, the bearing strata on the proposed site are not considered to be subject to liquefaction during an earthquake based on the criterion of Section 1806.4 of the Code.

6.0 – FOUNDATION CONSTRUCTION CONSIDERATIONS

6.1 – GENERAL RECOMMENDATIONS

This section addresses geotechnical aspects of the proposed supplemental foundation support construction which are considered by McPhail to be critical to proper foundation performance of the completed renovations as well as mitigating potential adverse foundation construction impacts on surrounding buildings, streets, utilities, and other site improvements, as applicable.

Prospective contractors should be provided with the following information regarding the foundation construction considerations; however, each contractor should perform an independent assessment based on their own equipment, personnel, and anticipated procedures with input from specialty foundation subcontractors.

6.2 – SURVEY MONITORING

During the underpinning process, the existing foundations to be underpinned should be monitored daily for vertical movement by installing monitoring points approximately every 5 feet on-center in the areas to be underpinned, including on building columns. With proper execution of the underpinning, the building settlement is anticipated to be less than 3/8-inch. The interior and exterior non-foundation related repairs of the building should be performed following the completion of all underpinning and foundation-related construction activities.

6.3 – GROUNDWATER CONTROL

Due to the moderately high silt content of the naturally deposited soils at the site (i.e., alluvium), a key construction consideration will be the depth of groundwater below ground surface, as proper control of groundwater and surface water will be necessary to maintain a firm subgrade to support construction traffic and to complete the construction in-the-dry. Even with proper control of both surface water and groundwater, it is probable that during periods of wet weather off-site gravel borrow and/or crushed stone may be required to maintain trafficability for construction equipment.

Groundwater readings within the completed explorations at the site indicate that groundwater is located between Elevation -13.8 and Elevation -21. At the time of construction, if the groundwater level is at or below the excavation subgrade elevations, it is anticipated that groundwater and surface water can be controlled using conventional sumping in combination with strategic use of trenches and berms. However, if the groundwater level at the time of construction is at or above the bearing strata elevation, it is anticipated that a system of strategically placed well-points would be required to assist in controlling the inflow of groundwater into the excavation. As discussed above, the conventional pit underpinning option would require temporary dewatering to prepare and maintain the underpinning pit subgrades in a dry condition prior to placement of concrete.

Pumped groundwater should be recharged on site where possible. Otherwise, the appropriate dewatering discharge permits should be obtained prior to discharging water into nearby storm drains which are anticipated to discharge into the Assabet River.

The construction dewatering system should be designed by a professional engineer registered in the Commonwealth of Massachusetts who is employed by the contractor. The design should be submitted to the Architect for review prior to the commencement of construction.

6.4 – REUSE OF ON-SITE SOILS

It is anticipated that portions of the excavated granular fill may be re-used on-site as ordinary fill and structural fill, provided they are maintained in a dry condition and can be properly compacted. Excavated granular fill material, to be reused on-site as structural fill, should typically contain less than 20% by weight passing the No. 200 sieve. Excavated soil with greater than 20% by weight passing the No. 200 sieve should be segregated and can be reused on-site as ordinary fill subject to the provisions contained herein.

Structural fill should consist of inorganic excavated on-site fill material and should conform to the following gradation requirements:

U.S. Sieve No.	Percent Passing by Weight
4″	100
1″	60 – 100
#4	25 – 95
#40	5 – 50
#200	0 – 20

It is recommended that stockpiles of excavated material intended for on-site reuse be protected against increases in moisture content by securely covering the stockpiles at all times with 6-mil polyethylene for protection from precipitation and also as a dust mitigation measure. The placement and compaction of on-site material should be completed during relatively dry and non-freezing conditions. If the earthwork operations are performed during a wet and/or cold period, it is anticipated that portions of the on-site soil may become unsuitable for re-use on-site. If, due to any of the above conditions, the excavated material is unsuitable for reuse, an off-site gravel borrow should be used.

Gravel borrow should consist of a well-graded, natural sand and gravel from an off-site source, conforming to the following gradation requirements:

U.S. Sieve No.	Percent Passing by Weight
3″	100
½″	50 – 85
#4	40 – 75
#50	8 – 28
#200	0 – 8

Due to the presence of organic material (roots) in the existing topsoil, we do not recommend reusing this material as structural fill beneath the slabs-on-grade. The on-site existing topsoil may be reused as ordinary fill in landscaped areas, provided it is protected from wet and freezing environments and can be compacted to the recommended densities. However, given that sufficient space on site to stockpile topsoil is likely not available, as a practical basis it is anticipated that the topsoil will be removed from the site.

Additionally, the results of our subsurface explorations indicate the presence of oversized material including brick, concrete, cobbles and boulders. Prior to reusing the material on-site as structural fill or exporting off-site, it will be necessary to cull out all material in excess of 4 inches in largest dimension. Depending upon the amount of oversized material, it may be practicable to remove oversized material by passing the material through a 4-inch bar screen prior to its reuse and/or using an excavator equipped with a skeleton bucket.

6.5 – OFF-SITE REMOVAL OF EXCESS SOILS

Current Department of Environmental Protection (DEP) policies and regulations for off-site removal of excess excavated soil require environmental characterization of the excess excavated soil prior to its off-site reuse or disposal. McPhail could perform this service as an additional service if requested.

7.0 – FUTURE WORK

7.1 – DESIGN ASSISTANCE

It is recommended that McPhail be retained to provide design assistance to the design team during the final design phase of this project. The purpose of this involvement is to review the structural foundation drawings and foundation notes for conformance with the recommendations presented herein and to generate the geotechnical-related specification sections for inclusion into the Contract Documents for construction.

7.2 – CONSTRUCTION OBSERVATION

It is recommended that McPhail be retained during the construction period to observe the underpinning operations in accordance with the provisions of the Code and the provisions of the Contract Documents. Our involvement during the construction phase of the work should minimize costly delays due to unanticipated field problems since our field representative would be under the direct supervision of our project manager who was responsible for the subsurface explorations and foundation design recommendations documented herein.

8.0 – LIMITATIONS

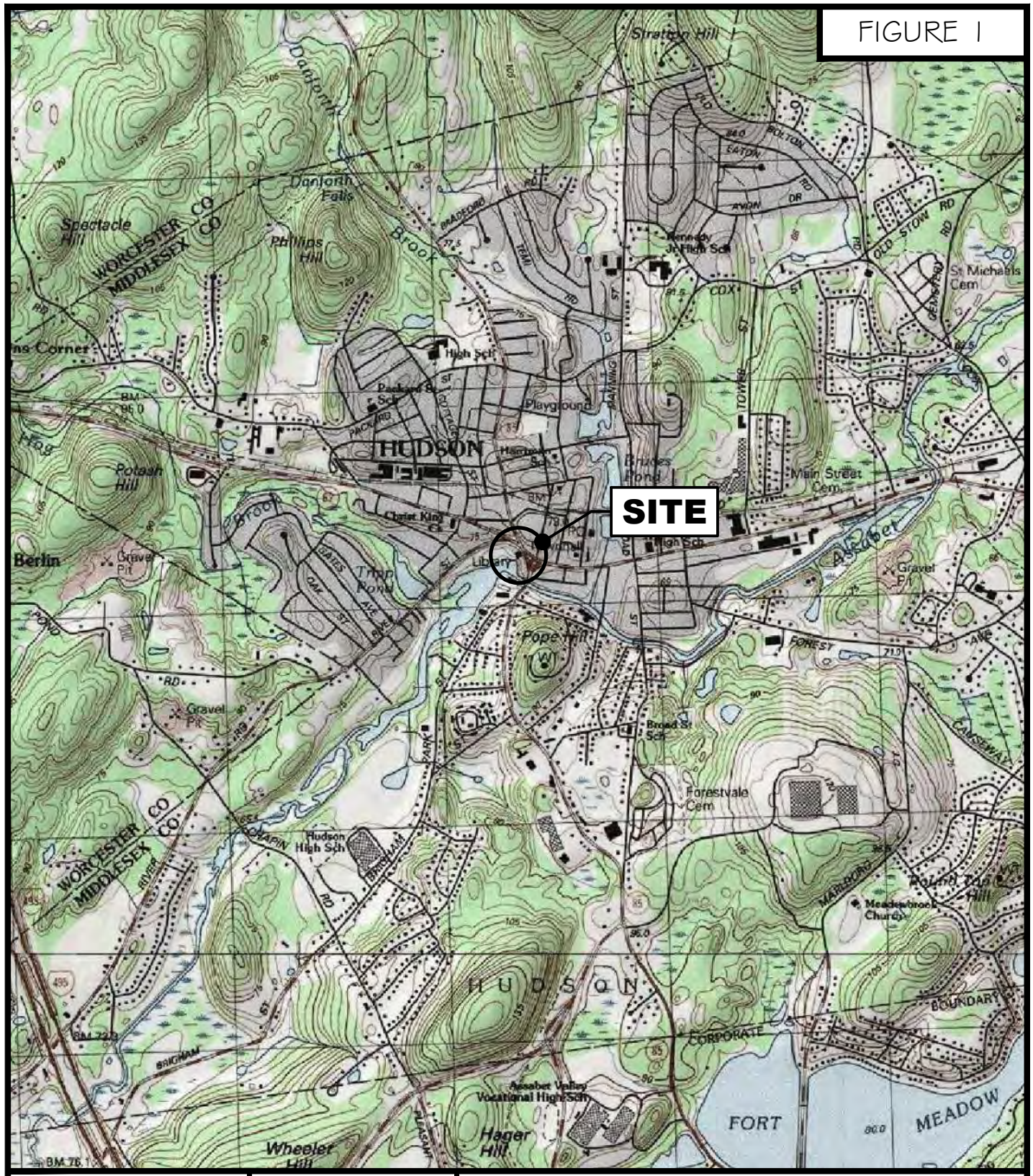
This report has been prepared in accordance with generally accepted soil and geotechnical engineering practices. No other warranty, expressed or implied, is made. If any changes in nature or design of the proposed construction are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by McPhail.

The analyses and recommendations presented in this report are based upon the data obtained from the subsurface explorations performed at the approximate locations indicated on the enclosed plan. If variations in the nature and extent of subsurface conditions between the widely spaced explorations become evident during construction, it will be necessary for a re-evaluation of the recommendations of this report to be made after

performing on-site observations during the construction period and noting the characteristics of any variations.

FIGURES

FIGURE 1



McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

N

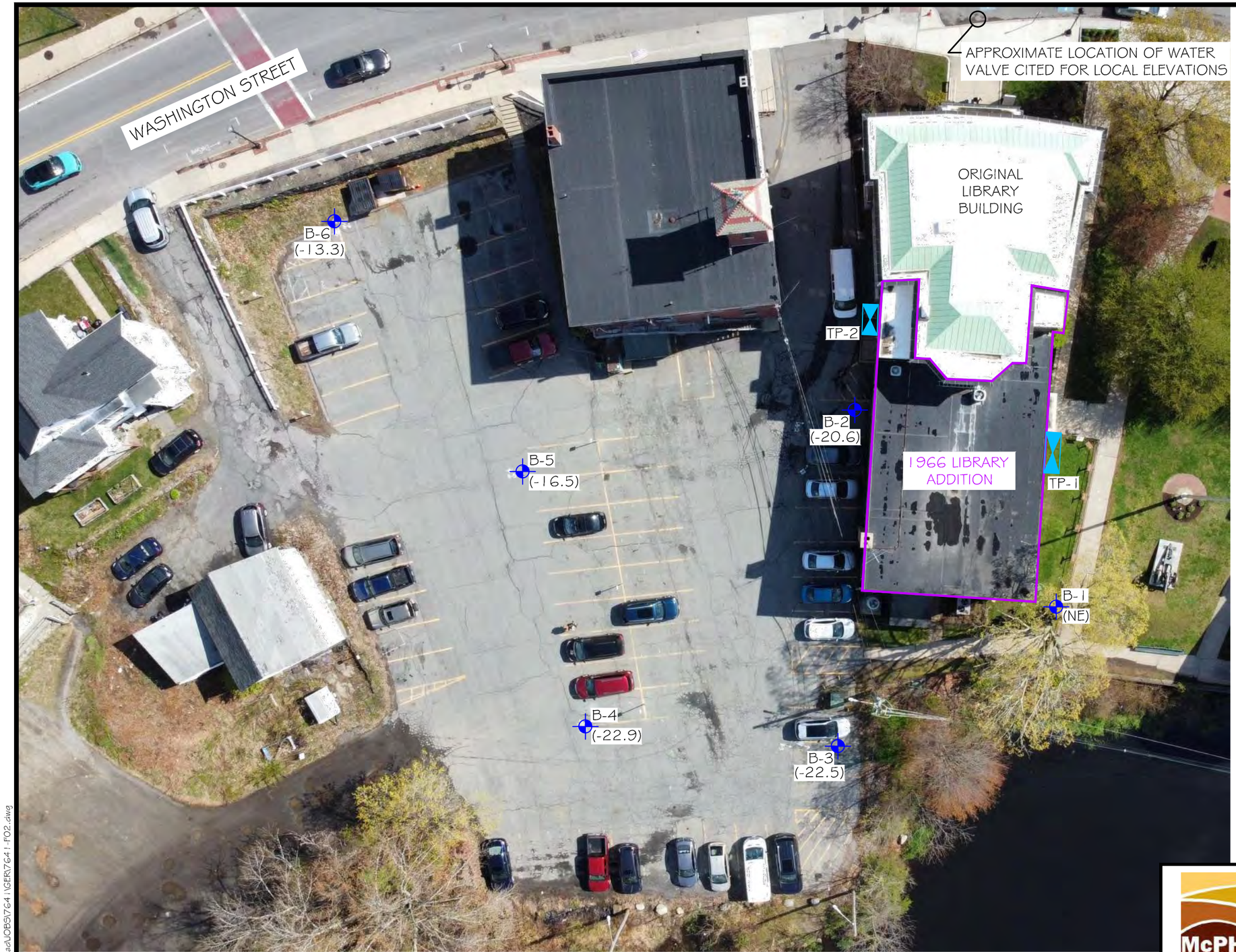
SCALE 1:25,000

PROJECT LOCATION PLAN

HUDSON PUBLIC LIBRARY

HUDSON MASSACHUSETTS

FIGURE 2



NORTH

LEGEND

— APPROXIMATE LOCATION OF TEST PIT PERFORMED BY T. D'AMATO EXCAVATING ON APRIL 27, 2023 FOR MCPHAIL ASSOCIATES, LLC

— APPROXIMATE LOCATION OF BORING PERFORMED BY CARR-DEE CORP. ON APRIL 26 AND 27, 2023 FOR McPHAIL ASSOCIATES, LLC

(-20.6) — INDICATES APPROXIMATE ELEVATION OF TOP OF ALLUVIAL DEPOSIT

(NE) — INDICATES ALLUVIAL DEPOSIT NOT ENCOUNTERED

REFERENCE: THIS PLAN WAS PREPARED FROM A NOT-TO-SCALE AERIAL PHOTO TAKEN ON APRIL 24, 2023 BY ATLANTIC GEOSERVICES, LLC

GRAPHIC SCALE

30 0 30 60

McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

HUDSON PUBLIC LIBRARY

HUDSON MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

TRIPI ENGINEERING SERVICES, LLC

BY

McPHAIL ASSOCIATES, LLC

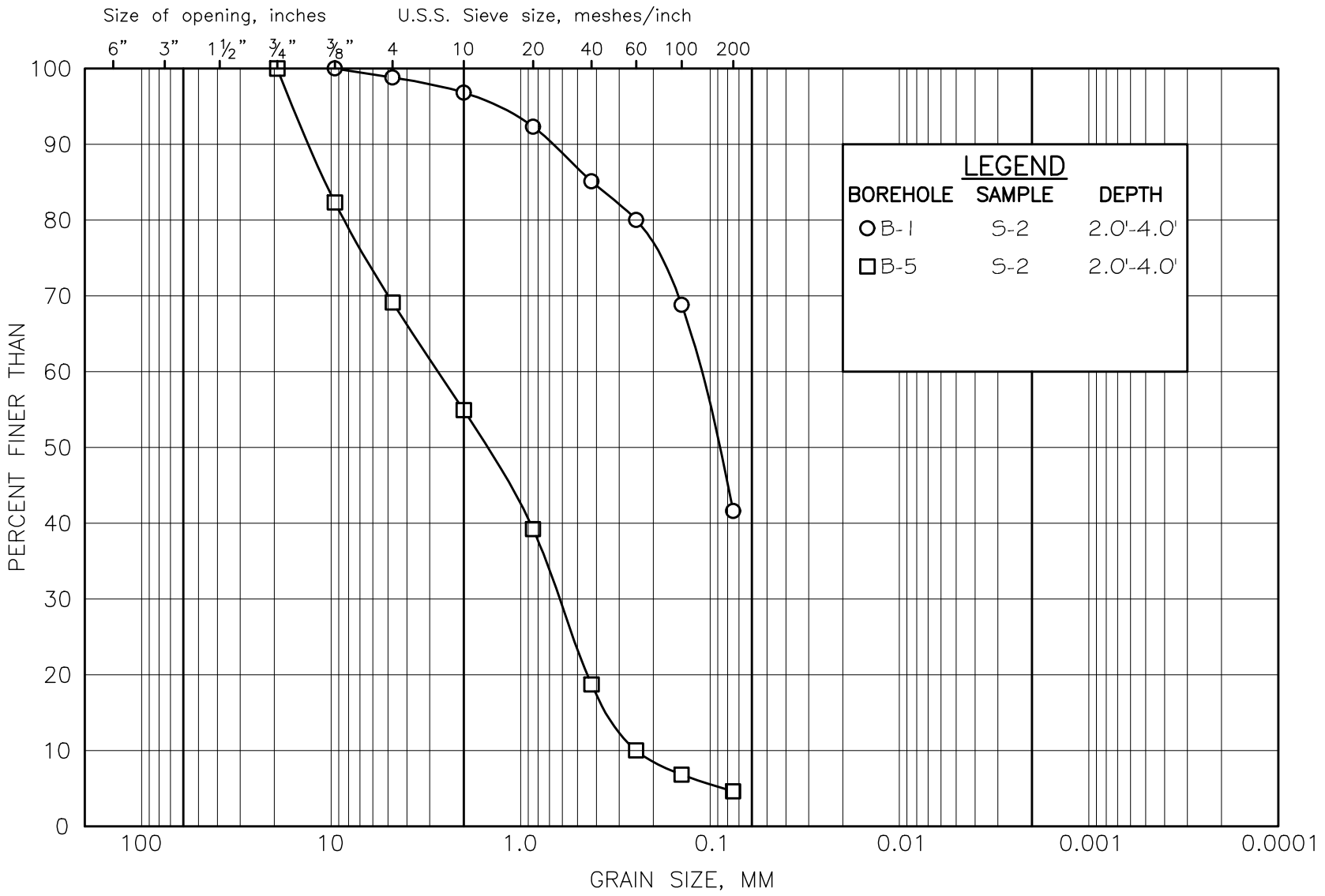
Date: AUGUST 2023	Dwn: M.B.S.	Chkd: C.P.M.	Scale: 1" = 30'
Project No: 7641			

FILE NAME: N:\Acad\JOBS\7641\GFR\7641-F02.dwg

FILE NAME: N:\Acad\JOBS\7641\GER\7641-F03_Sieve.dwg

PROJECT No. 7641

M.I.T. GRAIN SIZE SCALE



COBBLE SIZE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE
	GRAVEL SIZE			SAND SIZE			FINE GRAINED	

McPHAIL ASSOCIATES, LLC

GRAIN SIZE DISTRIBUTION
FILL

FIGURE 3

APPENDIX A:

EXPLORATION AND LABORATORY TESTING PROCEDURES

The borings were performed using a truck-mounted or track-mounted drill rig and advanced utilizing NW casing and the wet rotary drilling methods. Standard 2-inch O.D. split-spoon samples and standard penetration test results were generally obtained continuously to a minimum depth of 6 feet below existing grade and then at minimum 5-foot intervals for the remainder of the boring depths. The split-spoon sampling was performed in general accordance with the standard procedures described in ASTM D1586.

The test pits were performed using a Yanmar ViO55 rubber-tracked mini-excavator and excavated to depths of up to 7.9 feet below the existing ground surface.

The explorations were monitored by McPhail field representatives who performed field layout, prepared field logs, obtained and visually classified soil samples, monitored groundwater conditions in the open boreholes, and determined the required exploration depth based upon the actual subsurface conditions encountered.

Field locations of the explorations were determined by taping from existing site features included on the available drawings. Unless noted otherwise, the existing ground surface elevation at each exploration location was determined by a level survey performed by our field staff utilizing vertical control information on the available drawings.

At the completion of the field work, soil samples were returned to our laboratory for more detailed classification, analysis, and testing. The laboratory testing consisted of sieve analyses to determine the gradations and confirm the visual classifications of the soil deposits. Laboratory test procedures were in general accordance with applicable ASTM Standards.

SOIL CLASSIFICATION SYSTEM

The soil classifications contained herein were determined using the Modified Massachusetts Institute of Technology (MIT) Soil Classification System, which utilizes the following definitions and descriptive terms to describe the soil components, percentage of soil components, and soil densities:

Soil Type	Grain Size Range (millimeters)
Gravel	60 – 2
Sand	2 – 0.06
Silt	0.06 – 0.002
Clay	<0.002

Descriptive Term	Proportion of Total (%)
"Trace"	0 - 10
"Some"	10 - 20
ADJECTIVE (e.g., sandy, silty)	20 - 35
"And"	35 - 50

Granular Soils	
Density	**Penetration Resistance (blows per foot)**
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	>50

Cohesive Soils		
Density	**Penetration Resistance (blows per foot)**	**Undrained Shear Strength (pounds per foot)**
Very Soft	0 - 2	0 - 250
Soft	2 - 4	250 - 500
Firm	4 - 8	500 - 1000
Stiff	8 - 15	1000 - 2000
Very Stiff	15 - 30	2000 - 4000
Hard	>30	>4000

APPENDIX B:

BORING LOGS

Project: Hudson Public Library
Location: 3 Washington Street
City/State: Hudson, Massachusetts

Job #: 7641.2.T1
Date Started: 4-26-23
Date Finished: 4-26-23

Boring No.
B-1

Contractor: Carr-Dee Corp
Driller/Helper: S. DeSimone/J . DeSimone
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -13.0

Casing Type: NW
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-26-23	8	-21.0	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.5 / -13.5	TOPSOIL						
1	-14				5	S-1	24/15	0.0-2.0	3 3 2 4	Loose, brown, SAND, trace silt, with gray-black ash and cinders. (Fill)
2	-15									
3	-16				8	S-2	24/13	2.0-4.0	4 3 5 4	Loose, yellow-brown, fine SAND and SILT, trace gravel, with pockets of gray silt. (Fill)
4	-17									
5	-18			FILL						
6	-19				16	S-3	24/18	5.0-7.0	6 3 13 9	Compact, yellow-brown to orange-brown, fine SAND, some silt, to dark brown, SILT and fine SAND, trace organics. (Fill)
7	-20									
8	-21				17	S-4	18/12	7.0-8.5	8 6 11	Compact, dark brown, SILT and fine SAND, with organics, with layer of ash and cinders. (Fill)
9	-22				63/6"	S-4a	6/2	8.5-9.0	63	Very dense, mottled orange-brown to gray-brown, SAND and GRAVEL, some silt. (Fill)
10	-23		10.0 / -23.0	Bottom of Borehole at 10.0 feet below existing grade.	100/2"	S-5	2/1	9.9-10.1	100/2"	NOTE: Drove casing to refusal at 9 ft. Advanced roller bit to practical refusal at 9.9 feet. Very dense, GRAVEL. (Fill)
11	-24									
12	-25									
13	-26									
14	-27									
15	-28									
16	-29									
17	-30									
18	-31									
19	-32									
20	-33									
21	-34									
22	-35									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project:	Hudson Public Library	**Job #:**	7641.2.T1
Location:	3 Washington Street	**Date Started:**	4-26-23
City/State:	Hudson, Massachusetts	**Date Finished:**	4-26-23

Boring No.

B-2

Contractor: Carr-Dee Corp
Driller/Helper: S. DeSimone/J . DeSimone
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -9.6

Casing Type: 2.25" I.D. Hollow Stem Auger
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-26-23	11	-20.6	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
	-10		0.3 / -9.9	PAVEMENT						
1	-11				14	S-1	24/15	0.5-2.5	10 8 6 5	Compact, gray-brown, SILT and SAND, some gravel, with ash and cinders. (Fill)
2	-12									
3	-13				11	S-2	24/11	2.5-4.5	4 5 6 12	Compact, gray-brown, SILT and SAND, trace gravel, with brick. (Fill)
4	-14									
5	-15			FILL	31	S-3	24/7	5.0-7.0	16 10 21 7	Dense, gray-brown, SAND and GRAVEL, trace silt, with brick. (Fill)
6	-16									
7	-17				9	S-4	24/13	7.0-9.0	14 6 3 3	Loose, dark brown, SILT and fine SAND, with organics, ash, and cinders. (Fill)
8	-18									
9	-19				32	S-5	12/8	9.0-10.0	16 16	Compact to dense, orange-brown, SILT and fine SAND. (Fill)
10	-20				28	S-5a	12/8	10.0-11.0	14 14	Compact to dense, gray-brown, completely to very severely WEATHERED BOULDER. (Fill)
11	-21		11.0 / -20.6		18	S-6	12/10	11.0-12.0	8 10	Compact, stratified orange-brown to gray-brown, fine sandy SILT to silty fine SAND. (Alluvial Deposit)
12	-22				31	S-6a	12/10	12.0-13.0	15 16	Compact to dense, mottled orange-brown to gray-brown, SILT and SAND, some gravel. (Alluvial Deposit)
13	-23									
14	-24			ALLUVIAL DEPOSIT						
15	-25				100/2"	S-7	2/0	15.0-15.2	100/2"	NO RECOVERY. NOTE: Encountered cobble/boulders from ~14 feet to bottom of Borehole.
16	-26		16.7 / -26.3							
17	-27			Bottom of Borehole at 16.7 feet below existing grade.	100/1"	S-8	1/0	16.6-16.7	100/1"	Split Spoon Refusal. NOTE: Auger Refusal at 16.7 feet.
18	-28									
19	-29									
20	-30									
21	-31									
22	-32									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project:	Hudson Public Library	**Job #:**	7641.2.T1
Location:	3 Washington Street	**Date Started:**	4-26-23
City/State:	Hudson, Massachusetts	**Date Finished:**	4-26-23

Boring No. B-3

Contractor: Carr-Dee Corp
Driller/Helper: S. DeSimone/J . DeSimone
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -13.5

Casing Type: 2.25" I.D. Hollow Stem Auger/NW
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-26-23	7	-20.5	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.2 / -13.7	PAVEMENT						
1	-14			FILL	9	S-1	24/9	0.5-2.5	4 5 4 5	Loose, dark brown, SILT and SAND, with ash and cinders. (Fill)
2	-15									
3	-16				4	S-2	24/6	2.5-4.5	2 2 2 5	Very loose to loose, brown, SILT and SAND, with ash and cinders. (Fill)
4	-17									
5	-18									
6	-19		6.0 / -19.5		10	S-3	12/8	5.0-6.0	6 4	Loose to compact, black, SAND, trace silt, with ash and cinders. (Fill) Replaced augers with NW casing at 9 feet. Then proceeded with wet rotary drilling methods.
7	-20			ORGANICS	3	S-3a	12/8	6.0-7.0	2 1	Soft to firm, dark brown, ORGANIC SILT, trace sand. (Organics)
8	-21				3	S-4	24/3	7.0-9.0	1 1 2 1	Soft, dark brown, ORGANIC SILT, trace sand. (Organics)
9	-22		9.0 / -22.5							
10	-23			ALLUVIAL DEPOSIT	11	S-5	18/11	9.0-10.5	2 6 5	Stiff, yellow-gray, SILT, trace fine sand. (Alluvial Deposit)
11	-24				16/6"	S-5a	6/	10.5-11.0	16	Compact, gray, SILT to fine sandy SILT. (Alluvial Deposit)
12	-25				37	S-6	24/18	11.0-13.0	22 18 19 23	Dense, stratified gray to orange-brown and gray-brown SILT, fine sandy SILT to silty fine SAND. (Alluvial Deposit)
13	-26									
14	-27		13.5 / -27.0							
15	-28			GLACIAL TILL	52	S-7	24/14	15.0-17.0	18 29 23 19	Very dense, gray-brown, gravelly SILT and SAND. (Glacial Till)
16	-29									
17	-30									
18	-31									
19	-32									
20	-33									
21	-34				148	S-8	24/16	20.0-22.0	27 69 79 51	Very dense, mottled orange-brown to gray-brown, silty SAND and GRAVEL, to dark gray, silty SAND and GRAVEL. (Glacial Till)
22	-35		22.0 / -35.5							
	-36			Bottom of Borehole at 22.0 feet below existing grade,						

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Hudson Public library
Location: 3 Washington Street
City/State: Hudson, Massachusetts

Job #: 7641.2.T2
Date Started: 4-27-23
Date Finished: 4-27-23

Boring No. B-4

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/S. Desimone Jr.
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -13.4

Casing Type: 2.25 " I.D. Holow Stem Augers/NW
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-27-23	4.5	-17.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.3 / -13.7	PAVEMENT						
1	-14				16	S-1	18/14	0.5-2.0	10 9 7	Compact, yellow-brown, SAND and GRAVEL, trace silt. (Fill)
2	-15			FILL						
3	-16				3	S-2	24/11	2.0-4.0	5 2 1 1	Very loose, gray-brown, SILT and fine SAND, trace to some gravel. (Fill)
4	-17									
	-18		4.5 / -17.9							
5					3	S-3	24/10	5.0-7.0	3 2 1 WOH	Very soft to soft, brown, interebedded ORGANIC SILT and gray silty fine SAND. (Organics)
6	-19									
7	-20			ORGANICS						
8	-21				3	S-4	24/14	7.0-9.0	2 2 1 2	Soft, brown, FIBROUS PEAT and ORGANIC SILT, with occasional sand partings/seams. (Organics) After sampling to 9 ft., replaced auger with NW casing to 10 ft. Then proceeded to preform wet rotary drilling methods for remainder of Borehole.
9	-22									
	-23		9.5 / -22.9							
10					15	S-5	24/14	10.0-12.0	8 7 8 9	Compact, stratified yellow-gray to gray-brown, fine sandy SILT to silty fine SAND. (Alluvial Deposit)
11	-24									
12	-25									
13	-26									
14	-27									
15	-28				22	S-6	12/10	15.0-16.0	10 12	Compact, orange-brown to gray-brown, gravelly SAND, trace silt. (Alluvial Deposit)
16	-29			ALLUVIAL DEPOSIT	16	S-6a	12/10	16.0-17.0	8 8	Compact, stratified gray-brown, SILT to fine Sandy SILT to silty fine SAND. (Alluvial Deposit)
17	-30									
18	-31									
19	-32									
20	-33									
21	-34				15	S-7	24/16	20.0-22.0	9 8 7 8	Compact, stratified gray-brown, SILT to fine sandy SILT to silty fine SAND. (Alluvial Deposit)
22	-35		22.0 / -35.4							
	-36			Bottom of Borehole at 22.0 feet below existing grade.						

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Used Automatic hammer to drive Split Spoon

Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project:	Hudson Public library	**Job #:**	7641.2.T2
Location:	3 Washington Street	**Date Started:**	4-27-22
City/State:	Hudson, Massachusetts	**Date Finished:**	4-27-23

Boring No.

B-5

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/S. Desimone Jr.
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -6.5

Casing Type: 2.25 " I.D. Holow Stem Augers/NW
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-27-23	8.5	-15.0	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
	-7		0.3 / -6.8	PAVEMENT						
1	-8			FILL	19	S-1	18/16	0.5-2.0	9 9 10	Compact, yellow-brown, SAND and GRAVEL, trace silt. (Fill)
2	-9				15	S-2	24/18	2.0-4.0	10 8 7 7	Compact, yellow-brown, SAND and GRAVEL, trace silt. (Fill)
3	-10									
4	-11									
5	-12		5.4 / -11.9		100/5"	S-3	5/4	5.0-5.4	100/5"	Very dense, black, SILT and SAND, with wood. (Fill)
6	-13		6.4 / -12.9	CONCRETE SLAB						Advanced Augers through obstruction from 5.4 to ~ 6.4 ft.
7	-14			FILL	22	S-4	24/15	6.5-8.5	11 19 3 2	Compact, mottled dark gray-brown to black, SILT and SAND, with wood, ash, and cinders. (Fill) After sampling to 10 ft., replaced auger with NW casing to 10 ft. Then proceeded to preform wet rotary drilling methods for remainder of Borehole.
8	-15									
9	-16		10.0 / -16.5		4	S-5	18/16	8.5-10.0	3 2 2	Very loose to loose, gray-brown to gray, SILT, trace to some fine SAND, with organics. (Fill)
10	-17			ALLUVIAL DEPOSIT	17	S-6	24/18	10.0-12.0	6 7 10 8	Compact, statified gray, fine to medium SAND, trace to some silt. (Alluvial Deposit)
11	-18									
12	-19									
13	-20									
14	-21									
15	-22				19	S-7	24/13	15.0-17.0	8 10 9 7	Compact, orange-brown, gravelly SAND, trace silt. (Alluvial Deposit)
16	-23									
17	-24									
18	-25									
19	-26									
20	-27				8	S-8	24/15	20.0-22.0	5 4 4 5	Loose, stratified gray-brown, SILT to silty fine SAND. (Alluvial Deposit)
21	-28		22.0 / -28.5							
22	-29			Bottom of Borehole at 22.0 feet below existing grade.						

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Used Automatic hammer to drive Split Spoon

Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Hudson Public library
Location: 3 Washington Street
City/State: Hudson, Massachusetts

Job #: 7641.2.T2
Date Started: 4-27-22
Date Finished: 4-27-23

Boring No. B-6

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/S. Desimone Jr.
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -6.3

Casing Type: 2.25 " I.D. Holow Stem Augers/NW
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-27-23	7.5	-13.8	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.5 / -6.8	TOPSOIL						
1	-7				9	S-1	24/14	0.0-2.0	6 5 4 2	Loose, yellow-brown, SAND and GRAVEL, trace silt. (Fill)
2	-8									
3	-9									
4	-10			FILL						
5	-11									
6	-12				4	S-2	24/15	5.0-7.0	1 1 3 2	Very loose to loose, mottled black to gray-brown, SILT and SAND, with ash and cinders. (Fill) After sampling to 9 ft., replaced auger with NW casing to 10 ft. Then proceeded to preform wet rotary drilling methods for remainder of Borehole.
7	-13		7.0 / -13.3							
8	-14				11	S-3	24/16	7.0-9.0	8 6 5 6	Compact, stratified light gray-brown, fine to medium SAND, trace silt, to SAND, trace silt and gravel. (Alluvial Deposit)
9	-15									
10	-16									
11	-17				12	S-4	24/16	10.0-12.0	5 5 7 10	Compact, stratifed light gray-brown, fine to medium SAND, trace silt, to SAND, trace silt and gravel. (Alluvial Deposit)
12	-18									
13	-19									
14	-20									
15	-21			ALLUVIAL DEPOSIT						
16	-22				14	S-5	24/16	15.0-17.0	9 7 7 10	Compact, gray-brown, gravelly SAND, trace silt. (Alluvial Deposit)
17	-23									
18	-24									
19	-25									
20	-26				20	S-6	12/8	20.0-21.0	9 11	Compact, gray to gray-brown, gravelly SAND, trace silt. (Alluvial Deposit)
21	-27				21	S-6a	12/8	21.0-22.0	11 10	Compact, stratified gray-brown, SILT, to silty fine SAND. (Alluvial Deposit)
22	-28		22.0 / -28.3							
	-29			Bottom of Borehole at 22.0 feet below existing grade.						

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Used Automatic hammer to drive Split Spoon

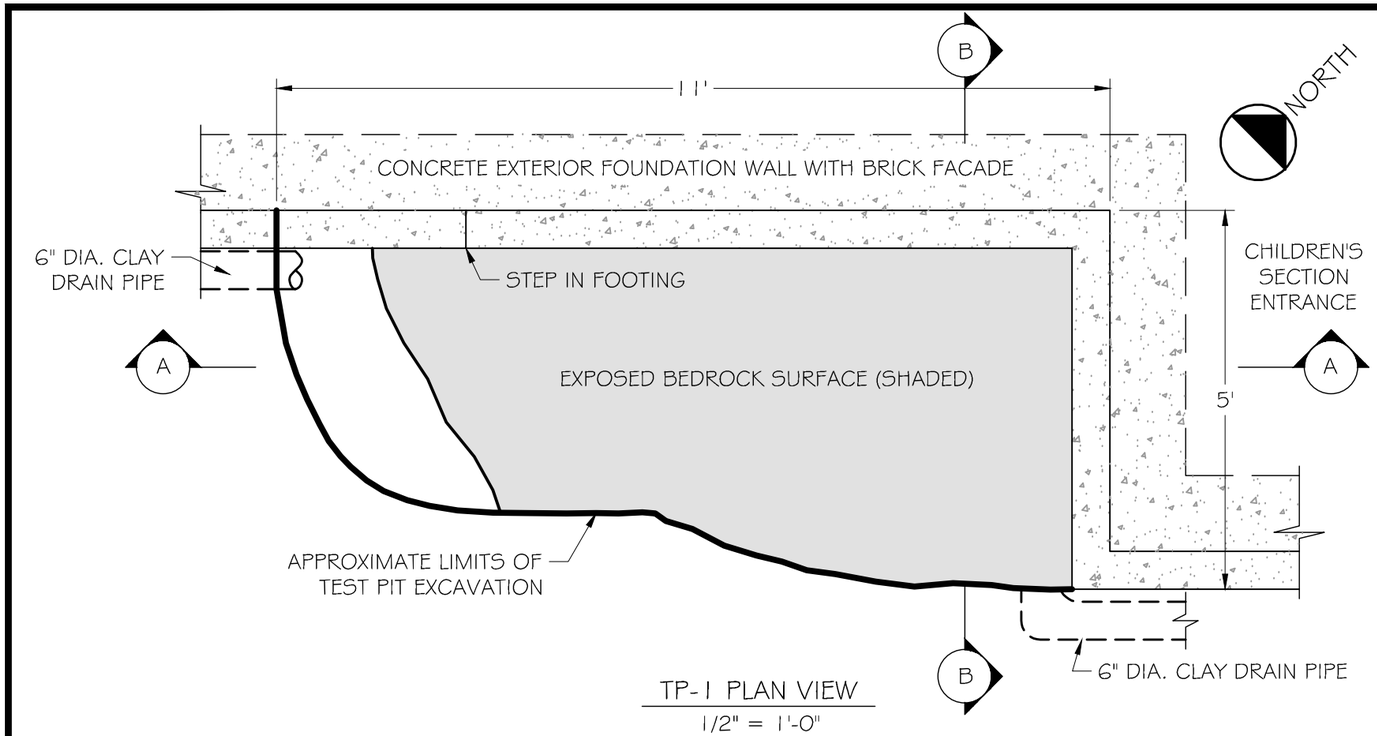
Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

APPENDIX C:

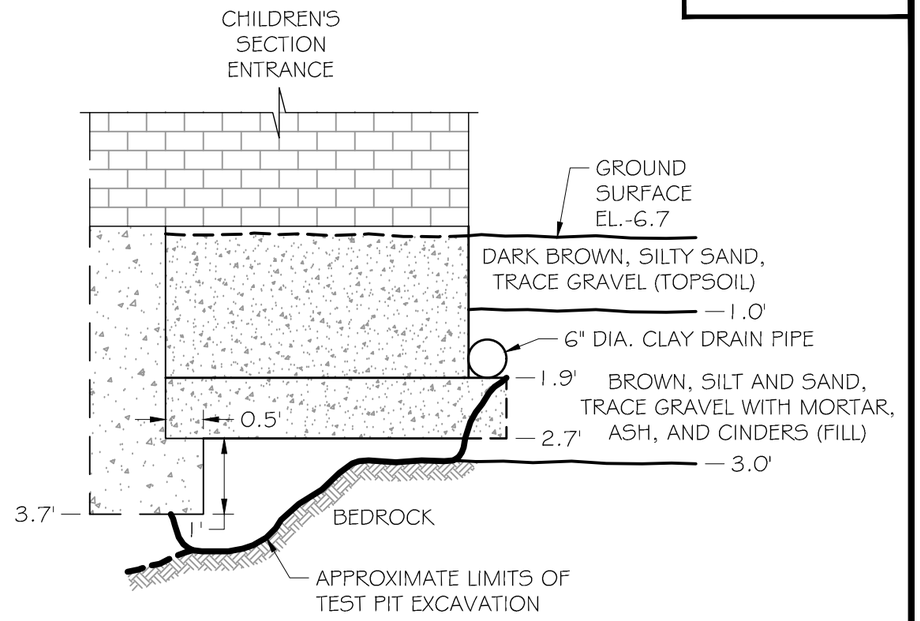
TEST PIT LOGS AND PHOTOGRAPHS

TP-1



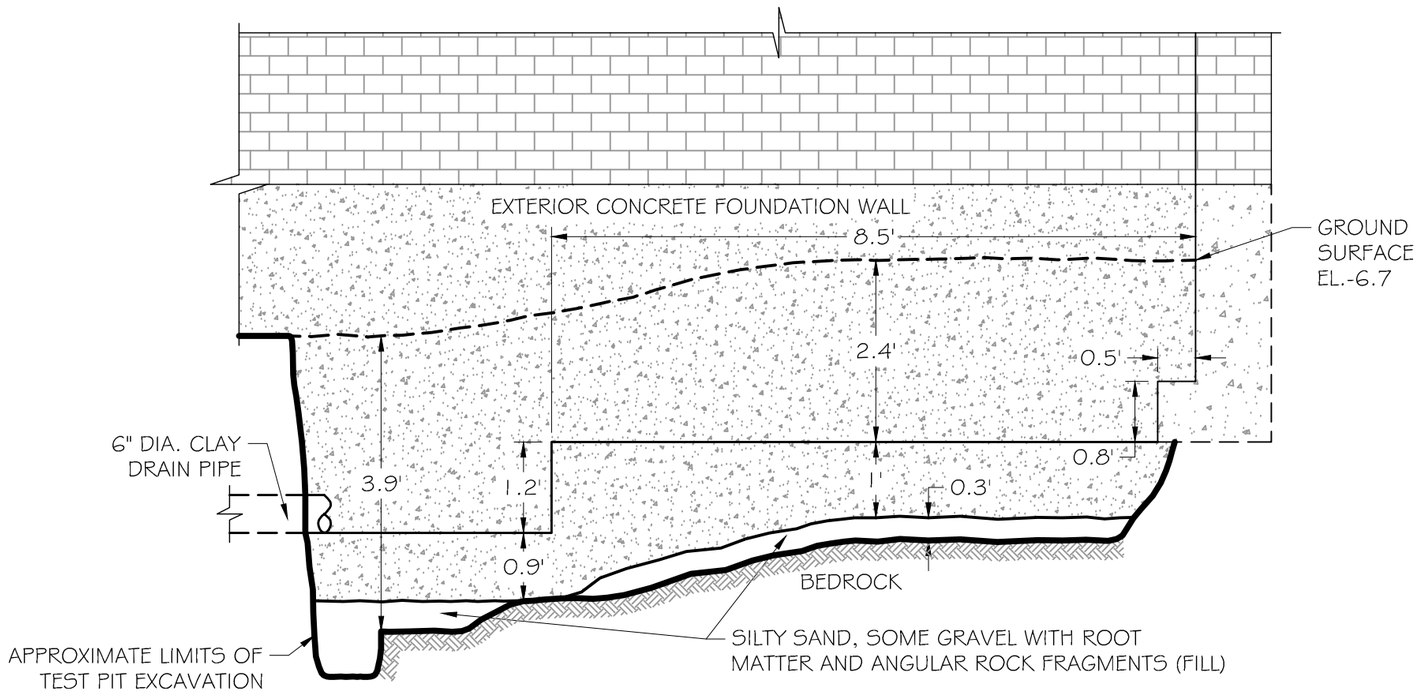
TP-1 PLAN VIEW

1/2" = 1'-0"



TP-1 SECTION B-B

1/2" = 1'-0"



TP-1 SECTION A-A

1/2" = 1'-0"

NOTES:

1. ALL FIELD MEASUREMENTS ARE CONSIDERED TO BE APPROXIMATE.

2. NO GROUNDWATER WAS OBSERVED IN TEST PIT UPON COMPLETION OF EXCAVATION.

McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

HUDSON PUBLIC LIBRARY

HUDSON MASSACHUSETTS

TEST PIT: TP-1

FOR

TRIPI ENGINEERING SERVICES, LLC

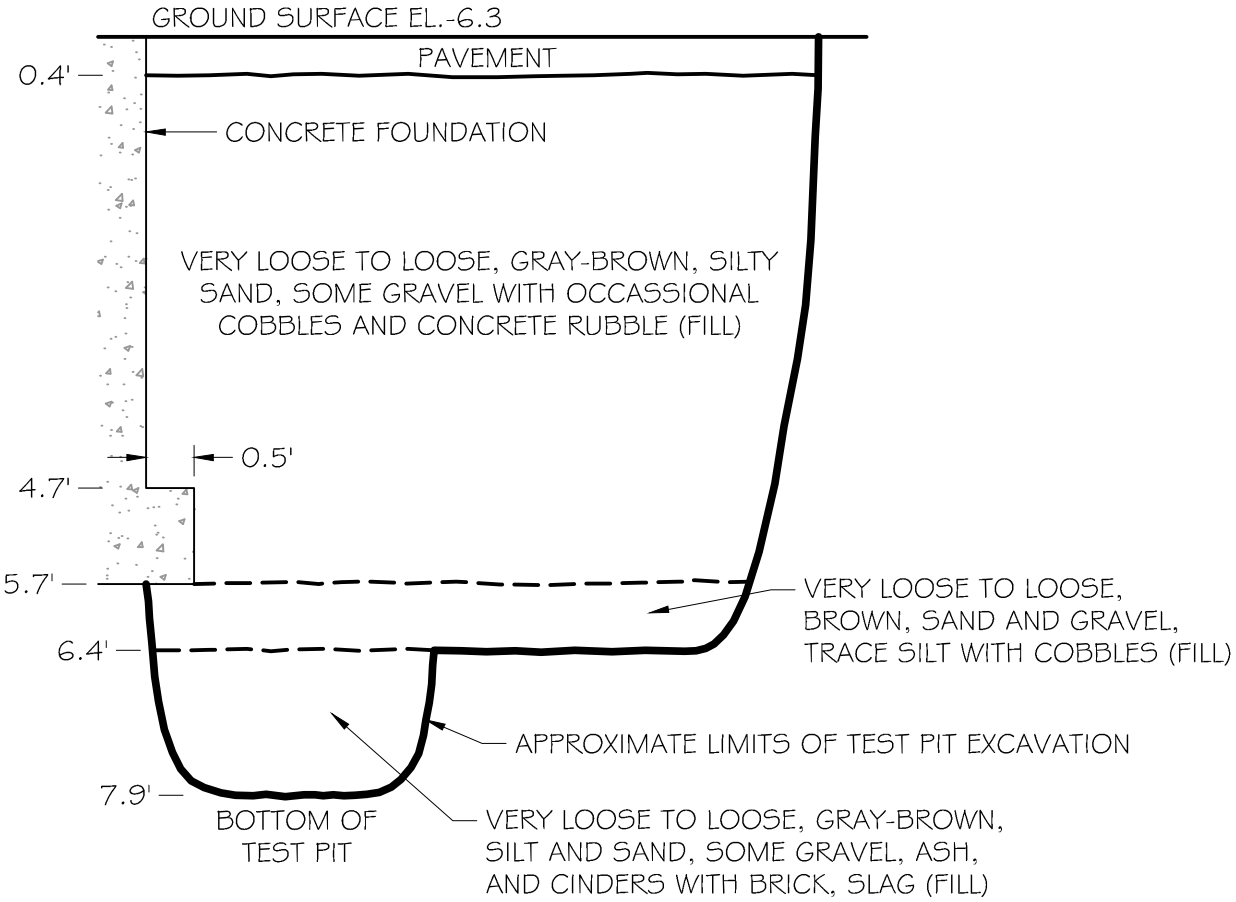
BY

McPHAIL ASSOCIATES, LLC

Date: AUGUST 2023	Dwn: M.B.S.	Chkd: C.P.M.	Scale: 1/2" = 1'-0"
Project No: 7641			

FILE NAME: N:\Acad\JOBS\7641\GER\7641-TP01.dwg

TP-2



TP-2 SECTION VIEW

1/2" = 1'-0"

NOTES:

1. ALL FIELD MEASUREMENTS ARE CONSIDERED TO BE APPROXIMATE.

2. NO GROUNDWATER WAS OBSERVED IN TEST PIT UPON COMPLETION OF EXCAVATION.

McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

HUDSON PUBLIC LIBRARY

HUDSON MASSACHUSETTS

TEST PIT: TP-2

FOR

TRIPI ENGINEERING SERVICES, LLC

BY

McPHAIL ASSOCIATES, LLC

Date: AUGUST 2023	Dwn: M.B.S.	Chkd: C.P.M.	Scale: 1/2" = 1'-0"
Project No: 7641			

FILE NAME: N:\CadJOBS\7641\GER\7641-TP02.dwg

Test Pit TP-1 Excavation, Looking North.

Test Pit TP-1 Excavation, Looking West.

**Test Pit TP-1 Excavation,
Looking West.
Note the edge of exposed
bedrock.**

Test Pit TP-2 Excavation, Looking East.
Note exposed bottom of footing bearing within the fill layer.

Test Pit TP-2 Excavation, Looking Northeast.
Note the quantity of cobbles and boulders within the uncontrolled fill.

APPENDIX D:

GEOPHYSICAL SURVEY RESULTS FIGURE

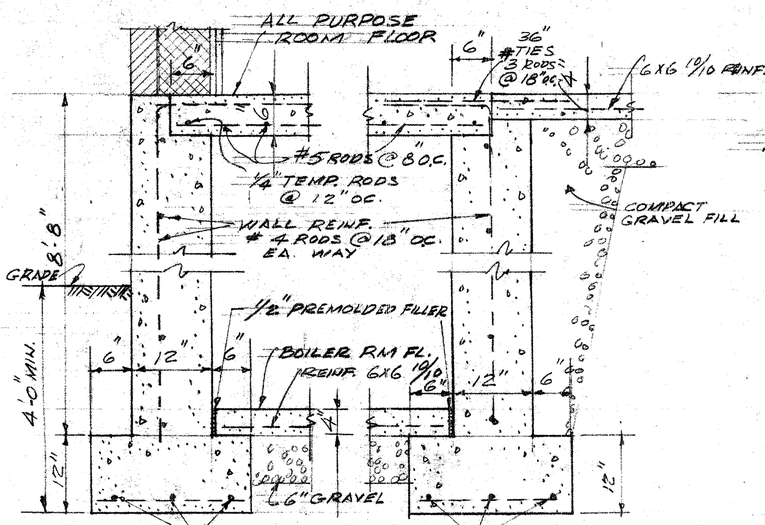
ATLANTIC GEOSERVICES	3 Washington St, Hudson, MA	Figure 1
	Client: McPhail / Date: 4/24/23	Geophysical Survey Results

APPENDIX E:

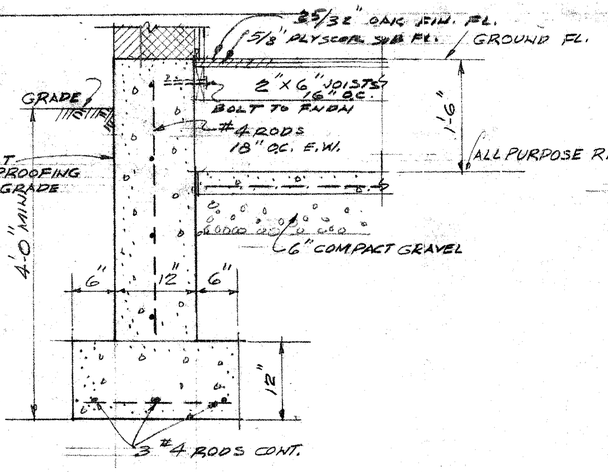
EXISTING FOUNDATION DRAWING, SOUTH ELEVATION, AND LONGITUDINAL SECTION

FOUNDATION DETAILS

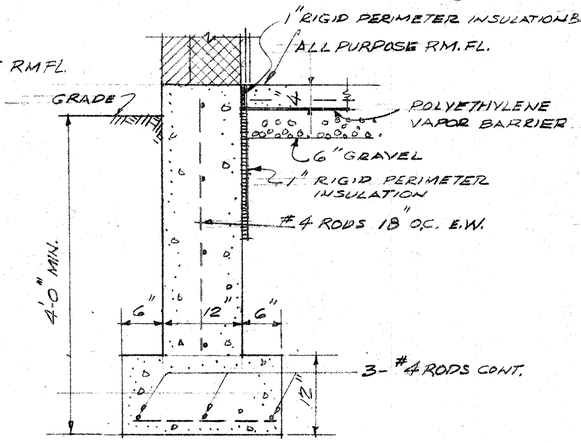
SCALE 3/4" = 1'-0"



SECTION A-A



SECTION C-C

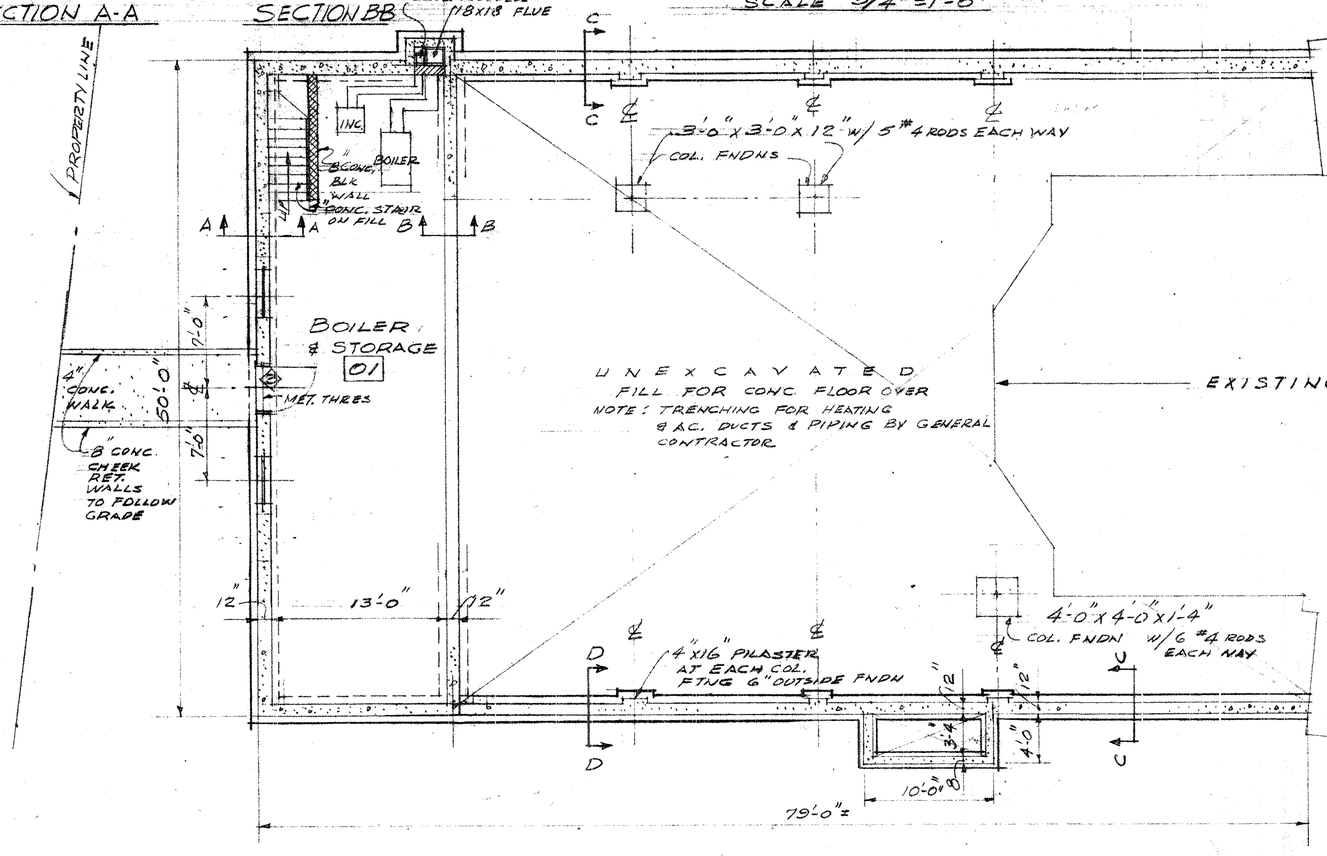


SECTION D-D

LEGEND OF MATERIALS

- CONCRETE
- CONCRETE BLOCK
- BRICK
- WOOD STUD PARTITION & PLAS.

SECTION BB



ADDITION TO THE HUDSON PUBLIC LIBRARY

MAIN ST. HUDSON MASS.

EARL V. ALDRICH & JOSEPH P. STANIUNAS

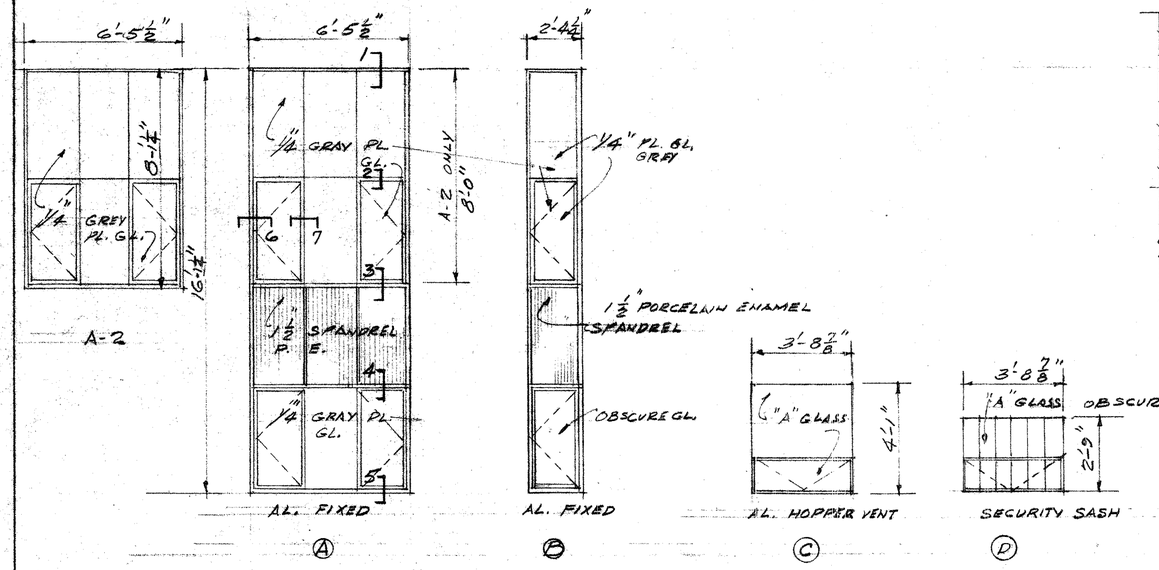
ASSOCIATED - ARCHITECTS

HUDSON, MASS.

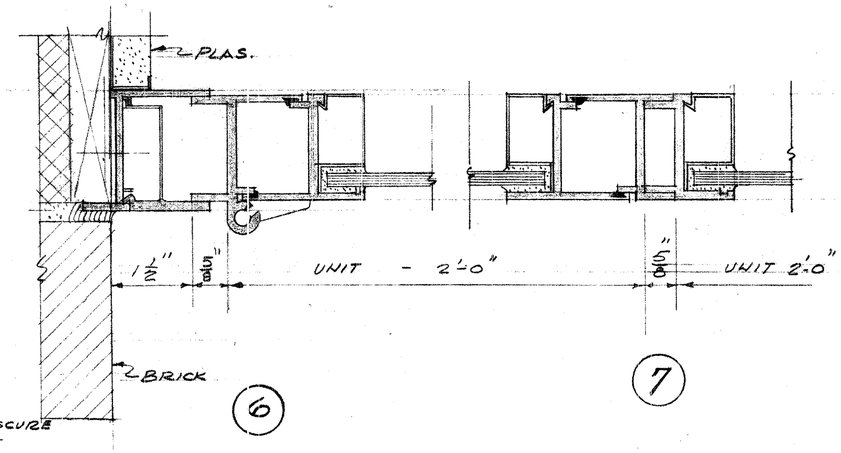
6-15-66 | FOUNDATION PLAN | SHEET A-1 OF 8

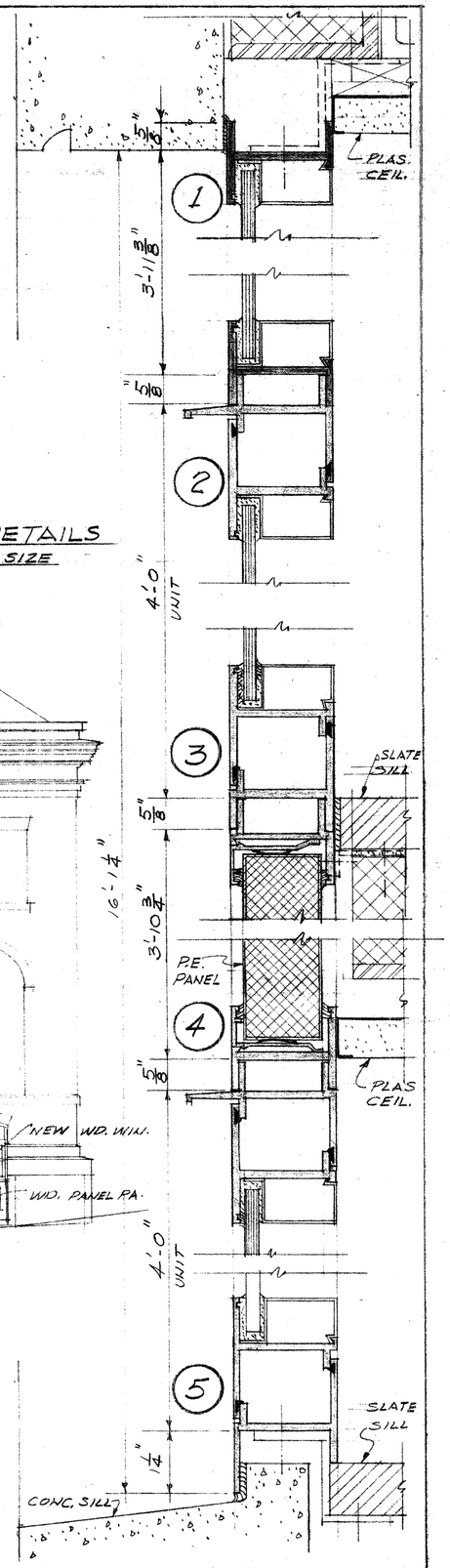
EARL V. ALDRICH No. 764 REGISTERED ARCHITECT COMMONWEALTH OF MASSACHUSETTS

JOSEPH P. STANIUNAS No. 1059 REGISTERED ARCHITECT HUDSON MASS. COMMONWEALTH OF MASSACHUSETTS

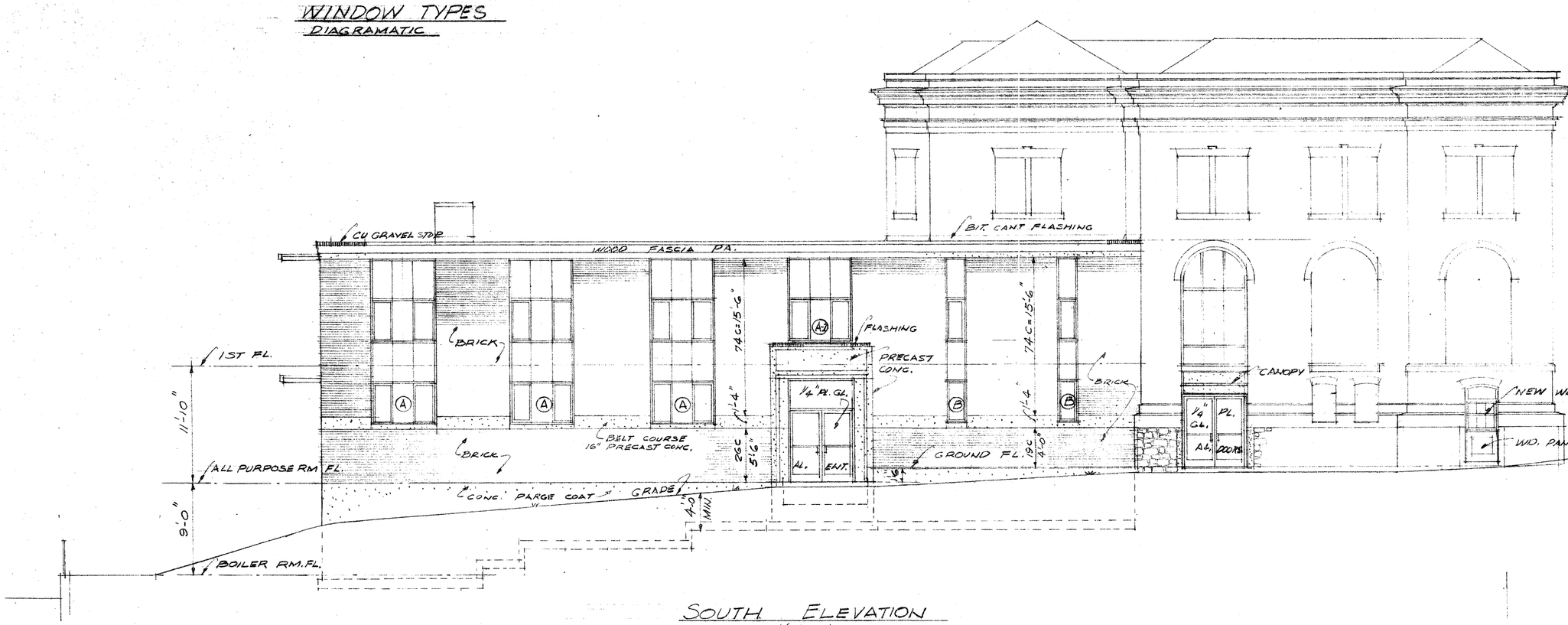


WINDOW TYPES
DIAGRAMATIC





WINDOW DETAILS
SCALE: HALF SIZE



SOUTH ELEVATION
SCALE ⅛" = 1'-0"

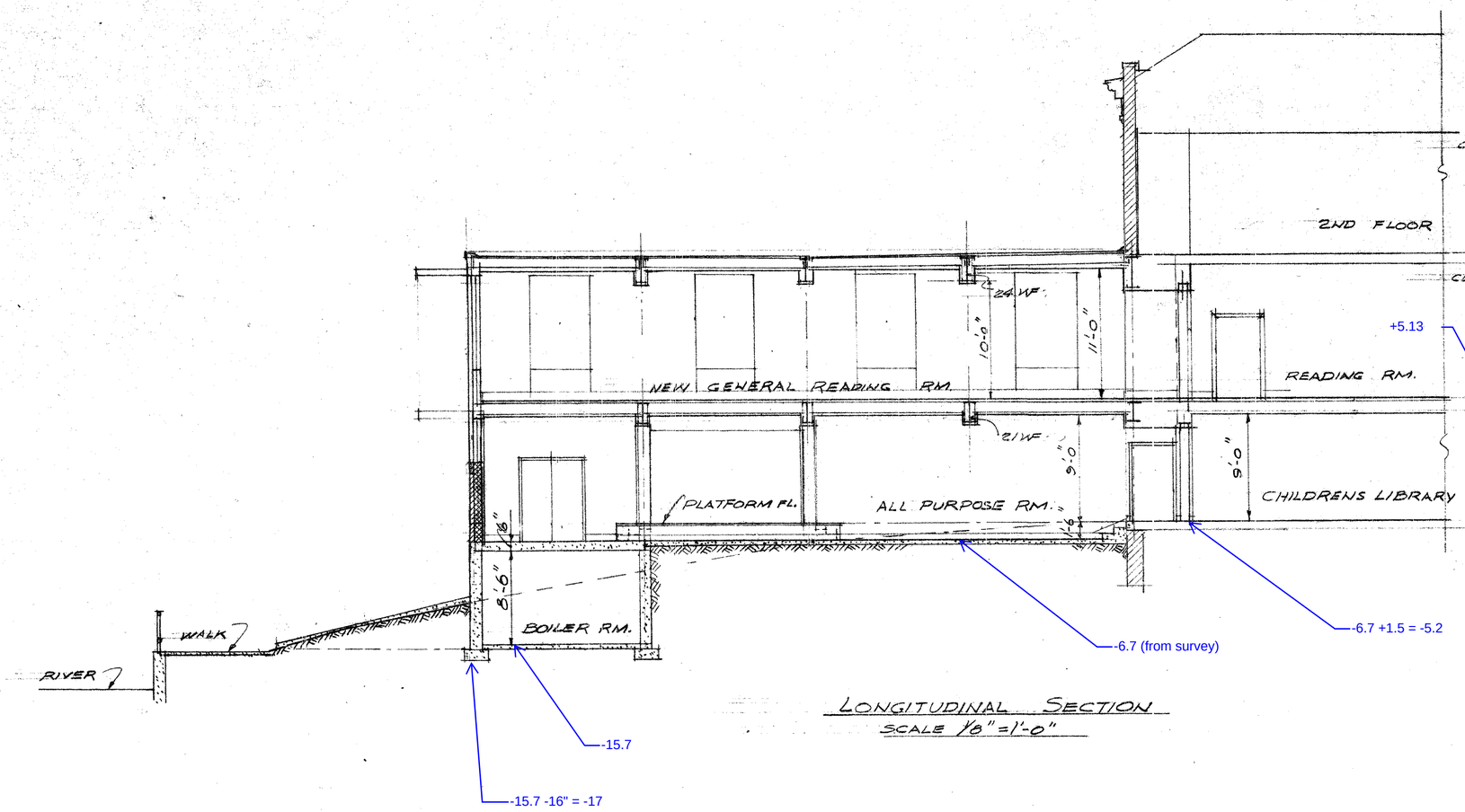
ADDITION TO THE HUDSON PUBLIC LIBRARY
MAIN ST. HUDSON, MASS

EARL V. ALDRICH & JOSEPH P STANIUNAS
ASSOCIATED ARCHITECTS
HUDSON MASS.

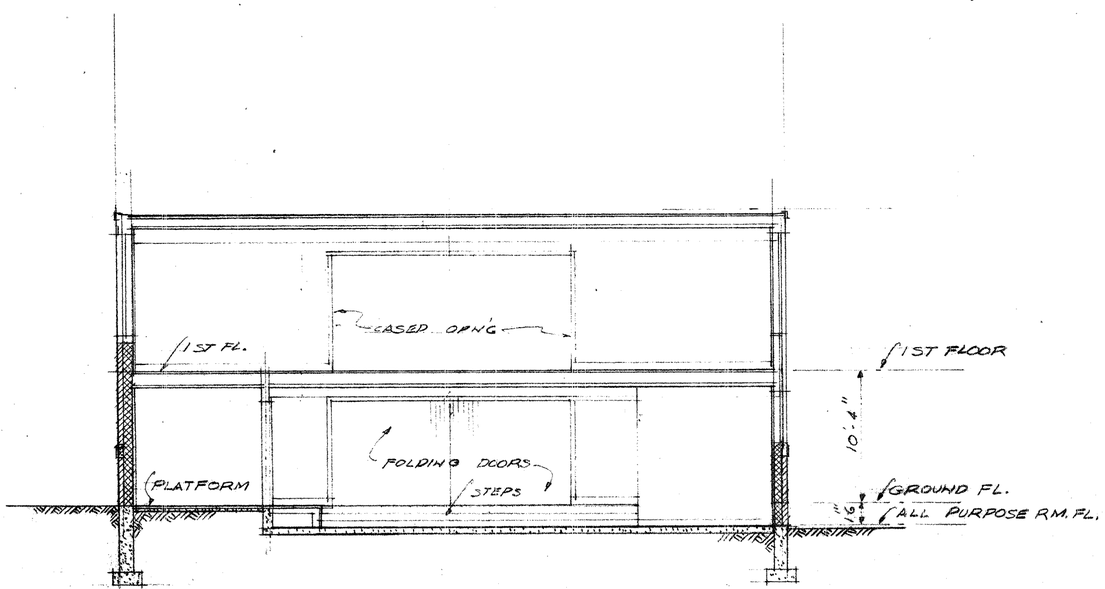
6-15-66 ELEVATIONS A-5 OF 8

EARL V ALDRICH No. 764 REGISTERED ARCHITECT HUDSON MASS. COMMONWEALTH OF MASSACHUSETTS

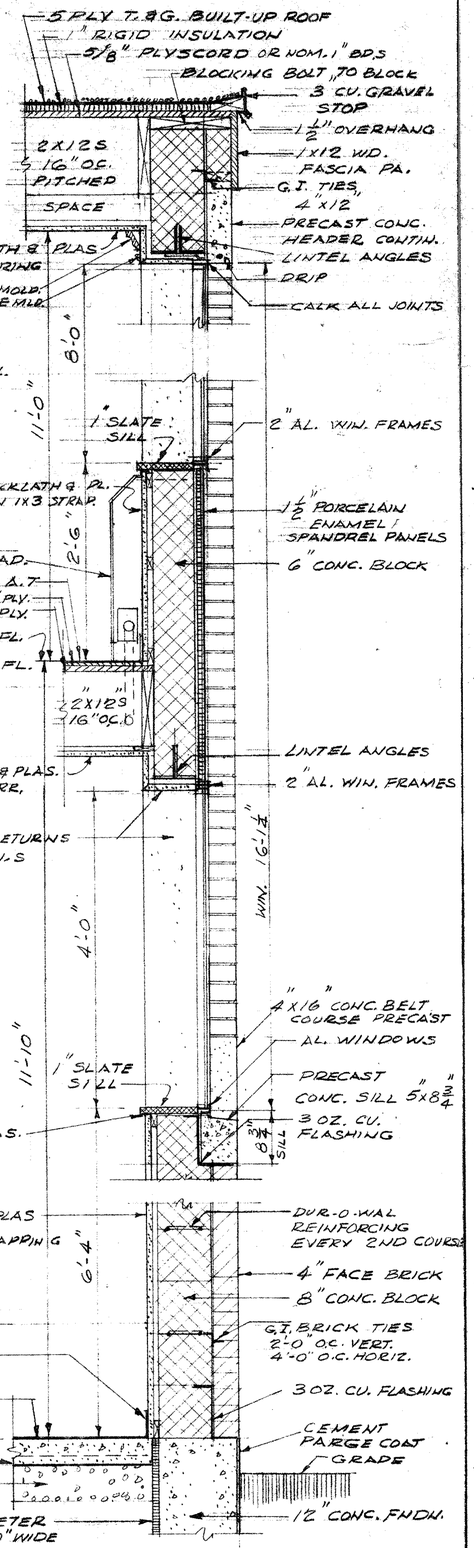
JOSEPH P. STANIUNAS No. 1059 REGISTERED ARCHITECT HUDSON MASS. COMMONWEALTH OF MASSACHUSETTS



LONGITUDINAL SECTION
SCALE 1/8" = 1'-0"



CROSS SECTION
SCALE 1/8" = 1'-0"



TYPICAL WALL SECTION
SCALE: 3/4" = 1'-0"

REGISTERED ARCHITECT EARL V. ALDRICH No. 761 HUDSON MASS. COMMONWEALTH OF MASSACHUSETTS

ADDITION TO THE HUDSON PUBLIC LIBRARY
MAIN ST. HUDSON MASS.

EARL V. ALDRICH & JOSEPH P. STANIUNAS
ASSOCIATED ARCHITECTS
HUDSON MASS.

6-15-66 | SECTIONS | A-7 OF 8

REGISTERED ARCHITECT JOSEPH P. STANIUNAS No. 1059 HUDSON MASS. COMMONWEALTH OF MASSACHUSETTS

Appendix C

2023 Preliminary Foundation Engineering Report, Hudson Public Library, New Addition, McPhail Associates, Christopher Miller, PE (MA License #56755) & Jonathan Patch, PE (MA License #47156)

PRELIMINARY FOUNDATION ENGINEERING REPORT

HUDSON PUBLIC LIBRARY – NEW ADDITION

3 WASHINGTON STREET

HUDSON, MASSACHUSETTS

AUGUST 14, 2023

Prepared For:

Tripi Engineering Services, LLC
433 Main Street, Suite 4
Hudson, MA 01749

PROJECT NO. 7641.2.T2

2269 Massachusetts Avenue
Cambridge, MA 02140
www.mcphailgeo.com
(617) 868-1420

August 14, 2023

Tripi Engineering Services, LLC
433 Main Street, Suite 4
Hudson, MA 01749

Attention: J. Matthew Tripi, P.E.

Reference: Hudson Public Library – New Addition
3 Washington Street; Hudson, Massachusetts
Preliminary Foundation Engineering Report – Executive Summary

Enclosed is our Preliminary Foundation Engineering Report for the above-referenced project. The following is an executive summary of the report.

The proposed redevelopment of the subject site may include the demolition of the entirety of the 1966 library addition located at the rear of the original library building, followed by the construction of a new 2-story, podium-style, addition located over the existing parking area and perpendicular to the current building alignment, in the east-west direction. The main level of the addition is understood to be coincident to the main level of the existing library building. Underlying the main level of the addition, open-air parking is proposed to be roughly coincident to the site grades of the existing parking lot. There is also a proposed pedestrian access to the western end of the addition from the sidewalk along Washington Street to the northwest of the fire station building.

The available subsurface information indicates the presence of existing fill material and an organic deposit which extends up to 11 feet below the existing ground surface in the vicinity of the proposed addition footprint. The existing fill material and organic deposit are not considered suitable for support of the proposed building. Based on the scope of the proposed construction and the subsurface conditions encountered at the site, it is recommended that foundation support of the proposed new addition transfer the structural loads through the existing fill, organic material, and natural, inorganic sand deposits to the glacial till and/or bedrock that underlies the project site.

At the northeast corner of the addition where the surface of the bedrock was observed to be relatively shallow, it is anticipated that new footing foundations bearing directly on bedrock, or on lean concrete placed directly over bedrock, could be utilized for support of the addition. However, elsewhere across the addition, where the surface of the glacial till and/or bedrock was observed to vary from depths of approximately 13.5 feet or greater in the explorations, pile foundations will be required. Specifically, it is recommended that support of the proposed addition be provided by drilled-in micropile foundations with design a capacity of 50 tons in compression. A final foundation engineering report (FFER) providing recommendations for final foundation design and construction should be prepared.

Other detailed geotechnical engineering recommendations and criteria for preliminary foundation design are documented in the report, as well as preliminary foundation construction considerations. Furthermore, construction observation considerations are also presented herein.

GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERS
2269 Massachusetts Avenue
Cambridge, Massachusetts 02140
(617) 868-1420

We look forward to continued participation with the design team during the remainder of the project. Should you have any questions concerning the recommendations presented herein, please do not hesitate to call us.

Very truly yours,

McPHAIL ASSOCIATES, LLC

Christopher P. Miller, P.E.

Jonathan W. Patch, P.E.

N:\Working Documents\Reports\7641_HudsonPublicLibraryHudson_PFER_081423.docx

CPM/hjb/jwp

GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERS
2269 Massachusetts Avenue
Cambridge, Massachusetts 02140
(617) 868-1420

CONTENTS:

FIGURES:

APPENDICES:

1.0 - INTRODUCTION

1.1 - GENERAL

This preliminary report presents the results of our subsurface exploration program and preliminary foundation design study for the proposed new addition to the existing Hudson Public Library located at 3 Washington Street in Hudson, Massachusetts. Refer to the Project Location Plan, **Figure 1**, for the general site locus.

The subsurface exploration program was conducted, and the foundation engineering services were performed in accordance with our proposal for geotechnical engineering services dated February 8, 2023, and the subsequent authorization of Tripi Engineering Services, LLC. These services are subject to the limitations contained herein.

1.2 – PURPOSE AND SCOPE

The purpose of the subsurface exploration program and preliminary foundation engineering study was to document the subsurface soil and groundwater conditions at the site to provide preliminary geotechnical engineering recommendations for foundation design for the proposed redevelopment.

Preliminary foundation design includes foundation support of the proposed addition structure and its lowest level slab, treatment of the lowest level slab in consideration of groundwater, lateral earth pressures on foundation walls, and seismic design considerations in accordance with the provisions of the Ninth Edition of the Massachusetts State Building Code (Code). Foundation construction considerations relating to geotechnical aspects of the proposed construction are also presented herein.

1.3 – AVAILABLE INFORMATION

Information available to McPhail Associates, LLC (McPhail) included the following:

- A set of historic plans entitled "Addition to the Hudson Public Library; Main St.; Hudson, Mass." dated June 15, 1966, prepared by Earl V. Aldrich & Joseph P. Staniunas Associated Architects.
- A schematic architectural drawing entitled "Scheme 1 – Expansion Over Parking Lot Main Level Plan" dated May 20, 2022, prepared by DRA Architects.
- An undated satellite image of the subject site annotated with a cloud indicating the approximate area of a proposed addition.

1.4 – ELEVATION DATUM

An existing conditions plan with site elevations was unavailable at the time of this report. As such, the elevations cited herein are in feet and are referenced to a local datum which

assumes a rim elevation of 0.0 for the water valve located in the street, just off the sidewalk, in front of the building along Washington Street, which is indicated on **Figure 2**.

2.0 – SITE AND PROJECT DESCRIPTION

2.1 – EXISTING SITE CONDITIONS

Fronting onto Washington Street to the northeast, the existing two-story masonry library building, which occupies an approximately 5,600-square-foot plan area, is bounded by the Town of Hudson Fire Station and parking lot to the northwest, Liberty Park to the southeast, and the Assabet River to the southwest. For the purposes of this report, Washington Street is referred to herein as "north". The ground surface across the site slopes downward approximately 13 feet from Washington Street toward the south side of the proposed new addition.

Based on our review of the Town of Hudson assessor's database, the original portion of the two-story masonry library building was constructed in 1905 and occupies an approximate 2,600-square-foot plan area and contains a partially below-grade level that is benched into the sloping site such that the northern portion is fully below-grade and the southern portion is at-grade. The rear (southern) portion of the library building was constructed in 1966 and occupies an approximate 3,000-square-foot plan area and contains a partially below-grade level, used as a boiler room, that is benched into the site and has walk-out access to the south of the building. Currently, a portion of the 1966 addition has apparently settled, resulting in interior cracking and exterior cracking of the foundations and brick façade. As such, an evaluation is being performed to determine if the 1966 addition should be repaired or demolished and replaced. This report focuses on the geotechnical-related issues associated with the replacement of the 1966 addition with a new addition.

Based on survey information obtained by McPhail and our review of the above-referenced historic plans, the main level of the original portion of the library is understood to be at approximately Elevation +5.1. The lowest-level slab of the original portion of the library is understood to be at about Elevation -5.2 and is about 1.5 feet higher than the 1966 addition lowest-level slab which is understood to be at approximately Elevation -6.7. Furthermore, the boiler room slab at the rear of the 1966 addition is understood to be at Elevation -15.7.

2.2 – PROPOSED REDEVELOPMENT

The proposed redevelopment of the subject site may include the demolition of the entirety of the 1966 library addition located at the rear of the original library building, followed by the construction of a new 2-story, podium-style, addition located over the existing parking area and perpendicular to the current building alignment, in the east-west direction. The main level of the addition is understood to be coincident to the main level of the existing library building, approximately Elevation +5.1. Underlying the majority of the main level of the addition, open-air parking is proposed to be roughly coincident to the site grades of the existing parking lot. There is also a proposed pedestrian access to the western end of the addition from the sidewalk along Washington Street to the northwest of the fire station

building. The remainder of the subject site, located outside of the proposed building footprint, is proposed to be occupied by an asphalt paved parking lot and landscaped areas.

As indicated above, the lowest-level slab of the proposed addition is anticipated to be coincident to the main level of the existing original library building, which is understood to be at Elevation +5.1. In consideration of the existing grades and that open-air parking will be provided below the main level of the addition, the main level slab of the addition will be structurally framed. Furthermore, our recommendations assume that the grade within the proposed open-air parking level below the addition will remain close to the existing grades.

3.0 – SUBSURFACE EXPLORATIONS

The approximate location of the subsurface explorations is indicated on the enclosed Subsurface Exploration Plan, **Figure 2**. The following subsurface explorations were completed at the project site under contract to McPhail:

- Two (2) machine-excavated test pits (TP-1 to TP-2) completed on April 27, 2023, by T. D'Amato Excavating, were performed using a mini-excavator with a toothed bucket.
- Six (6) borings (B-1 to B-6) completed on April 26 and 27, 2023, by Carr-Dee Corp.

Exploration procedures and soil classification methods are contained in **Appendix A**.

The borings were drilled to depths ranging from 10 to 22 feet below the existing ground surface and were terminated within a natural glacial outwash deposit or a natural alluvial deposit, with the exception of B-1, which was terminated upon roller bit refusal within the fill layer indicative of possible bedrock. Boring logs are contained in **Appendix B**.

Test pits TP-1 and TP-2 were performed adjacent to the foundation of the 1966 addition. The test pits were excavated to depths of up to 7.9 feet below the existing ground surface. Logs of the test pits prepared by McPhail are contained in **Appendix C**.

Prior to performance of the recent subsurface explorations, a geophysical survey using electromagnetic (EM) and ground-penetrating radar (GPR) techniques was performed on April 24, 2023, by Atlantic GeoServices (AGS) under contract to McPhail to locate utilities in the vicinity of the proposed explorations. The geophysical survey results figure prepared by AGS is contained in **Appendix D**.

4.0 – SUBSURFACE CONDITIONS

4.1 – SOIL AND BEDROCK CONDITIONS

A detailed description of the subsurface conditions encountered in the explorations is documented on the logs contained in the Appendices as described above. Based on the

explorations performed at the site, the following is a description of the generalized subsurface conditions across the site encountered from ground surface downward.

Generalized Subsurface Strata	***Approximate Thickness (Feet)***	***Top of Soil Strata (Elevation)***
Surface Treatment	0.2 to 1.0	Ground Surface (El. -6.3 to El. -13.5)
Fill Material	3.2 to 10.7	El. -7.3 to El. -13.7
Organic Deposit	Not Encountered to 5.0	El. -17.9 to El. -19.5 (Where Encountered)
Alluvial Deposit	Not Encountered and/or Not Fully Penetrated	El. -10.5 to El. -22.9 (Where Encountered)
Glacial Till Deposit	Not Encountered and/or Not Fully Penetrated	El. -27.0 (Where Encountered)
Bedrock	Not Encountered or Not Fully Penetrated	El. -9.7 (Where Encountered)

Surface Treatments: Ground surface was covered either by topsoil or bituminous concrete pavement. The topsoil generally consists of a dark brown, silty sand with trace gravel.

Fill Material: The fill material generally consists of very loose to very dense, yellow-brown to black, silt and sand, varying to sand and gravel with trace silt, also containing varying amounts of mortar, brick, asphalt, wood, ash, and cinders. Furthermore, what is believed to be an approximate 1-foot thick concrete slab was augered through in boring B-5 from a depth of 5.4 to 6.4 feet below grade. Grain size distributions of samples of the fill material are presented in the enclosed **Figure 3**.

Organic Deposit: Within borings B-3 and B-4, the fill material was underlain by an organic deposit which consists of a very soft to firm, dark brown to black, organic silt with trace sand, varying to fibrous peat and organic silt with fine sand seams.

Alluvial Deposit: The alluvial deposit, which underlies the fill material and/or organic deposit, generally consists of loose to dense, orange-brown to gray, gravelly sand with trace to some silt varying to silt. Refer to **Figure 2** for the elevation of the top of the alluvial deposit at each exploration location, where encountered. Except for borings B-1 and B-3, the explorations were terminated within the alluvium.

Glacial Till Deposit: A glacial till deposit was encountered below the alluvial deposit in boring B-3 at a depth of 13.5 feet. The glacial till generally consists of a very dense, mottled orange-brown to gray-brown, silty sand and gravel, varying to gravelly silt and sand.

Bedrock: Bedrock was encountered below the fill material in test pit TP-1 and may have been encountered below the fill in boring B-1 based on the roller bit refusal. Generally, the glacial till deposit is anticipated to be underlain by bedrock.

4.2 – GROUNDWATER CONDITIONS

The groundwater level in the completed boreholes, with the exception of B-4, was observed to range from about Elevation -13.8 to Elevation -21, or between depths of 7 feet below ground surface and 11 feet below ground surface. Boring B-4 observed groundwater at 4.5 feet below ground surface, corresponding to Elevation -17.9. The elevation of the water level in the Assabet River should be determined as part of a future topographic site survey, as well as determining what the design flood elevation is, if applicable.

It is anticipated that future groundwater levels across the site may vary from those reported herein due to factors such as the level of water in the Assabet River, normal seasonal changes, runoff particularly during or following periods of heavy precipitation, and alterations of existing drainage patterns.

4.3 – EXISTING FOUNDATION CONDITIONS

Based upon our review of the foundation plan contained in the above-referenced 1966 plans, which is included in **Appendix E** along with an elevation view and longitudinal section, the existing 1966 addition is supported on spread footing foundations. Specifically, the existing plan indicates that a 2-foot-wide concrete footing at a minimum 4-foot depth below grade is located around the east, south and west sides, and interior columns are supported on 3-foot and 4-foot square concrete footings.

Based upon our review of the 1966 drawings and our site reconnaissance, the southern end of the 1966 addition, identified on the plans as "Boiler Room", has a lowest level slab 9 feet below the remainder of the addition at Elevation -15.7, with the remainder of the lowest-level slab at Elevation -6.7. The continuous footings around the boiler room are anticipated to be 12 inches thick with the bottom at about Elevation -17. The continuous perimeter footings on the west and east sides of the 1966 addition are anticipated to step up from south to north from approximately Elevation -17 to approximately Elevation -10.7.

Test pit explorations TP-1 and TP-2 were performed on the exterior of the east and west sides of the 1966 addition, respectively. The existing lowest-level slab of the addition in this area is understood to be at approximately Elevation -6.7. It is noted that foundation conditions may vary from those observed in the test pits. Groundwater was not observed within the completed test pits. Test pit logs are included in **Appendix C**.

Test pit TP-1 was performed adjacent to the exterior foundation wall and the children's section entrance and exposed the foundation of the 1966 addition and the main building. A cast-in-place concrete foundation wall was observed to extend down approximately 2.4 feet below ground surface for the children's section entrance area, bearing on approximately 0.3 feet of fill material that overlies bedrock. For the main building, a cast-in-place concrete

foundation wall was observed to extend down approximately 3.4 feet below ground surface, bearing on a 0.3-foot-thick fill layer overlying bedrock. Approximately 8.5 feet south of the foundation wall for the children's section entrance, the cast-in-place foundation wall was observed to step down to approximately 3.8 feet below ground surface, continuing to bear on a thin layer of fill material overlying bedrock. Approximately 10.5 feet south of the foundation wall for the children's section entrance, the bedrock surface was observed to drop off vertically and the footing was observed to bear on an undetermined amount of fill material. Within boring B-1, which was performed at the southeast corner of the 1966 addition, the fill material was observed to extend to a depth of 10 feet below grade which corresponds to Elevation -23, where the boring was terminated upon practical refusal with the roller bit which could be indicative of the bedrock surface. Based on boring B-1, bedrock is anticipated to be about 6 feet below the bottom of footing of the boiler room foundations, which are anticipated to be at about Elevation -17.

Test pit TP-2 was performed adjacent to the exterior foundation wall of the 1966 addition proximal to the connection with the original library building. A cast-in-place foundation wall was observed to extend down approximately 5.7 feet below ground surface which corresponds to approximately Elevation -12, bearing on fill material. Test pit TP-2 was terminated in the fill material at a depth of 7.9 feet below ground surface, which was about 2.2 feet below bottom of footing. Within boring B-2, which was performed to the south of test pit TP-2, the fill material was observed to extend to a depth of 11 feet to Elevation -20.6, where the boring encountered the natural alluvial deposit. Based on boring B-2, the surface of the natural alluvial deposit is approximately 8.6 feet below the bottom of footing based on information obtained from test pit TP-2.

5.0 – GEOTECHNICAL RECOMMENDATIONS

5.1 – PROBABLE CAUSE OF BUILDING SETTLEMENT

The observed settlement of the existing 1966 addition is considered to be the result of the existing spread footings bearing on an "uncontrolled" fill material which, at some explorations, was observed to be underlain by a highly compressible organic deposit. Based on our observations of soil samples obtained from the borings and test pits, portions of the fill contain organics, ash, cinders, and brick. Furthermore, the density of the fill as determined by the borings was observed to vary, with portions of the fill being loose. As such, the fill material below the existing 1966 addition foundations is considered to be "uncontrolled", meaning that it was likely not placed and compacted in a controlled manner, and such, would likely cause settlement of an overlying structure. Additionally, the weight of the existing uncontrolled fill and the load from the existing spread footings would cause the organics, if present below the footings, to compress which would contribute to more structure settlement. Furthermore, step cracking of the exposed brick foundation wall on the east side of the 1966 addition is located proximal to where the bedrock observed in test pit TP-1 was observed to drop off. As such, differential settlement appears to have occurred where the footing support transitions from a thin layer of fill overlying bedrock to a greater thickness of the uncontrolled fill.

It is possible that the existing structure may continue to settle over time even with no appreciable changes to the existing structure. As such, in order to minimize the potential for future uncontrolled settlement, it is recommended that supplemental foundation support be provided unless the building is replaced. Refer to the Geotechnical Engineering Report dated August 14, 2023, for additional recommendations regarding supplemental foundation support for the 1966 addition.

5.2 – PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS - NEW ADDITION

The available subsurface information indicates the presence of existing fill material and an organic deposit which extends up to 11 feet below the existing ground surface in the vicinity of the proposed addition footprint. The existing fill material and organic deposit are not considered suitable for support of the proposed building. Furthermore, overexcavation of the existing fill material and organic deposit is not anticipated to be cost effective due to the relatively shallow depth to groundwater with respect to the depth of excavation below the groundwater level to reach the suitable bearing stratum. In addition, differential settlement of the building could occur if a portion of the building is supported directly on the shallow bedrock and a portion is supported on the variable density alluvial deposit. Therefore, based on the scope of the proposed construction and the subsurface conditions encountered at the site, it is recommended that foundation support of the proposed new addition transfer the structural loads through the existing fill, organic material, and natural, inorganic sand deposits to the glacial till and/or bedrock that underlies the project site.

At the northeast corner of the addition where the surface of the bedrock was observed to be relatively shallow, it is anticipated that new footing foundations bearing directly on bedrock, or on lean concrete placed directly over bedrock, could be utilized for support of the addition. However, elsewhere across the addition, where the surface of the glacial till and/or bedrock was observed to vary from depths of approximately 13.5 feet or greater in the explorations, pile foundations will be required. The design loads are unknown for the building, however, in consideration of buildings of this type, it is anticipated that pile foundations will be required to resist both tensile and compressive loads. Other pile types were considered, but for preliminary foundation design, drilled micropiles are recommended. The actual required pile type and design capacity will need to be confirmed as part of a final foundation engineering report (FFER).

5.3 – PRELIMINARY RECOMMENDATIONS FOR DRILLED MICROPILES

The following parameters are recommended for the preliminary design of the foundations:

- Design Pile Capacity:
    - Compressive Load = 50 Tons
    - Tensile Capacity = 50 Tons
    - Lateral Capacity = 2 Tons

- Drilled micropiles would derive their capacity in friction within the natural glacial till deposit or bedrock. Embedment in the bedrock deposit is anticipated to be required.
- All piles should have a minimum horizontal spacing of no less than 2.5 feet between piles. This spacing accounts for the micropile requirements of Section 1810.3.14 of the Code.
- Prior to commencement of production pile installation, it is recommended that one pile load test be performed on a drilled micropile in accordance with the requirements of Section 1810.3.3.1 of the Code for the pile type selected. Alternatively, the load test may be performed in tension in accordance with Section 1810.3.3.1.11.
- It is recommended that all perimeter pile caps and grade beams extend to a depth of 4 feet below exterior finished grade for frost protection.
- All foundations should be designed in accordance with the Code.
- All piles should be incorporated into pile caps which are designed in accordance with Section 1810.3.11 of the Code.
    - It is recommended that the pile caps be designed assuming a 3-inch eccentricity or the actual eccentricity, whichever is greater.
- The pile installation should be monitored by a registered design professional or their designated representative in accordance with the provisions of the Code.
- All foundations should be located such that they bear below a theoretical line drawn upward and outward at 2 to 1 (horizontal to vertical) from the bottom exterior edge of all adjacent existing or proposed footings, structures and/or utilities.
    - Depending on the configuration of the new addition foundations relative to the existing foundations, underpinning of the existing foundations may be required. If required, recommendations for underpinning would be contained in an FFER.

As stated above, the small diameter grouted piles (drilled micropiles) should be advanced through the fill, organic material, and natural, inorganic sand deposits into the glacial till and/or bedrock. The actual pile diameter, reinforcement type, bond stress, and bond length should be proposed by the pile contractor based on their experience and pile installation methods.

The drilled micropiles should be analyzed, designed, detailed, and installed in accordance with Sections 1810.1 through 1810.4 of the Code, as applicable. Each pile should be provided with steel reinforcing capable of carrying a minimum of 40 percent of the design pile compressive load utilizing 40 percent of the specified yield strength of the steel up to a maximum of 30,000 psi. The allowable design compressive load on the grout should not exceed 33 percent of its 28-day compressive strength. The grout should be placed by tremie methods under a minimum 100-psi pressure head.

The piles should be installed within a temporary casing that extends, at a minimum, to the surface of the bond zone. Centralizers spaced on maximum 10-foot centers should be provided along the pile length to ensure a minimum of 2.5-inch of grout cover beyond the outer edge of the pile's reinforcing steel.

5.4 – PRELIMINARY FOOOTING RECOMMENDATIONS

Based on the scope of the proposed construction and the subsurface conditions encountered at the site, for preliminary foundation design purposes, it is recommended that the foundations at the northeast corner of the proposed addition be founded on conventional footing foundations that bear on bedrock. At locations where the surface of the bedrock is lower than the proposed bottom of footing elevation, lean concrete is recommended for use as backfill up to the design bottom of footing subgrade.

The following parameters are recommended for the preliminary design of the foundations:

- Footings should be proportioned utilizing an allowable design net bearing pressure of three (3) tons per square-foot.
- The minimum footing width for continuous footings and isolated footings should be 30 inches and 36 inches, respectively.
- Perimeter foundations and interior foundations below unheated areas should be provided with a minimum 4-foot thickness of soil cover as frost protection. Interior foundations below heated areas should be located such that the top of foundation concrete is a minimum of six inches below the underside of the lowest level slab.

5.5 – LOWEST LEVEL SLAB RECOMMENDATIONS

As indicated above, the lowest level of the addition will be a framed slab and will be located above a level of open-air at-grade parking. It is anticipated that there may be a small lobby area at the level of the parking lot, which may contain stairs and an elevator. In consideration of the presence of the uncontrolled fill and the discontinuous layer of highly compressible organic soils which underly the site, it is recommended that the lowest level floor slabs of occupied building areas be designed as a structurally supported slabs doweled into the pile caps. Furthermore, the lowest level slabs of occupied building areas should be underlain by a polyethylene vapor barrier spread across the surface of a minimum 9-inch thickness of compacted 3/4-inch crushed stone placed over a layer of filter fabric that is laid across the subgrade.

In the locations of the open-air parking, it is anticipated that bituminous concrete paving would be placed, not concrete. Due to the presence of the existing fill and organic soils located beneath the car parking, there is potential for minor settlement and cracking of the pavement due to the uncontrolled and variable nature of these materials. Furthermore, in consideration of the organics, it is recommended that the proposed grade not be raised in the parking area as it could facilitate consolidation of the organics which would result in additional surface settlement.

Preparation of the subgrade for support of the open-air parking at grade level should include the removal of the existing surface treatments and proofrolling of the existing fill subgrade below the depth of the required base and subbase courses with at least four (4) passes of a 10-ton vibratory drum roller. All soft or compressible areas detected by the proofrolling should be excavated and replaced with a compacted, off-site gravel borrow.

The effect of site settlements, as discussed above, should be incorporated into the utility and site design. Below-grade utilities entering and exiting the building should be provided with oversized foundation penetrations and be designed utilizing flexible connections that account for differential settlement between the building and surrounding soil of up to 2 inches. Utilities located beneath the building slab that cannot tolerate settlement (i.e., cast iron plumbing penetrations) should be hung from the underside of the building slab. Slabs at building entrances should be designed to accommodate the predicted differential settlement to avoid a tripping hazard.

5.6 – GROUNDWATER CONSIDERATIONS

If the proposed addition is to include below-grade space below a portion of the building or if a portion of the building is to include a "walk-out" below-grade space, benched into the existing slope, it is recommended that the lowest level slab be provided with perimeter and underslab foundation drainage at locations where the proposed slab elevation is located 1-foot or greater below proposed exterior finished grade. The perimeter and underslab drains are intended to minimize groundwater intrusion into the below-grade space due to conditions when groundwater may become temporarily elevated due to precipitation events, surface water run-off, and/or seasonal groundwater changes. The underslab and perimeter drainage systems are not intended to lower the existing groundwater level. Additional details of a foundation drainage system would be included in a FFER.

All below-grade walls should receive a troweled-on bitumastic damp-proofing. A prefabricated drainage product, such as Miradrain 6000, should be installed directly against the below-grade perimeter foundation walls and be tied into the perimeter drainage system. Backfill against the perimeter foundation walls may consist of ordinary fill. Additionally, the exterior site grades should be sloped away from the perimeter of the proposed addition to minimize surface water infiltration.

All pits and depressions extending below the slab (e.g., elevator pits, etc.) should be provided with properly tied continuous waterstops in all construction joints and be waterproofed. Also, pits and depressions below the slab should be designed for hydrostatic uplift pressures corresponding to the groundwater being present 1-foot below the bottom of the proposed slab or the design flood elevation, whichever is higher.

5.7 – RESISTANCE TO LATERAL FORCES

Refer to the attached **Figure 4** for lateral pressure diagrams for use in the design of below-grade walls. Specifically, below-grade foundation walls receiving lateral support at the top and bottom (i.e., restrained walls) that are provided with positive drainage should be

designed for a lateral earth pressure corresponding to an equivalent fluid density of 60 pounds per cubic foot (pcf). To these values must be added the pressures attributable to earthquake forces per Section 1610.2 of the Code plus any permanent surcharge loads, if applicable. These provisions should include either a continuous perimeter foundation drain at the base of the back of the wall consisting of a perforated pipe surrounded with crushed stone and filter fabric. Site walls should be provided with a minimum 4-foot thickness of soil cover for frost protection and be backfilled with free draining gravel borrow.

Lateral forces can be transmitted from the structure to the soil by passive pressure on the foundation walls, footings, pile caps, and grade beams utilizing an equivalent fluid density of 120 pcf providing that these structural elements are designed to resist these pressures. Lateral forces can also be considered to be transmitted from the structure to the soil by friction on the base of the footings using a frictional coefficient of 0.4 to which a factor of safety of 1.5 should be applied.

5.8 – SEISMIC DESIGN CONSIDERATIONS

For the purposes of determining parameters for structural seismic design, this site is considered to be a Site Class D as defined in Chapter 20 of American Society of Civil Engineers (ASCE) Standard 7-10 "Minimum Design Loads for Buildings and Other Structures". Further, the bearing strata on the proposed site are not considered to be subject to liquefaction during an earthquake based on the criterion of Section 1806.4 of the Code.

6.0 – PRELIMINARY FOUNDATION CONSTRUCTION CONSIDERATIONS

6.1 – GENERAL RECOMMENDATIONS

The primary geotechnical construction considerations that are anticipated to have an impact on the site design are proposed grading, obstructions to pile installation, and off-site reuse/disposal of excess soil. Additional geotechnical construction considerations would be discussed in the FFER.

6.2 – PROPOSED GRADING

The borings indicate the site is underlain by up to 5 feet of organic soils, which are highly compressible and have the potential to undergo several inches of settlement if the load on the soil is increased above the existing load. The placement of conventional fill to raise the grade will result in consolidation of the organic deposit which will lead to settlement of surface treatments as well as existing and proposed below-grade utilities. The magnitude of settlement and time required for settlement to occur is dependent upon the soil conditions and soil properties, including such factors as the thickness of the organics, the stress history of the deposit, the in-situ vertical effective stress, and the compressibility parameters of the deposit. Settlement analyses would need to be performed to estimate the magnitude of consolidation settlement of the organic deposit due to the proposed construction.

As such, it is not recommended that the proposed site grade be raised by more than 1-foot because proposed utilities will experience settlement due to the raising of site grades which could result in damage to those utilities if they are unable to withstand the differential settlement. Furthermore, the at-grade parking area could also settle as a result of an increase in grade level. If the proposed grade within the building footprint is to be raised by more than one (1) foot, it may be necessary to construct a structurally-supported concrete slab supported on drilled micropiles to support the at-grade parking.

6.3 – OBSTRUCTIONS TO PILE INSTALLATION

The structures which currently occupy the subject site will be partially or fully demolished as part of the proposed development. Existing foundation remains should be removed where they interfere with new construction. Foundation remains may remain in place where they do not interfere with the proposed structure provided that they are removed to 24 inches beneath the proposed finished grade.

Obstructions to pile installation encountered in the fill deposit should be removed by the earthwork contractor to the extent feasible without requiring a support of excavation system. Note if rubble fill is encountered, it should be chased out laterally below the proposed building footprint. Obstructions that are encountered during pile installation that prevent continued pile installation at a particular pile location should be evaluated on a case-by-case basis to determine the necessity to remove the obstruction, to drill through the obstruction, or to design the structure to span over the obstruction. A contingency to drill through obstructions should be included in the pile contract.

6.4 – OFF-SITE REMOVAL OF EXCESS SOILS

Current Department of Environmental Protection (DEP) policies and regulations for off-site removal of excess excavated soil require environmental characterization of the excess excavated soil prior to its off-site reuse or disposal. McPhail could perform this service as an additional service if requested.

It is noted that drilled micropile installation will result in the generation of drilling spoils. It is generally anticipated that these spoils will be unsuitable for reuse at the project site. As such, off-site reuse or disposal of these spoils should be performed in a manner consistent with our recommendations below and should be included in the Base Bid.

7.0 – FUTURE WORK

7.1 – FINAL FOUNDATION ENGINEERING REPORT

It is recommended that McPhail be retained to prepare a Final Foundation Engineering Report (FFER) once the details of the proposed addition are finalized.

7.2 – DESIGN ASSISTANCE

It is recommended that McPhail be retained to provide design assistance to the design team during the final design phase of this project. The purpose of this involvement is to review the structural foundation drawings and foundation notes for conformance with the recommendations presented herein and to generate the geotechnical-related specification sections for inclusion into the Contract Documents for construction.

7.3 – CONSTRUCTION OBSERVATION

It is recommended that McPhail be retained during the construction period to observe the over-excavation of unsuitable soils, installation of micropiles, final preparation of the foundation bearing surfaces, preparation of the slab-on-grade subgrade, installation of the foundation drainage system (if required), and the placement and compaction of structural fill in accordance with the provisions of the Code and the provisions of the Contract Documents. Our involvement during the construction phase of the work should minimize costly delays due to unanticipated field problems since our field representative would be under the direct supervision of our project manager who was responsible for the subsurface explorations and foundation design recommendations documented herein.

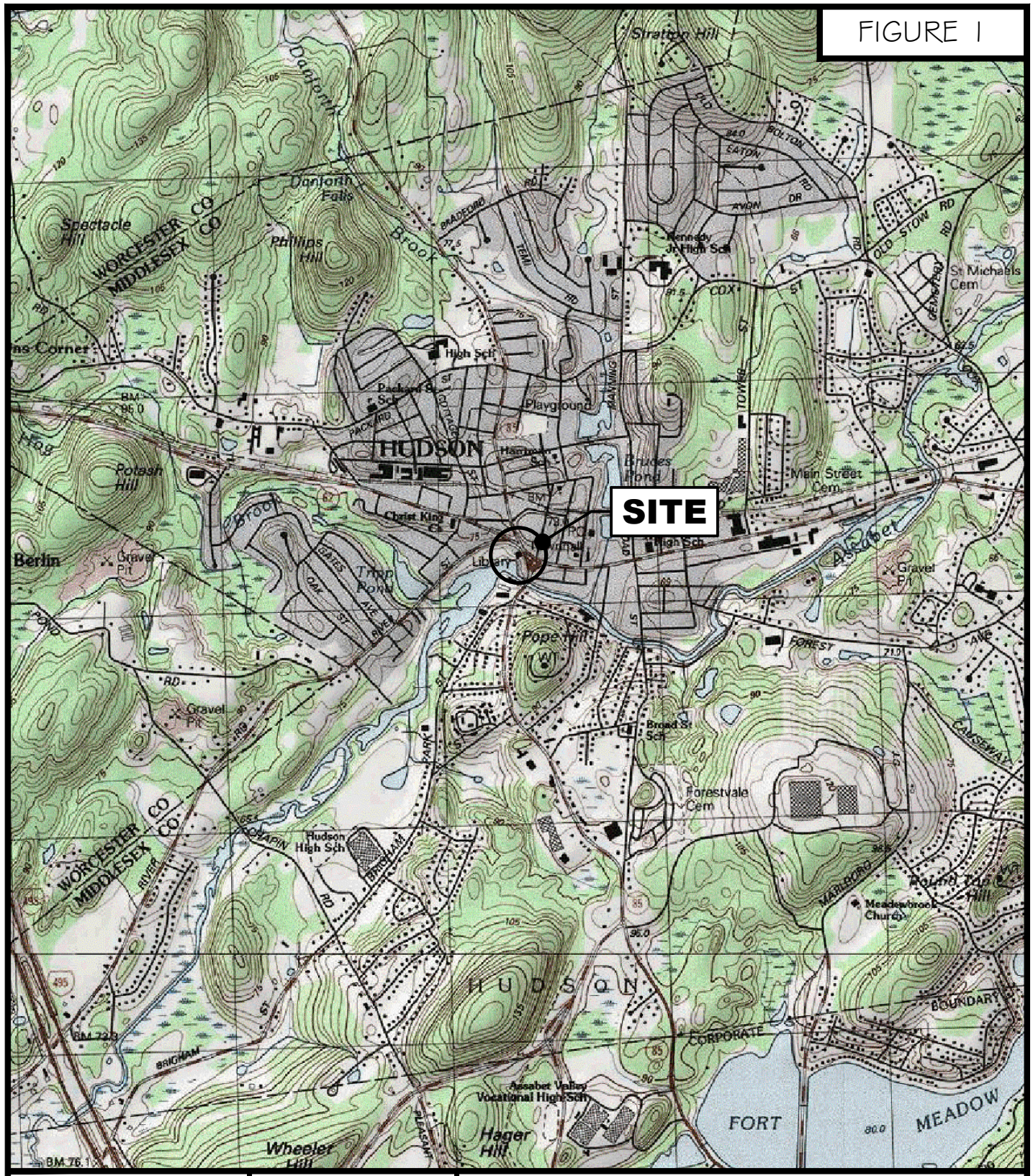
8.0 – LIMITATIONS

This preliminary report has been prepared in accordance with generally accepted soil and geotechnical engineering practices. No other warranty, expressed or implied, is made. If any changes in nature or design of the proposed construction are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by McPhail.

The analyses and recommendations presented in this preliminary report are based upon the data obtained from the subsurface explorations performed at the approximate locations indicated on the enclosed plan. If variations in the nature and extent of subsurface conditions between the widely spaced explorations become evident during construction, it will be necessary for a re-evaluation of the recommendations of this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations.

FIGURES

FIGURE 1



McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

N

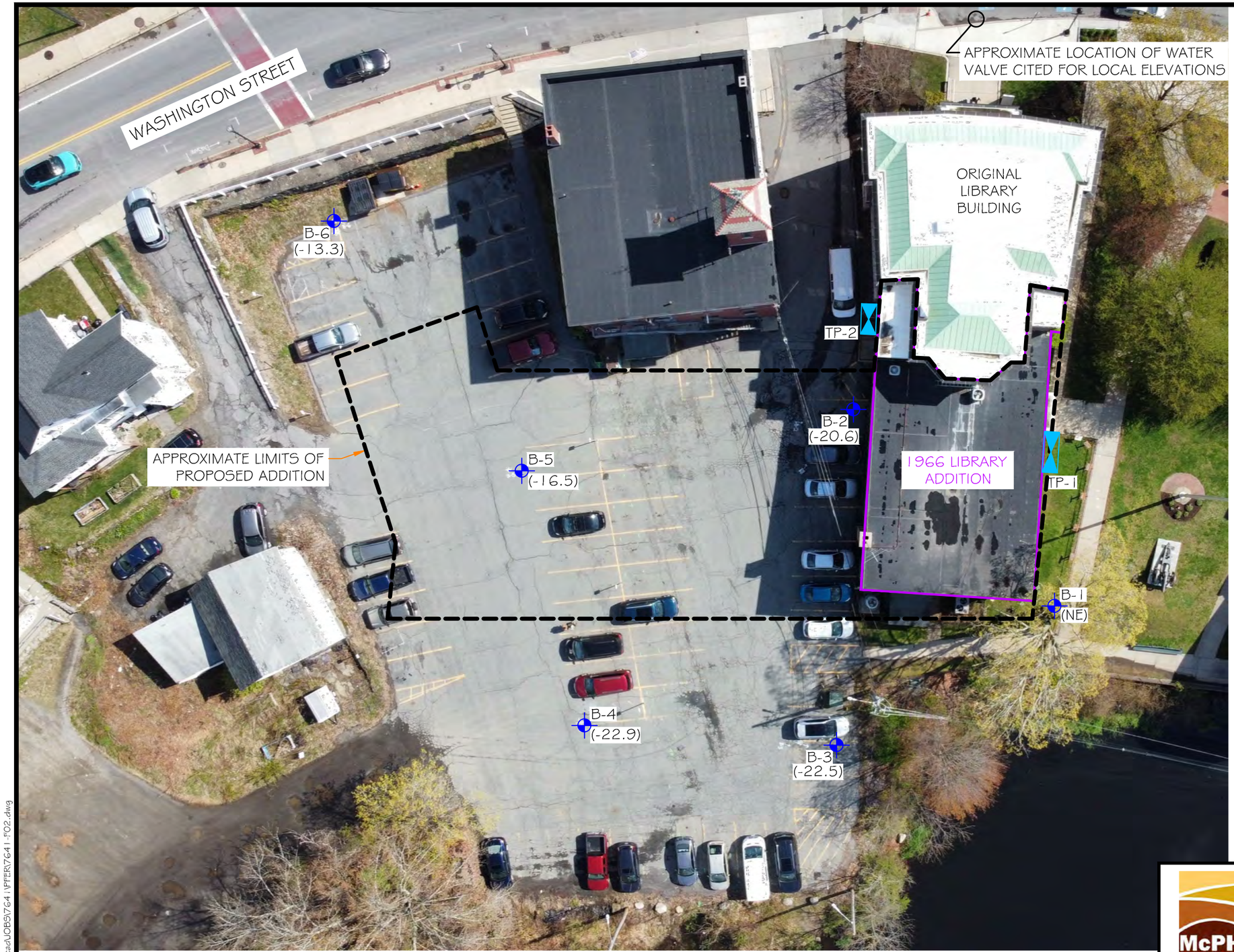
SCALE 1:25,000

PROJECT LOCATION PLAN

HUDSON PUBLIC LIBRARY

HUDSON MASSACHUSETTS

FIGURE 2



NORTH

LEGEND

— APPROXIMATE LOCATION OF TEST PIT PERFORMED BY T. D'AMATO EXCAVATING ON APRIL 27, 2023 FOR MCPHAIL ASSOCIATES, LLC

— APPROXIMATE LOCATION OF BORING PERFORMED BY CARR-DEE CORP. ON APRIL 26 AND 27, 2023 FOR McPHAIL ASSOCIATES, LLC

(-20.6) — INDICATES APPROXIMATE ELEVATION OF TOP OF ALLUVIAL DEPOSIT

(NE) — INDICATES ALLUVIAL DEPOSIT NOT ENCOUNTERED

REFERENCE: THIS PLAN WAS PREPARED FROM A NOT-TO-SCALE AERIAL PHOTO TAKEN ON APRIL 24, 2023 BY ATLANTIC GEOSERVICES, LLC

GRAPHIC SCALE

30 0 30 60

McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

HUDSON PUBLIC LIBRARY

HUDSON MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

TRIPI ENGINEERING SERVICES, LLC

BY

McPHAIL ASSOCIATES, LLC

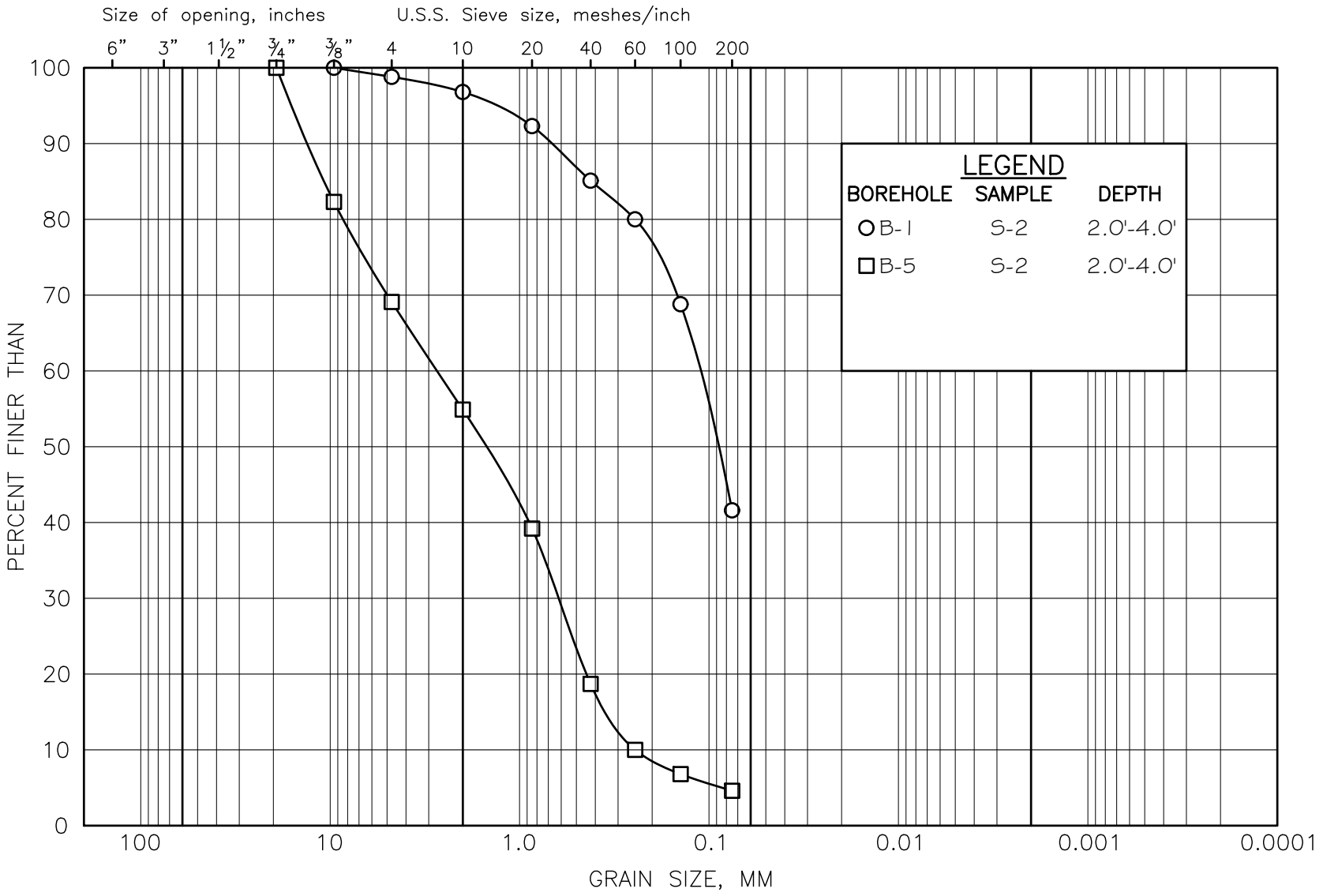
Date: AUGUST 2023	Dwn: M.B.S.	Chkd: C.P.M.	Scale: 1" = 30'
Project No: 7641			

FILE NAME: N:\Acad\JOBS\7641\PFER\7641-F02.dwg

FILE NAME: N:\Acad\JOBS\7641\PFER\7641-F03_Sieve.dwg

PROJECT No. 7641

M.I.T. GRAIN SIZE SCALE



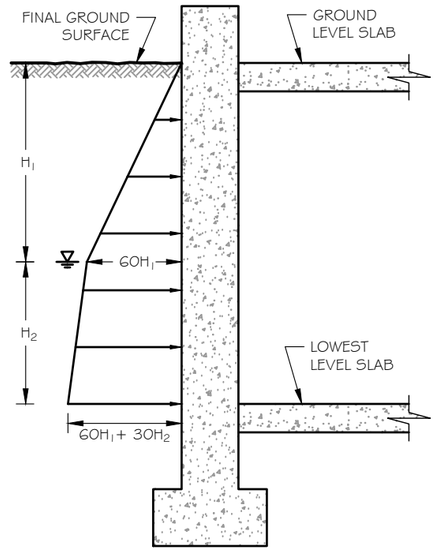
COBBLE SIZE	GRAVEL SIZE			SAND SIZE			FINE GRAINED	
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

McPHAIL ASSOCIATES, LLC

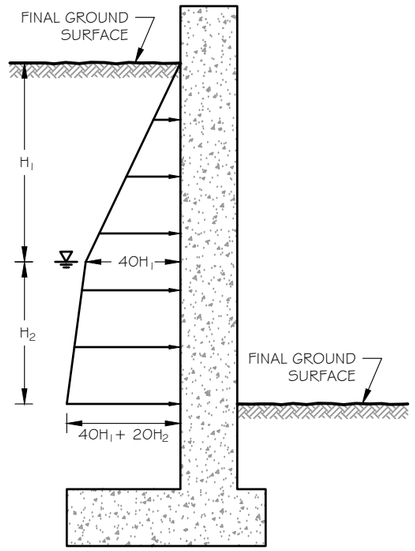
GRAIN SIZE DISTRIBUTION
FILL

FIGURE 3

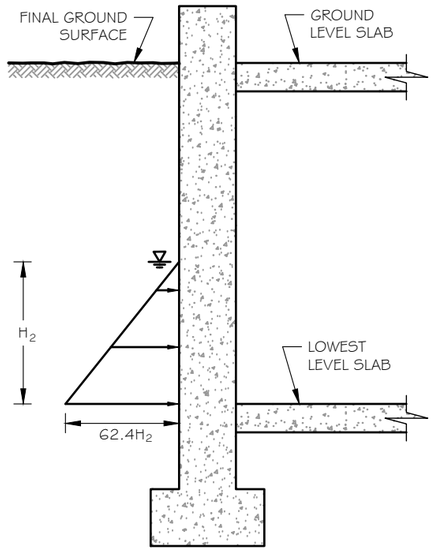
FIGURE 4



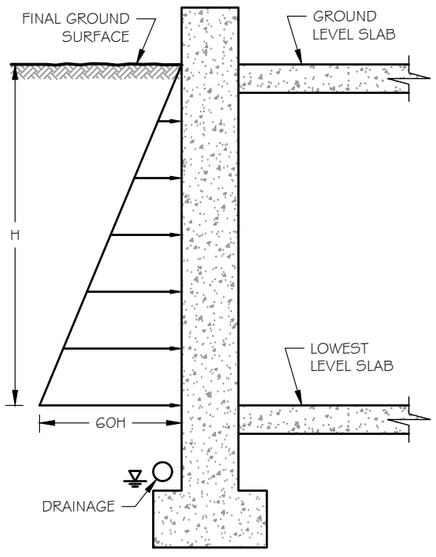
AT-REST EARTH PRESSURES (UNDRAINED FOUNDATION WALL)



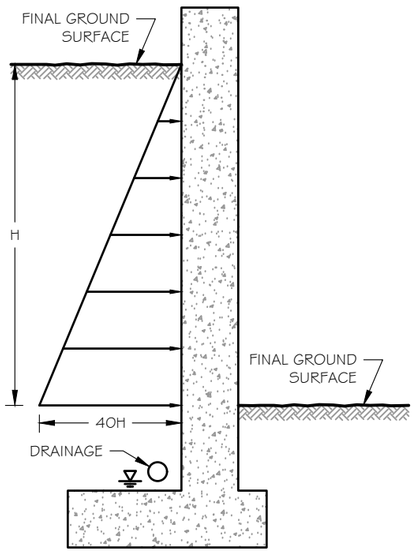
ACTIVE EARTH PRESSURES (UNDRAINED CANTILEVER RETAINING WALL)



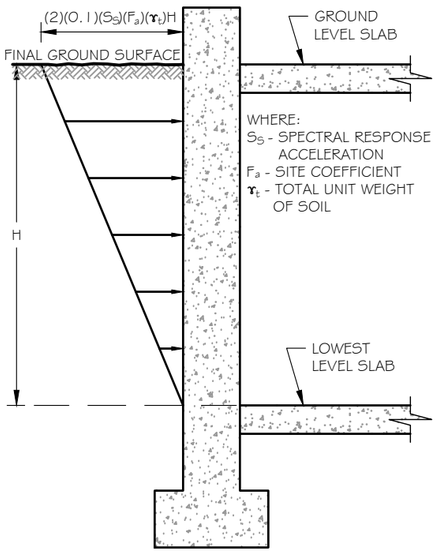
HYDROSTATIC PRESSURES (UNDRAINED FOUNDATION AND RETAINING WALLS)



AT-REST EARTH PRESSURES (DRAINED FOUNDATION WALL)



ACTIVE EARTH PRESSURES (DRAINED CANTILEVER RETAINING WALL)



EARTHQUAKE PRESSURES

NOTES:

1. THESE PRESSURE DIAGRAMS ARE INTENDED FOR USE IN DESIGNING BELOW-GRADE FOUNDATION WALLS AND RETAINING WALLS FOR THE PERMANENT CONDITIONS.
2. VALUES OF PRESSURE IN THESE DIAGRAMS ARE IN UNITS OF POUNDS PER SQUARE FOOT.
3. AN EQUIVALENT FLUID DENSITY OF 120 POUNDS PER CUBIC FOOT IS RECOMMENDED FOR PASSIVE EARTH PRESSURES.
4. PRESSURE DIAGRAMS ASSUME AN ANGLE OF INTERNAL FRICTION OF 30 DEGREES AND A TOTAL UNIT WEIGHT OF 120 POUNDS PER CUBIC FOOT.
5. LATERAL PRESSURES RESULTING FROM ADJACENT VERTICAL SURCHARGE LOADS SHOULD BE INCLUDED IN THE DESIGN OF BELOW-GRADE FOUNDATION WALLS AND RETAINING WALLS WHERE APPLICABLE.
6. H_1 = DISTANCE FROM EXTERIOR GROUND SURFACE FOR FOUNDATION WALLS OR RETAINED GROUND SURFACE FOR RETAINING WALLS TO DESIGN GROUNDWATER ELEVATION.

   H_2 = DISTANCE FROM DESIGN GROUNDWATER ELEVATION TO TOP OF LOWEST LEVEL SLAB FOR FOUNDATION WALLS OR TO UNRETAINED GROUND SURFACE FOR RETAINING WALLS.

   H = DISTANCE FROM EXTERIOR GROUND SURFACE TO TOP OF LOWEST LEVEL SLAB FOR FOUNDATION WALLS OR FROM RETAINED GROUND SURFACE TO UNRETAINED GROUND SURFACE FOR RETAINING WALLS.

   ∇ = DENOTES DESIGN GROUNDWATER ELEVATION.
7. REFER TO REPORT TEXT FOR DESIGN GROUNDWATER ELEVATION.

McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

HUDSON PUBLIC LIBRARY

HUDSON MASSACHUSETTS

LATERAL PRESSURES FOR DESIGN OF BELOW-GRADE WALLS

FOR

TRIPI ENGINEERING SERVICES, LLC

BY

McPHAIL ASSOCIATES, LLC

Date: AUGUST 2023	Dwn: M.B.S.	Chkd: C.P.M.	Scale: N.T.S.
Project No: 7641			

FILE NAME: N:\Acad\JOBS\7641\PFER\7641-F04.dwg

APPENDIX A:

EXPLORATION AND LABORATORY TESTING PROCEDURES

The borings were performed using a truck-mounted or track-mounted drill rig and advanced utilizing NW casing and the wet rotary drilling methods. Standard 2-inch O.D. split-spoon samples and standard penetration test results were generally obtained continuously to a minimum depth of 6 feet below existing grade and then at minimum 5-foot intervals for the remainder of the boring depths. The split-spoon sampling was performed in general accordance with the standard procedures described in ASTM D1586.

The test pits were performed using a Yanmar ViO55 rubber-tracked mini-excavator and excavated to depths of up to 7.9 feet below the existing ground surface.

The explorations were monitored by McPhail field representatives who performed field layout, prepared field logs, obtained and visually classified soil samples, monitored groundwater conditions in the open boreholes, and determined the required exploration depth based upon the actual subsurface conditions encountered.

Field locations of the explorations were determined by taping from existing site features included on the available drawings. Unless noted otherwise, the existing ground surface elevation at each exploration location was determined by a level survey performed by our field staff utilizing vertical control information on the available drawings.

At the completion of the field work, soil samples were returned to our laboratory for more detailed classification, analysis, and testing. The laboratory testing consisted of sieve analyses to determine the gradations and confirm the visual classifications of the soil deposits. Laboratory test procedures were in general accordance with applicable ASTM Standards.

SOIL CLASSIFICATION SYSTEM

The soil classifications contained herein were determined using the Modified Massachusetts Institute of Technology (MIT) Soil Classification System, which utilizes the following definitions and descriptive terms to describe the soil components, percentage of soil components, and soil densities:

Soil Type	Grain Size Range (millimeters)
Gravel	60 – 2
Sand	2 – 0.06
Silt	0.06 – 0.002
Clay	<0.002

Descriptive Term	Proportion of Total (%)
"Trace"	0 - 10
"Some"	10 - 20
ADJECTIVE (e.g., sandy, silty)	20 - 35
"And"	35 - 50

Granular Soils	
Density	**Penetration Resistance (blows per foot)**
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	>50

Cohesive Soils		
Density	**Penetration Resistance (blows per foot)**	**Undrained Shear Strength (pounds per foot)**
Very Soft	0 - 2	0 - 250
Soft	2 - 4	250 - 500
Firm	4 - 8	500 - 1000
Stiff	8 - 15	1000 - 2000
Very Stiff	15 - 30	2000 - 4000
Hard	>30	>4000

APPENDIX B:

BORING LOGS

Project: Hudson Public Library
Location: 3 Washington Street
City/State: Hudson, Massachusetts

Job #: 7641.2.T1
Date Started: 4-26-23
Date Finished: 4-26-23

Boring No.

B-1

Contractor: Carr-Dee Corp
Driller/Helper: S. DeSimone/J . DeSimone
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -13.0

Casing Type: NW
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-26-23	8	-21.0	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.5 / -13.5	TOPSOIL						
1	-14				5	S-1	24/15	0.0-2.0	3 3 2 4	Loose, brown, SAND, trace silt, with gray-black ash and cinders. (Fill)
2	-15									
3	-16				8	S-2	24/13	2.0-4.0	4 3 5 4	Loose, yellow-brown, fine SAND and SILT, trace gravel, with pockets of gray silt. (Fill)
4	-17									
5	-18			FILL						
6	-19				16	S-3	24/18	5.0-7.0	6 3 13 9	Compact, yellow-brown to orange-brown, fine SAND, some silt, to dark brown, SILT and fine SAND, trace organics. (Fill)
7	-20									
8	-21				17	S-4	18/12	7.0-8.5	8 6 11	Compact, dark brown, SILT and fine SAND, with organics, with layer of ash and cinders. (Fill)
9	-22				63/6"	S-4a	6/2	8.5-9.0	63	Very dense, mottled orange-brown to gray-brown, SAND and GRAVEL, some silt. (Fill)
10	-23		10.0 / -23.0	Bottom of Borehole at 10.0 feet below existing grade.	100/2"	S-5	2/1	9.9-10.1	100/2"	NOTE: Drove casing to refusal at 9 ft. Advanced roller bit to practical refusal at 9.9 feet. Very dense, GRAVEL. (Fill)
11	-24									
12	-25									
13	-26									
14	-27									
15	-28									
16	-29									
17	-30									
18	-31									
19	-32									
20	-33									
21	-34									
22	-35									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Hudson Public Library
Location: 3 Washington Street
City/State: Hudson, Massachusetts

Job #: 7641.2.T1
Date Started: 4-26-23
Date Finished: 4-26-23

Boring No.
B-2

Contractor: Carr-Dee Corp
Driller/Helper: S. DeSimone/J . DeSimone
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -9.6

Casing Type: 2.25" I.D. Hollow Stem Auger
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-26-23	11	-20.6	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
	-10		0.3 / -9.9	PAVEMENT						
1	-11				14	S-1	24/15	0.5-2.5	10 8 6 5	Compact, gray-brown, SILT and SAND, some gravel, with ash and cinders. (Fill)
2	-12									
3	-13				11	S-2	24/11	2.5-4.5	4 5 6 12	Compact, gray-brown, SILT and SAND, trace gravel, with brick. (Fill)
4	-14									
5	-15			FILL	31	S-3	24/7	5.0-7.0	16 10 21 7	Dense, gray-brown, SAND and GRAVEL, trace silt, with brick. (Fill)
6	-16									
7	-17				9	S-4	24/13	7.0-9.0	14 6 3 3	Loose, dark brown, SILT and fine SAND, with organics, ash, and cinders. (Fill)
8	-18									
9	-19				32	S-5	12/8	9.0-10.0	16 16	Compact to dense, orange-brown, SILT and fine SAND. (Fill)
10	-20				28	S-5a	12/8	10.0-11.0	14 14	Compact to dense, gray-brown, completely to very severely WEATHERED BOULDER. (Fill)
11	-21		11.0 / -20.6		18	S-6	12/10	11.0-12.0	8 10	Compact, stratified orange-brown to gray-brown, fine sandy SILT to silty fine SAND. (Alluvial Deposit)
12	-22				31	S-6a	12/10	12.0-13.0	15 16	Compact to dense, mottled orange-brown to gray-brown, SILT and SAND, some gravel. (Alluvial Deposit)
13	-23									
14	-24			ALLUVIAL DEPOSIT						
15	-25				100/2"	S-7	2/0	15.0-15.2	100/2"	NO RECOVERY. NOTE: Encountered cobble/boulders from ~14 feet to bottom of Borehole.
16	-26		16.7 / -26.3							
17	-27			Bottom of Borehole at 16.7 feet below existing grade.	100/1"	S-8	1/0	16.6-16.7	100/1"	Split Spoon Refusal. NOTE: Auger Refusal at 16.7 feet.
18	-28									
19	-29									
20	-30									
21	-31									
22	-32									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project:	Hudson Public Library	**Job #:**	7641.2.T1
Location:	3 Washington Street	**Date Started:**	4-26-23
City/State:	Hudson, Massachusetts	**Date Finished:**	4-26-23

Boring No.

B-3

Contractor: Carr-Dee Corp
Driller/Helper: S. DeSimone/J . DeSimone
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -13.5

Casing Type: 2.25" I.D. Hollow Stem Auger/NW
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-26-23	7	-20.5	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
	-14		0.2 / -13.7	PAVEMENT						
1	-15			FILL	9	S-1	24/9	0.5-2.5	4 5 4 5	Loose, dark brown, SILT and SAND, with ash and cinders. (Fill)
2	-16				4	S-2	24/6	2.5-4.5	2 2 2 5	Very loose to loose, brown, SILT and SAND, with ash and cinders. (Fill)
3	-17									
4	-18									
5	-19				10	S-3	12/8	5.0-6.0	6 4	Loose to compact, black, SAND, trace silt, with ash and cinders. (Fill)
6	-20		6.0 / -19.5		3	S-3a	12/8	6.0-7.0	2 1	Replaced augers with NW casing at 9 feet. Then proceeded with wet rotary drilling methods. Soft to firm, dark brown, ORGANIC SILT, trace sand. (Organics)
7	-21			ORGANICS	3	S-4	24/3	7.0-9.0	1 1 2 1	Soft, dark brown, ORGANIC SILT, trace sand. (Organics)
8	-22		9.0 / -22.5							
9	-23			ALLUVIAL DEPOSIT	11	S-5	18/11	9.0-10.5	2 6 5	Stiff, yellow-gray, SILT, trace fine sand. (Alluvial Deposit)
10	-24				16/6"	S-5a	6/	10.5-11.0	16	Compact, gray, SILT to fine sandy SILT. (Alluvial Deposit)
11	-25				37	S-6	24/18	11.0-13.0	22 18 19 23	Dense, stratified gray to orange-brown and gray-brown SILT, fine sandy SILT to silty fine SAND. (Alluvial Deposit)
12	-26									
13	-27		13.5 / -27.0							
14	-28			GLACIAL TILL						
15	-29				52	S-7	24/14	15.0-17.0	18 29 23 19	Very dense, gray-brown, gravelly SILT and SAND. (Glacial Till)
16	-30									
17	-31									
18	-32									
19	-33									
20	-34				148	S-8	24/16	20.0-22.0	27 69 79 51	Very dense, mottled orange-brown to gray-brown, silty SAND and GRAVEL, to dark gray, silty SAND and GRAVEL. (Glacial Till)
21	-35									
22	-36		22.0 / -35.5	Bottom of Borehole at 22.0 feet below existing grade,						

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Hudson Public library
Location: 3 Washington Street
City/State: Hudson, Massachusetts

Job #: 7641.2.T2
Date Started: 4-27-23
Date Finished: 4-27-23

Boring No. B-4

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/S. Desimone Jr.
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -13.4

Casing Type: 2.25 " I.D. Holow Stem Augers/NW
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-27-23	4.5	-17.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
	-13.4		0.3 / -13.7	PAVEMENT						
1	-14				16	S-1	18/14	0.5-2.0	10 9 7	Compact, yellow-brown, SAND and GRAVEL, trace silt. (Fill)
2	-15			FILL						
3	-16				3	S-2	24/11	2.0-4.0	5 2 1 1	Very loose, gray-brown, SILT and fine SAND, trace to some gravel. (Fill)
4	-17									
	-18		4.5 / -17.9							
5	-19				3	S-3	24/10	5.0-7.0	3 2 1 WOH	Very soft to soft, brown, interebedded ORGANIC SILT and gray silty fine SAND. (Organics)
6	-20			ORGANICS						
7	-21				3	S-4	24/14	7.0-9.0	2 2 1 2	Soft, brown, FIBROUS PEAT and ORGANIC SILT, with occasional sand partings/seams. (Organics) After sampling to 9 ft., replaced auger with NW casing to 10 ft. Then proceeded to preform wet rotary drilling methods for remainder of Borehole.
8	-22									
9	-23		9.5 / -22.9							
10	-24				15	S-5	24/14	10.0-12.0	8 7 8 9	Compact, stratified yellow-gray to gray-brown, fine sandy SILT to silty fine SAND. (Alluvial Deposit)
11	-25									
12	-26									
13	-27									
14	-28									
15	-29			ALLUVIAL DEPOSIT	22	S-6	12/10	15.0-16.0	10 12	Compact, orange-brown to gray-brown, gravelly SAND, trace silt. (Alluvial Deposit)
16	-30				16	S-6a	12/10	16.0-17.0	8 8	Compact, stratified gray-brown, SILT to fine Sandy SILT to silty fine SAND. (Alluvial Deposit)
17	-31									
18	-32									
19	-33									
20	-34				15	S-7	24/16	20.0-22.0	9 8 7 8	Compact, stratified gray-brown, SILT to fine sandy SILT to silty fine SAND. (Alluvial Deposit)
21	-35		22.0 / -35.4							
22	-36			Bottom of Borehole at 22.0 feet below existing grade.						

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Used Automatic hammer to drive Split Spoon

Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Hudson Public library
Location: 3 Washington Street
City/State: Hudson, Massachusetts

Job #: 7641.2.T2
Date Started: 4-27-22
Date Finished: 4-27-23

Boring No. B-5

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/S. Desimone Jr.
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -6.5

Casing Type: 2.25 " I.D. Holow Stem Augers/NW
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations			
Date	Depth	Elev.	Notes
4-27-23	8.5	-15.0	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
	-7		0.3 / -6.8	PAVEMENT						
1	-8			FILL	19	S-1	18/16	0.5-2.0	9 9 10	Compact, yellow-brown, SAND and GRAVEL, trace silt. (Fill)
2	-9				15	S-2	24/18	2.0-4.0	10 8 7 7	Compact, yellow-brown, SAND and GRAVEL, trace silt. (Fill)
3	-10									
4	-11									
5	-12		5.4 / -11.9		100/5"	S-3	5/4	5.0-5.4	100/5"	Very dense, black, SILT and SAND, with wood. (Fill)
6	-13		6.4 / -12.9	CONCRETE SLAB						Advanced Augers through obstruction from 5.4 to ~ 6.4 ft.
7	-14			FILL	22	S-4	24/15	6.5-8.5	11 19 3 2	Compact, mottled dark gray-brown to black, SILT and SAND, with wood, ash, and cinders. (Fill) After sampling to 10 ft., replaced auger with NW casing to 10 ft. Then proceeded to preform wet rotary drilling methods for remainder of Borehole.
8	-15									
9	-16		10.0 / -16.5		4	S-5	18/16	8.5-10.0	3 2 2	Very loose to loose, gray-brown to gray, SILT, trace to some fine SAND, with organics. (Fill)
10	-17			ALLUVIAL DEPOSIT	17	S-6	24/18	10.0-12.0	6 7 10 8	Compact, statified gray, fine to medium SAND, trace to some silt. (Alluvial Deposit)
11	-18									
12	-19									
13	-20									
14	-21									
15	-22				19	S-7	24/13	15.0-17.0	8 10 9 7	Compact, orange-brown, gravelly SAND, trace silt. (Alluvial Deposit)
16	-23									
17	-24									
18	-25									
19	-26									
20	-27				8	S-8	24/15	20.0-22.0	5 4 4 5	Loose, stratified gray-brown, SILT to silty fine SAND. (Alluvial Deposit)
21	-28		22.0 / -28.5							
22	-29			Bottom of Borehole at 22.0 feet below existing grade.						

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Used Automatic hammer to drive Split Spoon

Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Hudson Public library
Location: 3 Washington Street
City/State: Hudson, Massachusetts

Job #: 7641.2.T2
Date Started: 4-27-22
Date Finished: 4-27-23

Boring No. B-6

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/S. Desimone Jr.
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): -6.3

Casing Type: 2.25 " I.D. Holow Stem Augers/NW
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
4-27-23	7.5	-13.8	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.5 / -6.8	TOPSOIL						
1	-7				9	S-1	24/14	0.0-2.0	6 5 4 2	Loose, yellow-brown, SAND and GRAVEL, trace silt. (Fill)
2	-8									
3	-9									
4	-10			FILL						
5	-11									
6	-12				4	S-2	24/15	5.0-7.0	1 1 3 2	Very loose to loose, mottled black to gray-brown, SILT and SAND, with ash and cinders. (Fill) After sampling to 9 ft., replaced auger with NW casing to 10 ft. Then proceeded to preform wet rotary drilling methods for remainder of Borehole.
7	-13		7.0 / -13.3							
8	-14				11	S-3	24/16	7.0-9.0	8 6 5 6	Compact, stratified light gray-brown, fine to medium SAND, trace silt, to SAND, trace silt and gravel. (Alluvial Deposit)
9	-15									
10	-16									
11	-17				12	S-4	24/16	10.0-12.0	5 5 7 10	Compact, stratifed light gray-brown, fine to medium SAND, trace silt, to SAND, trace silt and gravel. (Alluvial Deposit)
12	-18									
13	-19									
14	-20									
15	-21			ALLUVIAL DEPOSIT						
16	-22				14	S-5	24/16	15.0-17.0	9 7 7 10	Compact, gray-brown, gravelly SAND, trace silt. (Alluvial Deposit)
17	-23									
18	-24									
19	-25									
20	-26				20	S-6	12/8	20.0-21.0	9 11	Compact, gray to gray-brown, gravelly SAND, trace silt. (Alluvial Deposit)
21	-27				21	S-6a	12/8	21.0-22.0	11 10	Compact, stratified gray-brown, SILT, to silty fine SAND. (Alluvial Deposit)
22	-28		22.0 / -28.3							
	-29			Bottom of Borehole at 22.0 feet below existing grade.						

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Used Automatic hammer to drive Split Spoon

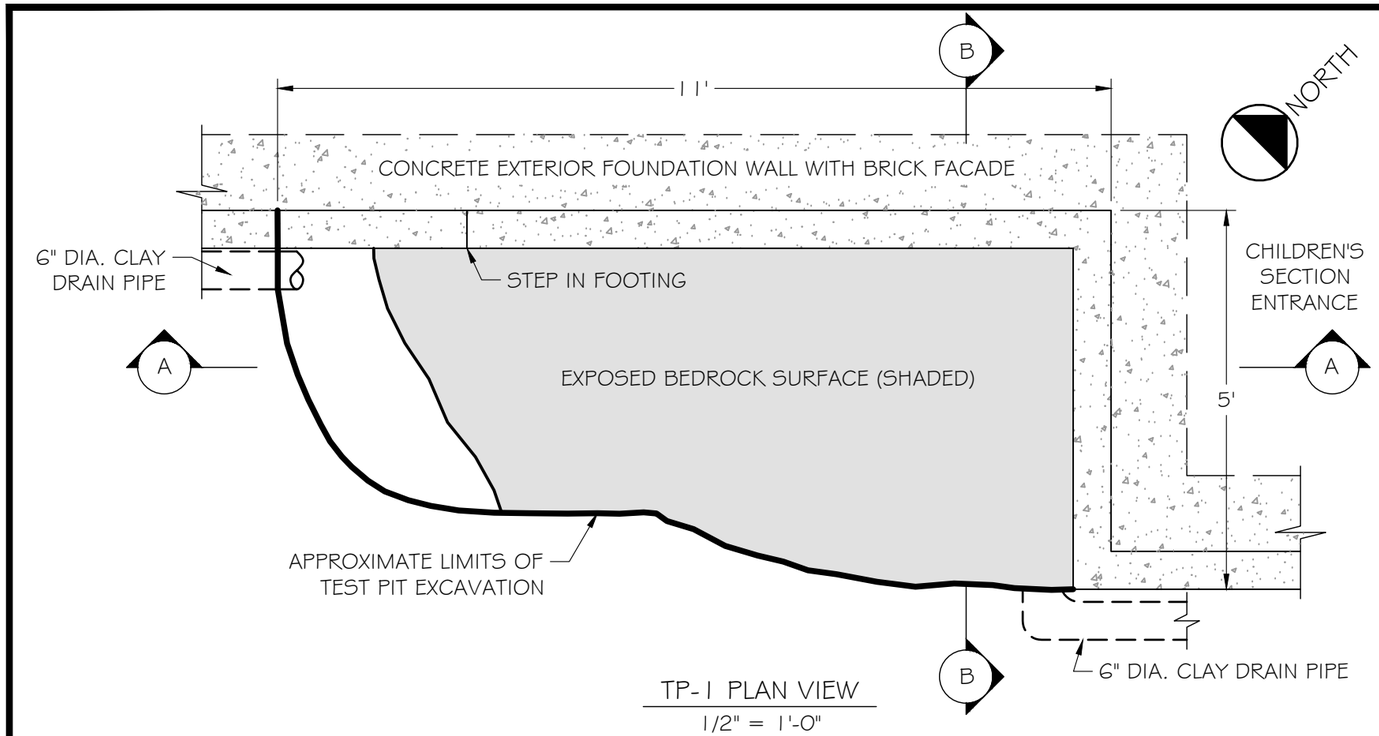
Weather: Variable

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

APPENDIX C:

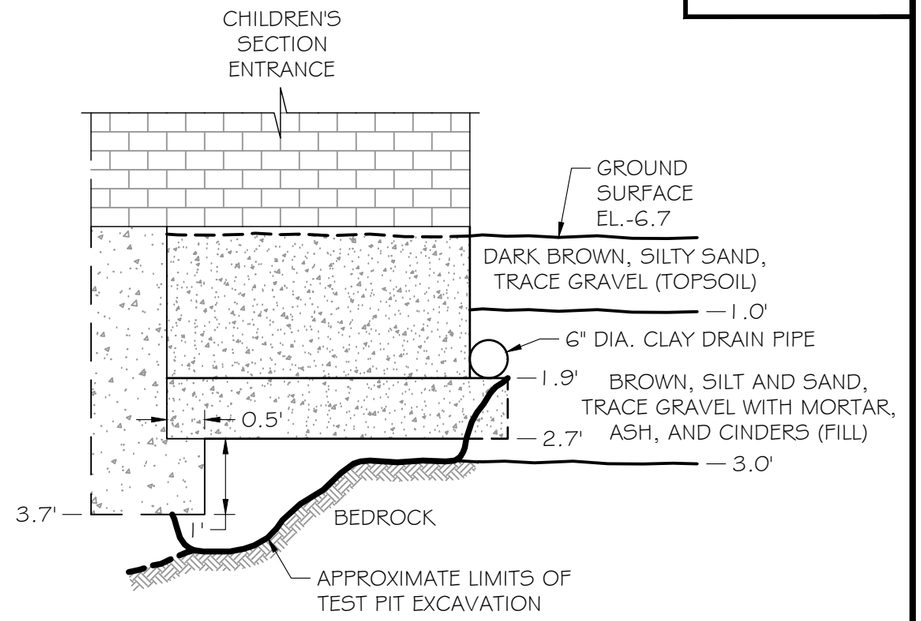
TEST PIT LOGS

TP-1



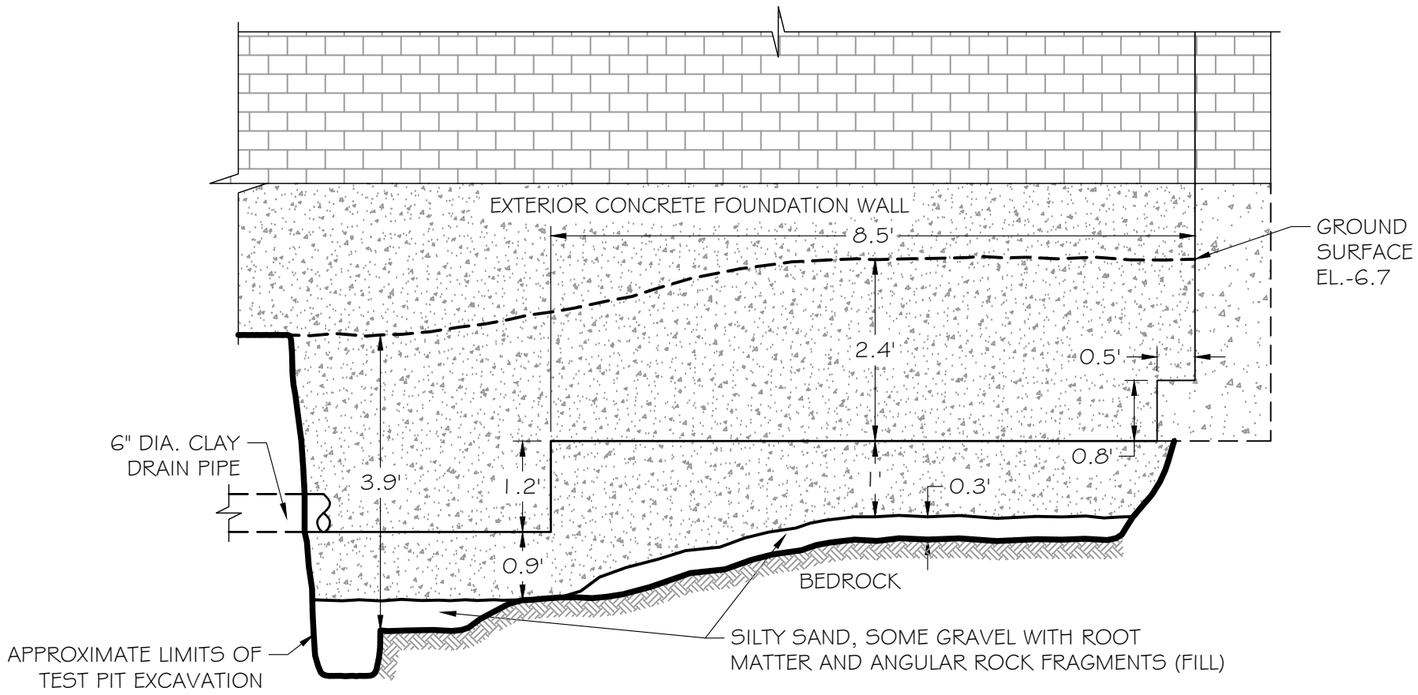
TP-1 PLAN VIEW

1/2" = 1'-0"



TP-1 SECTION B-B

1/2" = 1'-0"



TP-1 SECTION A-A

1/2" = 1'-0"

NOTES:

1. ALL FIELD MEASUREMENTS ARE CONSIDERED TO BE APPROXIMATE.
2. NO GROUNDWATER WAS OBSERVED IN TEST PIT UPON COMPLETION OF EXCAVATION.

McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

HUDSON PUBLIC LIBRARY

HUDSON MASSACHUSETTS

TEST PIT: TP-1

FOR

TRIPI ENGINEERING SERVICES, LLC

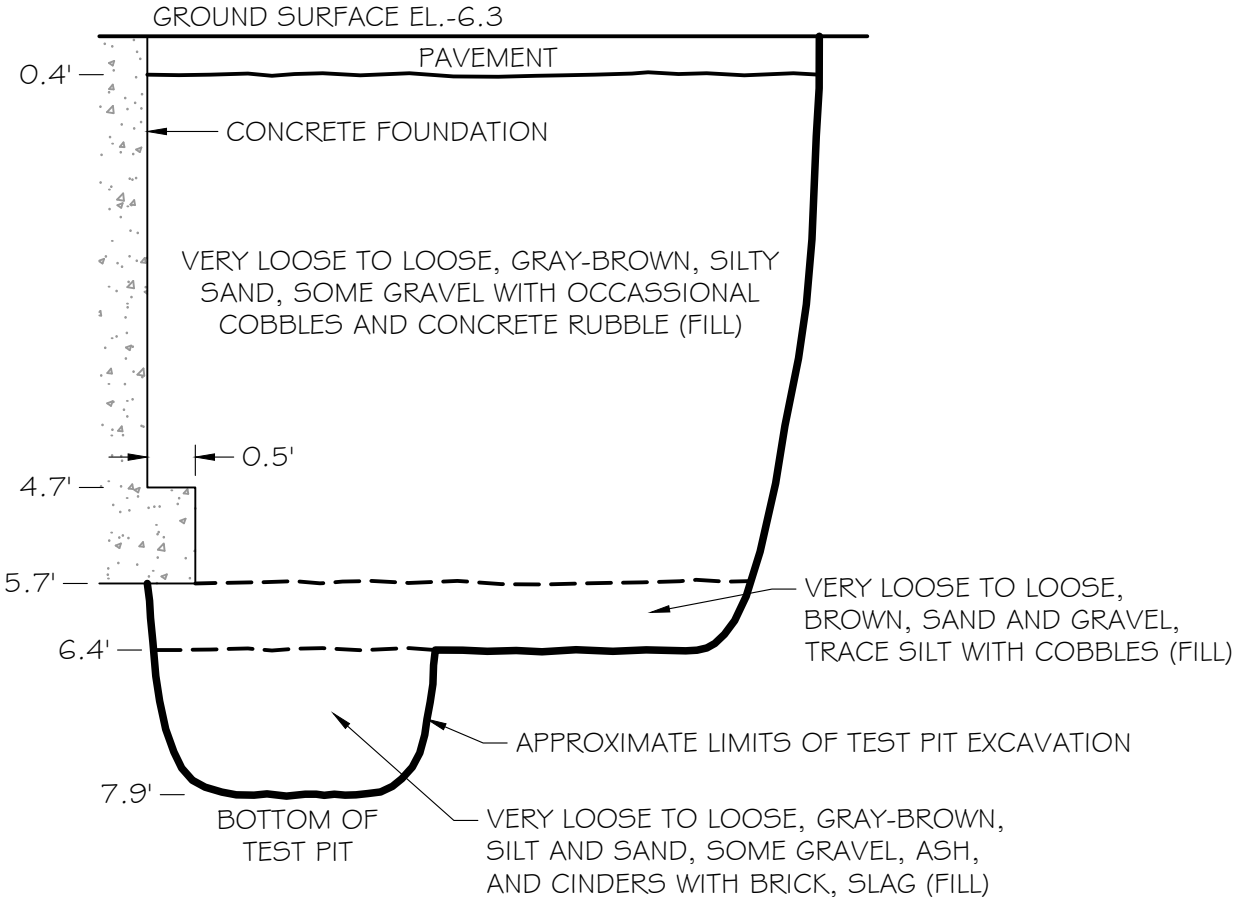
BY

McPHAIL ASSOCIATES, LLC

Date: AUGUST 2023	Dwn: M.B.S.	Chkd: C.P.M.	Scale: 1/2" = 1'-0"
Project No: 7641			

FILE NAME: N:\Acad\JOBS\7641\FFER\7641-TP01.dwg

TP-2



TP-2 SECTION VIEW

1/2" = 1'-0"

NOTES:

1. ALL FIELD MEASUREMENTS ARE CONSIDERED TO BE APPROXIMATE.

2. NO GROUNDWATER WAS OBSERVED IN TEST PIT UPON COMPLETION OF EXCAVATION.

McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

HUDSON PUBLIC LIBRARY

HUDSON MASSACHUSETTS

TEST PIT: TP-2

FOR

TRIPI ENGINEERING SERVICES, LLC

BY

McPHAIL ASSOCIATES, LLC

Date: AUGUST 2023	Dwn: M.B.S.	Chkd: C.P.M.	Scale: 1/2" = 1'-0"
Project No: 7641			

FILE NAME: N:\Acad\JOBS\7641\PFER\7641-TP02.dwg

APPENDIX D:

GEOPHYSICAL SURVEY RESULTS FIGURE

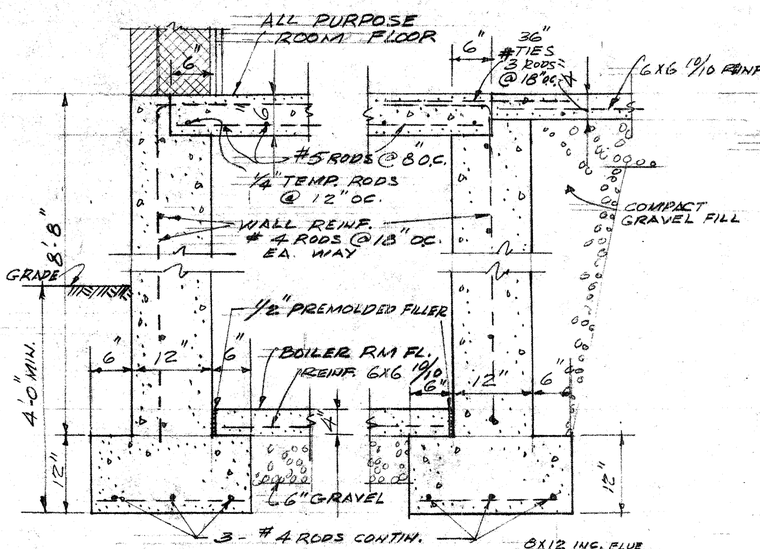
ATLANTIC GEOSERVICES	3 Washington St, Hudson, MA	Figure 1
	Client: McPhail / Date: 4/24/23	Geophysical Survey Results

APPENDIX E:

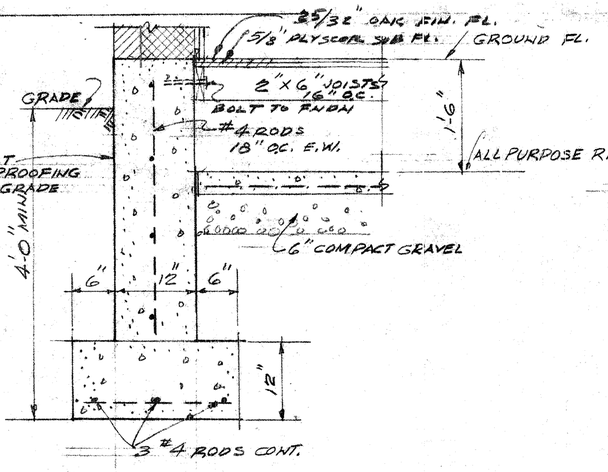
EXISTING FOUNDATION DRAWING

FOUNDATION DETAILS

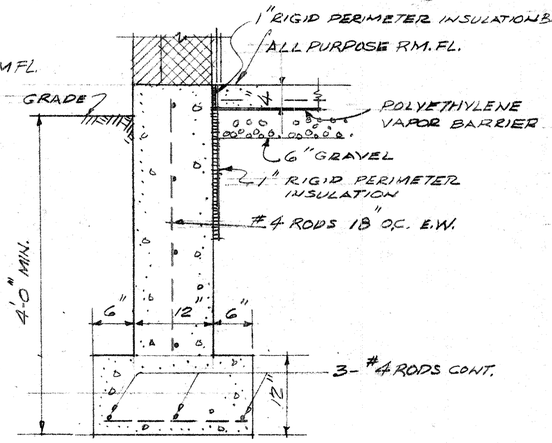
SCALE 3/4"=1'-0"



SECTION A-A



SECTION C-C

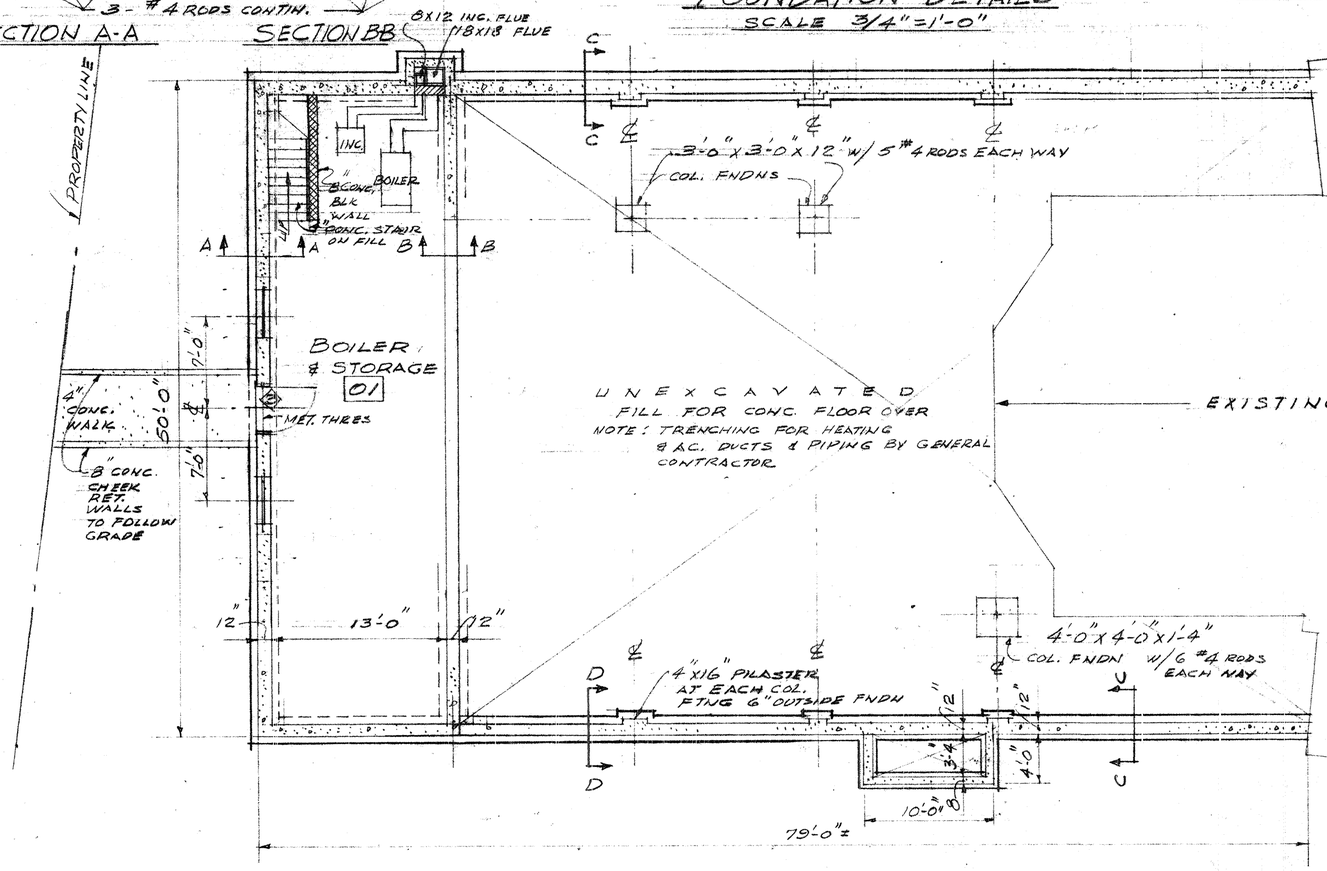


SECTION D-D

LEGEND OF MATERIALS

- CONCRETE
- CONCRETE BLOCK
- BRICK
- WOOD STUD PARTITION & PLAS.

SECTION BB



ADDITION TO THE HUDSON PUBLIC LIBRARY

MAIN ST. HUDSON MASS.

EARL V. ALDRICH & JOSEPH P. STANIUNAS

ASSOCIATED - ARCHITECTS

HUDSON MASS.

6-15-66 | FOUNDATION PLAN | SHEET A-1 OF 8

EARL V. ALDRICH No. 764 REGISTERED ARCHITECT COMMONWEALTH OF MASSACHUSETTS

JOSEPH P. STANIUNAS No. 1059 REGISTERED ARCHITECT HUDSON MASS. COMMONWEALTH OF MASSACHUSETTS