Tighe&Bond

23.5002.015
March 18, 2021

Kenneth Sugarman
Senior Associate
Desman Design Management
175 Capital Boulevard, Suite 402
Rocky Hill, CT 06067

Re: **Preliminary GeoEnvironmental Evaluation Summary Report**
Union Station Planning Study
New Haven, CT

Dear Mr. Sugarman,

Tighe & Bond is pleased to provide a preliminary geotechnical and environmental (geoenvironmental) subsurface evaluation of the East and West Lots associated with the Union Station in New Haven, Connecticut. A Site Locus is presented as Figure 1 in Appendix A. This evaluation was completed in accordance with the proposed scope of work, dated July 27, 2021. Elevations presented in this letter reference the North American Vertical Datum of 1988 (NAVD88).

Executive Summary

In general, subsurface conditions throughout the East and West Lots consisted of asphalt and aggregate base overlying up to 15 feet of existing fill, which in turn overlies native silty sands interbedded with organic silts and peat. The organic deposits were observed within the upper 40 to 45 feet below existing ground surface. The native silty sands extend beyond the limits of our explorations. Bedrock was not encountered in the explorations. Groundwater was observed during drilling at depths varying from approximately 5 to 13 feet below existing ground surface during drilling (approximately elevations El +5 feet to -5 feet). Given their proximity to New Haven Harbor, groundwater could be influenced by tidal fluctuations.

It is our opinion that the existing fill soils and underlying compressible soils are not suitable for support of conventional shallow spread footings. Instead, we recommend the structures be supported on deep foundations integrated into a structural slab. Fill is likely needed to achieve the finished grades, which would cause loading of the compressible soils and result in post-construction settlement and down drag loading of the piles. We therefore recommend the piles be designed to resist down drag loading. A settlement analysis should be performed once the building loads and site grading are better understood. To mitigate the risk of settlement and down drag loading on the piles, light weight aggregate fill could be used instead of conventional fill material.

Additional borings and laboratory testing are recommended to further define the extents of unsuitable soils and properties of the soils within the anticipated bearing strata. The results of the laboratory testing, along with a better understanding of building loads, will aid in providing estimates of settlement, design parameters for piles, and lateral Earth pressures for the below-grade elevator pit. It is anticipated that the information provided by additional borings and testing could be used to provide more accurate opinions of probable cost (OPCs) for deep foundations, if necessary.

Environmental analytical results of soil samples obtained during this and prior investigations identified the presence of several regulated compounds in the fill material within the proposed project limits at concentrations exceeding numeric criteria provided in the Connecticut

Department of Energy and Environmental Protection (CTDEEP) Remediation Standard Regulations (RSRs). In accordance with the RSRs and the CTDEEP Solid Waste Regulations, soils impacted with contaminants above typical background levels are classified as Polluted Soil and/or Polluted Fill. Soil excavated during the work may be re-used within the project limits, as long as it is structurally suitable for its intended purpose. Soil containing regulated compounds above RSR criteria should be managed accordingly with respect to the provisions of the RSRs and Solid Waste Regulations.

Any excess soil potentially generated during the proposed construction project will require special management and off-site disposal at a properly permitted facility. Contractors should use the soil analytical data in this report for bidding purposes (to evaluate disposal options and to obtain transportation and disposal pricing for disposal at an appropriate facility). Upon contract award, the Contractor selected for the proposed construction project should use the data in this report to obtain final disposal approval of the excess material from the Contractor-selected disposal facility, if possible. The existing data provided in this report may be sufficient to satisfy some disposal facility's waste characterization acceptance requirements, however, additional in-situ waste characterization samples may be necessary depending on the quantity of excess material generated or the Contractor's-selected disposal facility's specific sampling and analytical requirements. Based on the results obtained during this investigation, there were no areas of soil identified that would be classified as Resource Conservation and Recovery Act (RCRA) Characteristically Hazardous Waste.

Groundwater impacts were identified at the West Lot and included elevated concentrations of petroleum hydrocarbons as well as free phase liquid on the top of the water table.

Site Conditions

Existing – The sites are currently developed as surface parking lots located east and west of the New Haven Union Station and Union Station Parking Garage in New Haven, Connecticut. The lots are owned by the State of Connecticut and are bound by Union Avenue to the northwest, the New Haven Rail Yard to the southeast, a railroad maintenance facility to the southwest, and a United Illuminating Company substation to the northeast. The East Lot is relatively level with surface elevations varying from approximately El 6.5 and El 10 feet (NAVD88) sloping downward gradually to the north and east. The West Lot is relatively level with surface elevations varying from approximately El 10 and El 12 feet (NAVD88) sloping downward gradually to the south and west.

Although the East and West Lots are currently used as surface parking lots, records indicate that these sites formerly contained buildings dating back to the 1800s, including several storage facilities and a Yard House. Buried utilities also exist beneath both lots, including a 66-inch diameter brick sewer reported supported by timber piles that crosses diagonally under the existing entrance to the East Lot and northeast corner of the existing parking garage. Other utilities include catch basins, storm drains, traffic signal loop detectors, underground electric and gas, and overhead electric. Both lots also contain buried obstructions including abandoned rails and possible foundations.

Proposed – Construction is likely to consist of a multi-level parking garage on both the East and West Lots. However, at the time of this report, only a conceptual drawing of the West Lot garage was provided for our review. Based on our review of this conceptual drawing, we anticipate construction will consist of an approximately 33,000-square foot garage that will provide access for transport shuttles and parking for transit buses and rental cars. The garage would also include staircases, an elevator pit, and an elevated pedestrian walkway connecting the West Lot garage to the New Haven Union Station. Below-grade space, other than the elevator pit, is not anticipated. The finished floor elevation (FFE) of the West Lot garage is proposed at El 12, resulting in up to two feet of fill to achieve site grades. The FFE for the East Lot garage is unknown at this time, but is anticipated to be greater than 2 feet. Structural loads were not provided for the parking garages prior to this report; however, we consider these loads will be significant.

Subsurface Conditions

The generalized subsurface conditions described in the text below summarize trends observed in the explorations. The boundaries between soil strata are approximate and are based on interpretations of widely spaced explorations and samples. Actual conditions could be more variable.

Historical Subsurface Explorations & Environmental Testing – East Lot

Previous environmental testing and geotechnical exploration have been performed at the Union Station East Lot in support of a proposed parking garage and made available for our review. Therefore, additional explorations at the East Lot were not conducted as part of this evaluation. The subsurface explorations conducted as part of the previous evaluations are summarized below. Given recent changes to the CTDEEP RSRs, the environmental data provided in these reports were compared against the current version of the RSRs. Although the RSRs do not apply to the Site by regulation, the RSRs contain the most widely accepted criteria for evaluating properties in Connecticut. Copies of the reports containing figures, tables, and boring logs are attached in Appendix B.

Task 210: Surficial Site Investigation, Maguire Group Inc., November 8, 1999 – A Task 210: Surficial Site Investigation was performed by the Maguire Group Inc. (Maguire) in support of a proposed parking garage north of the existing parking garage, which is currently a parking lot (i.e., East Lot). According to the report, the East Lot formerly contained several structures dating back to the late 1800s and included rag sorting and rag storage buildings, kerosene storage buildings, a molasses storage building, and a salt packing house. The report indicated that on October 15 and 16, 1999, 32 soil borings (GP-1 to GP-32) were advanced in a grid throughout the East Lot to depths of up to 12 feet below grade or refusal. Groundwater was reportedly identified at depths between four and seven feet below grade. One soil sample was reportedly collected from each boring and analyzed for volatile organic compounds (VOCs), total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, total Resource Conservation and Recovery Act (RCRA) 8 metals, and RCRA 8 metals by the Synthetic Precipitation Leaching Procedure (SPLP). Five grab groundwater samples were reportedly collected from select boring locations (GP-2, GP-4, GP-15, GP-28, and GP-29) and analyzed for VOCs, TPH, PAHs, PCBs, pesticides, and total RCRA 8 metals. The soil and groundwater results provided in the report were reviewed and compared against current RSR criteria, as summarized below:

<u>Soil</u>

- TPH was detected in 24 of the 32 samples analyzed at concentrations ranging between 18 mg/Kg and 149 mg/Kg, which are all below RSR criteria.
- PAHs were detected in 13 of the 32 samples analyzed. Concentrations of certain individual PAHs were above the Residential Direct Exposure Criteria (RES DEC) in samples collected from borings GP-8, GP-18, GP-20, GP-22, GP-23, and GP-28; the Industrial/Commercial Direct Exposure Criteria (I/C DEC) in samples collected from borings GP-8, GP-18, GP-20, GP-22, and GP-23; and the GB Pollutant Mobility Criteria (GB PMC) in samples collected from GP-1, GP-8, GP-18, GP-20, GP-22, GP-23, and GP-28.
- The metals arsenic, barium, cadmium, chromium, lead, mercury, and/or selenium were detected in each sample collected from East Lot. Arsenic was detected at

concentrations above the RES DEC of 10 mg/Kg and I/C DEC of 10 mg/Kg in samples GP-18 (2-4'), GP-20 (2-4'), GP-26 (2-4'), and GP-29 (2-4'). Lead was detected at concentrations above the RES DEC of 400 mg/Kg in samples GP-4 (2-4'), GP-8 (2-4'), GP-18 (2-4'), GP-20 (2-4'), GO-22 (2-4'), GP-25 (4-8'), and GP-29 (2-4'). The remaining metals detected were at concentrations below RSR criteria. Leachable barium, lead, and/or mercury (by SPLP analysis) were also detected in each sample at concentrations below the GB PMC.

- VOCs, PCBs, and pesticides were not detected in any sample analyzed at concentrations above the laboratory reporting limits.

<u>Groundwater</u>

- Two VOC compounds were detected in the groundwater at East Lot. 1,1,1-Trichloroethane was detected in the groundwater sample collected from boring GP-15 at a concentration well below RSR criteria. 1,2,4-Trichlorobenzene was detected in the groundwater sample collected from boring GP-4 at a concentration well below RSR criteria.
- The metals arsenic, barium, cadmium, chromium, lead, and/or mercury were detected in each groundwater sample collected from East Lot. Arsenic was detected at a concentration above the Surface Water Protection Criteria (SWPC) of 0.004 mg/L in the groundwater samples collected from boring GP-28. Lead was detected at concentrations above the SWPC of 0.013 mg/L in the groundwater samples collected from borings GP-28 and GP-29. Mercury was detected at concentrations above the SWPC of 0.0004 mg/L in groundwater samples collected from borings GP-15 and GP-28. The remaining metals were detected at concentrations below RSR criteria. It should be noted that the groundwater samples were collected as grab samples from certain borings. This type of sampling often creates turbid groundwater samples that when analyzed may result in inaccurate detections/concentrations.
- TPH, PAHs, PCBs, and pesticides were not detected in any sample at concentrations above the laboratory reporting limits.

Due to the widespread presence of soil contaminated with PAHs, lead, and arsenic above RSR criteria, Maguire recommended that the entire project area (East Lot) be considered an Area of Environmental Concern (AOEC). In addition, groundwater in the northern portion of East Lot was contaminated with lead, arsenic, and mercury above the SWPC. Maquire indicated that excavation de-watering may be required based on the identified depth of groundwater. Based on the known soil and groundwater impacts, Maguire recommended the completion of a "Task 310 Remedial Management Plan."

Task 210: Subsurface Site Investigation Report, CDR Group Inc., February 11, 2016 – A Subsurface Site Investigation Report was completed by CDR Group Inc. (CDR) in support of a proposed parking garage north of the existing Union Station Parking Garage (i.e., East Lot). The report indicated that on November 15, 2015, nine soil borings (CDR-1 to CDR-9) were advanced throughout the East Lot to depths of eight feet below grade or refusal. Groundwater was identified at depths between seven and eight feet below grade. One soil sample was reportedly collected from each boring and analyzed for extractable total petroleum hydrocarbons (ETPH), VOCs, semi-volatile organic compounds (SVOCs), PCBs, chlorinated herbicides, pesticides, total RCRA 8 metals, and RCRA 8 metals by the Toxicity Characteristic Leaching Procedure (TCLP). Two grab groundwater samples were reportedly collected from select boring locations (CDR-1 GW and CDR-9 GW) and analyzed for ETPH, VOCs, SVOCs, PCBS, chlorinated herbicides, pesticides, total RCRA 8 metals, and dissolved RCRA 8 metals (filtered through 0.45 μm membrane filter). The soil and groundwater results provided in the report were reviewed and compared against current RSR criteria, as summarized below:

Soil

- ETPH was detected samples CDR-5 (1-3′) and CDR-9 (1-3′) at concentrations of 480 mg/Kg and 250 mg/Kg, respectively, which are below RSR criteria.
- SVOCs were detected in seven of the nine samples analyzed. Concentrations of certain individual PAHs were above the RES DEC, I/C DEC, and/or GB PMC in samples collected from borings CDR-4, CDR-5, and CDR-9.
- The pesticide 4,4-DDT was only detected in sample CDR-5 (1-3′) at a concentration of 0.03 mg/Kg. The total DDT concentration of this sample was slightly above the GB PMC of 0.02 mg/Kg.
- The metals arsenic, barium, cadmium, chromium, lead, mercury, and/or silver were detected in each sample collected from East Lot. Arsenic was detected at concentrations above the RES DEC of 10 mg/Kg and I/C DEC of 10 mg/Kg in samples CDR-5 (1-3′), CDR-7 (2-4′), and CDR-9 (1-3′). Lead was detected above the RES DEC of 400 mg/Kg in samples CDR-2 (1-3′), CDR-5 (1-3′), CDR-6 (1-3′), and CDR-9 (1-3′). Mercury was detected at concentrations above the RES DEC of 20 mg/Kg in sample CDR-6 (1-3′). The remaining metals detected were at concentrations below RSR criteria. Leachable barium, lead, and/or mercury (by TCLP) were also detected in each sample with concentrations of leachable lead in samples CDR-2 (1-3′), CDR-3 (1-3′), CDR-4 (1-3′), CDR-6 (1-3′), and CDR-8 (1-3′) at concentrations above the GB PMC. However, it should be noted that TCLP analysis is typically used to characterize soil for disposal purposes and may not be appropriate for evaluating site conditions.
- VOCs, PCBs, and chlorinated herbicides were not detected in any sample analyzed at concentrations above the laboratory reporting limits.

Groundwater

- Total barium, dissolved barium, total cadmium, total chromium, and dissolved lead were detected in the two groundwater samples collected from East Lot. The concentrations of these metals were below RSR criteria.
- ETPH, VOCs, SVOCs, PCBs, pesticides, and chlorinated herbicides were not detected in any sample at concentrations above the laboratory reporting limits.

CDR concluded based on the results of their investigation that the entire project limits (i.e., East Lot) is designated an AOEC for soil. Although impact was previously identified in the groundwater, CDR did not identify the groundwater as an AOEC based on their results. CDR also recommended the completion of Task 310 Plans and Specifications.

Final Geotechnical Engineering Report, CHA Consulting, Inc., July 2018 – A Final Geotechnical Engineering Report was completed by CHA Consulting, Inc. (CHA) in support for a proposed parking garage at East Lot. The subsurface exploration included the advancement of 18 borings (B-1 to B-18) within or near the proposed parking garage structure footprint. The borings were advanced by General Borings, Inc. of Prospect, Connecticut between November 8 and November 18, 2015. The test borings were generally advanced with a roller bit and flush-joint casings with an inside diameter of four inches. Shallower borings (B-2, B-7, B-9, B-11, B-15, and B-17) were advanced using hollow-stem augers with an inside diameter of 3.25 inches. Split spoon samples were generally obtained continuously from the ground surface to approximately 17 feet surface grade, then at 5-foot intervals. Standard penetration testing (SPT) was utilized during split spoon sampling. The borings were advanced to depths between 22 and 102 feet below grade.

Information contained in the report indicated that a layer of fill was encountered beneath the asphalt pavement of the parking lot to depths ranging between two feet and nine feet below existing ground surface. The fill consisted of varying amounts of fine to coarse sand, fine gravel, and trace to some silt. The fill contained occasional pieces of concrete, brick, asphalt, coal, or wood fragments and was brown, gray, and black in color. Soil beneath the fill layer reportedly consisted of sandy soils with interbedded layers of organic silt.

Groundwater was observed in the East Lot at depths ranging from approximately 5 to 13 feet below the existing ground surface during drilling. Tables 1 below summarize groundwater observations. Elevations are based on NAVD88 datum.

Table 1
East Lot Groundwater Summary (CHA Explorations)

Boring Number	Surface Elevation	Groundwater Depth (feet)	Groundwater Elevation (feet)
B-1	9.92	8.00	1.92
B-2	8.00	7.00	1.00
B-3	6.96	6.00	0.96
B-4	8.18	7.00	1.18
B-5	8.00	13.00	-5.00
B-6	8.32	8.00	0.32
B-7	8.48	8.75	-0.27
B-8	8.49	7.25	1.24
B-9	8.30	8.50	-0.20
B-10	8.15	8.00	0.15
B-11	8.99	5.00	3.99
B-12	8.71	7.00	1.71
B-13	8.72	8.50	0.22
B-14	8.67	11.50	-2.83
B-15	8.14	5.00	3.14
B-16	9.00	9.00	0.00
B-17	8.87	9.00	-0.13
B-18	9.56	9.00	0.56

Water levels can fluctuate with tides, season, precipitation, and nearby construction or other below grade activities, such as excavation, dewatering, wells, infiltration basins, etc.

A ground penetrating radar survey (i.e., geophysical investigation) was also completed to identify buried concrete or masonry foundation walls and other buried obstructions based on the past uses of the East Lot. Underground obstructions including a possible abandoned platform, abandoned rail bed or roadway, and other anomalies that correlate with utilities or indicate possible debris, metal, utilities, or filled utility trenches were identified.

Recent Subsurface Explorations – West Lot

West Lot History – Tighe & Bond reviewed publicly available historical aerial photographs and Sanborn Fire Insurance Maps to assist in the preparation of the subsurface exploration and sampling program. Several historical structures were identified throughout the West Lot prior to 1934 through 2004. These structures consisted of several buildings within the central and southern portions of West Lot and possible railroad tracks along the southeast boundary. The purpose of the buildings could not be determined based on the historical record sources reviewed; however, at least one building within the southwest portion of the West Lot was identified as a former Yard House.

West Lot Test Borings – Seven geotechnical test borings identified as B-1, B-2, B-2A, B-3, B-4, B-5, B-5A were drilled by General Boring Contractors, Inc. of Prospect, Connecticut between November 10, 2021, and November 16, 2021. Shallow borings B-2A, B-3, B-4, and B-5 were advanced with 3.25-inch inner-diameter hollow-stem augers and terminated without refusal at depths ranging from approximately 9 to 24 feet below existing ground surface. Deeper borings B-1, B-2, and B-5A were advanced with 3.25-inch inner-diameter hollow-stem augers to a depth of approximately 10 feet then by 4-inch inner-diameter flush-joint casing using drive-and-wash methods and terminated without refusal at depths ranging from approximately 77 to 150 feet. Split-spoon sampling and SPTs were conducted continuously to 10 feet then at maximum 10-foot intervals thereafter. An undisturbed Shelby tube sample was obtained within an organic layer encountered in boring B-4.

At the time of the field work an existing groundwater monitoring well was observed within the southwest portion of West Lot. For the purposes of this report, this monitoring well is identified as monitoring well MW-1. Two new groundwater monitoring wells were installed as part of Tighe & Bond's subsurface exploration at the locations of borings B-4 and B-5. These monitoring wells are identified as monitoring wells MW-3 and MW-2, respectively.

Borings were backfilled upon completion with a cuttings and grout mixture. Boring locations are shown on Figure 2 in Appendix A. Test boring logs are included in Appendix C.

Environmental Observations – Tighe & Bond collected soil samples for environmental screening purposes during the advancement of borings. Soils were observed in the field for signs of potential environmental impacts including staining; presence of urban fill material containing anthropogenic materials of concern such as asphalt bits, coal, ash, cinders, slag, etc.; and odors indicative of petroleum impact. A photoionization detector (PID) was also used to screen soils for the presence of total organic vapors (TOV). Black staining, petroleum odors, and elevated PID readings were observed in the fill material of all the borings as part of this assessment.

Geotechnical Laboratory Testing – Laboratory tests were performed to aid in soil classifications, assist with correlating properties of the subsurface materials, evaluate liquefaction and settlement potential, and evaluate soil re-use potential. Six mechanical Particle Size Analysis tests (ASTM D6913), one Atterberg limits test (ASTM D4318), and one One-Dimensional Consolidation test (ASTM D2435 Method B) were performed on samples taken during the explorations. Laboratory test results are included in Appendix D.

Environmental Soil Sample Collection & Laboratory Analysis – Tighe & Bond analyzed one to two soil samples from each geotechnical boring. Soil samples were selected based on visual, olfactory, and elevated PID readings; as well as, inferred contaminate transport and potential historic sources. A total of nine soil samples were collected and submitted to Phoenix Environmental Laboratories, Inc. (Phoenix) of Manchester, Connecticut for select analysis of the following: ETPH by the Connecticut Department of Public Health (CTDPH) approved method, total RSR 15 metals, pesticides by EPA Method 8081, PCBs by EPA Method 8082, PAHs by EPA Method 8270, and VOCs Full Scan by EPA Method 8260. In addition, soil sample B-4 (3-5') was analyzed for antimony and lead by SPLP based on initial total results. The environmental soil analytical laboratory reports are included in Appendix E.

Groundwater Sample Collection & Laboratory Analysis – Tighe & Bond collected groundwater samples from the existing monitoring well MW-1 and the newly installed monitoring wells MW-2 and MW-3. Prior to sampling the depth to water in each well was measured and used in connection with elevation survey data to develop a groundwater contour map. Based on the groundwater measurements, the shallow groundwater flow at the Site is easterly towards New Haven Harbor. However, due to the tidal nature of the area, groundwater flow direction may vary. The gauging data is provided on Table E1 in Appendix E. The groundwater contour map is provided as Figure 3.

Free-standing product was observed within the existing monitoring well MW-1 (0.06 feet) and the newly installed monitoring well MW-2 (0.52 feet). Given the presence of free product, an oil/water mixture was collected from these wells and submitted to Phoenix for the analysis of PCBs by EPA Method 8082 on November 23, 2021. Free-standing product was not observed at monitoring well MW-3. Therefore, Tighe & Bond collected a groundwater sample from monitoring well MW-3 in general accordance with EPA Low-Flow sampling protocols on December 2, 2021. The groundwater sample (MW-3) was submitted to Phoenix for analysis of the following: VOCs Full Scan by EPA Method 8260, PAHs by EPA Method 8270, and ETPH by the CTDPH approved method. The groundwater analytical laboratory reports are included in Appendix E.

Summary of Subsurface Conditions – In general, subsurface conditions observed in the West Lot explorations consisted of asphalt, overlying up to 15 feet of existing fill, overlying sands with interbedded layers of organics and silt/clayey silt extending beyond the depths of the explorations. Bedrock was not encountered in the explorations. Table 2 below presents the general stratigraphy encountered during the subsurface exploration program in descending depth from the ground surface.

Table 2
Description of Subsurface Conditions Encountered

Strata (In Descending Depth)	General Description[1, 2]
AGGREGATE BASE [3]	Gray, fine to coarse SAND, some Gravel, little Silt
FILL	Very loose to very dense, gray to brown, fine to coarse SAND, with varying amounts of gravel and silt and containing pieces of concrete, brick, asphalt, coal, wood, ash, and foam.
DISTAL DELTAIC DEPOSITS	Loose to dense, red/brown, fine to coarse SAND, little fine Gravel, trace Silt; varying to fine SAND, some Silt; varying to medium dense to dense, red/brown, SILT, some fine Sand, trace Gravel; varying to very stiff to hard, red/brown, Clayey SILT, trace to little fine Sand
	Very soft to stiff, dark gray, organic silt containing varying amounts of fine to medium sand and trace to little shells;

Strata (In Descending Depth)	General Description[1, 2]
	was encountered intermittently within the sand strata / very soft fibrous peat [4]

[1] Definition of Soil Description Terms: "trace" = 0-10%, "little" = 10-20%, "some" = 20-35%, "and" = 35-50%, by weight.
[2] Approximately 3 to 6 inches of asphalt was observed at ground surface.
[3] Approximately 6 inches of Aggregate Base was observed beneath the asphalt in B-1, B-2, B-3, and B-5A
[4] Organic silt and fibrous peat were encountered intermittently within the sand strata. Fibrous peat was observed only in Tighe & Bond boring B-4.

Groundwater was observed in the West Lot at depths ranging from approximately 5 to 8 feet below the existing ground surface during drilling. Tighe & Bond returned to the West Lot on November 23, 2021, to collect ground water samples for laboratory analysis and to measure groundwater levels in the monitoring wells MW-1, MW-2, and MW-3. The depth to groundwater in the monitoring wells ranged from approximately 7 to 8 feet below existing ground surface. Table 3 below summarize groundwater observations made within the West Lot. Elevations are based on NAVD88 datum.

Table 3
West Lot Groundwater Summary (Tighe & Bond Explorations)

Boring Number	Surface Elevation	Groundwater Depth (feet)	Groundwater Elevation (feet)
B-1	10	5	5
B-2	11	6	5
B-2A	11	7	4
B-3	11	7	4
B-4/MW-3	11.81	7.5 8.05 (on 11/23/2021)	4.5 3.76
B-5/MW-2	11.38	6.5 7.20 (on 11/23/2021)	3.5 4.18
B-5A	10	6	4
MW-1	11.56	6.89 (on 11/23/2021)	4.67

Water levels can fluctuate with tides, season, precipitation, and nearby construction or other below grade activities, such as excavation, dewatering, wells, infiltration basins, etc.

Summary of Environmental Laboratory Results – West Lot

Soil Analytical Results – A summary of soil analytical results are provided in Table E2 in Appendix E. Soil sample locations are depicted on Figure 2. Although the RSRs do not apply to the Site by regulation, the RSRs contain the most widely accepted criteria for evaluating properties in Connecticut. Therefore, the analytical results were compared against applicable criteria contained in the RSRs, as discussed below:

- ETPH was detected in each sample analyzed. ETPH was detected above the RES DEC of 500 mg/Kg, the I/C DEC of 2,500 mg/Kg, and the GB PMC of 2,500 mg/Kg in samples B-1 (5-7') at 63,000 mg/Kg, B-2A (7-9') at 5,200 mg/Kg, B-3 (7-9') at 15,000 mg/Kg, and B-5A (7-9’) at 5,800 mg/Kg. Although these concentrations were above the numerical GB PMC, the samples were collected from the saturated soil and appeared to be below the groundwater table. Therefore, the GB PMC would not apply.

- Metals were detected in each sample analyzed. Mass concentrations of several metals including antimony, arsenic, barium, cooper, and lead were detected at elevated levels in sample B-4 (3-5’) with respect to the other samples analyzed on the Site. Although many of these concentrations are well below respective RSR criteria, concentrations of antimony (265 mg/kg) and lead (1,730 mg/kg) were detected at levels exceeding the RES DEC and the I/C DEC, respectively. Metals detected in the other samples are at levels well below comparable RSR criteria and appear consistent with typical background concentrations. The mass concentrations of antimony and lead theoretically exceeded the GB PMC using the “20 Time Rule” in sample B-4 (3-5’); therefore, they were additionally analyzed for these metals by SPLP to further evaluate compliance with the GB PMC. Leachable antimony was not detected at concentrations above the laboratory reporting limits and leachable lead was detected at a concentration of 0.01 mg/L, which is well below the GB PMC of 0.15 mg/L.
- Pesticides and PCBs were not detected at concentrations above the laboratory reporting limits in any of the samples analyzed.
- PAHs were detected in each sample analyzed. The PAH 2-methylnaphthalene was detected above the GB PMC of 5.6 mg/Kg in samples B-1 (5-7’) at 220 mg/Kg, B-3 (7-9’) at 8.1 mg/Kg, and B-5A (7-9’) at 22 mg/Kg. Although these concentrations were above the numerical GB PMC, the samples were collected from the saturated soil and appeared to be below the groundwater table. Therefore, the GB PMC would not apply. The remaining PAHs were not detected at concentrations above RSR criteria.
- VOCs were detected in each sample analyzed at concentrations below RSR criteria.

Groundwater Analytical Results – A summary of groundwater analytical results are provided in Table E3 in Appendix E. Monitoring well locations are depicted on Figure 2. The groundwater results were compared against applicable criteria contained in the RSRs, as discussed below:

<u>MW-1 and MW-2</u>

- As previously discussed, separate phase product was observed in monitoring wells MW-1 and MW-2. An oil-water mixture was collected from each well and analyzed for PCBs for characterization purposes. PCBs were detected in the sample collected from monitoring well MW-2 at a concentration of 99 µg/L, which was above the SWPC of 0.5 µg/L. PCBs were not detected at concentrations above the laboratory reporting limits in the sample collected from monitoring well MW-1.

<u>MW-3</u>

- ETPH was detected in the groundwater sample collected from monitoring well MW-3 at a concentration of 15,000 µg/L, which was above the Surface Water Protection Criteria (SWPC) of 250 µg/L, the Residential Volatilization Criteria (RES VC) of 250 µg/L, and the Industrial/Commercial Volatilization Criteria (I/C VC) of 250 µg/L.
- VOCs were not detected at concentrations above the laboratory reporting limits in the groundwater sample collected from monitoring well MW-3.
- The PAHs acenaphthene, fluorene, 2-methylnaphthalene, naphthalene, and phenanthrene were detected in the groundwater sample collected from monitoring well MW-3 at concentrations below respective RSR criteria.

Preliminary Geotechnical Evaluation and Recommendations

The preliminary recommendations submitted in this evaluation are based upon the data obtained from the relatively widely spaced subsurface explorations at both the East and West Lots. The nature and extent of variations between explorations may not become evident until construction. If significant variations from these descriptions appear during construction, it will be necessary to re-evaluate these recommendations.

Preliminary Geotechnical Design Recommendations

Based on the results of the explorations, the subsurface conditions beneath the East and West Lots can be generalized as fill over native silty sands interbedded with organic silts and peat. The fill generally consists of silty sand with gravel and contains pieces of concrete, brick, asphalt, coal, wood, ash, and foam. Fill thickness varies up to approximately 15 feet, generally being deeper in the West Lot. Below the fill, native sandy soils were encountered to a depth of approximately 150 feet. However, organic silts were observed interbedded within the sands within the upper 40 to 45 feet below existing ground surface. Bedrock was not encountered in the explorations. Based on our understanding of the subsurface conditions, it is our opinion the very loose fill and very soft underlying compressible soils are unsuitable for support of heavily-loaded parking garages at shallow depths.

In general, there are four overall approaches used to address the presence of unsuitable material for support of structures: Removal and Replacement of the unsuitable materials, a pre-construction surcharge load, in-situ improvement of the unsuitable material, or support of structures on deep foundations.

Removal of these unsuitable materials for the purpose of replacing them with Structural Fill would be beyond the limits of most excavation depths and would require handling and disposal of a significant quantity of contaminated material. We therefore do not consider Removal and Replacement of the unsuitable material to be feasible. Furthermore, a pre-construction surcharge load, while technically feasible, would be impractical given the extended period of time that the surcharge load would need to be placed and the on-going use of both lots.

Other challenges include the placement of fill for the purposes of raising grades across the sites. Fill used to raise grade would likely cause loading of the compressible cohesive soils, resulting in greater-than-acceptable settlements and down drag forces on foundations. Therefore, we recommend the parking garages be supported on deep foundations integrated into a structural slab. This includes supporting the elevated pedestrian walkway to the existing Union Station, staircases, and elevator pits on a deep foundation system. Piles should be designed to resist down drag forces. A settlement analysis should be performed once the building loads and site grading are better understood. To mitigate the risk of settlement and down drag loading on the piles. To further mitigate the effects of settlement, light weight aggregate fill could be used instead of conventional fill material.

Deep Foundations – Technically feasible deep foundation system include driven piles (H-piles, steel pipe piles, and prestressed precast concrete piles) and drilled displacement piles (cast-in-place concrete piles, drilled shafts and micropiles). However, drilled foundation systems would likely generate a large quantity of contaminated soil that would need to be managed and disposed of properly. Final selection of the foundation support system should be based on building layout, structural design loads, environmental considerations, and cost.

Both the prestressed precast concrete piles and cast-in-place concrete piles would be appropriate deep foundation systems capable of supporting high capacities likely to be used for these garages in granular soils. The piles would derive support from friction. The cast-in-place concrete piles may be better suited for the construction of these heavily-loaded garages since they can more easily be installed to greater depths, if needed, and can achieve higher capacities. However, as stated above, cast-in-place concrete piles will generate large quantities of contaminated soils that will need to be managed and disposed of properly. Drilled shafts and micropiles were considered; however, it is our opinion that these types of deep foundations would not be able to provide the capacities required for the anticipated structures.

Due to the potential for obstructions within the fill, the pile locations should either be pre-augered or cleared using a spud or similar device. Any spoils generated as a result of the pre-clearing would need to be disposed of properly. We recommend additional explorations be conducted throughout the sites to better identify location of potential obstructs, as described in further detail later in this report.

Relatively high vibrations are generated during pile installation which may affect nearby structures. Vibration monitoring during pile installation should be implemented to monitor vibrations close to selected existing structures to be protected. Final capacity of production driven piles should be evaluated by means of wave equation (WEAP) calculations, or, more likely, by means of dynamic testing (PDA with signal matching) on 5% of the production piles. A static load test on one sacrificial pile will be required to confirm driven piles capacity.

Due to the presence of nearby structures to be protected, the feasibility of driven piles should ultimately be assessed after consultation with a specialty pile driving contractor.

Underslab Drainage – Groundwater was encountered 5 to 13 feet below the existing ground surface. Based on this information, foundation and underslab drainage is not likely necessary for the structural slab. However, considering the FEMA 100-year flood elevation of 11 feet, the structural slab should be designed to resist uplift pressures. We recommend that pit walls and slabs below the design flood elevation be fully waterproofed using a fully-bonded membrane-type waterproofing system such as those manufactured by GCP Applied Technologies or Laurenco, Inc.

Below-Grade Wall Considerations – The proposed elevator pit in the West Lot garage will be below grade; therefore, we recommend that lateral pressures for design of braced walls be considered for use in the design of the below-grade pit walls. Furthermore, since the FEMA 100-year flood elevation is El 11 feet, hydrostatic loads should be considered.

Seismic Design – Based on data from the borings, the site is assigned to Site Class E, according to the Connecticut State Building Code. The design spectral response accelerations at short periods (S_{DS}) and at 1-second period (S_{D1}) are 0.310 and 0.145, respectively. These values were calculated based on mapped spectral response accelerations and the appropriate magnification factors for Site Class E. The structural engineer should determine the Seismic Design Category based upon the assumed seismic use group.

Loose, saturated sand layers were identified in the borings, thus warranting the need for an analysis of liquefaction potential across the site. Using an Earthquake Magnitude of 6.3 with a peak ground acceleration of 0.15g, factors of safety against liquefaction were greater than 1.1, indicating that earthquake induced liquefaction is unlikely.

Preliminary Geotechnical Construction Recommendations

This section provides comments related to foundation construction, earthwork, and other geotechnical aspects of the project that will aid those responsible for preparing construction specifications.

Preconstruction Conditions Documentation and Monitoring – We recommend that preconstruction conditions of existing structures to remain be performed to document existing conditions and identify obvious visual deficiencies and areas requiring specific monitoring during construction. We also recommend that a monitoring program be developed and incorporated into the Contract Documents. The monitoring program should include means to measure movement (i.e., optical surveying) and vibration (i.e., seismographs) due to construction operations. The type and locations of specific monitoring equipment, threshold values, and monitoring durations should be developed based on review of the anticipated construction means and methods in conjunction with proximity to existing structures and utilities. The monitoring program is anticipated to provide reasonable feedback as to the performance of the contractor with respect to protecting existing structures and utilities, and to assess any necessary changes to means and methods of construction.

Excavation and Fill – Conventional heavy construction equipment should be suitable for excavation in existing soil materials. Excavation should conform to OSHA excavation regulations contained in 29 CFR Part 1926, latest edition. Complete removal of below-grade structures and utilities to be abandoned is recommended within the footprints of the proposed addition to limit potential obstructions that could be encountered during construction, particularly during installation of deep foundations.

Subgrades should be excavated in such a way to minimize disturbance, such as using a smooth faced bucket. Gravel Borrow should be used for the slab base course. Other fill needed below the structure, if any, should consist of Granular Fill, compacted Crushed Stone wrapped in a non-woven geotextile separation fabric. Table 2 below presents the required gradations for imported materials. Lightweight, if used, should meet the requirements of ASTM C330 with a gradation consisting of a minus 1-inch crushed stone with 90 to 100 percent passing the ¾-inch Sieve, 10 to 50 percent passing the 3/8-inch Sieve, and a maximum of 15 percent passing the No. 4 sieve.

Table 4
Gradation Requirements for Borrow Materials

Sieve Size	**Percent Finer by Weight**		
	Granular Fill	**Gravel Borrow**	**1-1/2" Crushed Stone**
2/3rd lift thickness	100		
2 inch	--	100	100
1½ inch	--	--	95-100
1 inch	--	--	35-70
¾ inch	--	--	0-25
½ inch	--	50-85	--
No. 4	--	40-75	--
No. 10	30-95	--	--
No. 40	10-70	--	--
No. 50	--	8-28	--
No. 200	0-15	0-10	--

All backfill should be placed in maximum 12-inch-thick loose lifts and should be compacted to at least 95 percent of the maximum dry density as determined by the Modified Proctor laboratory test (ASTM D1557). Thinner lifts may be needed depending on the material placed and the type of compactor used. Crushed Stone should be placed in loose lift thicknesses of less than 12 inches and be compacted with heavy compaction equipment to achieve an unyielding subgrade.

Dewatering – Groundwater will likely not be encountered during excavation for pile caps but may be encountered during excavation for elevator pits. If dewatering becomes necessary, it is likely that an engineered dewatering system, such as well points, will be required to adequately dewater the excavations. Additionally, since the groundwater is contaminated and separate phase product is present, treatment will be required before it can be discharged to the sanitary sewer. Design of the well point and treatment system should be stamped by a Professional Engineer licensed in the State of Connecticut as well as a CT Licensed Environmental Professional (LEP). Dewatering discharge will need to be permitted by CTDEEP and should be discharged according to federal, state, and local regulations. The groundwater level should be temporarily lowered at least 2 feet below excavations to limit potential "boils," loss of fines, or softening of the ground. Surface water entering the construction area should be diverted away from excavations.

Bearing Surface Preparation – Excavated subgrades should be proof compacted with either ten passes of a 10-ton vibratory drum roller for open excavations or six passes of a large, reversible, walk behind vibratory compactor capable of exerting a minimum force of 2,000 lbs in trench or pit excavations. Any subgrades that are soft or yielding under proof compaction efforts should be removed below the footprint of the structure as well as in the footing bearing zone which is defined by a 1H:1V plane extending downward and outward from one foot beyond the edge of footing and replaced with compacted Granular Fill or compacted Crushed Stone wrapped in a non-woven geotextile. If proof compaction will prove detrimental to the surface due to the presence of groundwater, static rolling may be allowed at the discretion of the Engineer.

Due to the high fines (silt) content, some of the bearing surfaces may be easily disturbed during foundation construction activities should they become wet from precipitation or groundwater. If desired, the bearing surfaces may be over-excavated by 6 to 12 inches and replaced by a layer of compacted Crushed Stone wrapped in a separation geotextile to provide a stable working surface.

Time between final excavation and concrete placement should be minimized to limit disturbance and groundwater-induced softening of the subgrade. Soil bearing surfaces should be protected against freezing and the elements before and after concrete placement. If construction is performed during freezing weather, footings and foundation walls should be backfilled as soon as possible after they are constructed. Alternatively, insulating blankets or other means may be used for protection against freezing.

Reuse of Existing Soils – Some of the existing subsurface materials, excluding topsoil, may be re-used as Granular Fill with approval of an LEP via a Soil and Groundwater Management Plan (SGMP), regardless of its gradation, provided it is environmentally appropriate, free of organics, debris, stones greater than two thirds the lift thickness in diameter, or other unsuitable material, and they are placed to the required degree of compaction. It should be noted that some of the existing site soils have a relatively high fine-grained content, which could make them difficult to place and compact to the required degree of compaction when excessively wet.

Existing site soils may not be re-used as Gravel Borrow or Crushed Stone unless it meets the gradation requirements presented above, which is unlikely. Existing topsoil/subsoil may be reused in landscaped areas but should be tested for pH, percent organics, and nutrient content and modified as needed to support vegetative growth.

Additional Explorations and Evaluations –The results of the previous geophysical investigation in the East Lot as well as our review of available historical documentation of the West Lot indicate that obstructions are likely to be present within the fill layer. In order to mitigate the risk of potentially encountering these obstructions during pile installation, we recommend additional subsurface explorations (test pits) and noninvasive geophysical investigations (i.e., Ground Penetration Radar) be conducted within both lots.

Additional borings and laboratory testing are also recommended to further define the extents of unsuitable soils and properties of the soils within the bearing strata. The results of the laboratory testing, along with a better understanding of building loads, will aid in providing estimates of settlement, design parameters for piles, and lateral Earth pressures for the below-grade elevator pits. It is anticipated that the information provided by additional borings and testing could be used to provide more accurate opinions of probable cost (OPCs) for deep foundations, if necessary.

Environmental Soil Characterization and Recommendations

Based on laboratory analytical results, the existing fill material within West Lot is impacted with ETPH at concentrations above the I/C DEC and GB PMC. In addition, concentrations of antimony and lead were above the RES DEC with concentrations of lead also above the I/C DEC. Soils also contained detections of various VOCs and PAHS, which is not representative of background concentrations.

Based on a review of previous environmental testing and geotechnical exploration reports, a layer of fill material is present within East Lot that is impacted with PAHs above the RES DEC, I/C DEC, and/or GB PMC. In addition, concentrations of arsenic, lead, and/or mercury were above the RES DEC with concentrations of arsenic also above the I/C DEC. Total DDT (i.e., 4,4-DDT) and lead (by TCLP analysis) were also detected at concentrations above the GB PMC. Soils also contained detections of ETPH, which is not representative of background.

In accordance with the CTDEEP RSRs and the CTDEEP Solid Waste Regulations, soil impacted with contaminants above typical background levels is classified as Polluted Soil and/or Polluted Fill. Based on the results of this investigation, Tighe & Bond provides the following recommendations:

- All soil within the project limits is classified as "Polluted Soil" and/or "Polluted Fill" (collectively classified as "Contaminated Materials") and will require special handling and management procedures during construction under a SGMP.
- Soil excavated during the work may be re-used within the project limits, as long as it is structurally and geotechnically suitable. However, if "grossly" impacted soil is encountered (saturated with petroleum product, strong odors, etc.) such soil should not be re-used. Based on available information for the site and the new development, it is likely that grossly impacted soil is present within the footprint of the site. We recommend further characterization and delineation of the impacted soils to further assist with site redevelopment and soil management as the project design process advances.
- If the site is not entered into a DEEP Cleanup Program and excavated soil is re-used, Tighe & Bond recommends that the soil be re-used in general accordance with the provisions in the CTDEEP RSRs and the site SGMP which include:

  (1) Placement beneath a building or other permanent structure,

  (2) Placement beneath a paved surface (bituminous or concrete),

(3) In unpaved areas the soil should be covered with a minimum of one foot of clean cover (above a demarcation layer), which may include topsoil, gravel, soil fill material, and hardscape surfaces such as pavers.

(4) Re-used impacted soils shall not be placed below the water table or in areas subject to erosion.

- If the site is entered into a DEEP Cleanup Program, then strict conformance with the RSRs will be required including a 2-foot layer of clean fill under paved surfaces and a 4-foot layer of clean fill under vegetative covers that are used to cap contaminated fill at the site to address RES DEC exceedances. The contaminated fill must also be rendered environmentally isolated by being placed beneath a building or other appropriate permanent structure or beneath an Engineered Control that reduces the permeability to less than 10^{-6} cm/sec in accordance with the RSRs to address GB PMC exceedances. The Engineered Control would be requested under an Engineered Control Variance. The Engineered Control could also address the RES DEC exceedances.
- Based on the results obtained to date, there were no areas of soil identified that would appear be classified as RCRA Characteristically Hazardous Waste.
- All excess soil or soil that cannot be re-used that is generated during the proposed construction project will require disposal at a properly permitted facility. Bidding contactors should select disposal facilities based on the data included in this report.
- Tighe & Bond can develop plans and specifications for contaminated soil excavation, handling, on-site re-use, and off-site disposal along with other related environmental specification sections applicable to the work if requested and under a new contract.
- Based on the depth to groundwater observed during this assessment, dewatering and groundwater management is unlikely during construction. However, a final determination regarding the potential for the need for dewatering will be made once the foundation and site utility designs are complete. Based on the groundwater analytical data from the sampled monitoring well, groundwater pumped from excavations during construction may contain significant levels of ETPH and PCBs due to the past uses of the Site and the product plume observed during drilling operations and well sampling. A performance-based specification and SGMP for groundwater dewatering, management, treatment, and discharge will need to be prepared. A permit from DEEP will also be required for discharge into the sanitary sewer.

Closing

The preceding recommendations provided herein are for specific application to the proposed Union Station East Lot and West Lot development in New Haven, Connecticut, in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made. In the event that any changes in the design or location of the proposed structure are made, the conclusions and recommendations in this report should not be considered valid unless verified in writing. This report is for design purposes only and may not be sufficient to prepare accurate quantity take-offs. It is discouraged that this report in its entirety be included in the construction documents or be provided to a contractor. Rather, the construction recommendations should be incorporated appropriately into the construction specifications as well as exploration locations, exploration logs, and laboratory test results for the contractor's use under informational purposes only.

Thank you for the opportunity to provide these services. Please contact James Olsen, PG, LEP at (860) 805-8776 or Brian Opp, PE at (203) 610-9061 if you should have any questions, comments, or require additional information.

Very truly yours,

TIGHE & BOND, INC.

Brian D. Opp, PE
Principal Engineer

James T. Olsen, PG, LEP
Vice President

Enclosures: Appendix A – Figures
Appendix B – Historical Reports
Appendix C – Recent Exploration Logs
Appendix D – Geotechnical Laboratory Test Results
Appendix E – Soil and Groundwater Analytical Data

J:\N\N5002 NHPA\015 Union Station Planning Study\Report\N-5002-015_Geoenvironmental Evaluation.Docx

APPENDIX A

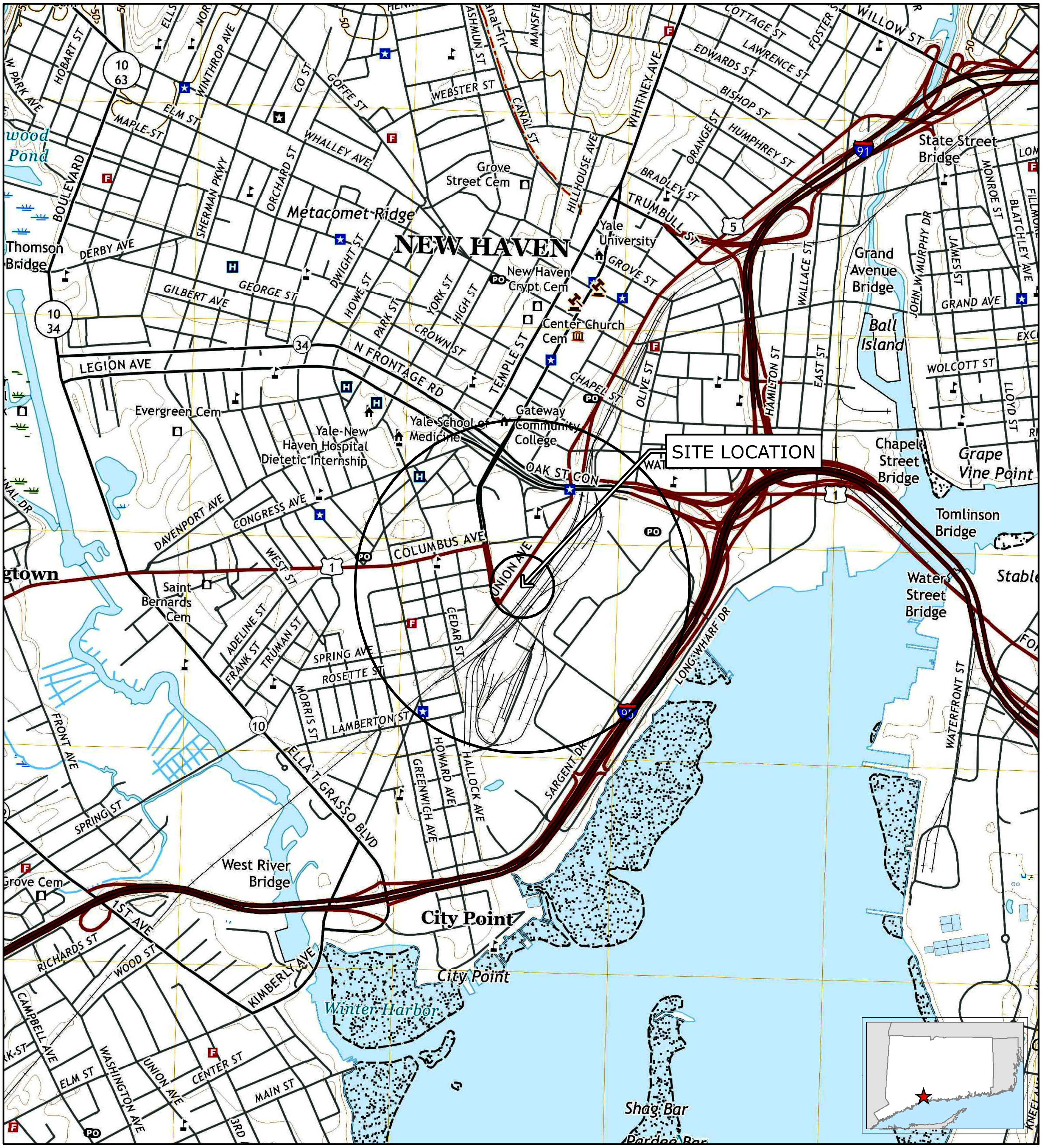


FIGURE 1
SITE LOCATION MAP

Union Station Planning Study
New Haven, Connecticut

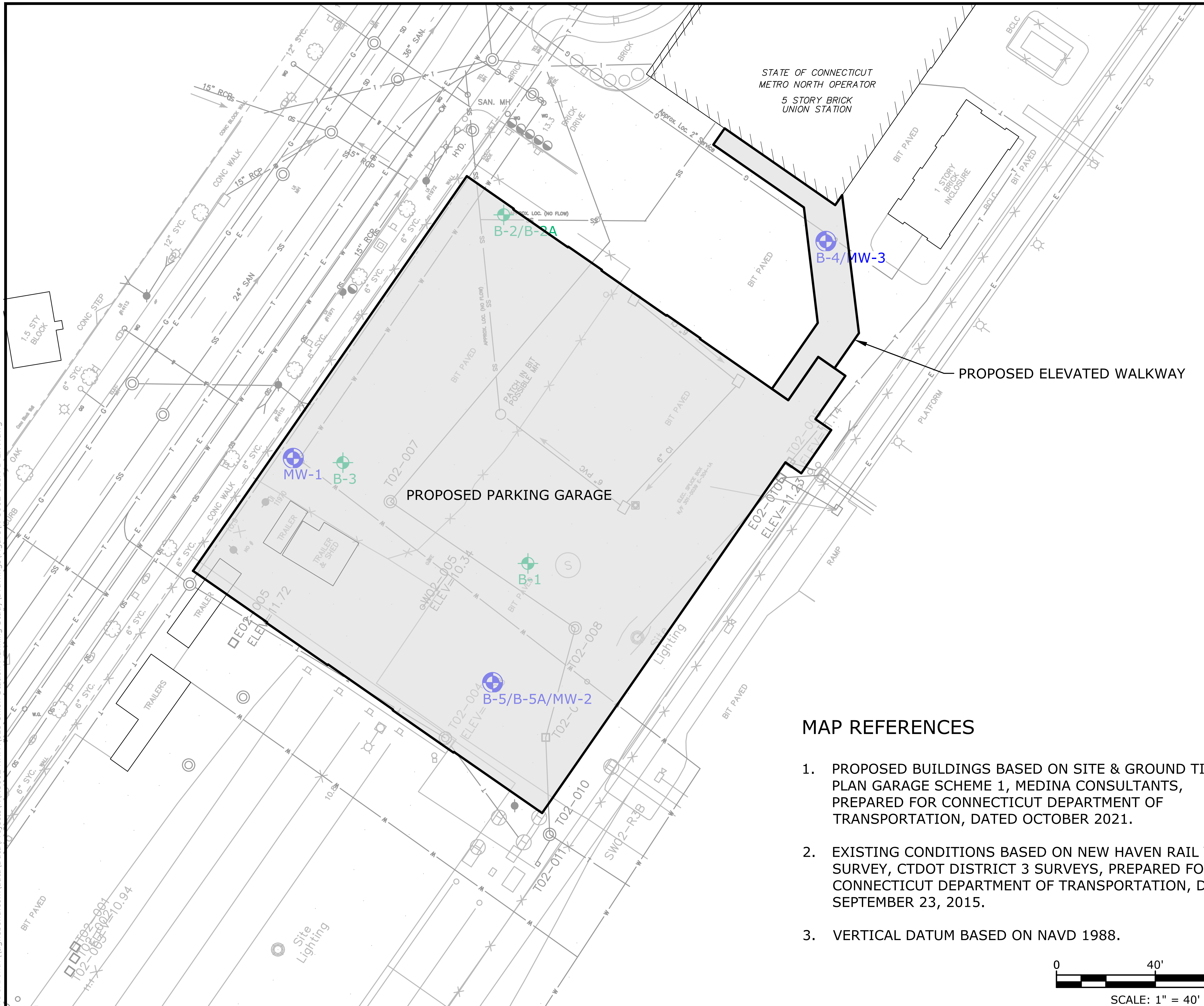
Tighe&Bond

Based on USGS Topographic Map for
New Haven, CT Revised 2021.
Contour Interval Equals 10 feet.
Downloaded from ngmdb.usgs.gov/topoview
Circles indicate 500-foot and half-mile radii

1:24,000
0 1,000 2,000
Feet

N

December 2021



LEGEND

- PROPERTY LINE
- EDGE OF PAVEMENT
- CURB LINE
- EXISTING BUILDING
- PROPOSED BUILDING
- CHAIN LINK FENCE
- STORM SEWER (SD)
- SANITARY SEWER (SS)
- WATER MAIN (W)
- GAS MAIN (G)
- TEL-DATA - BURIED (T)
- MANHOLE
- CATCH BASIN
- SOIL BORING
- MONITORING WELL

MAP REFERENCES

1. PROPOSED BUILDINGS BASED ON SITE & GROUND TIER PLAN GARAGE SCHEME 1, MEDINA CONSULTANTS, PREPARED FOR CONNECTICUT DEPARTMENT OF TRANSPORTATION, DATED OCTOBER 2021.
2. EXISTING CONDITIONS BASED ON NEW HAVEN RAIL YARD SURVEY, CTDOT DISTRICT 3 SURVEYS, PREPARED FOR CONNECTICUT DEPARTMENT OF TRANSPORTATION, DATED SEPTEMBER 23, 2015.
3. VERTICAL DATUM BASED ON NAVD 1988.

0 40' 80'

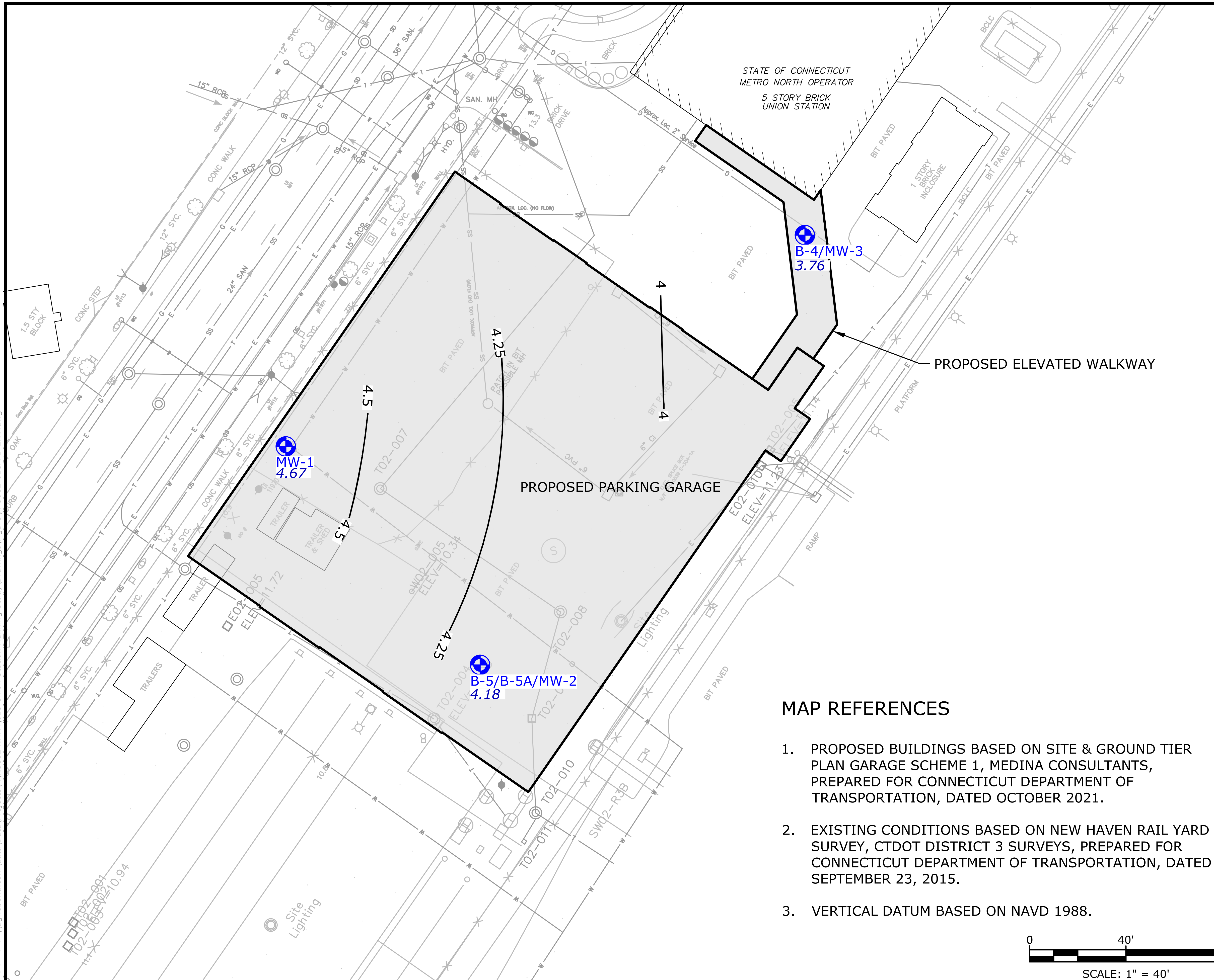
SCALE: 1" = 40'

UNION STATION PLANNING STUDY
NEW HAVEN, CONNECTICUT

SITE PLAN

DATE:	3/16/2022
SCALE:	AS SHOWN
FIGURE:	2

Tighe&Bond



LEGEND

PROPERTY LINE	
EDGE OF PAVEMENT	
CURB LINE	
EXISTING BUILDING	
PROPOSED BUILDING	
CHAIN LINK FENCE	
STORM SEWER	SD
SANITARY SEWER	SS
WATER MAIN	W
GAS MAIN	G
TEL-DATA - BURIED	T
MANHOLE	
CATCH BASIN	
MONITORING WELL	
GROUNDWATER ELEVATION	4.67
GROUNDWATER CONTOUR	4 — 4

MAP REFERENCES

1. PROPOSED BUILDINGS BASED ON SITE & GROUND TIER PLAN GARAGE SCHEME 1, MEDINA CONSULTANTS, PREPARED FOR CONNECTICUT DEPARTMENT OF TRANSPORTATION, DATED OCTOBER 2021.
2. EXISTING CONDITIONS BASED ON NEW HAVEN RAIL YARD SURVEY, CTDOT DISTRICT 3 SURVEYS, PREPARED FOR CONNECTICUT DEPARTMENT OF TRANSPORTATION, DATED SEPTEMBER 23, 2015.
3. VERTICAL DATUM BASED ON NAVD 1988.

0 40' 80'

SCALE: 1" = 40'

UNION STATION PLANNING STUDY
NEW HAVEN, CONNECTICUT

GROUNDWATER CONTOUR MAP
(NOVEMBER 23, 2021)

DATE: 3/16/2022
SCALE: AS SHOWN
FIGURE: 3

Tighe&Bond