GEOTECHNICAL ENGINEERING REPORT

For

New Union County Government Complex
61-99 West Grand Street
Elizabeth, New Jersey

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INTRODUCTION

This report presents the results of a subsurface investigation and geotechnical engineering study performed by Langan Engineering and Environmental Services (Langan) for the proposed New Union County Government Complex to be located at 61-99 West Grand Street in Elizabeth, New Jersey. The purpose of this study was to investigate the subsurface conditions at the site and develop design recommendations for foundation support and other geotechnical aspects of design and construction.

The following sections include a description of the site and adjacent properties, proposed construction, site history, regional geology, subsurface investigations, subsurface conditions encountered, and an evaluation of those conditions with respect to the geotechnical-related aspects of the proposed project.

REPORT DATUM

Elevations given in this report are approximate and based on surface contours provided on the Drawing entitled "Boundary & Topographic Survey 61-99 West Grand Street Tax Account: 6-1589 City of Elizabeth" dated 24 July 2019, prepared by Neglia Engineering Associates. Unless noted otherwise, elevations given herein are referenced to the above-referenced drawing, which refers to the North American Vertical Datum of 1988 (NAVD88).

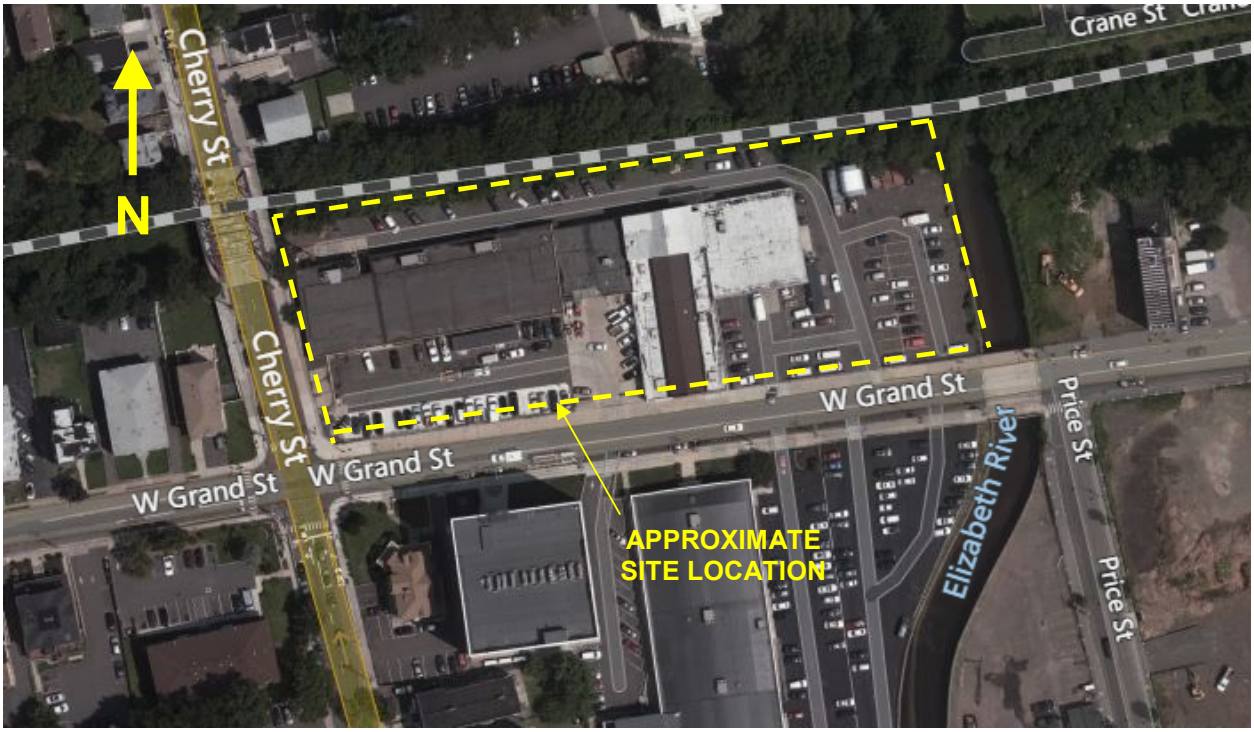
SITE DESCRIPTION

The Government Complex property is a rectangular-shaped 2.4-acre site located at 61-99 West Grand Street in Elizabeth, New Jersey. The site is bound by Cherry Street and a bridge abutment on the west, the Elizabeth River and a tall concrete retaining wall structure on the east, an abandoned railroad line (Central New Jersey Railroad) on the north and West Grand Street on the south.

The majority of the site consists of a paved lot with typical surface grades ranging between approximately elevation (el) 35 at the southwest and el 16 at the southeast. A large 1-story masonry building occupies the west and center portions of the site with lowest ground floor ranging from approximately el 31 to el 25.

The existing building abuts a bridge abutment on Cherry Street at the western boundary of the site. An approximately 12-ft-high retaining wall is also located at the northwest corner of the site between the building and the bridge abutment. The surface grades at this boundary slope upwards to the north from approximately el 35 at the southwest corner of the property to el 42

at the northwest corner of the building. There is an 18-inch-diameter RCP sanitary utility at the eastern portion of the site, with reported inverts ranging from el 3 to el 4. A site location map is provided as Figure 1 and an aerial photograph of the site is provided on the below.



Aerial Photograph of the Site (Bing Map)

PROPOSED CONSTRUCTION

The proposed development will include demolition of the existing 1-story warehouse building and construction of two office buildings with an adjoining lower level, paved parking areas, site retaining walls and sloped landscaped areas. The proposed school and site features are discussed separately below.

Office Buildings

Per the latest available documents, the proposed development includes two new office buildings which have an adjoining lowest level, identified as Level 0. The western office building is identified as Building 1 and the eastern office building is identified as Building 2. Based on available information, we understand that the lowest levels (concrete slabs) of the buildings will vary and both buildings will have proposed overhang areas supported by exposed columns to the north. Our understanding of the proposed finished floor elevations for the first three levels of both buildings is as follows:

- Level 0 – el 18.15
- Level 1 – el 32.15
- Level 2 – at approximately el 48 (to be confirmed by architect)

Building 1

The proposed building will have 6 above-grade levels, and a below-grade level (Level 0) located at the center and southern portions of building, extending beyond the Level 1 footprint to the east and west. At the northern portion of the building, exposed columns will support the building overhang of Level 2. The proposed ground surface at this building overhang area will consist of asphalt pavement and will have grades ranging from approximately el 22 to el 30. Starting at Level 2, the building will have an approximately 17,600 square foot (sf) footprint area. The proposed building will be at least 20 ft south of the northern property line.

Building 2

The proposed building will have 8 above-grade levels including Level 0. At the northern portion of the building, exposed columns will support the building overhang of Level 1. The proposed ground surface at this building overhang area will consist of asphalt pavement and will have grades ranging from approximately el 17 to el 18. Starting at Level 1, the building will have an approximately 22,000 sf footprint area. The proposed building will be at least 55 ft east of the Elizabeth River and 30 ft south of the northern property line.

Level 0

This lowest level extends into both buildings and approximately 100 ft west from the Building 1 footprint. At the western portion of the site, this level is a proposed below-grade level and will require a cut up to approximately 18 ft from existing grade to reach the design level. At the western extension beyond Building 1, the proposed ground level will consist of asphalt pavement with proposed grades ranging from el 31 to el 32. At the eastern portion of the site, this level "daylights" and typically matches the proposed ground level surface grades ranging between el 17 and el 18.

Structural Information

Preliminary structural information provided on a plan prepared by the project structural engineer (O'Donnell & Naccarato Structural Engineers) and project architect (RSC Architects) is summarized below and applies to both buildings.

- Structural System: The structural system will be a steel frame with a concrete core at the elevator and stairs.
- Typical Column Spacing: Approximately 37 ft by 30 ft spacing.
- Column Service Loads: Maximum column load will be on the order of 1,300 kips.

- Wall Service Loads: Maximum wall service load will be on the order of 35 kips per foot.
- Risk Category: Category II per the 2018 International Building Code New Jersey Edition (Building Code)

Site Grading and Retaining Walls

Based on the drawing No. CG101 entitled "Grading Plan", dated 11 June 2021 prepared by Langan, the proposed design grades will require significant filling at the western and northern site boundary.

Western Boundary

Up to approximately 12 ft of additional fill will be needed at the western boundary following demolition of the existing warehouse building to reach proposed surface grades. The above-referenced plan shows this area to be occupied by landscape areas sloping downward into the site at an approximately 1 vertical to 3 horizontal slope. A proposed approximate 2-ft to 13-ft-high cast-in-place concrete retaining wall will be located at the northwest corner of the site to accommodate the grade changes.

Northern Boundary

Up to approximately 8 ft of cut will be needed near the northern boundary following demolition of the existing warehouse building to reach proposed surface grades. This area will be occupied by landscape areas sloping downward into the site at an approximately 1 vertical to 3 horizontal slope. A proposed cast-in-place concrete retaining wall up to 5 ft high will also be located in this sloping landscaping to accommodate the grade changes.

Utilities

Based on drawing CG102 entitled "Drainage Plan", dated 11 June 2021 prepared by Langan, the proposed stormwater utilities will be located in the proposed pavement areas at the building overhangs. These pipes will be in close proximity to the proposed exposed column footings in this area. The bottom of the utilities will range from about el 26 to el 19 at the Building 1 overhang and from about el 16 to el 13 at the Building 2 overhang. It is reported that no below-grade storage tanks will be utilized for this project.

Additionally, we understand that existing outfall pipe located through the existing retaining wall at the southeastern boundary may be utilized for site drainage in the future. The available drawing does not illustrate any connection to the existing outfall pipe.

Existing Eastern Retaining Wall Adjacent to Elizabeth River

We understand the existing concrete retaining wall located at the eastern boundary adjacent to the Elizabeth River will remain in place and will be protected during construction. The existing grades adjacent to the retaining wall will be maintained. There is also an existing 18-inch-diameter RCP sanitary sewer line and associated manhole structures approximately 7 ft west of the retaining wall, parallel to the top of the wall. Pipe inverts reportedly range from approximately el 3 to el 4. We understand this utility is to remain and should be protected and monitored during construction.

REVIEW OF AVAILABLE INFORMATION

We reviewed historic topographic maps, aerial photographs and Sanborn maps, geologic information, and the Flood Insurance Rate Map (FIRM) data for the site vicinity. Pertinent information obtained from the above documents is summarized in the following paragraphs.

Historic Topographic Maps

We reviewed historical topographic maps dated 1891, 1898, 1900, 1905, 1925, 1947, 1955, 1967, 1981, 1995, and 2014 to evaluate pre-development conditions at the site. In all topographic maps, site grades were depicted as ranging from el 40 on the western side of the site to el 20 on the eastern side of the site. In the 1891 topographic map, three small structures were shown along West Grand Street at the central and western portions of the site. The three previous structures were replaced with one long structure along West Grand Street sometime between 1891 and 1898.

Sometime between 1925 and 1947, the structure along West Grand Street was demolished. A structure was shown in the central area of the site with two smaller structures shown on either side. Topographic maps dated 1955 through 2014 did not show any structures on site. Copies of relevant maps are provided in Attachment A and a copy of the 1898 historic USGS map is provided as Figure 2.

Historic Aerial Photographs

We reviewed historical aerial photographs dated 1931, 1940, 1946, 1951, 1954, 1961, 1966, 1970, 1974, 1984, 1995, 2006, 2010, 2013, and 2017 to evaluate pre-development conditions at the site. Aerial photographs dated from 1940 to 1954 show the eastern portion of the site being utilized as storage. Multiple structures and their driveways are shown in the central and western portion of the site. In the 1961 aerial photograph, the western portion of the site appears to be vacant. Aerial photographs dated from 1966 through 1970 show the western portion of the site used for vehicle parking, and the eastern portion of the site is vacant.

Sometime between 1970 and 1974, an addition was constructed on the west side of the main structure at the central portion of the site. The 1966 photo shows a narrow bridge connecting the site to the eastern bank of the Elizabeth River. Aerial photographs dated from 1984 through 2017 depict the site with the current-day buildings and parking areas. Copies of the aerial photographs are provided in Attachment B.

Sanborn Maps

We reviewed Sanborn maps dated 1889, 1903, 1922, 1923, 1950, 1951, 1958, 1963, 1965, 1969, and 1980 to evaluate pre-development conditions at the site. In the 1889 and 1903 Sanborn maps, several 2-story structures are shown on the central and western portions of the site. To the east, there is a structure labeled Elizabeth dye wash and the eastern portion of the site is occupied by a 3-story lumber house, lumber yards and train tracks leading to a coal shed.

Between 1923 and 1950, an automobile and storage facility was added and an office and driveway were constructed at the central portion of the site. The dwelling at the central portion of the site was demolished and a new structure was constructed in the central portion of the site sometime between 1950 and 1951. Between 1951 and 1958, the structures on the western portion of the site were demolished, and the lumber and coal yard were transitioned to the Elizabethtown water company consolidated storage and pipe yard. Sometime between 1969 and 1980, a structure was constructed on the western portion of the site, and the Elizabethtown water company storage has been removed.

The 1899 through 1903 maps show a wooden bridge and a narrow railroad trestle connecting both banks of the Elizabeth River. The wooden bridge was demolished sometime before 1922 and trestle was demolished sometime after 1980. Copies of the Sanborn maps are provided in Attachment C.

Regional Geology

We reviewed the surficial geology and bedrock maps available through the NJDEP's on-line NJ-GeoWeb database. The soil overburden consists of Rahway Till (clayey silt to sandy silt with cobbles and boulders). A copy of the surficial geology map is provided as Figure 3A.

Based on the geological maps, the bedrock at the site consists of sandy mudstone of the Passaic Formation Mudstone facies. The top of bedrock in the vicinity of the site is expected to vary between el 0 at the east and el 50 at the west. A copy of the geological bedrock map is provided as Figure 3B.

FEMA Flood Map

We reviewed the preliminary FEMA flood map panels 34039C0023G and 34039C0024G, dated February 3, 2015. According to the preliminary FEMA flood maps, the majority of the site lies within Zone X (0.2% annual chance flood hazard). The eastern edge of the site lies with Zone AE with base flood elevation defined as el 11 to el 12 (NAVD88). This Zone AE area is also identified as a "floodway is channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights". A copy of the preliminary flood map is provided in Figure 4.

SUBSURFACE INVESTIGATIONS

A site-specific geotechnical subsurface investigation consisting of borings, an exploratory test pit adjacent to Cherry Street and installation of groundwater level observation wells was performed at the site between May and June 2021. This geotechnical subsurface investigation was performed under the full-time observation of Langan. In 2019, a preliminary geotechnical investigation consisting of borings was performed for the site by French & Parrello Associates (FPA). The locations of all borings, wells and the test pit are shown in Figure 5. Each investigation is discussed separately below.

2021 Langan Investigation

A geotechnical subsurface investigation was performed at the project site between 19 May and 9 June 2021 prior to demolition of the existing buildings. The investigation consisted of drilling 22 borings, installing 2 permanent groundwater level observation wells, and excavating 1 exploratory test pit. The logs of the building borings and site borings are included in Appendices A and B, respectively. The log of the exploratory test pit is included in Appendix C. Select photographs of the test pit are provided in Appendix D.

Borings

Borings, identified as LB-2, LB-4 through LB-6, LB-9, LB-11 through LB-15, SLB-1, and SLB-3 through SLB-7 were located outside of the existing building and were performed by Craig Geotechnical Drilling Co. Inc. (Craig) using a truck-mounted drill rig with mud-rotary drilling techniques. Borings LB-1, LB-3, LB-7, LB-8, LB-10, and SLB-2 were performed inside the existing building by Craig using a track-mounted drill rig with mud-rotary drilling techniques.

Borings were extended approximately 13 ft to 35 ft below the existing surface grades. Boring LB-14 was relocated due to a shallow obstruction. Boring SLB-5 was abandoned and plugged when a void beneath an obstruction was encountered at 13 ft below surface grade. This and other buried obstructions may be related to remnants of the former demolished structures including the trestle connecting both banks of the river.

Soil samples were collected and Standard Penetration Tests (SPT) were performed using a standard 2-inch outside-diameter split-spoon sampler driven by a 140-pound safety hammer in accordance with ASTM D1586. Soil sampling and SPTs were typically performed continuously in the upper 12 ft and at 5-ft-intervals thereafter. Recovered soil samples were visually examined and classified in the field in accordance with the Unified Soil Classification System (USCS) and the 2018 International Building Code New Jersey Edition (Building Code).

Rock was encountered and cored using NQ2-size double tube core barrels in several borings. Rock core recovery values (REC) and rock quality designation (RQD) values were recorded in the logs.

Storage: Soil cuttings, drilling fluids and washing fluid generated during the drilling were drummed in 55-gallon steel drums and stored on site.

Surface Repair: Upon completion, all borings were grouted from bottom up. Rigid (asphalt or concrete) surfaces, where drilled, were patched temporarily using concrete or cold patched blacktop. Please note that the surface repairs are considered to be temporary fixes until the start of the proposed construction, which is assumed to start in a year or less. If the proposed construction does not start at the anticipated time, the property Owner should perform periodic maintenance of the repair work.

Groundwater Level Observation Wells

Two permanent groundwater level observation wells were installed in completed boreholes LB-5 and LB-11. The wells consisted of 2-inch-diameter PVC screened and solid pipes and groundwater levels were monitored throughout the field work and during the preparation of this report.

Exploratory Test Pit

An exploratory test pit, identified as LTP-1, was excavated at the western property line between the existing building and Cherry Street bridge abutment. The test pit was excavated by ATA Construction using hand operated tools on 24 May 2021. The test pit extended to 3 ft below surface grades. Upon completion, the pit was backfilled with the excavated materials.

2019 French & Parrello Associates (FPA) Investigation

A geotechnical subsurface investigation consisting of 6 borings, identified as B-1 through B-6, was performed throughout the site in 2019 by FPA. The locations of the 2019 borings are shown on Figure 5. The 2019 subsurface exploration and geotechnical engineering assessment report is provided as Attachment D. Borings were drilled using rotary-mud drilling techniques and extended 15 ft to 30 ft below existing surface grades. Soil samples were classified in accordance

with the Burmister soil classification system and rock was cored in borings B-1, B-3, B-4 and B-5.

LABORATORY TESTING

Soil samples collected during the 2021 subsurface investigation were classified and examined in the field by a Langan geotechnical engineer. Representative soil samples were selected and tested to determine index properties of the soils to verify field classifications. The results of the laboratory tests performed by TerraSense, LLC are included in Appendix E. The results of the corrosion potential testing performed by Test America are included in Appendix F. The laboratory testing included:

- Natural water content determinations (ASTM D2216)
- Fines content passing the No. 200 sieve (ASTM D1140)
- Liquid and plastic limit determinations (ASTM D4318)
- Consolidation test (ASTM D2345)
- Corrosion Suite (resistivity, redox potential, sulfides, sulfates, chlorides, pH, water content)

SUBSURFACE CONDITIONS

The subsurface conditions generally consist of fill materials underlain by alternating layers of natural soils (silt, sand and clay) overlying decomposed rock and competent rock. The rock is sloping downward from west to east towards the Elizabeth River located at the eastern boundary of the site. Thicker fill materials and softer natural cohesive soils were typically encountered at the eastern portion of the site.

Representative simplified graphical presentations of subsurface conditions encountered in borings at the western and eastern portions of the site, including N-values, are presented in Table 1A and Table 1B, respectively. Subsurface strata encountered in the borings are described below and generalized subsurface profiles are provided as Figure 6.

Surficial Materials and Fill

Borings were performed in areas that are covered with asphalt, driveway concrete or interior floor slab. The typical thickness of the exterior surficial pavement materials ranged from approximately 4 inches to 6 inches. The typical thickness of the interior concrete slab was approximately 6 inches.

The fill materials were encountered in all borings and the test pit throughout the site. The fill typically consisted of reddish brown sand mixed with silt, clay, and gravel with roots, wood

pieces, concrete, slag and brick pieces. The thickness of the fill layer typically ranged between approximately 1 ft and 20 ft below the existing surface grades. Fill materials were thicker at the eastern portion of the site.

Western Portion of Site

The fill typically consisted of reddish brown to dark brown silt or sand with varying amounts of gravel, clay, ash, roots and wood pieces. The thickness of the fill layer varied between approximately 2 ft and 7 ft. A possible concrete slab was identified at approximately 3.5 ft below surface grade in boring B-1 located at the northwest corner of the site.

The recorded N-values within the fill varied from 9 blows per foot (bl/ft) to 43 bl/ft, excluding 1 split spoon refusal. The significant variation in the N-values can be attributed to the heterogeneous nature of the fill materials and the presence of remnants of former demolished structures.

Eastern Portion of Site

The fill typically consisted of reddish brown to dark brown silt or sand with varying amounts of gravel, clay, ash, slag, roots, concrete pieces, brick pieces and wood pieces. The thickness of the fill layer varied between approximately 2 ft and 20 ft, but was generally over 10-ft-thick. Additionally, lower layers of soft clayey fill was also encountered in a few borings. Rigid obstructions (up to 5-ft-thick concrete) were encountered in site borings SLB-5 and SLB-7 located at the northeast corner of the site starting approximately 8 ft and 9 ft below existing surface grades.

The recorded N-values within the fill varied from weight of hammer to 61 bl/ft, excluding several split spoon refusals. The unconfined compressive strengths (qu values) as measured by the field pocket penetrometer were measured to be as low as 500 pounds per square foot (psf) in the softer clayey fill material encountered in a few borings. The significant variation in the N-values can be attributed to the heterogeneous nature of the fill materials and the presence of remnants of former demolished structures.

Laboratory Testing

Laboratory tests were performed on 4 representative samples taken from the fill layer. The test results are provided in the table on the following page.

Identification Tests (Fill)

Boring No.	Depth (ft)	Water Content (%)	Fines Content (%)
LB-8	6 - 8	13.4	12
LB-10	4 - 6	12	18.2
LB-15	10 - 12	28	22
SLB-7	2 - 4	14.3	30

Upper Silt, Clay and Gravel Layers

Natural soils generally consisting of silt, clay or gravel were encountered below the fill in all the borings, excluding most of the site borings along the eastern and western property boundaries. The natural soil layers are described separately below.

At the western portion of the site, the top of these upper soils was encountered between approximately el 32 and el 21 (or approximately 2 ft and 7 ft below the surface grades). The combined thickness of these natural deposits was determined to be approximately between 2 ft and 10 ft.

At the eastern portion of the site, the top of these upper soils was encountered between approximately el 25 and el 7 (or approximately 6 ft and 15 ft below the surface grades). The combined thickness of these natural deposits were determined to be approximately between approximately 2 ft and 11 ft.

Silt

A 1-ft to 8-ft-thick silt layer was encountered across the site below the fill layer in many of the borings throughout the site. The silt layer typically consisted of reddish brown clayey silt or silt with varying amounts of sand and gravel.

The recorded N-values in this layer ranged between 6 bl/ft and 52 bl/ft, excluding one split spoon refusal, indicative of a soft to hard consistency. The unconfined compressive strengths (q_u values) as measured by the field pocket penetrometer were measured to be between 1,000 pounds per square foot (psf) and 2,000 pounds psf in the softer silt material encountered in borings LB-8, LB-10 and LB-14.

Clay

A 2-ft to 12-ft-thick clay layer was encountered below the fill layer in many of the borings drilled throughout the site. These soils generally consisted of grayish brown or reddish brown clay with varying amounts of silt, sand and gravel.

The recorded N-values in this layer ranged between 3 bl/ft and 55 bl/ft, indicative of a soft to hard consistency. The unconfined compressive strengths (q_u values) as measured by the field pocket penetrometer, were measured to be between 1,000 psf and 5,000 psf, indicative of soft to firm consistency.

Gravel

A 3-ft and 6-ft-thick gravel layer was also encountered in borings B-3 and B-5 performed by FPA in 2019. This layer generally consisted of gravel with varying amounts of sand, silt and clay. The recorded N-values in this layer ranged between 19 bl/ft and 83 bl/ft, indicative of a medium dense to dense material.

Laboratory Testing

Laboratory tests were performed on 7 representative samples taken from the natural silt and clay soil deposits. The test results are provided in the table below. The tested soils are classified as ML and CL in accordance with USCS.

Identification Tests (Upper Silt and Clay)

Boring No.	Depth (ft)	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Class.
LB-2	6 – 8	17.3	32	17	15	CL
LB-6	5 – 7	17.9	35	17	18	CL
LB-9	2 – 4	17.1	29	16	13	CL
LB-10	13.5 - 15.5	17	18	17	1	ML
LB-14	15 – 17	21.9	20	17	3	ML
LB-15	17 – 19	24.5	29	19	10	CL
SLB-4	6 – 8	16.6	32	17	15	CL

Consolidation Tests (Upper Silt and Clay)

Boring No.	Depth (ft)	Initial Void Ratio	Compression Index, Cc	Recompression Index, Cr	Estimated Preconsolidation Pressure (tsf) (see note 1)	USCS Class.
LB-10	13.5 – 15.5	0.480	0.065	0.009	4	ML
LB-15	17 – 19	0.627	0.124	0.013	4.4	CL

Note 1 – *The reported pre-consolidation pressure estimates from the laboratory tests are probably not realistic since these soils are expected to be normally consolidated.*

Decomposed Rock

A decomposed rock layer was encountered in all borings except borings SLB-5 and SLB-7. The decomposed rock was typically in the form of reddish brown silt with varying amounts of sand and clay with pockets of gray silt and sand, and rock pieces. All recorded SPT N-values recorded in the decomposed rock ranged from 36 bl/ft to split spoon refusals, indicative of dense to very dense materials.

On the western portion of the site, the top of this layer was encountered between approximately el 30 and el 16 (or approximately 2 ft and 15 ft below the existing surface grades). On the eastern portion of the site, the top of this layer was encountered between approximately el 17 and el -1 (or approximately 8 ft to 23 ft below the existing surface grades).

Bedrock

A sedimentary rock stratum of shale and mudstone was encountered in all borings, except SLB-5, below the overburden soils. The rock consisted of fractured reddish brown shale (and mudstone) with gray and white shale in the rock fractures and with varying degrees of weathering. Top of rock was determined by split spoon refusals and coring.

On the western portion of the site, the top of rock varied from el 27 to el 7 (or approximately 4 ft to 24 ft below the existing surface grades). The recorded rock core recovery (REC) values varied from 77% to 100% and Rock Quality Designation (RQD) values varied from 9% to 70%, indicative of very poor to fair quality rock.

On the eastern portion of the site, the top of rock varied from el 11 to el -2 (or approximately 14 ft to 23 ft below the existing surface grades). The recorded rock core recovery (REC) values varied from 88% to 100% and RQD values varied from 15% to 70%, indicative of very poor to fair quality rock.

It should be noted that the top of rock elevations given herein are approximate and the reported conditions refer to the conditions at the specific investigation locations. Variations in the top of rock elevations, rock quality and weathering should be expected across the site.

Groundwater

Groundwater levels were monitored in the groundwater level observation wells installed in boreholes LB-5 and LB-11. The stabilized water level in the LB-5 well was approximately at el 18.5 (or approximately 13 ft below existing surface grade). The water level measured in LB-11 was approximately at el 5 (or approximately 16.5 ft below the existing surface grade). Groundwater levels are subject to seasonal fluctuations. A summary of groundwater measurements is provided in Table 2.

TEST PIT OBSERVATION

An exploratory test pit, identified as LTP-1, was excavated in the northern end of the areaway between the existing building on site and the concrete retaining wall adjacent to the Cherry Street bridge abutment. The intent was to determine the depth of the concrete wall retaining Cherry Street or the bridge abutment.

The areaway is covered by an approximately 11-inch-thick asphalt layer overlying a membrane underlain by an 8-inch to 12-inch-thick concrete slab. The test pit was excavated adjacent to the Cherry Street concrete wall and extended approximately 3 ft below the existing areaway asphalt cover, or 12 inches below the bottom of the concrete slab. No groundwater seepage was observed within the termination depth of the test pit.

The wall is supported on a concrete grade beam, which protruded 4 inches laterally from the bridge abutment face. The concrete grade beam extended approximately 19 inches below the existing asphalt surface. A 5-inch gap was observed between the base of the grade beam and the soil subgrade. A probe (thin steel rod) was inserted laterally to determine the lateral extent of the void. No resistance was encountered for an approximately 3 ft to 4 ft radius in the west, north and south directions. The foundation system of the concrete wall could not be determined. A plastic liner was placed over the areaway concrete slab and test pit was backfilled with excavated materials.

SITE OBSERVATIONS OF EXISTING ELIZABETH RIVER RETAINING WALLS

There is no design or as-built information related to the Elizabeth River retaining walls. However, per our visual observation during a site visit, the retaining wall adjacent to the site is an approximately 2-ft-thick concrete wall with vertical joints spaced approximately every 15 ft. Weep holes were observed at the base of each wall panel. The Elizabeth River appears to flow over a concrete base (flow channel). At the time of our observation, there was approximately 1 ft of

water flowing over the base. The existing retaining wall is approximately 16-ft to 20-ft high from the top of the concrete base. At the southeast corner of the site, the top of the wall is at approximately el 16, flush with the existing surface grade, and the top of the concrete base is then determined to be at approximately el 0.

DISCUSSION

Subsurface conditions vary across the site and generally consist of up to 20 ft of sandy fill underlain by thin, natural cohesive soils overlying natural, dense glacial soils and rock strata. The thickness of the fill and natural soils were thinner in the western portion of the site and thicker in the eastern portion. The proposed basement excavation will remove all of the overburden soils within the proposed Building 1 footprint and will extend into the decomposed rock or rock. Therefore, the proposed building can be supported on shallow foundations bearing on decomposed rock or rock.

For the proposed Building 2 footprint, the proposed excavation to reach proposed design grades will remove most of the overburden materials in the western portion and some of the fill materials in the central and eastern portions. The existing fill materials and the underlying softer soils and "sensitive" soils, in their present conditions, are not suitable for conventional shallow foundation support. The underlying competent denser natural soils, decomposed rock and rock are suitable for conventional foundation bearing.

Therefore, proposed Building 2 can be supported on shallow foundations bearing on properly prepared competent natural soils or properly improved competent bearing materials. The bearing strata at the western portion will require minimal preparation but the remaining portions (center and eastern portions) will require significant ground improvement to allow construction of conventional shallow foundations. We have evaluated the following ground improvement options as described below.

Removal and Replacement of Unsuitable Soils

This alternative involves the removal of all existing fill and unsuitable compressible soils from below the proposed foundations and replacing the excavated soils with compacted structural fill. The anticipated excavations for the foundations would be up to 20 ft below the existing surface grades (or up to 15 ft below the proposed lowest level) and would require extensive temporary shoring and dewatering measures. Due to the environmental sensitivity associated with handling of the on-site soils and comprehensive shoring/dewatering measures, this removal and replacement approach does not seem cost effective, except at the western edge of the proposed Building 2.

Deep Dynamic Compaction (DDC)

To minimize the excavations and the associated environmental sensitivity, the existing unsuitable soils could be improved in-situ by Deep Dynamic Compaction (DDC) improvement procedures, which is cost effective. However, DDC could generate significant vibrations that can adversely affect the surrounding structures and would not be a suitable alternative for this site within a congested urban area adjacent to a bridge and masonry retaining walls along the Elizabeth River.

Rigid Inclusions

The unsuitable soils (existing fill and upper soft and sensitive soils) can be improved by rigid inclusions to allow conventional shallow foundation (spread footings) and slab-on-grade system construction. This improvement procedure would be practical and relatively cost effective as compared to other alternatives discussed above. Rigid inclusions (e.g. stone columns, controlled modulus columns, rammed aggregate piers) can be considered.

The improvement elements (rigid inclusions) would extend into the lower dense natural bearing strata and would be required to support the columns, walls, and the lowest floor slab. Following installation of the rigid inclusions, shallow foundations and slab-on-grade can be constructed conventionally over a 2-ft to 3-ft-thick load transfer platform (LTP), consisting of a structural granular fill layer placed over the improved ground. Additionally, underslab utilities do not have to be hung from the slab (as it would be for a deep foundation option).

Grouted rigid inclusions are advanced using augers and generate little to no spoils and no vibrations. Non-grouted inclusions (rammed aggregate piers or stone columns) are relatively less expensive than the grouted inclusions, but could generate vibrations, which may require some preventative measures. This alternative would require considerable amounts of granular fill (sand and gravel) to construct the LTP. Some of the granular on-site soils can be reutilized for LTP but not all. Therefore, some import fill will likely be needed.

Considering the environmental sensitivity associated with handling of the on-site soils and groundwater table, rigid inclusions would be the desired ground improvement method for this project.

EVALUATIONS AND RECOMMENDATIONS

The following provides our recommendations for seismicity, the foundation system for the proposed buildings, ground improvement, and other geotechnical related aspects of design and construction.

Seismicity

The 2018 International Building Code NJ Edition (Building Code) assigns a seismic site class based on the type, thickness and average properties in the top 100 ft of bearing stratum. Seismic site-class values are given in accordance with Chapter 20 of ASCE 7 per the Building Code.

Building 1

The bearing strata underlying proposed Building 1 typically consist of thin natural soils overlying bedrock. The recommended seismic design parameters are summarized in the table provided on the following page.

Seismic Parameters	**Value at short period**	**Value at 1-second period**
Mapped Spectral Response Acceleration *(in terms of gravitational acceleration, g)*	S_S= 0.282g	S_1= 0.06g
Seismic Site Class	Class C (very dense soil or soft rock)	
Seismic Site Coefficients	F_A = 1.3	F_V = 1.5
Design spectral response acceleration, S_{DS}=2/3xFxS	S_{DS}=0.244g	S_{D1}=0.06g
Risk Category	II	
Seismic Design Category	B	B

Building 2

The bearing strata underlying proposed Building 2 typically consist of sandy fill underlain by a natural cohesive layer overlying dense glacial till and bedrock. The recommended seismic design parameters are summarized in the following table.

Seismic Parameters	Value at short period	Value at 1-second period
Mapped Spectral Response Acceleration *(in terms of gravitational acceleration, g)*	S_S= 0.282g	S_1= 0.06g
Seismic Site Class	Class D (very dense soil)	
Seismic Site Coefficients	F_A = 1.575	F_V = 2.4
Design spectral response acceleration, S_{DS}=2/3xFxS	S_{DS}=0.296g	S_{D1}=0.094g
Risk Category	II	
Seismic Design Category	B	B

Liquefaction Potential

The Building Code requires an evaluation of the liquefaction potential of non-cohesive soils below the groundwater table and up to 50 ft below the ground surface. Typically, the non-cohesive soils encountered below the measured groundwater consisted of medium-dense to dense sandy soils. Therefore, liquefaction potential is not a concern and does not need to be taken into account in the design for both buildings.

Foundation System

Subsurface conditions vary across the site and generally consist of up to 20 ft of sandy fill underlain by thin, natural cohesive soils overlying natural dense natural soils, decomposed rock and rock. The fill materials and the upper soft and sensitive soils (where present), in their present conditions, are not adequate to support a conventional shallow foundation system. The thickness of the unsuitable soils are thinner in the western portion of the site and thicker in the eastern portion.

As outlined in the "Discussion" section of this report, the proposed excavations to reach design grades will remove all of the unsuitable soils at the western portion of the site (within the proposed Building 1 footprint) and some of the unsuitable soils at the eastern portion of the site (within the proposed Building 2 footprint). Therefore, the proposed buildings can be supported on a conventional shallow foundation and a slab-on-grade system provided that the proposed lowest floor excavations are performed and ground improvement (rigid inclusions with a load transfer platform) is performed under proposed Building 2.

It should be noted that the northern portions of both buildings will have exposed columns supporting building overhangs spanning over the asphalt pavement at the proposed ground surface.

Once the proposed excavations are performed, subgrades are properly prepared and the ground improvement is performed under Building 2, a shallow foundation system consisting of spread, combined and strip footings, or a combination of these, should be used to support the proposed buildings. Foundations should bear directly on the properly prepared competent subgrades or a load transfer platform (LTP) overlying improved subgrade. The recommendations for the proposed foundation system are provided below and the recommendations for the proposed ground improvement are provided later in the "Ground Improvement" section of this report.

Allowable Bearing Pressure and Lateral Sliding Resistance

Proposed Building 1 can be supported on cast-in-place concrete footings bearing directly on the competent bearing materials as identified in the table below. Proposed Building 2 will be supported on cast-in-place concrete footings bearing directly on the competent bearing materials as identified in the table below and on subgrade improved by means of rigid inclusions and LTP.

We recommend that the allowable bearing pressure and the coefficient of base friction, (fc), between the cast-in-place concrete and the competent bearing materials are taken in accordance with the table below:

Bearing Material	**Recommended Allowable Bearing Pressure, q_{all}**	**Recommended Coefficient of Base Friction, f_c**
Decomposed and competent rock, or Lean concrete placed over decomposed rock and rock (applies to Building 1 only)	10 kips per square foot (ksf)	0.45 for bare concrete
Natural, undisturbed dense natural sandy soils or Lean concrete placed over undisturbed dense natural sandy soils (applies to western portion of Building 2)	7 ksf (see Note 1)	0.35 for bare concrete
Subgrade improved by rigid inclusions and LTP (applies to center and eastern portions of Building 2)	6 ksf	0.35 for bare concrete

Note 1: Alternatively, if any over-excavated foundation is backfilled with compacted ¾-inch crushed stone wrapped in Mirafi 180N filter fabric (to the base of the foundation), the allowable bearing pressure should be reduced to 5 ksf.

Minimum Dimensions and Frost Protection Depth

All isolated and continuous footings should be a minimum of 3-ft-wide and 2-ft-wide, respectively. Perimeter foundations and foundations in unheated areas should be placed at least 3.5 ft below adjacent grades for frost protection.

Settlement Estimates

Total settlements at columns/walls and differential settlements between adjacent columns/walls are estimated to be less than 1 inch and 1/2 inch, respectively.

Positioning of Adjacent Foundations

The proposed foundations should be located out of the influence zone of nearby foundations and walls to avoid inducing load on adjacent foundations (proposed or existing) and below-grade walls. For below-grade walls, the theoretical influence zone is defined as a 1 Horizontal (H) on 1 Vertical (V) theoretical line drawn upward from the base of the wall. For foundations, the theoretical influence is defined as a 1H on 1V line drawn downward from the edge of a footing. A schematic position detail is given in Figure 7.

For Building 1, the northern exposed columns supporting the Level 2 overhang should be lowered to avoid inducing load on the adjacent below-grade level (Level 0) foundation walls and foundations. Additionally, the proposed foundations adjacent to the proposed utilities should be lowered to match the bottom of the proposed utilities, at a minimum, to prevent any potential disturbance of foundation bearing soils during utility construction or for any possible future utility remedial work.

For Building 2, the easternmost perimeter foundations should be lowered to el 10 at this time. This elevation may be adjusted following the global stability evaluation of the Elizabeth River retaining wall.

Foundation Subgrade Preparation Procedures

Upon completion of final excavation to reach the design grades and suitable bearing material as defined in this report (determined by the geotechnical engineer), foundation subgrades should be compacted (ironing pass) and leveled with a vibratory plate compactor having a static weight of not less than 0.5 tons. Foundation bearing surfaces should be level and clear of debris, standing or frozen water, accumulated sedimentation and other deleterious materials, and should be protected against frost. Exposed subgrades should be protected against weather and run-off water that can soften the subgrades.

Sealer Concrete: Site soils contain significant amounts of fine soil particles and sedimentary rock that are sensitive to moisture. All exposed subgrades should be protected against weather and run-off water, which can soften the subgrades. The inspected and approved foundation

subgrades (soil or rock) should be sealed with a sealer concrete layer (3-inch-thick lean concrete having 2,500 pounds per square inch (psi) 28-day compressive strength) for protection against weather effects and disturbance during foundation construction.

Over-excavation Filling: Over-excavations, where needed, should be filled with lean concrete having a 28-day compressive strength not less than 2,500 psi or compacted ¾-inch crushed stone (ASTM #57, with reduced allowable bearing pressure as defined in the table above) fully wrapped with Mirafi 180N filter fabric. All subgrade preparation work should be performed under supervision of a geotechnical engineer.

Special Inspection

A qualified geotechnical engineer, experienced in this type of work, should inspect and approve the foundation subgrades to verify that the subgrade materials are adequate to provide the recommended allowable bearing pressure.

Lowest Floor Slab

The lowest floor of the proposed buildings will be at el 18.15 (Level 0) and will be at the measured groundwater level in the western portion and several feet above the measured groundwater table in the eastern portion. The groundwater level appears to be flowing downward towards the Elizabeth River and over the impervious strata (dense glacial soils, decomposed rock and rock).

The building footprint areas located outside the proposed Level 0 limits will consist of asphalt pavement and concrete hardscapes at the proposed grade level. Refer to "Pavement" section of this report for details on subgrade preparation procedures and other requirements for these areas.

The lowest floor slabs can be designed and constructed as a slab-on-grade provided that the subgrade preparation measures described herein and ground improvement (where specified) described in the "Ground Improvement" section of this report are implemented. The proposed lowest floor slabs bearing on the properly prepared and improved subgrade as discussed in detail later in this report can be designed using a design subgrade modulus of 175 pounds per cubic inch (pci).

Subgrade Preparation

Soil subgrades within the proposed buildings pads should be proofrolled in accordance with the "Proofrolling" section of this report.

Vapor Barrier and Bedding Layer

A minimum 6-inch-thick layer of ¾-inch natural crushed stone should be placed immediately below the slab as a bedding layer, which will also serve as a capillary break. This capillary break

could also be included in the LTP, where specified. A plastic sheet vapor barrier should also be installed beneath the slab. The position of the vapor barrier should be chosen by the structural engineer in accordance with the latest ACI guidelines. The vapor barrier should not be less than 15-mil-thick and should conform to ASTM E 1745 Class A requirements. The bedding layer should be coordinated with the environmental consultant.

Drainage

The proposed lowest floors will be bearing on relatively impervious soils, which will not allow vertical drainage. Perched water and surface water flowing over the impervious strata may be encountered behind the below-grade walls. Therefore an adequate perimeter foundation drainage system should be provided behind the below-grade walls as discussed further in Below-Grade Building Walls section of this report.

We also recommend a secondary underslab drainage system beneath the proposed Building 1 lowest floor. The underslab drainage system should consist of 4-inch-diameter perforated PVC pipes embedded in a layer of ¾-inch clean crushed stone, wrapped in Mirafi 140N filter fabric. The thickness of the crushed stone layer (bedding layer) should be increased to at least 8 inches at the pipe locations to provide a minimum 4-inch-clear cover between the pipes and the slab. The pipes should be spaced in a grid pattern about 30 ft apart and should be connected to a discharge system independent of the perimeter drainage system. Cleanouts should be provided to allow for future maintenance. The underslab drainage system will require a discharge, which could be a gravity pipe, where feasible, and should be designed by the project mechanical engineer.

Ground Improvement

Ground improvement should be performed at the center and eastern portions of the proposed Building 2. The limits of the proposed improvement are shown in Figure 5. A specialty subcontractor should evaluate and design the appropriate, cost-effective ground improvement by means of rigid inclusions based on the subsurface conditions and the design targets for building foundations and slab on grade. The selected improvement procedure should satisfy the following criteria for the subgrade:

- An allowable bearing pressure of 6 ksf for the proposed foundations
- Total and differential settlements should not exceed 1 inch and 0.5 inch, respectively
- An allowable reaction of subgrade modulus of 175 pci for the proposed slab-on-grade
- Peak particle velocity (PPV) during installation should not exceed 1.5 inches per second (ips)

Typical, preliminary details of the ground improvement (controlled modulus columns or stone columns) and LTP are discussed separately below.

Grouted Rigid Inclusions (Controlled Modulus Columns)

Grouted rigid inclusions (referred herein as "elements") consist of drilling a hollow auger through the fill and underlying unsuitable soil layers and filling the hole with a cement-based grout column using pressure through the hollow auger. The process of augering leaves the majority of the drilled soil in place, to minimize spoils generation. The elements essentially improve the ground conditions by providing a stiff composite ground mass. Minimal vibrations are generated during the advancement of these drilled elements.

The elements are typically 10 inches to 20 inches in diameter and installed throughout the building footprint on a grid pattern that is spaced depending on the underlying soils, building loads, and settlement criteria. A group of elements are also installed at each individual column location to support the column footing. The number of elements at each location will be dependent on the column loading. In addition, elements are installed beneath the center-line of the perimeter wall foundations. The spacing of elements beneath the perimeter wall typically ranges from 4 ft to 8 ft. We anticipate that the elements will need to be installed at least 5 ft into the dense soils and the element lengths will typically range from approximately 15 ft to 20 ft.

A stable working platform is required to allow the uninterrupted installation of rigid inclusions throughout the site. Once the desired grade for element installation is reached, the exposed subgrade should be properly proofrolled in accordance with the requirements of the "Proofrolling" section of this report. If the subgrade is determined not to be suitable by the specialty contractor, a thin crushed stone layer may be required to stabilize the subgrade.

Stone Columns

Stone columns are also augered down to the suitable bearing material (similar to the grouted elements), however the borehole is then raised with compacted lifts of stone aggregate from the bottom to the top using a down the hole vibrator suspended from a crane or specialty rig. Compaction of the aggregate lifts would generate vibrations, which should be taken into account. These columns are typically 24 inches in diameter or greater and, similar to the grouted columns, will improve the ground conditions by providing a stiff composite ground mass. These compacted aggregate elements can be utilized provided that such use is acceptable to the project environmental engineer and adequate measures are taken to mitigate the vibrations caused by the compaction of the aggregate lifts.

Load Transfer Platform (LTP)

After installing the improvement elements (rigid inclusions), an LTP typically consisting of approximately 2 ft to 3 ft of compacted granular material (structural fill) should be placed between the top of the elements and the proposed slab. The LTP beneath the proposed foundations should be at least 1 ft thick. The backfilling and compaction for the LTP should be performed in accordance with the requirements of the "Engineered Fill" section of this report and requirements from the specialty designer. The slab bedding layer (crushed stone) can also be incorporated into the LTP. The reuse of existing granular soils as part of the LTP can be evaluated by the specialty designer and the project geotechnical engineer.

General

The ground improvement design and implementation will have to be performed by a specialty subcontractor and should be designed to satisfy the recommendations provided in "Foundation System" and "Lowest Floor Slab" sections of this report. The element diameter, spacing, grout mix/strength, locations, LTP thickness and fill requirements should be designed by a Professional Engineer licensed in New Jersey and should be submitted to the project geotechnical engineer for review.

Below-Grade Walls

The proposed lowest floors will be up 14 ft below the proposed grades in the western and central portions of the site. Some of the below-grade wall sections will be at the measured groundwater levels. Therefore, these walls should be designed to resist lateral pressures due to soil, surcharge (temporary and permanent) loads and seismic loads (if applicable) and should be designed with proper drainage which should include perimeter drainage pipe and vertical prefabricated composite drainage mats.

Seismic pressures can be disregarded because the proposed buildings are classified as seismic design category B. Hydrostatic pressures can be ignored for the below-grade wall sections that are above the design groundwater table provided that adequate drainage measures are taken. Based on the available grading plan, the proposed below-grade walls of the Level 0 extension at the western portion of the site will be adjacent to sloping backfill. The recommended pressure distributions for walls are shown in Figure 8 for below-grade walls.

Any additional loads such as adjacent foundations, surcharge, vehicular loading within the zone of influence, defined by a 1H on 1V line drawn from the base of the wall to the surface, should be added to lateral pressure loads.

Perimeter Wall Drainage

A perimeter drainage pipe should be placed behind the below-grade foundation walls at the foundation level. The pipe should consist of 4-inch-diameter, perforated PVC pipes embedded in a layer of ¾-inch clean crushed stone wrapped with a Mirafi 180N filter fabric, or equal. The crushed stone layer should provide at least 6-inch-thick cover around the pipes. The perimeter drainage pipes should be connected to a discharge system.

Since the proposed building lowest floor will be bearing on relatively impervious materials (i.e. glacial soils, decomposed rock or rock), it is important to provide an adequate perimeter foundation drainage system to prevent water buildup (perched water, utility leaks, run-off etc) behind the below-grade foundation walls. Vertical prefabricated composite drainage mats, such as Miradrain 6000 or equal, should be placed behind the below-grade walls. Drainage mats should extend from ground surface level to the lower perimeter drainage pipe installed at the bottom of the exterior foundation walls and connected to a discharge system.

The proposed perimeter foundations at the western portion of Building 1 should be socketed at least 6 inches into rock to reduce infiltration that can be generated by groundwater flowing over the rock surface.

Backfilling

The fill behind the below-grade walls should not be placed until the concrete has reached its design strength and either the first floor slab (entry floor) has been poured, or the walls have been properly braced. All backfill placement behind the walls should comply with the requirements of the "Engineered Fill" section of this report and should be inspected by a qualified geotechnical engineer.

Demolition and Site Clearing

Obstructions were encountered during drilling of Langan borings and former structures previously occupied the site. Prior to commencement of grading or fill placement, any miscellaneous trash, debris, or other unsuitable materials should be removed from the site. All debris should be properly disposed of off the site in accordance with applicable regulations. Below are our recommendations for demolition of the former buildings, former building remnants, site utilities, and other site features:

- The existing warehouse building should be completely removed.
- Existing foundations, concrete floor slabs and loading dock aprons should be completely removed.
- From a geotechnical perspective, concrete from the site can be crushed and reused as fill material.

- In proposed pavement and landscape areas, foundations associated with the former buildings can be abandoned in-place provided they are removed within 3 ft of finished subgrade levels, and so as not to conflict with new site improvements including utilities and associated structures.
- All abandoned buried structure (i.e. foundations, slabs, walls, tanks, utilities, pits) below the proposed building foundations should be removed completely. Any buried abandoned structure beneath the proposed slabs should be removed at least 3 ft below the existing surface grade. No void or pit should be left beneath the proposed slabs.
- Utilities associated with the former development and designated for removal should be completely removed within the proposed building footprint.
- Existing utilities located outside the proposed building footprint should be removed or abandoned in-place by complete filling with grout.
- Excavations made to remove foundation elements or utilities should be backfilled with approved compacted fill as discussed herein.
- Any existing pavement and concrete walkways that are not part of the final design layout should be demolished in their entirety. Existing asphalt pavement designated for removal can be milled/broken and stockpiled for re-use as pavement subbase in proposed pavement areas.

Clearing and grubbing of all trees (including removal of any associated root systems and stumps) and vegetation designated for removal should be performed, if applicable. Topsoil (where it exists) should be completely stripped from the proposed building footprint and 10-feet beyond the building limits where accessible.

All clearing and stripping activities should be performed in strict accordance with the approved soil erosion and sediment control plan prepared for the project. All site demolition and site clearing operations should be performed in accordance with any environmental regulations and requirements established for the site as well as all Local, State, and Federal regulations. Dust control measures should be implemented during construction to limit the generation of airborne particulates.

All work should be performed so as not to adversely impact the existing and neighboring buildings, off-site structures, or utilities. Protection of these elements should be provided as necessary during the course of all construction activities at the site.

Site Retaining Walls

The proposed permanent site retaining walls will retain up to approximately 13 ft of soil and possible surcharge loads. These retaining walls should be designed to resist lateral pressures due to soil, seismic (if applicable) and surcharge (temporary and permanent) loads. Typical soil

parameters, which can be utilized in the estimation of the lateral earth pressures for a wall, are provided in the table below.

Parameter	Granular Fill
Unit weight of soil backfill	140 pounds per cubic foot (pcf)
Active earth pressure coefficient, Ka (*wall rotates)*	0.33 for flat top backfill 0.45 for up to 20 degrees sloping backfill (from horizontal)
Active Equivalent fluid unit weight, with proper drainage	45 pcf (active) for flat top backfill 63 pcf for up to 20 degree sloping backfill
Passive earth pressure coefficient, Kp *(see Note 1)*	3 for flat base toe 1.6 for up to -20 degrees base (from horizontal) *(does not include reduction factors)*
Allowable bearing pressures for retaining wall foundations	3 ksf for properly proofrolled soils or 10 ksf for subgrade consisting of decomposed or competent rock

Note 1: Apply reduction factor of 2 to limit movement; disregard passive resistance within 3 ft of the base or toe or foundation)

Pavements

All surficial materials (asphalt, concrete, topsoil) and deleterious materials (timber, metal, garbage, and organic soils) should be removed entirely from the proposed pavement areas. The exposed subgrade for the proposed pavement (asphalt or concrete) should be improved by proofrolling, which should be performed in accordance with the"Proofrolling" section of this report.

California Bearing Ratio (CBR)

The anticipated CBR values for properly improved pavement subgrades consisting of granular sandy soils and inorganic cohesive soils are estimated based on field observations. The on-site soils should be placed in accordance with the "Engineered Fill" section of this report. The granular on-site sandy soils or imported sandy soils compacted to 95% of their maximum dry density as per ASTM D 1557 are anticipated to achieve a CBR value of 10. The inorganic cohesive on-site soils compacted to 95% of their maximum dry density as per ASTM D 1557 are anticipated to achieve a CBR value of 5. These CBR values should be verified during construction by performing laboratory test results on actual subgrade materials.

Utilities

The subgrade for proposed utilities bearing should be improved by surface compaction using a vibratory compactor having a static weight not less than 0.5 tons. Surface compaction should be performed after excavation of the utility trenches. Appropriate bedding materials should be placed over the subgrades. At a minimum, a 6-inch-thick bedding layer of ¾-inch crushed stone should be placed immediately below the utility pipes. Specific requirements of the individual utility companies should also be addressed. Requirements for fill and compaction are discussed in the "Engineered Fill" section of this report.

Excavation and Support of Excavation

The proposed construction will require significant excavations and grading to reach the design grades. We anticipate that typical excavations between 5 ft and 16 ft below existing surface grades will be required to reach the design grades. The excavations in soils can be performed using conventional earthwork equipment. However, excavations in rock strata will require large excavators equipped with rock teeth. Hydraulic hoe-rams may be required for harder rock and obstructions, where encountered.

Open-cut excavations seem feasible along the proposed northern and eastern building lines, where the proposed buildings are setback from the lot lines. Excavation sides should be sloped, benched or braced properly in accordance with OSHA guidelines. Open-cut excavations, where feasible, should be stable slope satisfying OSHA.

In areas where open-cut excavations are not feasible or desired (areas immediately adjacent to the lot lines), a proper temporary support of excavation (SOE) system (i.e. soldier pile and lagging etc.) is required to retain the cuts. Soldier piles will need to be installed by drilling through soils into the rock strata due to shallow rock conditions preventing sufficient embedment. All SOE systems should be designed by a licensed professional engineer retained by the contractor and should be reviewed by the project geotechnical engineer.

<u>Cherry Street Abutment</u>

Cherry Street and its bridge abutment along the western property line are retained by existing retaining walls and the existing building. Protective measures should be taken to prevent instability of the adjacent Cherry Street and the bridge abutment during demolition and construction. An SOE system should be installed prior to demolition of the western section of the existing building, which may be providing support for the roadway along the western property line.

<u>Elizabeth River Retaining Walls</u>

The proposed construction will be setback from the Elizabeth River. The banks of the river are supported by concrete retaining walls. There is no design or as-built information related to the

Elizabeth River retaining walls. However, per our visual observation, the retaining wall adjacent to the site is an approximately 2-ft-thick concrete wall with vertical joints spaced approximately every 15 ft with weep holes at the base of each wall panel. The Elizabeth River appears to flow over a concrete base (flow channel). The existing retaining wall is approximately 16-ft to 20-ft high from the top of the concrete base. At the southeast corner of the site, the top of the wall is at approximately el 16, flush with the existing surface grade, and the top of the concrete base is then determined to be at approximately el 0.

The retaining walls should be protected during the demolition and construction phases. Surcharge load (material stockpile, equipment) should not be placed within the influence zone (i.e. 50 ft lateral distance) of the retaining walls, so as to prevent impact to the existing walls and their below-grade elements. A global stability check should be performed to evaluate the impact, if any, of the proposed building on the existing retaining wall.

Construction Dewatering

The construction dewatering will be limited to removal of perched and surface runoff water during the foundation and utility excavations. These excavations will be above the measured groundwater levels recorded during the investigation at the majority of the site. The excavations in the western end will be at the level of the measured groundwater levels. Therefore, some dewatering measures (e.g. trenching, sump pumping) during construction may be necessary to maintain a dry and workable site to control surface water. Cohesive on-site soils (silt and clay), on-site sandy soils with significant fine soil particles and sedimentary rock are sensitive to moisture. Water should not be allowed to pond and sit over soil subgrades. Proper grading, trenching and periodic pumping will be needed to maintain the site in a dry and workable conditions. The pumping, handling and discharge of all dewatering effluent should be performed in accordance with all applicable regulations and any environmental requirements for the site.

Proofrolling

Proofrolling of soil subgrades for building and pavement areas should be performed after demolition, site clearing and completion of all other required excavations. Proofrolling can be achieved by a minimum of 6 overlapping passes of a heavy vibratory drum compactor having a static drum weight of at least 10 tons. Padded or sheepsfoot compactors should be utilized to compact the on-site cohesive soils and subgrades. Due to the anticipated buried rigid obstructions, we also recommend that all exposed subgrades be proofrolled using a fully loaded tri-axle dump truck. Proofrolling should be performed in overlapping passes in both directions (perpendicular to each other).

Any areas exhibiting evidence of poor subgrade, such as rutting or weaving beneath the proofrolling equipment, or containing deleterious materials, should be removed to competent

material and replaced with compacted structural fill. Requirements for compacted fill and its placement should be in accordance with the "Engineered Fill" section below.

Engineered Fill

All fill materials to be used within the site should be free of organic, frozen, hazardous items and other deleterious materials. All engineered fill (structural fill) materials should consist of clean, well-graded granular soils having no more than 15% by weight passing the No. 200 sieve and a maximum particle size no greater than 4 inches. Non-deleterious and non-hazardous on-site materials can be used as structural fill if they meet the above criteria. The use of larger aggregate should only be done as approved by a qualified geotechnical engineer based on inspection of conditions encountered during construction.

On-Site Soils

The proposed excavations will generate excess materials. Non-deleterious on-site soils can be processed (screening, mixing, aeration, moisture conditioning) for reuse as engineered fill within the site. Deleterious materials encountered within the fill and deemed geotechnically unsuitable for re-use as compacted fill by the inspecting geotechnical engineer should be screened/removed from the fill material and disposed off-site.

The excavated soils generated from the proposed cuts are not expected to meet the material criteria for engineered fill given above. In this case, the fines content criteria for engineered fill can be increased up to 30% for general backfilling beyond the proposed foundation bearing areas.

Higher fine soil particles content will result in higher sensitivity to moisture and weather and will require more intensive and controlled compaction efforts. On-site soils with higher fines content can be reused as structural fill if appropriate measures are taken to maintain their moisture content within a few percentage points of the optimum water content. These measures include, but are not limited to, screening, aeration, covering or mixing with granular soils to reduce their moisture content and sensitivity to moisture to a more manageable level needed for achieving the specified compaction degree.

The reuse of on-site soils should be performed in accordance with all environmental requirements established for the site, including any restrictions on the reuse of excavated fill material due to concerns regarding contamination.

Reuse of Crushed Demolition Debris

From a geotechnical perspective, demolished concrete/masonry debris free of reinforcing steel and other deleterious materials can be processed and re-used as engineered fill (structural fill) at the site subject to approval by the project environmental consultant. Mixing of recycled concrete with on-site soils for re-use as fill should be evaluated by a qualified geotechnical engineer during construction. These materials should be crushed to meet the material criteria for engineered fill given above. The re-use of any on-site materials should be performed in accordance with any

established environmental requirements for the site, subsequent to environmental testing of these materials and acceptance by the project environmental consultants.

Reuse of Milled Asphalt

The existing asphalt designated for removal can be milled/broken and stockpiled for reuse as pavement subbase in proposed pavement areas, subject to any environmental requirements for reuse of materials at the site. Removed asphalt that will be reused should be broken into a well-graded mixture with pieces having dimensions less than 2 inches in any direction. The Contractor should provide adequate dust control during the milling process. The reuse of asphalt millings at the site should also be reviewed and approved by the project environmental consultant.

Imported Fill

Imported fill should consist of a relatively well-graded mixture of sand and gravel and meet the material criteria for engineered fill (structural fill) given above. Imported fill should be free of organics and other deleterious materials. Imported fill shall be certified clean fill as defined in NJAC 7:26E – Technical Requirements for Site Remediation and shall be free of all extraneous debris or solid waste, and shall not contain free liquids.

The certified clean fill should also be free of any material that meets all criteria or action levels for contaminants without standards, available on the NJDEP's website at www.nj.gov/dep/srp. Grain size distribution, maximum dry density, and the optimum water content determinations should be made on representative samples of the backfill and fill materials proposed by the contractor.

Grain size distribution and Modified Proctor compaction tests (ASTM D1557) should be done on representative samples of the backfill and imported fill material proposed by the contractor. Imported fill should be placed in accordance with the above-described procedure for on-site soils used as compacted structural fill.

Fill Placement and Compaction

All fill should be placed in loose lifts not exceeding 12 inches in thickness and each lift should be compacted to a minimum of 95% of its maximum dry density as determined by the Modified Proctor Test in accordance with ASTM D1557. The compaction criteria can be reduced to 90% of its maximum dry density as determined by ASTM D1557 for non-structural fill placed in landscape areas.

The water content of the fill should be maintained within a few percentages of the optimum water content to achieve the desired compaction. All fill placement should be subject to inspection and testing by a qualified geotechnical engineer. Compaction of all fills should be verified by means of field density tests.

Corrosion Potential

Laboratory chemical tests were performed on two (2) composite samples taken from the upper site soils to evaluate the potential for corrosion of concrete structures and ductile/cast iron pipe. The composite samples were taken from the upper 6 ft for borings LB-14 and SLB-4. The samples were tested for pH levels, redox potential, soil resistivity, sulfide, sulfate and chloride contents. The results of these laboratory tests and a summary of the corrosivity evaluation are provided in Appendix F.

Requirements for Buried Elements

The tested soil samples were found to contain negligible quantities of sulfates and elevated amounts of chloride (221 ppm and 275 ppm). Therefore, we recommend that the structural engineer should evaluate whether the use of Type II (moderate sulfate resistance) or Type V (high sulfate resistance) cement (in lieu of Type I cement) in concrete for foundation components anticipated to come in contact with the existing fill.

Both composite samples had low resistivity values and contained elevated levels of chlorides, indicative of aggressive ground. Based on these results, the existing fill soils are considered to be corrosive to gray and ductile iron based on the evaluation Table X1.1 of ASTM A674-18. Therefore, the ductile iron pipes for the project should be properly protected from corrosion using polyethylene encasement as a passive protective system in accordance with ANSI/AWWA C105/A21.5, or other means as determined by the project civil engineer, architect and MEP engineer.

Any other direct buried elements should be evaluated for corrosion potential.

Protection and Monitoring of Adjacent Structures

Construction activities such as demolition, soil and rock excavation, dewatering, installation of rigid inclusions, and shoring may affect the adjacent structures, if not adequately protected and monitored during construction. It is possible that some movement or perceived movement may occur during construction. Contract documents should clearly state that the contractor is responsible for the repair of any damage to existing structures, which are a result of his construction operations.

For this particular project, the structures of interest for preconstruction conditions documentation and monitoring purposes include adjacent roadways, Cherry Street bridge abutment, Elizabeth River retaining wall, the abandoned railroad on the north and the existing 18-inch-diameter sanitary utility to remain on the eastern portion of the site. The sections of the structures of interest that are within 30 ft of the site should be documented and monitored continuously throughout the excavation and foundation construction phases. Monitoring should include periodic measurements of vibration levels and movement of survey control points.

Pre-Construction Conditions Documentation

We recommend that a thorough pre-construction conditions documentation of the structures of interest be performed by a qualified professional engineer experienced in such documentation work. The documentation will serve as a reference document to assess conditions prior to, during, and after construction. The documentation should include photographs, sketches, and measurements of ambient vibrations. Crack reference gauges/lines and settlement survey control points should be established in advance for monitoring during construction. The survey would serve as a pictorial and quantitative record for future reference.

Vibration

Seismographs should be installed next to the Cherry Street bridge abutment and Elizabeth River retaining wall to monitor vibrations during rock excavation and installation of rigid inclusions. Vibration levels, measured in terms of Peak Particle Velocity (PPV), should be maintained below the allowable limits, which will be determined after preconstruction conditions documentation.

Monitoring During Construction

Lateral and vertical movement survey control points should be established on the structures of interest and temporary SOE elements. These control points should be monitored periodically (i.e. once a week) by the project surveyor during sensitive construction operations such as excavation, underpinning and dewatering, etc. Periodic measurements should be forwarded to the project geotechnical engineer and structural engineer for evaluation. The lateral and vertical movements should not exceed 0.5 inch for temporary shoring or ground beyond the property line and 0.3 inch for nearby structures. The construction procedures should be re-evaluated when the magnitude of the movement reaches half of the allowable value.

A network of movement control points should also be established on cuts and SOE systems and these points should be monitored on frequent regular intervals by the contractor's surveyor during excavation and foundation construction. The results of the surveys should be provided to the project structural and geotechnical engineers. At least 4 control points should be established over each structure of interest and at least 8 points should be established on each exposed face of SOE system.

Claims

The Owner should be prepared to address claims, if any, of adjacent building owners and should be proactive with regard to complaints during the construction process in order to reduce the risk of legal claims. It would be prudent to carry a construction contingency to deal with claims and repairs to the adjacent structures.

Additional Investigation

We recommend the following additional investigation be performed:

- Performing exploratory test pits throughout the site after demolition to determine the extent of buried obstructions.
- The bottom elevation of the Elizabeth River bed should be determined.
- The global stability of the existing Elizabeth River retaining wall (to remain) should be evaluated.

CONSTRUCTION DOCUMENTS AND QUALITY ASSURANCE

Technical specifications and design drawings should incorporate Langan's recommendations. When authorized, Langan will assist the design team in preparing specification sections related to geotechnical issues such as earthwork, pile foundations, backfill and excavation support. Langan should also, when authorized, review drawings prepared by the Structural Engineer, as well as Contractor submittals relating to materials and construction procedures for geotechnical work.

A professional engineer must verify that the soils, rock and groundwater conditions encountered at the site during construction are consistent with those described in this report since all recommendations presented are dependent on this consistency. Failure to verify these conditions could cause the recommendations provided to be no longer valid.

Langan has investigated and interpreted the site subsurface conditions and developed the floor slab design recommendations contained herein, and is therefore best suited to perform quality assurance observation and testing of geotechnical-related work during construction. This work requiring quality assurance confirmation includes, but is not limited to, earthwork, ground improvement, backfill, and excavation support. Recognizing that construction is essentially the completion of design, Langan's quality assurance observation and testing during construction is necessary to maintain our continuity of responsibility on this project.

OWNER AND CONTRACTOR OBLIGATIONS

The Contractor is responsible for construction quality control, which includes satisfactorily constructing the foundation system and any associated temporary works to achieve the design intent while not adversely impacting or causing loss of support to neighboring structures. Construction activities that can alter the existing ground conditions such as excavation, fill placement, foundation construction, ground improvement, shoring installation, dewatering, etc. can also potentially induce stresses, vibrations, and movements in nearby structures and utilities, and disturb occupants of nearby structures. Contractors working at the site must ensure that

their activities will not adversely affect the performance of the structures and utilities, and will not disturb occupants of nearby structures. Contractors must also take all necessary measures to protect the existing structures during construction. By using this report, the Owner agrees that Langan will not be held responsible for any damage to adjacent structures.

The preparation and use of this report is based on the condition that the project construction contract between the Owner and their Contractor(s) will include: 1) Langan being added to the Project Wrap and/or Contractor's General Liability insurance as an additional insured, and 2) language specifically stating the Foundation Contractor will defend, indemnify, and hold harmless the Owner and Langan against all claims related to disturbance or damage to adjacent structures or properties.

LIMITATIONS

The conclusions and recommendations provided in this report are based on subsurface conditions inferred from a limited number of borings and test pits, as well as architectural and structural information provided by the project architect (RSC architects) and the project structural engineer (O'Donnell & Naccarato Structural Engineers). Recommendations provided are dependent upon one another and no recommendation should be followed independent of the others.

Any proposed changes in structures or their locations should be brought to Langan's attention as soon as possible so that we can determine whether such changes affect our recommendations. Information on subsurface strata and groundwater levels shown on the logs represent conditions encountered only at the locations indicated and at the time of investigation. If different conditions are encountered during construction, they should immediately be brought to Langan's attention for evaluation, as they may affect our recommendations.

This report has been prepared to assist the Owner, architect and structural engineer in the design process and is only applicable to the design of the specific project identified. The information in this report cannot be utilized or depended on by engineers or contractors who are involved in evaluations or designs of facilities (including underpinning, grouting, stabilization, etc.) on adjacent properties which are beyond the limits of that which is the specific subject of this report.

Environmental issues are outside the scope of this study and should be addressed in a separate study by qualified professionals.

TABLES

NEW UNION COUNTY GOVERNMENT COMPLEX
ELIZABETH, NJ
#100889101

TABLE 1A- SUMMARY OF BORINGS AT WESTERN PORTION OF THE SITE (BUILDING 1)

ELEVATION (NAVD 88)	NORTHWEST SITE AREA			BUILDING 1 BASEMENT EXTENSION		WEST	BUILDING 1 (WEST BUILDING)					EAST
	SLB-1	B-1	B-2	SLB-2	SLB-3	LB-1	B-4	LB-5 (OW)	LB-3	LB-2	LB-4	LB-6
surface elevation	30.5	31	31	31	35	31	29.5	31.5	31	30.5	28	27
total depth (feet)	13	15	25	20	18	35.1	20	21	22	33	23	25
48						Overhang				Overhang		
47												
46												
45												
44												
43												
42												
41												
40												
39												
38												
37												
36												
35												
34					CONCRETE							
33					21							
32												
31					52			CONCRETE				
30	ASPHALT			CONCRETE		CONCRETE		31	CONCRETE	ASPHALT		
29	9	36	16	8	REFUSAL	8			19	27		
28		REFUSAL		REFUSAL	REFUSAL	16	9	24				
27	21	CONCRETE	11	REFUSAL				qu = 1 tsf	31	30	CONCRETE	
26						17	23	22		qu = 2 tsf	24	CONCRETE
25	REFUSAL	24	16	REFUSAL				qu = 0.75 tsf	14	20		32
24					REC = 93%	30	43	50		qu = 1 tsf	22	
23		55	16	REFUSAL	RQD = 25%				29	38		17
22						REFUSAL	REFUSAL	REFUSAL		qu = 1.5 tsf	27	
21	REC = 88%		8	REFUSAL		REFUSAL			REFUSAL	REFUSAL		36
20	RQD = 18%	REFUSAL			REC = 97%		REFUSAL				23	qu = 2 tsf
19			41		RQD = 23%			REC = 92%	REFUSAL	REFUSAL	qu = 1.5 tsf	43
18		REC = 83%					REFUSAL	RQD = 25%			REFUSAL	
17		RQD = 41%							REC = 77%			REFUSAL
16						REFUSAL			RQD = 18%			
15												
14			REFUSAL	REC = 93%				REC = 93%		REFUSAL		
13				RQD = 48%			REFUSAL	RQD = 43%			REFUSAL	
12									REC = 98%			REFUSAL
11						REFUSAL	REF = 100%		RQD = 60%			
10							RQD = 42%					REC = 63%
9			REFUSAL							REFUSAL		RQD = 9%
8											REC = 95%	
7											RQD = 68%	
6						REFUSAL						
5										REC = 92%		REC = 93%
4			REFUSAL							RQD = 68%		RQD = 45%
3												
2												
1						REFUSAL						
0										REC = 100%		
-1						REC = 87%				RQD = 70%		
-2						RQD = 67%						
-3												
-4												
-5												

Proposed Level 2 at approx. el 48

Proposed Adjacent Grades range between el 22 and el 33

Proposed Adjacent Grades range between el 22 and el 33

Proposed Level 0 at el 18.15

COLOR LEGEND

FILL

CLAY
silty CLAY

SILT
clayey SILT
sandy SILT

DECOMPOSED ROCK

ROCK

NOTES

1. Subsurface information provided is generalized and is shown for illustration purposes only.
2. Refer to location plan for actual locations.
3. Refer to logs for actual soil descriptions and details.
4. The N-values tabulated are in blows/ft.

LEGEND

REFUSAL	Split Spoon Refusal Value
REC	Total Rock Core Recovery
RQD	Rock Quality Designation
qu	Unconfined compressive strength as measured in the field by a pocket penetrometer
(OW)	Groundwater Level Observation Well Location
▽	Measured Groundwater Level

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NEW UNION COUNTY GOVERNMENT COMPLEX
ELIZABETH, NJ
#100889101

TABLE 1B- SUMMARY OF BORINGS AT EASTERN PORTION OF THE SITE (BUILDING 2)

	NORTH AND EAST PERIMETER					WEST	BUILDING 2 (EAST BUILDING)										EAST	
	SLB-4	SLB-5	SLB-7	SLB-6	B-6	LB-7	LB-9	B-5	LB-12	LB-8	LB-10	LB-13	LB-15	B-3	LB-11 (OW)	LB-14	
surface elevation	28.5	22	21.5	20	20.5	25	25	24.5	23.5	25	25	21	21.5	23	21.5	18.5	
total depth (feet)	18	7	25	23	25	50	27	30	20	27.5	26	23	27	30	27	26	
33						Overhang			Overhang	Overhang		Overhang	Overhang	Overhang	Overhang	Overhang	Proposed Level 1
32																	at el 32.15
31																	
30																	
29																	
28	ASPHALT																
27	32																
26	12																
25																	
24	14					CONCRETE	ASPHALT	13		CONCRETE	CONCRETE						
23						26	20		ASPHALT	11	11						
22	25					30	19	9	10	20	25			14			
21		ASPHALT	ASPHALT				qu = 1.5 tsf						ASPHALT		ASPHALT		Proposed Level 0
20	33	38	27			19	24	18	15	15	23	ASPHALT	18	REFUSAL			or proposed adjacent grades
19	qu = 1 tsf	48	20	ASPHALT	11		qu = 3.5 tsf					14	REFUSAL				at approximately el 18
18	49			48		17	40	32	36	8	56			4		ASPHALT	
17	qu = 1.5 tsf	20	8	15	15							39	REFUSAL			29	
16			qu = 2.50 tsf			17	71	19	52	6	30		qu = 0.50 tsf	2		28	
15		REFUSAL	REFUSAL	12	3							15	14		30		
14						48	REFUSAL	83	REFUSAL	15	42		qu = 1.50 tsf	W O H		51	
13	REFUSAL		REFUSAL	6	16				REFUSAL			11	61		15		
12														REFUSAL		20	
11	REFUSAL			5	13							9	21				
10			CONCRETE	qu = 1 tsf			REFUSAL					qu = 1 tsf			24	6	
9				8	5	REC = 93%		REFUSAL		6	6	6					
8				qu = 0.50 tsf		RQD = 33%				qu = 1 tsf	qu = 1 tsf	qu = 0.50 tsf				7	
7									REC = 98%					12		qu = 0.75 tsf	
6			8				REC = 88%		RQD = 31%				9		7		
5			qu = 0.25 tsf				RQD = 38%						qu = 0.75 tsf				
4				REFUSAL	4			REFUSAL			REFUSAL	REFUSAL					
3										REFUSAL						3	
2			71								REC = 85%		50	29		qu = 0.50 tsf	
1							REC = 95%				RQD = 32%	REC = 100%	qu = 2.50 tsf		REFUSAL		
0				REFUSAL			RQD = 67%	REFUSAL		REC = 85%		RQD = 48%					
-1					REFUSAL					RQD = 48%							
-2								REC=100%						REF	REC = 85%	REFUSAL	
-3			REFUSAL	REFUSAL				RQD = 70%					REC = 100%		RQD = 15%		
-4													RQD = 47%	REC = 83%		REC = 100%	
-5														RQD = 41%		RQD = 50%	
-6					REF												
-7																	
-8																	

COLOR LEGEND
FILL
CLAY
silty CLAY
SILT
clayey SILT
sandy SILT
GRAVEL
SAND and GRAVEL
DECOMPOSED ROCK
ROCK

NOTES

1. Subsurface information provided is generalized and is shown for illustration purposes only.
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3. Refer to logs for actual soil descriptions and details.
4. The N-values tabulated are in blows/ft.

LEGEND

REFUSAL	Split Spoon Refusal Value
REC	Total Rock Core Recovery
RQD	Rock Quality Designation
W.O.H.	Weight of Hammer
qu	Unconfined compressive strength as measured in the field by a pocket penetrometer
(OW)	Groundwater Level Observation Well Location
▼	Measured Groundwater Level

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Union County Government Complex **As of 2021-06-28**

Elizabeth, New Jersey

#100889101

TABLE 2 - SUMMARY OF GROUNDWATER MEASUREMENTS

DATE	TIME	LB-5 (OW) Ground surface @ EL 31.5		LB-11 (OW) Ground surface @ EL 21.5		REMARKS
		DEPTH TO WATER (ft)	WATER LEVEL ELEVATION (el)	DEPTH TO WATER (ft)	WATER LEVEL ELEVATION (el)	
20-May-21	13:08	0.0	31.5			Installed well and flushed well with water.
	14:25	7.4	24.1			
21-May-21	8:05	12.1	19.4			
	8:10	15.0	16.5			After bailing dry
	8:20	14.0	17.5			
24-May-21	7:00	13.5	18.0			
	13:00					Installed well
	14:18			14.0	7.5	
	14:24			16.2	5.3	After bailing 10 full bailers, 3 clean water, 7 silty water
25-May-21	7:00			16.4	5.1	
	14:15			12.2	9.3	
	14:25			18.0	3.5	After bailing 10 full bailers
	14:30	13.5	18.0			
	14:35	15.0	16.5			After bailing dry
26-May-21	6:55	13.5	18.0			
	7:00			16.5	5.0	
	2:20			16.5	5.0	
	14:25			18.9	2.6	After bailing 10 full bailers
	14:30	13.5	18.0			
	14:35	15.0	16.5			After bailing dry
27-May-21	6:50	13.5	18.0			
	6:55			16.5	5.0	
	14:35			16.5	5.0	
7-Jun-21	14:30	12.4	19.1	16.1	5.4	Bailed after readings
8-Jun-21	14:10	12.4	19.1	16.2	5.3	Bailed after readings
9-Jun-21	14:30	12.1	19.4	16.2	5.3	
28-Jun-21	14:50	13.0	18.5	16.3	5.2	

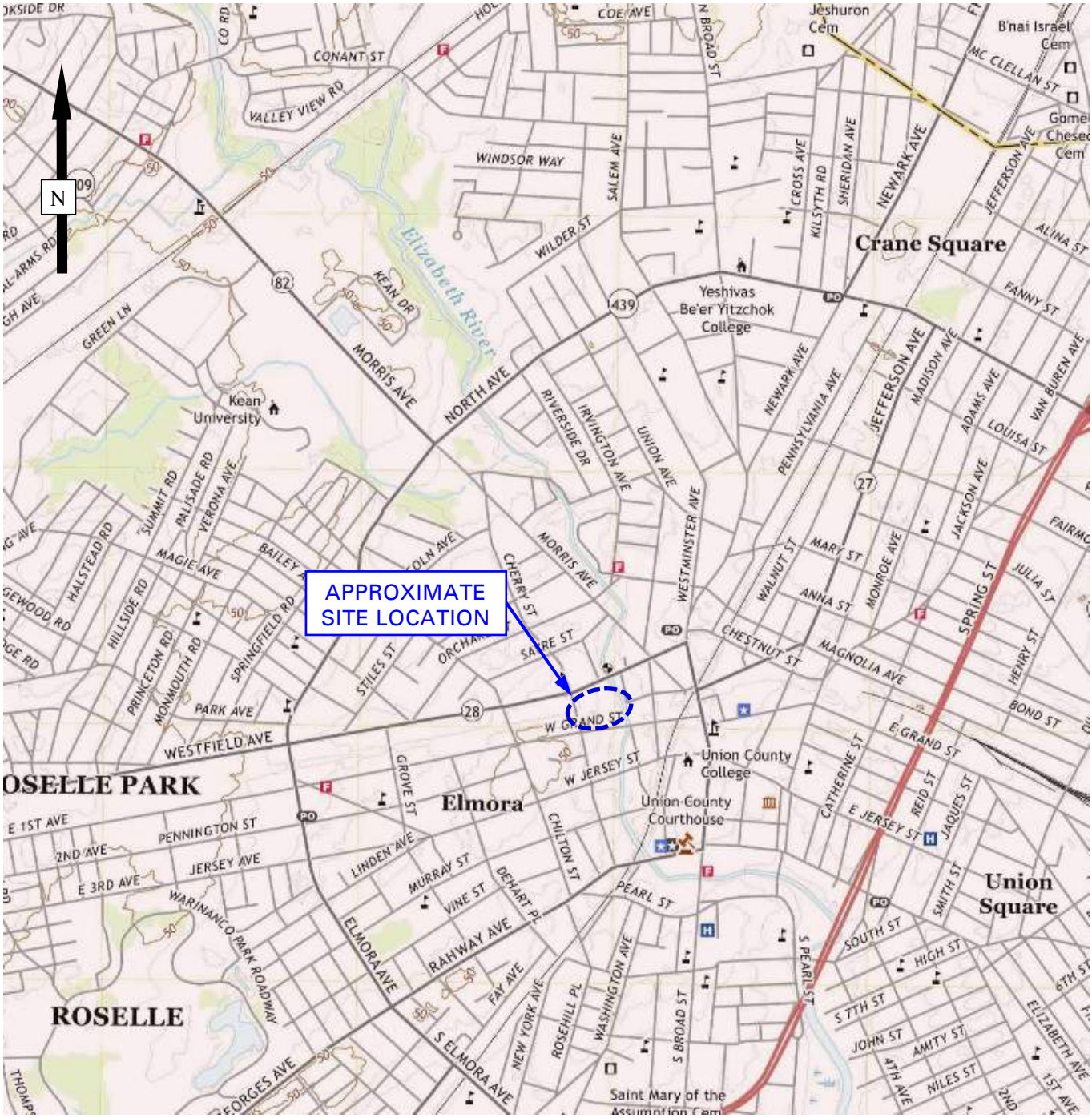
NOTES

1- Permanent groundwater level observation wells were installed in completed boreholes LB-5 and LB-11.

2- The observation well in LB-5 consisted of 2-inch diameter, 10ft long screened PVC and a 5ft riser.

3- The observation well in LB-11 consisted of 2-inch diameter, 10 ft long screened PVC and 10ft solid riser.

LIST OF FIGURES



Source: United States Geological Survey (USGS) – Elizabeth Quadrangle 2019

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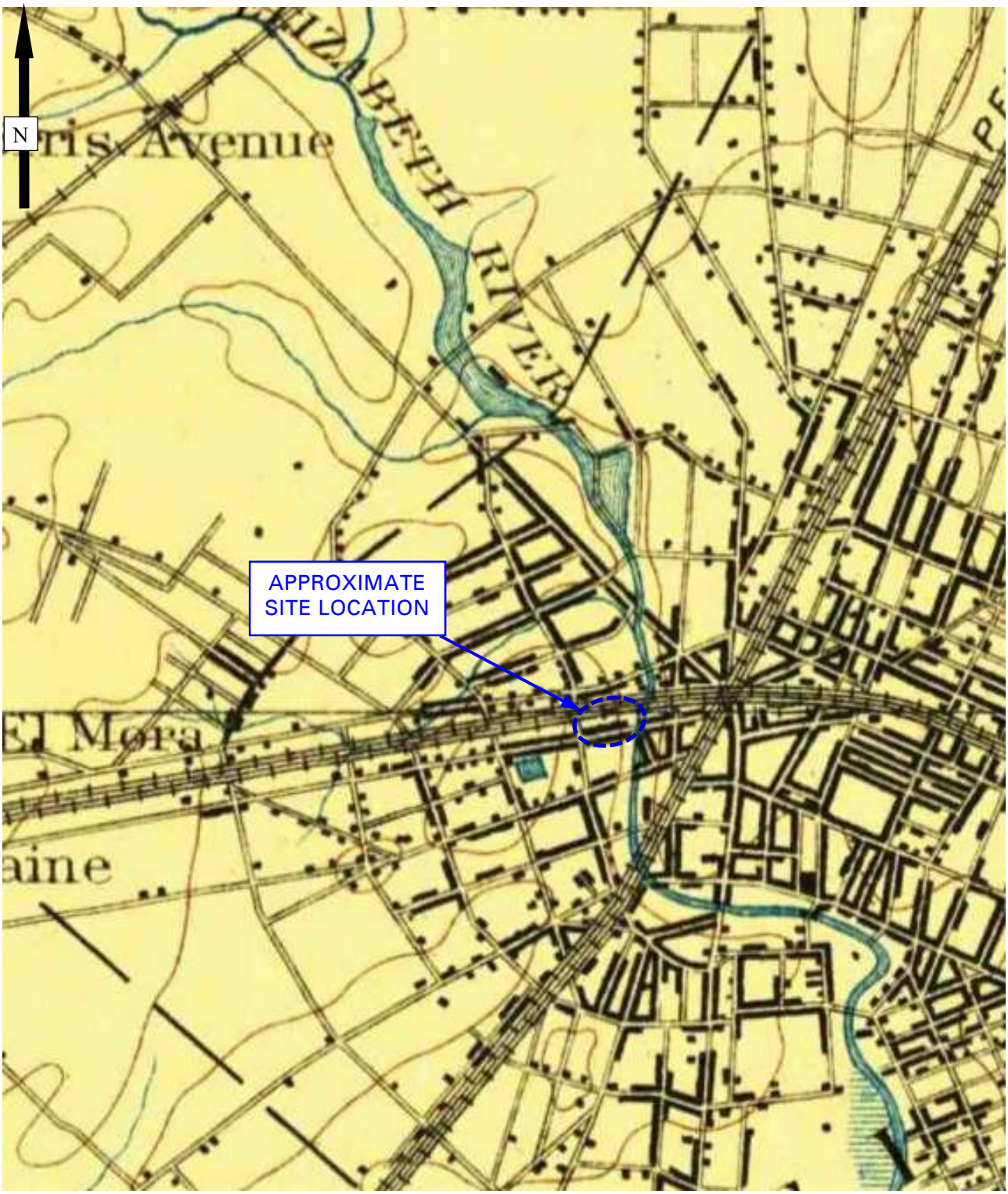
NEW UNION COUNTY GOVERNMENT COMPLEX

SITE LOCATION MAP

ELIZABETH **NEW JERSEY**

PROJECT NO.	SCALE	DATE	FIGURE
100889101	N.T.S.	06/19/2021	1

\\langan.com\data\PAR\data1\100889101\Project Data_Discipline\Geotechnical\Reports\Figures\Figure 1 - Site Location Map.docx



Source: United States Geological Survey (USGS) – Staten Island Quadrangle (1898)

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NEW UNION COUNTY GOVERNMENT COMPLEX

HISTORIC USGS MAP

ELIZABETH **NEW JERSEY**

PROJECT NO.	SCALE	DATE	FIGURE
100889101	**N.T.S.**	**6/19/2021**	**2**

LEGEND

Qwtr – Rahway Till – Clayey silt to sandy silt with some to many pebbles and cobbles and few boulders; reddish brown, reddish yellow, yellowish brown, brown. As much as 100 feet thick, generally less than 40 feet thick

Qwlb – Late Wisconsinan Glacial Lake-Bottom Deposits – silt, clay, fine sand; gray, brown, yellowish-brown, reddish-brown. As much as 200 feet thick.

Source: NJDEP, NJ-GeoWeb interactive maps

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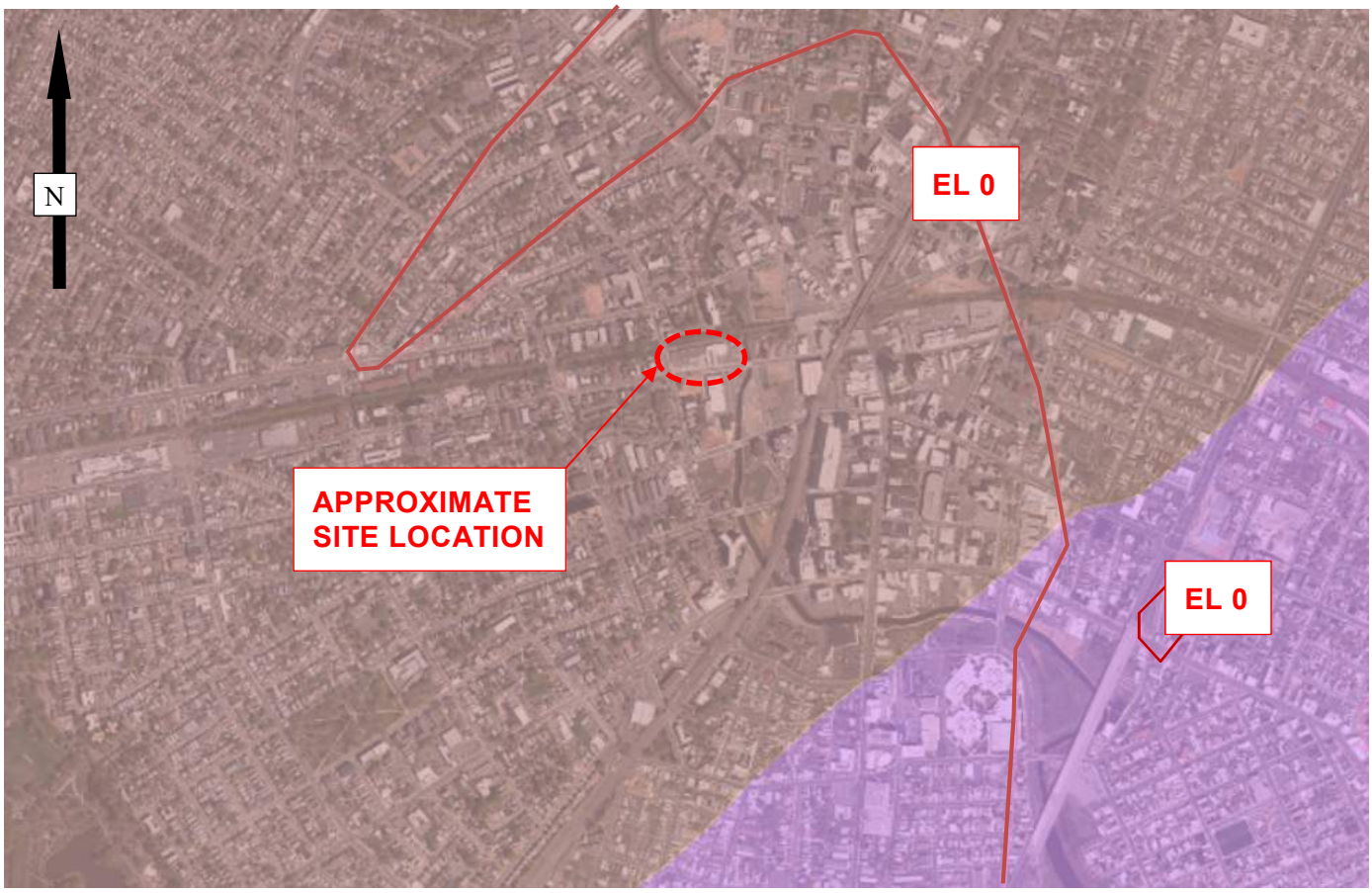
NEW UNION COUNTY GOVERNMENT COMPLEX

SURFICIAL GEOLOGY MAP

ELIZABETH **NEW JERSEY**

PROJECT NO.	SCALE	DATE	FIGURE
100889101	**N.T.S.**	**3/19/2021**	**3A**

\\langan.com\data\PAR\data1\100889101\Project Data_Discipline\Geotechnical\Reports\Figures\Figure 3A - Surficial Geology Map.docx



LEGEND

JTrpms – Passaic Formation Mudstone facies– sandy mudstone

JTrp – Passaic Formation – siltstone and shale

Bedrock – Subsurface Topography (top of rock elevation)

Source: NJDEP, NJ-GeoWeb interactive maps

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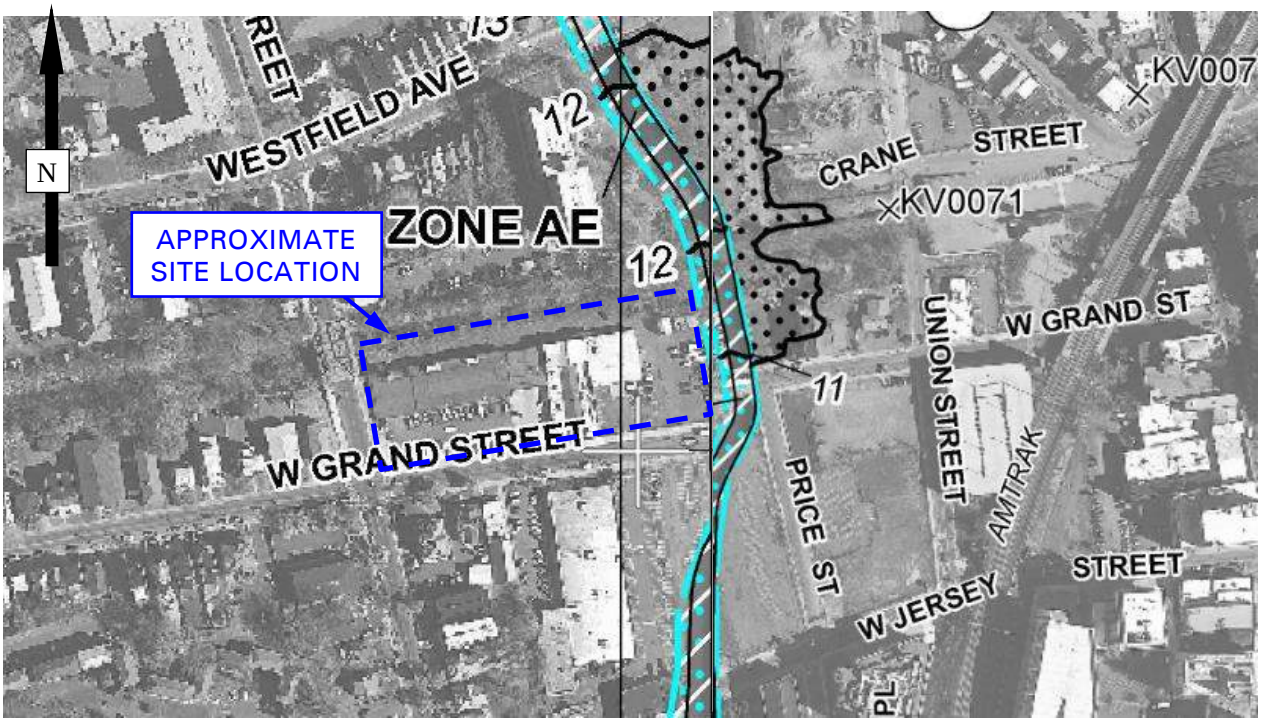
NEW UNION COUNTY GOVERNMENT COMPLEX

GEOLOGIC BEDROCK MAP

ELIZABETH **NEW JERSEY**

PROJECT NO.	SCALE	DATE	FIGURE
100889101	**N.T.S.**	**3/19/2021**	**3B**



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- New Jersey Flood Hazard Area Design Flood (NJFHADF)
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Limit of Moderate Wave Action
- 513 (EL. 987) — Base Flood Elevation line and value; elevation in feet*; Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- Cross section line
- Limited detail cross section line
- Transect line
- 87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 1000-meter Universal Transverse Mercator grid values, zone 18
- 600000 FT — 5000-foot grid values: New Jersey State Plane coordinate system (FIPSZONE 2900), Transverse Mercator projection
- DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

Source: FEMA Preliminary FIRM, Panels: 34039C0023G, and 34039C0024G 2/3/2015

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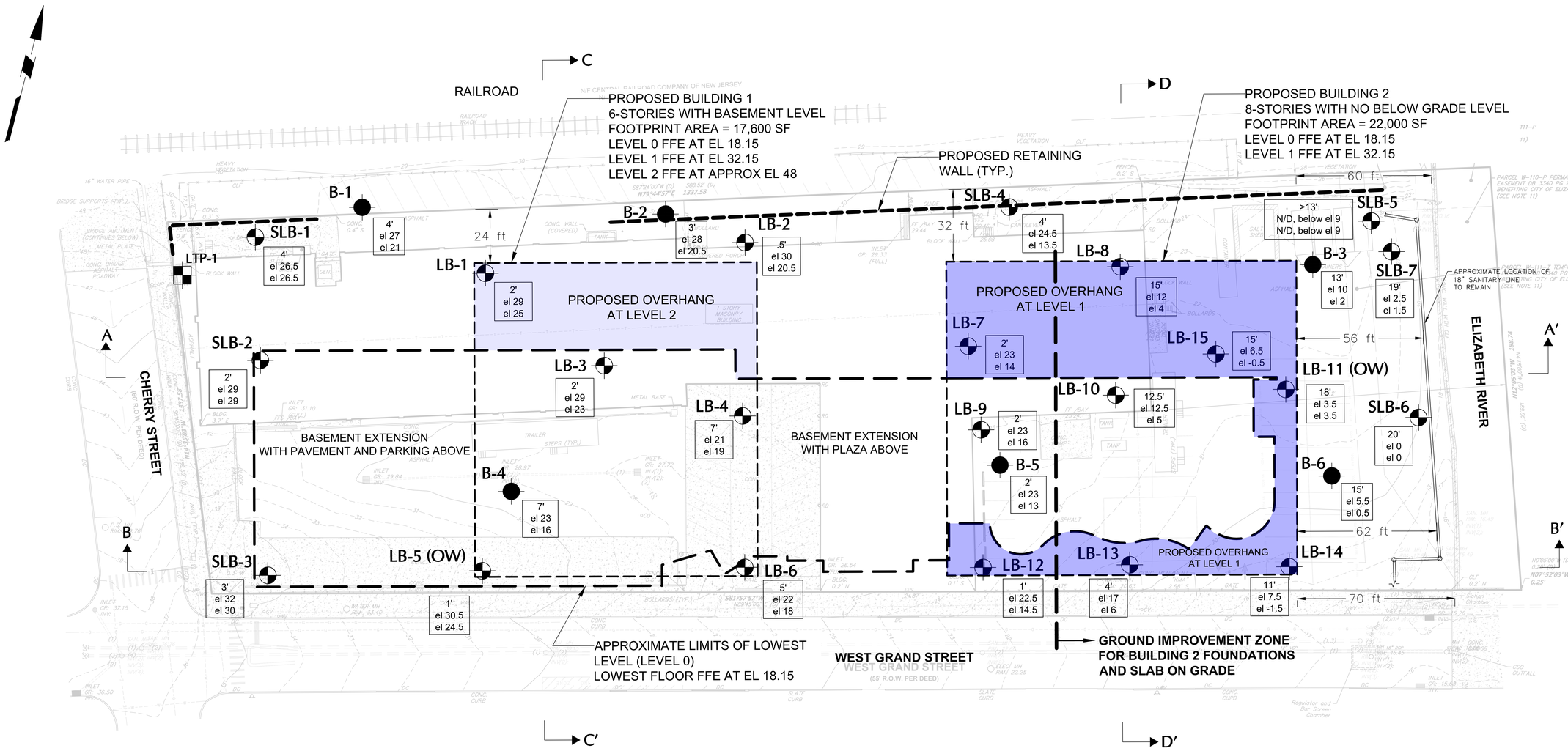
NEW UNION COUNTY GOVERNMENT COMPLEX

FEMA FLOOD MAP

ELIZABETH **NEW JERSEY**

PROJECT NO.	SCALE	DATE	FIGURE
100889101	N.T.S.	6/28/2021	4



NOTES

1. BASE PLAN IS TAKEN FROM DRAWING ENTITLED, "BOUNDARY & TOPOGRAPHIC SURVEY 61-99 WEST GRAND STREET TAX ACCOUNT: 6-1589 CITY OF ELIZABETH" DATED 24 JULY 2019, PREPARED BY NEGLIA ENGINEERING ASSOCIATES.
2. THE ELEVATIONS AND DIMENSIONS SHOWN ARE APPROXIMATE AND BASED ON ABOVE-REFERENCED DRAWING, WHICH REFERS TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)
3. BUILDING INFORMATION WAS OBTAINED FROM DRAWING ENTITLED "NEW UNION COUNTY GOVERNMENT COMPLEX - GRADING PLAN" PREPARED BY LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC (LANGAN) DATED 11 JUNE 2021.
4. LB AND SLB SERIES BORINGS WERE PERFORMED BETWEEN 19 MAY AND 9 JUNE 2021 BY CRAIG GEOTECHINCAL DRILLING (CRAIG) UNDER FULL-TIME OBSERVATION OF LANGAN.
5. TEST PIT LTP-1 WAS PERFORMED ON 24 MAY 2021 BY ATA CONSTRUCTION UNDER FULL-TIME OBSERVATION OF LANGAN.
6. BORINGS B-1 THROUGH B-6 WERE DRILLED BY FRENCH & PARRELLO ASSOCIATES (FPA) IN 2019.
7. ALL LOCATIONS, ELEVATIONS, DIMENSIONS, BUILDING LIMITS AND BUILDING INFORMATION ARE APPROXIMATE AND SHALL BE VERIFIED IN FIELD.

LEGEND

LB-1	APPROXIMATE 2021 LANGAN BORING LOCATION
LTP-1	APPROXIMATE 2021 TEST PIT LOCATION
B-1	APPROXIMATE BORING LOCATION BY FPA IN 2019
4' / el 27 / el 21	APPROXIMATE FILL THICKNESS IN FEET APPROXIMATE TOP ELEVATION OF NATURAL SOILS APPROXIMATE TOP ELEVATION OF DECOMPOSED ROCK
(N/D)	NOT DETERMINED
(OW)	GROUNDWATER OBSERVATION WELL LOCATION
A A′	APPROXIMATE SUBSURFACE PROFILE LOCATION
	APPROXIMATE LIMITS OF LOWEST LEVEL (LEVEL 0)
	APPROXIMATE LIMITS OF BUILDING FOOTPRINTS ABOVE LEVEL 2
	APPROXIMATE LIMITS BUILDING 1 OVERHANG AT LEVEL 2 (PAVEMENT AT PROPOSED GROUND SURFACE BETWEEN EL 25 AND EL 30)
	APPROXIMATE LIMITS OF BUILDING 2 OVERHANG AT LEVEL 1 (PAVEMENT OR CONCRETE HARDSCAPES AT PROPOSED GROUND SURFACE BETWEEN EL 17 AND EL 18)

SCALE: 1 INCH = 20 FEET

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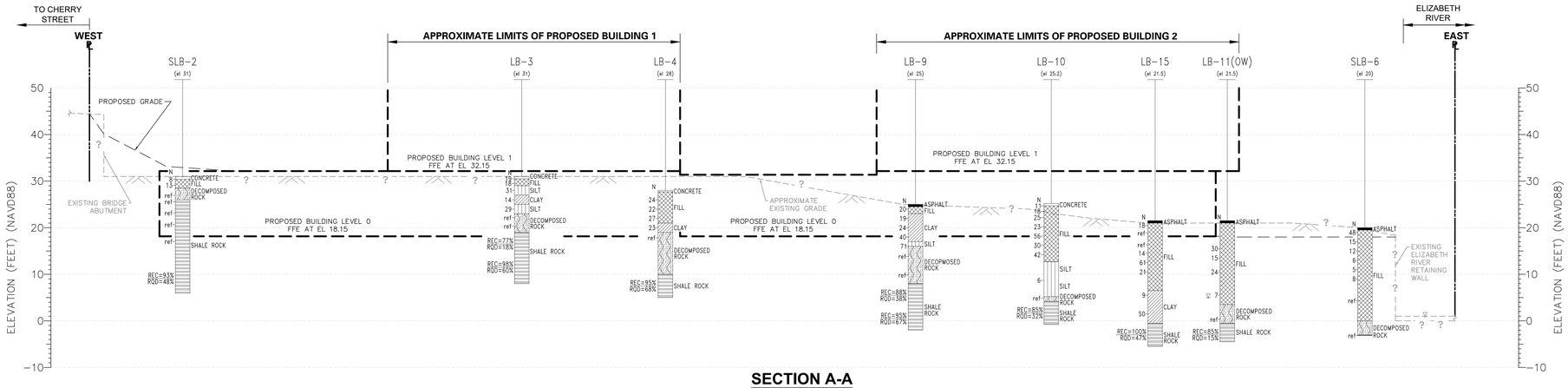
NJ CERTIFICATE OF AUTHORIZATION NO. 24GA27996400

Project
NEW UNION COUNTY GOVERNMENT COMPLEX
ELIZABETH
UNION COUNTY NEW JERSEY

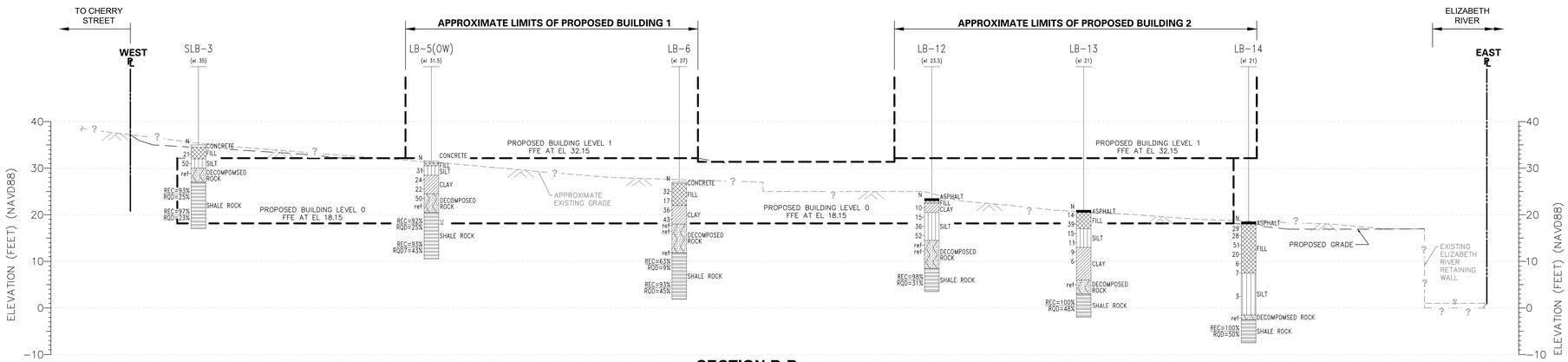
Drawing Title
LOCATION PLAN

Project No. 100889101	Figure 5
Date 07/01/2021	
Drawn By VAR	
Checked By BCE	

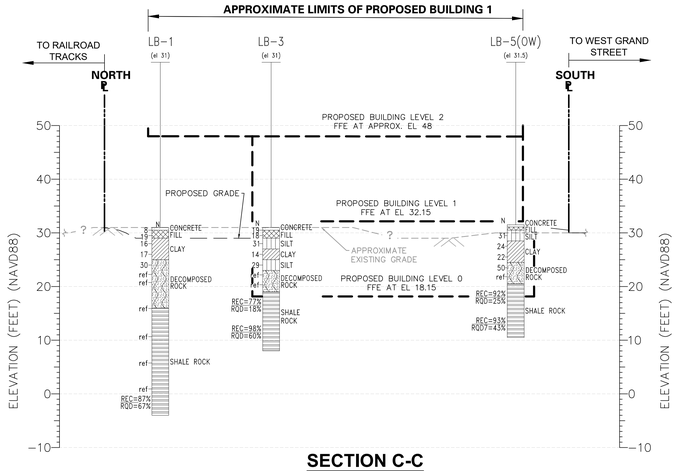
Project No. 100889101



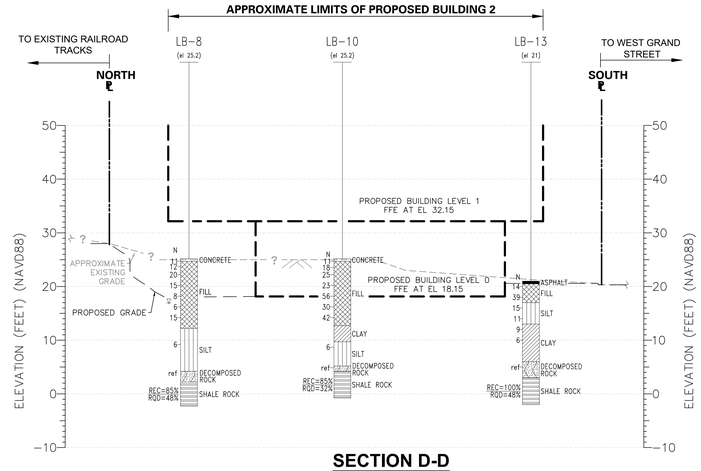
SECTION A-A
VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 20'
FACING NORTH



SECTION B-B
VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 20'
FACING NORTH



SECTION C-C
(BUILDING 1)
VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 20'
FACING EAST



SECTION D-D
(BUILDING 2)
VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 20'
FACING EAST

LB/SLB/B-# (el. xx) — Borehole Number (elevation)
Standard Penetration Resistance in blows/ft — N
Lithology

▽ Observed Groundwater Level in Well
(OW) Observed Groundwater Level in Well
ref Split Spoon Refusal (100 blows per 6 inches or less)
REC Total Rock Core Recovery Value
RQD Rock Quality Designation Value

Lithology Graphics

ASPHALT · CONCRETE · FILL · CLAY · SILT · DECOMPOSED ROCK · SHALE ROCK

NOTES

1. REFERENCE SURVEY IS TAKEN FROM PLAN ENTITLED "BOUNDARY & TOPOGRAPHIC SURVEY 61-99 WEST GRAND STREET TAX ACCOUNT: 6-1589 CITY OF ELIZABETH" DATED 24 JULY 2019, PREPARED BY NEGLIA ENGINEERING ASSOCIATES.
2. THE ELEVATIONS AND DIMENSIONS SHOWN ARE APPROXIMATE AND BASED ON THE ABOVE-REFERENCED SURVEY DRAWING, WHICH REFERENCES THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. BUILDING INFORMATION WAS OBTAINED FROM DRAWING ENTITLED "NEW UNION COUNTY GOVERNMENT COMPLEX - GRADING PLAN" PREPARED BY LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC (LANGAN) DATED 11 JUNE 2021.
4. LB AND SLB SERIES BORINGS WERE PERFORMED BETWEEN 19 MAY AND 9 JUNE 2021 BY CRAIG GEOTECHNICAL DRILLING, INC. (CRAIG) UNDER THE FULL-TIME OBSERVATION OF LANGAN.
5. THIS PROFILE IS A GENERALIZED SOIL CROSS SECTION INTERPRETED FROM WIDELY SPACED BORINGS. SOIL AND GROUNDWATER MAY VARY IN TYPE, LOCATION, ELEVATION AND ENVIRONMENTAL AND ENGINEERING PROPERTIES BETWEEN POINTS OF EXPLORATION. VARIATIONS IN SUBSURFACE CONDITIONS SHOULD BE EXPECTED BETWEEN BORINGS.
6. REFER TO BORING LOGS FOR DETAILED DESCRIPTIONS OF BORINGS.
7. REFER TO FIGURE 5 FOR BORING LOCATION PLAN.

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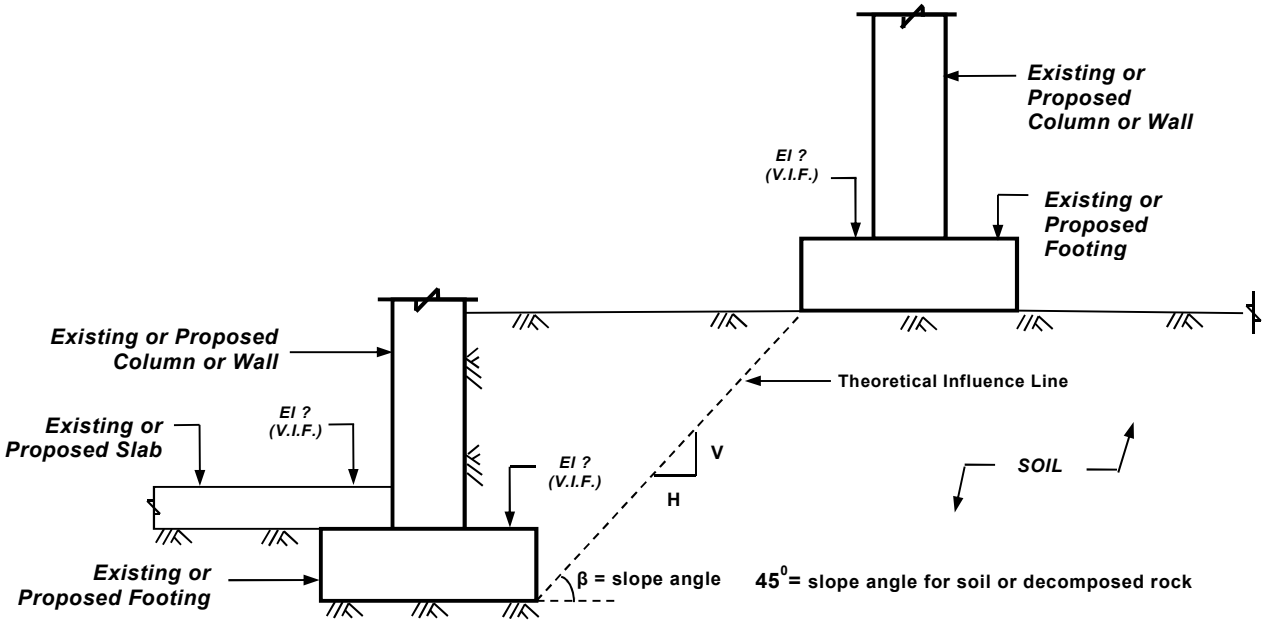
NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400

Project: NEW UNION COUNTY GOVERNMENT COMPLEX
ELIZABETH
UNION COUNTY NEW JERSEY

Drawing Title: SUBSURFACE PROFILES

Project No. 100889101
Date 07/01/2021
Drawn By AC
Checked By JJ
Figure 6

EXISTING OR PROPOSED ADJACENT FOOTINGS

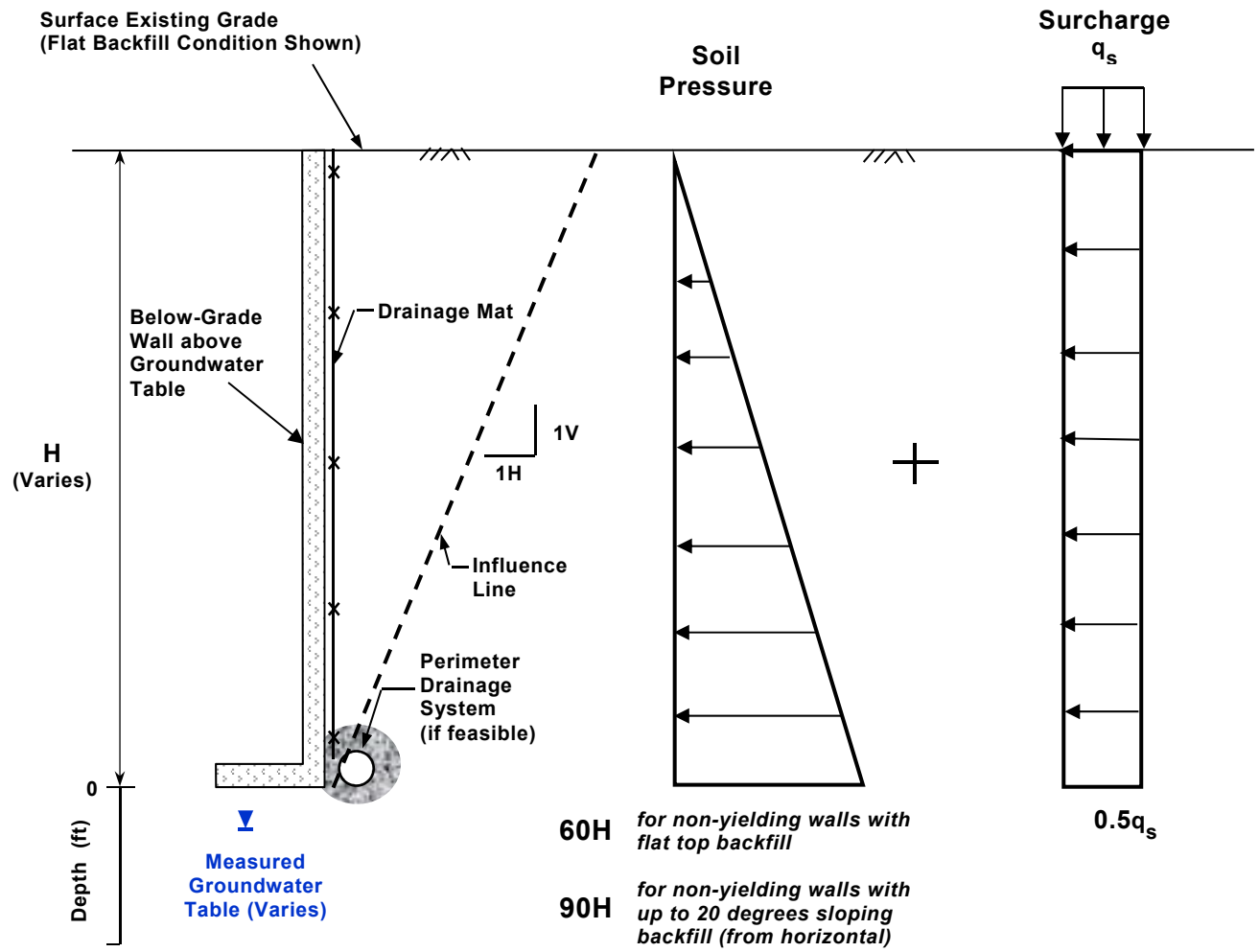


NOTES

1. The adjacent footing bearing on soil shall be positioned in a manner that the vertical distance between the wall and footing bases is equal to or less than the horizontal distance.

2. If the above recommendations are not satisfied, special measures reviewed by the geotechnical engineer are needed.

3. As-built conditions and elevations of existing foundations and walls should be verified in the field by the contractor.



NOTES

1. Diagram shows all components of lateral pressures and applicable to walls above the groundwater table with flat backfill only. For structures with seismic design category C or better, seismic pressures do not need to be taken into account
2. All surcharge loads within the theoretical zone of influence of the wall should be considered in the design, including the adjacent structure loads.
3. H is the height of below-grade wall in feet. Pressures are in pounds per square foot and are given per unit width of wall.
4. q_s is the surcharge including surface and adjacent building loads, if any.
5. Earth pressures are based on “at rest” conditions and are applicable to relatively rigid foundation walls (i.e. walls braced by floors).
6. Base of wall is assumed to be above the groundwater table. A prefabricated composite drainage mat should be installed. Where feasible, consider also installing a base perimeter drainage pipe with discharge outlet.

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NEW UNION COUNTY GOVERNMENT COMPLEX

LATERAL PRESSURE DIAGRAM FOR BUILDING BELOW GRADE WALLS

ELIZABETH NEW JERSEY

PROJECT NO	SCALE	DATE	FIGURE
100889101	N.T.S	07/01/2021	8

APPENDIX A

Logs of 2021 Langan Building Borings

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Log of Boring **LB-1** Sheet 1 of 2

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 31
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 06/07/2021 — Date Finished: 06/08/2021
Drilling Equipment: CME-55 Rubber Track Mounted Drill Rig	Completion Depth: 35.1 ft — Rock Depth: 6 ft
Size and Type of Bit: 3-7/8in Tricone Roller Bit	Number of Samples: Disturbed 10 — Undisturbed - — Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 4	Water Level (ft.): First ▽ 6 — Completion ▼ - — 24 HR. ▼ -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Mike Tarter
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rodrigo Fernandez Santoyo
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+31.0			0						
	+30.5	CONCRETE								Started Drilling at 10:30 AM on 6/7/2021. Drlled through approximately 6-inch-thick concrete slab with scraper bit.
		Reddish brown sandy SILT, trace clay, trace fine gravel (moist) [FILL]		1	S-1	SS	12	4 4 15	8	S-1 at 0.5ft
	+29.0	Reddish brown silty CLAY, some f-m sand, trace fine gravel (moist) [CL]		2	S-2	SS	12	20 9 7 7	16	S-2 at 2ft q_u=0.75 tsf (PP)
		Reddish brown silty CLAY, some f-c sand (moist) [CL]		3						
				4	S-3	SS	8	28 8 9 12	17	Drove casing to 4.0ft. Drilled to 4.0ft. Reddish brown wash. S-3 at 4ft q_u=0.75 tsf (PP)
	+25.0		▽	5						
		DECOMPOSED ROCK in form of reddish brown SILT, some friable rock fragments, trace f-c sand, trace clay (wet) [DECOMPOSED ROCK]		6	S-4	SS	24	12 10 20 20	30	S-4 at 6ft
		DECOMPOSED ROCK in form of reddish brown silty f-c SAND, some friable rock fragments, trace clay (wet) [DECOMPOSED ROCK]		7						
				8	S-5	SS	6	23 50/3	50/3	Drilled to 8.0ft. Reddish brown wash. S-5 at 8ft Hard drilling from 9ft
		DECOMPOSED ROCK in form of reddish brown silty f-c SAND, some friable rock fragments (wet) [DECOMPOSED ROCK]		9						
				10	S-6	SS	2	70/3	70/3	Drilled to 10.0ft. Reddish brown wash. S-6 at 10ft
				11						
				12						
				13						
				14						
	+16.0			15	S-7	SS	1	50/1	50/1	Drilled to 15.0ft. Reddish brown wash. Intermittent easy drilling. S-7 at 15ft
		Reddish brown ROCK FRAGMENTS (wet) [PROBABLE ROCK]		16						
				17						
				18						
				19						
				20	S-8	SS	2	80/4		

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Log of Boring **LB-1** Sheet 2 of 2

Project	Project No.
New Union County Government Complex	100889101
Location	**Elevation and Datum**
61-99 West Grand Street	Approx el. 31

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+11.0	Reddish brown ROCK FRAGMENTS, some silty f-c sand (wet) [PROBABLE ROCK]		20					80/4	Drilled to 20.0ft. Reddish brown wash. Intermittent easy drilling. S-8 at 20ft.
				21						
				22						
				23						
				24						
				25	S-9	SS	2	50/3	50/3	Drilled to 25.0ft. Reddish brown wash. Intermittent easy drilling. S-9 at 25ft
		Reddish brown ROCK FRAGMENTS (wet) [PROBABLE ROCK]		26						
				27						
				28						
				29						
				30	S-10	SS	1	80/1	80/1	Drilled to 30.0ft. Hard drilling. S-10 at 30ft C-1 at 30.08ft
			6:06	31	C-1	NX Core	REC=52"/60" =87%	RQD=40"/60" =67%		
			7:10	32						
		Reddish brown SHALE; close fracture spacing; fractures near horizontal; massive; clay in fractures [ROCK]	6:10	33						
			3:18	34						
			5:01	35						
	-4.0	End of boring at 35 ft.		36						Finsihed drilling at 2:45 PM on 6/8/2021. Boring grouted upon completion and surface patched with concrete.
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

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Log of Boring **LB-2** Sheet 1 of 2

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 30.5
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/27/2021 — Date Finished: 05/27/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 33 ft — Rock Depth: 10 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 8 — Undisturbed - — Core 2
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 8	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks
	+30.5								10 20 30 40	
	+30.0	Asphalt		0						Started Drilling at 5/27/2021 11:07 AM. S-1 at 0ft
		Brown CLAY, some silt, trace f-m sand (moist)[ML]		1	S-1	SS	6	6, 14, 13, 8	27	
		Reddish brown CLAY, trace silt, trace f-m sand (moist)[CL]		2	S-2	SS	7	12, 16, 14, 20	30	S-2 at 2ft q_u=2.00 tsf (PP)
		Reddish brown CLAY, some silt, trace f-m sand (moist)[CL]		3						
				4	S-3	SS	10	12, 11, 9, 11	20	Drive casing to 4.0ft. Drill to 4.0ft. S-3 at 4ft q_u=1.00 tsf (PP)
		Reddish brown CLAY, some silt, trace f-m sand, trace fine gravel (moist)[CL]		5						
		[wc=1.3% ; LL=32, PL=17. PI = 15]		6	S-4	SS	16	16, 16, 22, 21	38	S-4 at 6ft q_u=1.50 tsf (PP)
	+22.5	Reddish brown SILT, some f-c sand, trace clay, trace gravel (moist)[ML]		7						
				8	S-5	SS	16	13, 31, 69, 50/2	100	Drive casing to 8.0ft. Drill to 8.0ft. S-5 at 8ft
	+20.5	DECOMPOSED ROCK in form of reddish brown to gray SILT, trace clay, with rock pieces (wet)[DECOMPOSED ROCK]		9						
				10	S-6	SS	3	100/5	100/5	Drill to 10.0ft. S-6 at 10ft
				11						
				12						
				13						
				14						
		DECOMPOSED ROCK in form of reddish brown to gray SILT, some clay, with rock pieces (wet)[DECOMPOSED ROCK]		15	S-7	SS	14	79, 53, 50/2	50/2	Drill to 15.0ft. S-7 at 15ft
				16						
				17						
				18						
				19						
				20						

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Log of Boring **LB-2** Sheet 2 of 2

Project	Project No.
New Union County Government Complex	100889101
Location	**Elevation and Datum**
61-99 West Grand Street	Approx el. 30.5

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+10.5	DECOMPOSED ROCK in form of reddish brown to gray GRAVEL, some silt, trace clay (wet)[DECOMPOSED ROCK]		20	S-8	SS	16	44 67 100	167	Drill to 20.0ft. S-8 at 20ft
	+7.5	Reddish brown to gray fractured SHALE [ROCK]	3:07 4:43 3:28 6:50 11:51	23 24 25 26 27	C-1	NX Core	REC=55"/60" =92%	RQD=41"/60" =68%		Drill to 23.0ft. C-1 at 23ft
		Reddish brown to gray fractured SHALE [ROCK]	2:52 2:30 2:45 2:50 4:06	28 29 30 31 32	C-2	NX Core	REC=60"/60" =100%	RQD=42"/60" =70%		C-2 at 28ft
	-2.5	End of boring at 33 ft.		33 34 35 36 37 38 39 40 41 42 43 44 45						Bottom of boring at 5/27/2021 12:56 PM. Boring grouted upon completion. Surface patched with concrete.

N-Value (Blows/ft) scale: 10 20 30 40

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Log of Boring **LB-3** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 31
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 06/08/2021 — Date Finished: 06/08/2021
Drilling Equipment: CME-55 Rubber Track Mounted Drill Rig	Completion Depth: 22 ft — Rock Depth: 8 ft
Size and Type of Bit: 3-7/8in Tricone Roller Bit	Number of Samples: Disturbed 6 — Undisturbed - — Core 2
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 4	Water Level (ft.): First ▽ 10 — Completion ▼ - — 24 HR. ▼ -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Mike Tarter
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rodrigo Fernandez Santoyo
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+31.0			0						
	+30.5	CONCRETE Reddish brown SILT, some f-m sand, trace ash (moist) [FILL]		1	S-1	SS	10	9 10 8	19	Started Drilling at 7:08 AM on 6/8/2021. Drilled through approximately 6-inch-thick concrete slab with drag bit. S-1 at 0.5ft S-2 at 2ft
	+29.0	Reddish brown sandy SILT, trace fine gravel (moist) [ML]		2 3	S-2	SS	24	13 13 18 15	31	
	+27.0	Reddish brown silty CLAY, trace f-c sand, trace fine gravel (moist) [CL]		4 5	S-3	SS	13	3 7 7 8	14	Drove casing to 4.0ft. Drilled to 4.0ft. Reddish brown wash. S-3 at 4ft q_u=1.25 tsf (PP)
	+25.0	Reddish brown sandy SILT, some f-c gravel (moist) [ML]		6 7	S-4	SS	19	13 16 13 16	29	S-4 at 6ft
	+23.0	DECOMPOSED ROCK in form of reddish brown SILT, trace clay, trace fine sand (moist) [DECOMPOSED ROCK]		8	S-5	SS	6	38 50/4	50/4	Drilled to 8.0ft. Reddish brown wash. Easy drilling. S-5 at 8ft
		DECOMPOSED ROCK in form of reddish brown SILT, some f-c sand (wet) [DECOMPOSED ROCK]		9 10	S-6	SS	5	68 50/2	50/2	Drilled to 10.0ft. Reddish brown wash. S-6 at 10ft
	+19.0	Reddish brown WEATHERED SHALE; soil in fractures [ROCK]	6:31 3:31 4:12 3:34 2:41	11 12 13 14 15 16	C-1	NX Core	REC=46"/60" =77%	RQD=10.5"/60" =18%		Drilled to 12.0ft. Reddish brown wash. C-1 at 12ft
	+14.0	Reddish brown SHALE; close fracture spacing [ROCK]	3:15 3:25 4:43 3:50 4:15	17 18 19 20 21 22	C-2	NX Core	REC=59"/60" =98%	RQD=36"/60" =60%		C-2 at 17ft. Reddish brown wash.
	+8.0	End of boring at 23 ft.		23 24						Finished drilling at 9:34 AM on 6/8/2021. Boring grouted upon completion and surface patched with concrete.

N-Value (Blows/ft) scale: 10 20 30 40

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Log of Boring **LB-4** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 28
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/20/2021 — Date Finished: 05/24/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 23 ft — Rock Depth: 9 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 6 — Undisturbed - — Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 9	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks
	+28.0									Started Drilling at 5/20/2021 1:18 PM
	+27.7	Concrete		0						
		Reddish brown f-c SAND, some silt, some gravel (moist)[FILL]		2	S-1	SS	7	18 12 12 11	24	S-1 at 1ft
		Reddish brown f-c SAND, some silt, some gravel (moist)[FILL]		4	S-2	SS	4	8 9 13 14	22	S-2 at 3ft
		No Recovery		6	S-3	SS	0	6 11 16 12	27	Drive casing to 5.0ft. Drill to 5.0ft. S-3 at 5ft
	+21.0	Reddish brown CLAY, some silt, trace f-m sand, with pockets of grey f-m sand (wet)[CL]		8	S-4	SS	10	10 11 12 14	23	S-4 at 7ft q_u=1.50 tsf (PP)
	+19.0	DECOMPOSED ROCK in form of reddish brown SILT, trace clay, trace f-m sand, trace rock pieces (wet)[DECOMPOSED ROCK]		10	S-5	SS	11	13 24 50/2	50/2	Drive casing to 9.0ft. Drill to 9.0ft. S-5 at 9ft Odor detected from 9ft to 15ft
		DECOMPOSED ROCK in form of reddish brown to light gray SILT, some f-c sand, trace clay, trace rock pieces (wet)[DECOMPOSED ROCK]		14	S-6	SS	5	100		Drill to 15.0ft. S-6 at 15ft
	+10.0	Reddish brown to light gray SHALE [ROCK]	4:10 4:23 4:37 8:18 6:31	18 20 22	C-1	NX Core	REC=57"/60" =95%	RQD=41"/60" =68%		Stopped Drilling for the day at 5/20/2021 2:07 PM. Started Drilling at 5/24/2021 7:19 AM. Drill to 18.0ft. C-1 at 18ft
	+5.0	End of boring at 23 ft.		24 25						Bottom of boring at 5/24/2021 8:40 AM. Boring grouted upon completion. Surface patched with concrete.

N-Value (Blows/ft) scale: 10 20 30 40

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Log of Boring **LB-5 (OW)** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 31.5
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/20/2021 — Date Finished: 05/20/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 21 ft — Rock Depth: 7 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 5 — Undisturbed - — Core 2
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 9	Water Level (ft.): First - — Completion - — 24 HR. 13.5
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+31.5			0						Started Drilling at 5/20/2021 7:53 AM
	+31.1	Concrete								
	+30.5	Reddish brown SILT, some clay, some f-c sand (moist)[ML]		2	S-1	SS	7	13 12 19 19	31	S-1 at 1ft
	+28.5	Reddish brown CLAY, some silt, some f-m sand (moist)[CL]		4	S-2	SS	10	13 10 14 11	24	S-2 at 3ft q_u=1.00 tsf (PP)
		Reddish brown CLAY, some silt, some f-m sand, trace gravel (wet)[CL]		6	S-3	SS	6	9 11 11 22	22	Drive casing to 5.0ft. Drill to 5.0ft. S-3 at 5ft q_u=.75 tsf (PP)
	+24.5	DECOMPOSED ROCK in form of reddish brown SILT, some clay, trace f-m sand (wet)[DECOMPOSED ROCK]		8	S-4	SS	18	27 26 24 22	50	S-4 at 7ft Hard drilling
		DECOMPOSED ROCK in form of reddish brown to light gray SILT, some rock pieces, trace clay (wet)[DECOMPOSED ROCK]		10	S-5	SS	7	38 50/2	50/2	Drive casing to 9.0ft. Drill to 9.0ft. S-5 at 9ft
	+20.5	Reddish brown highly fractured SHALE [ROCK]	5:15 5:10 6:52 10:11 9:37	12 14	C-1	NX Core	REC=55"/60" =92%	RQD=15"/60" =25%		Drill to 11.0ft. C-1 at 11ft
		Reddish brown SHALE; with grey siltstone in fractures [ROCK]	6:22 5:04 12:03 4:48 8:27	16 18 20	C-2	NX Core	REC=56"/60" =93%	RQD=25.5"/60" =43%		C-2 at 16ft
	+10.5	End of boring at 21 ft.		22 24 25						Bottom of boring at 5/20/2021 10:20 AM. Installed permanent groundwater level observation well to 15ft upon completion. Consisting of 10ft of screened PVC and 5ft of solid riser.

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Log of Boring **LB-6** Sheet 1 of 2

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 27
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/24/2021 — Date Finished: 05/24/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 25.2 ft — Rock Depth: 9 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 7 — Undisturbed - — Core 2
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 9	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description
	+27.0	
	+26.7	Concrete
		Light gray to black f-c SAND, some gravel (moist)[FILL]
		Reddish brown SILT, some f-c sand, trace clay, trace gravel (wet)[FILL]
	+22.0	
		Reddish brown CLAY, some silt, some gravel (moist)[CL]
		[wc=17.9%; LL=35, PL=17, PI=18]
		Reddish brown silty CLAY, some gravel (moist)[CL]
	+18.0	
		No Recovery
		Reddish brown GRAVEL, trace silt (moist)[DECOMPOSED ROCK]
	+11.8	
		No Recovery
		Reddish brown to gray SHALE [ROCK]

Coring (min)	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	0						Started Drilling at 5/24/2021 8:41 AM
	1	S-1	SS	1	27 19 13 12	32	S-1 at 1ft
	2						
	3	S-2	SS	3	6 9 8 5	17	S-2 at 3ft
	4						
	5	S-3	SS	20	13 15 21 17	36	Drive casing to 5.0ft. Drill to 5.0ft. S-3 at 5ft q_u=2.00 tsf (PP)
	6						
	7	S-4	SS	23	22 21 22 31	43	S-4 at 7ft
	8						
	9	S-5	SS	0	50/2	50/2	Drive casing to 9.0ft. Drill to 9.0ft. S-5 at 9ft
	10	S-6	SS	1	50/2	50/2	Drill to 10.0ft. S-6 at 10ft
	11						
	12						
	13						
	14						
	15	S-7	SS	0	50/2	50/2	Drill to 15.0ft. S-7 at 15ft C-1 at 15.17ft
9:28	16						
7:15	17	C-1	NX Core	REC=38"/60" =63%	RQD=5.5"/60" =9%		
4:35	18						
4:40	19						
4:47	20						

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Log of Boring **LB-6** Sheet 2 of 2

Project	Project No.
New Union County Government Complex	100889101
Location	**Elevation and Datum**
61-99 West Grand Street	Approx el. 27

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+7.0			20						
			6:28	21						C-2 at 20.17ft
			5:09	22						
		Reddish brown to gray SHALE [ROCK]	4:42	23	C-2	NX Core	REC=56"/60" =93%	RQD=27"/60" =45%		
			6:43	24						
			6:41	25						Bottom of boring at 5/24/2021 11:47 AM. Boring grouted upon completion. Surface patched with concrete.
	+1.8	End of boring at 25.2 ft.		26						
				27						
				28						
				29						
				30						
				31						
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

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Log of Boring **LB-7** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 25.2
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 06/09/2021 — Date Finished: 06/10/2021
Drilling Equipment: CME-55 Rubber Track Mounted Drill Rig	Completion Depth: 20 ft — Rock Depth: 11 ft
Size and Type of Bit: 3-7/8in Tricone Roller Bit	Number of Samples: Disturbed 6 — Undisturbed - — Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 8	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Mike Tarter
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rodrigo Fernandez Santoyo
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+25.2			0						
	+24.7	CONCRETE								Started Drilling at 10:17 AM on 6/9/202. Relocated boring. Drilled through approximately 6-inch-thick concrete slab with drag bit.
		Reddish brown to black SILT, some f-c sand, trace f-c gravel (dry) [FILL]		1	S-1	SS	8	13 13 12	26	S-1 at 0.5ft
	+23.2	Reddish brown SILT, trace f-m sand, trace f-c gravel, trace clay (moist) [ML]		2						S-2 at 2ft
				3	S-2	SS	10	16 10 20 20	30	
	+21.2	Reddish brown silty CLAY, trace f-c sand, trace fine gravel (moist) [CL]		4						Drove casing to 4.0ft. Drilled to 4.0ft. Reddish brown wash.
				5	S-3	SS	4	13 10 9 8	19	S-3 at 4ft
	+19.2	Reddish brown SILT, some clay, trace f-c sand, trace fine gravel (moist) [ML]		6						S-4 at 6ft
				7	S-4	SS	15	9 9 8 10	17	
	+17.2	Reddish brown silty CLAY, trace f-c sand, trace f-c gravel (moist)[CL]		8						Drilled to 8.0ft. Grayish brown wash.
				9	S-5	SS	15	6 8 9 12	17	S-5 at 8ft
				10						S-6 at 10ft
	+14.2	DECOMPOSED ROCK in form of reddish brown SILT, some rock fragments (moist) [DECOMPOSED ROCK]		11	S-6	SS	18	16 16 32 50	48	
	+11.2	? ? ? ?		12						
				13						
				14						
		Reddish brown SHALE; close fracture spacing [ROCK]		15						Hard drilling from 14ft. Reddish brown wash. Rock chips in wash. Drilled to 15.0ft. Reddish brown wash. C-1 at 15ft
			4:34	16						
			4:58	17						
			4:55	18						
			4:39	19						
			3:47	20	C-1	NX Core	REC=56"/60" =93%	RQD=20"/60" =33%		
	+5.2	End of boring at 20 ft.		21						Finished drilling at 11:14 AM on 6/10/2021. Boring grouted upon completion and patched surface with concrete.
				22						

N-Value (Blows/ft) scale: 10 20 30 40

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Log of Boring **LB-8** Sheet 1 of 2

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 25.2
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 06/08/2021 / Date Finished: 06/08/2021
Drilling Equipment: CME-55 Rubber Track Mounted Drill Rig	Completion Depth: 27.5 ft / Rock Depth: 21 ft
Size and Type of Bit: 3-7/8in Tricone Roller Bit	Number of Samples: Disturbed 8 / Undisturbed - / Core 1
Casing Diameter (in): 4"- diameter steel / Casing Depth (ft): 4	Water Level (ft.): First ▽ 8 / Completion ▼ - / 24 HR. ▼ -
Casing Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	Drilling Foreman: Mike Tarter
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rodrigo Fernandez Santoyo
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+25.2			0						
	+24.7	CONCRETE		1						Started Drilling at 10:35 AM on 6/8/2021. Drilled through approximately 6-inch-thick concrete slab with drag bit.
		Light brown f-m SAND, trace silt (moist) [FILL]			S-1	SS	15	5 6 6	11	S-1 at 0.5ft
		Light brown f-m SAND, trace silt (moist)[FILL]		2	S-2	SS	16	4 7 13 14	20	S-2 at 2ft
		Light brown f-m SAND, some silt (wet) [FILL]		4	S-3	SS	8	9 6 9 8	15	Drove casing to 4.0ft. Drilled to 4.0ft. S-3 at 4ft
		Light brown f-m SAND, trace silt, trace fine gravel (moist) [FILL] [wc=13.4%; passing #200 = 12%]		6	S-4	SS	8	4 4 4 5	8	S-4 at 6ft
		Light brown to dark gray f-m SAND, trace silt, trace slag (wet) [FILL]		8	S-5	SS	2	2 3 3 4	6	Drilled to 8.0ft. Brown wash. S-5 at 8ft
		Brown to dark gray f-c SAND, trace silt, trace fine gravel with concrete and brick pieces (wet) [FILL]		10	S-6	SS	4	3 7 8 7	15	S-6 at 10ft
	+12.2	? ? ? ?		12						Easy drilling from 13ft.
		Reddish brown clayey SILT, trace f-c sand, trace f-c gravel (wet) [ML]		14	S-7	SS	5	3 2 4 2	6	Drilled to 15.0ft. Brown wash. S-7 at 15ft. Dilatant response to shaking. Odor. q_u=1.00 tsf (PP)
				16						
				18						
				20						

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Log of Boring **LB-8** Sheet 2 of 2

Project	Project No.
New Union County Government Complex	100889101
Location	**Elevation and Datum**
61-99 West Grand Street	Approx el. 25.2

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+5.2	Reddish brown SILT, some f-c sand, trace rock fragments (wet) [ML]		20	S-8	SS	15	15 48 50/4	50/4	Drilled to 20.0ft. Reddish brown wash. S-8 at 20ft
	+4.2	DECOMPOSED ROCK		21						
				22						
	+2.2			23						Drilled to 23.0ft. Reddish brown wash. Hard drilling. C-1 at 23ft. Stopped core run after 4.5 feet due to plugged barrel shoe.
		Reddish brown SHALE; close fracture spacing	3:43	24	C-1	NX Core	REC=46"/54" =85%	RQD=26"/54" =48%		
			3:03	25						
			3:21	26						
			2:33	27						
	-2.3		3:29							
		End of boring at 27.5 ft.		28						Finished drilling at 1:42 PM on 6/8/2021. Boring grouted upon completion and surface patched with concrete.
				29						
				30						
				31						
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

N-Value (Blows/ft) scale: 10 20 30 40

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Log of Boring **LB-9** Sheet 1 of 2

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 25
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/25/2021 — Date Finished: 05/25/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 27 ft — Rock Depth: 9 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 7 — Undisturbed - — Core 2
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 8	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+25.0			0						Started Drilling at 5/25/2021 7:41 AM. S-1 at 0ft q_u=1.00 tsf (PP)
	+24.5	Asphalt								
		Brown CLAY, some silt, trace f-c sand (moist)[FILL]		1	S-1	SS	18	4 15 5 5	20	
	+23.0			2						S-2 at 2ft q_u=1.50 tsf (PP)
		Reddish brown CLAY, some silt, trace f-c sand (moist)[CL] [wc=17.1%; LL=29, PL=16, PI=13]		3	S-2	SS	19	7 11 8 10	19	
		Brown silty CLAY, trace f-m sand, trace gravel (moist)[CL]		4						Drive casing to 4.0ft. Drill to 4.0ft. S-3 at 4ft q_u=3.50 tsf (PP)
				5	S-3	SS	16	5 10 14 20	24	
		Brown silty CLAY, trace f-m sand, trace gravel (moist)[CL]		6						S-4 at 6ft
				7	S-4	SS	16	22 20 20 17	40	
	+17.0			8						Drive casing to 8.0ft. Drill to 8.0ft. S-5 at 8ft
		Reddish brown to gray SILT, some f-c sand, trace clay (moist)[ML]			S-5	SS	17	19 20 51 50/2	71	
	+16.0			9						
		DECOMPOSED ROCK in form of reddish brown to gray sandy SILT, trace clay (moist)[DECOMPOSED ROCK]		10	S-6	SS	12	55 40 50/2	50/2	Drill to 10.0ft. S-6 at 10ft
				11						
				12						
				13						
				14						
		DECOMPOSED ROCK in form of reddish brown to gray sandy SILT, trace clay, trace rock pieces (moist)[DECOMPOSED ROCK]		15	S-7	SS	2	50/2	50/2	Drill to 15.0ft. S-7 at 15ft
	+8.0			16						
				17						Drill to 17.0ft. C-1 at 17ft
			5:42							
		Reddish brown to gray SHALE [ROCK]	8:00	18	C-1	NX Core	REC=53"/60" =88%	RQD=23"/60" =38%		
			8:49	19						
				20						

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Log of Boring **LB-9** Sheet 2 of 2

Project	Project No.
New Union County Government Complex	100889101
Location	**Elevation and Datum**
61-99 West Grand Street	Approx el. 25

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+5.0			20					10 20 30 40	
			4:26	21	C-1	NX Core				
			7:06	22						C-2 at 22ft
			6:03	23	C-2	NX Core	REC=57"/60" =95%	RQD=40"/60" =67%		
		Reddish brown to gray SHALE [ROCK]	4:19	24						
			4:13	25						
			5:08	26						
			6:04	27						
	-2.0	End of boring at 27 ft.		28						Bottom of boring at 5/25/2021 10:09 AM. Boring grouted upon completion. Surface patched with concrete.
				29						
				30						
				31						
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

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Log of Boring **LB-10** Sheet 1 of 2

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 25.2
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 06/09/2021 — Date Finished: 06/09/2021
Drilling Equipment: CME-55 Rubber Track Mounted Drill Rig	Completion Depth: 26 ft — Rock Depth: 20 ft
Size and Type of Bit: 3-7/8in Tricone Roller Bit	Number of Samples: Disturbed 8 — Undisturbed 1 — Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 4	Water Level (ft.): First ▽ 13.5 — Completion ▼ - — 24 HR. ▼ -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Mike Tarter
Sampler: 2-inch-diameter split spoon; Shelby Tube; NX Core Barrel	Field Engineer: Rodrigo Fernandez Santoyo
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks
	+25.2									
	+24.7	CONCRETE		0						Started Drilling at 7:17 AM on 6/9/2021. Drilled through approximately 6-inch-thick concrete slab with drag bit.
		Light brown f-m SAND, trace coarse gravel (moist) [FILL]		1	S-1	SS	5	5 6 12	11	S-1 at 0.5ft
		Light brown f-m SAND, trace silt (moist) [FILL]		2	S-2	SS	15	12 12 13 14	25	S-2 at 2ft
		Light brown f-m SAND, some silt, trace fine gravel (moist) [FILL] [wc=12%; passing #200 = 18.2%]		3 4 5	S-3	SS	28	9 11 12 15	23	Drove casing to 4.0ft. Drilled to 4.0ft. Brown wash. S-3 at 4ft
		Light brown f-m SAND, trace silt, trace f-c gravel (moist) [FILL]		6 7	S-4	SS	18	15 30 26 20	56	S-4 at 6ft
		Light brown f-m SAND, trace silt, trace fine gravel (moist) [FILL]		8 9	S-5	SS	18	9 14 16 25	30	Drove casing to 8.0ft. Drilled to 8.0ft. Light brown wash. S-5 at 8ft.
		Light brown f-c SAND, trace silt, trace f-c gravel (moist) [FILL]		10 11	S-6	SS	20	19 22 20 18	42	S-6 at 10ft
	+12.7			12						Easy drilling and grayish brown wash from 12.5ft.
		Grayish brown SILT, some clay, trace f-c sand (wet) [ML] [wc=17%; LL=18, PL=17, PI=1]	▽	13 14 15	U-1	ST	18			Drilled to 13.5. Grayish brown wash. U-1 at 13.5ft. 20 minute rest period prior to retrieving tube. q_u=2.75 tsf (PP)s_u=0.90 tsf
		Grayish brown clayey SILT, trace f-c sand, trace fine gravel (wet) [ML]		16 17	S-7	SS	6	2 3 3 2	6	S-7 at 15.5ft. Dilatant response to shaking. Odor q_u=1.00 tsf (PP)
	+5.2			18 19 20	S-8	SS	4	80/4		

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Log of Boring **LB-10** Sheet 2 of 2

Project	Project No.
New Union County Government Complex	100889101
Location	**Elevation and Datum**
61-99 West Grand Street	Approx el. 25.2

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+5.2	DECOMPOSED ROCK in form of reddish brown SILT, trace clay, trace f-c sand, Some rock fragments [DECOMPOSED ROCK]		20					80/4	Drilled to 20.0ft. S-8 at 20ft
	+4.2		5:37	21	C-1	NX Core	REC=51"/60" =85%	RQD=19"/60" =32%		Drilled to 21.0ft. Reddish brown wash. C-1 at 21ft
		Reddish brown WEATHERED SHALE; very close to close fracture spacing; soil in fractures [ROCK]	5:43	22						
			5:28	23						
			5:20	24						
			5:15	25						
	-0.8	End of boring at 26 ft.		26						Finished drilling at 9:54 AM on 6/9/2021. Boring grouted upon completion and surface patched with concrete.
				27						
				28						
				29						
				30						
				31						
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

N-Value (Blows/ft) scale: 10 20 30 40

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Log of Boring **LB-11 (OW)** Sheet 1 of 2

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 21.5
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/19/2021 — Date Finished: 05/19/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 27 ft — Rock Depth: 18 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 5 — Undisturbed - — Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 22	Water Level (ft.): First ▽ - — Completion ▼ - — 24 HR. ▼ 16.5
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+21.5			0						Started Drilling at 5/19/2021 8:34 AM
	+21.0	Asphalt		1						4-inch thick asphalt. Hand auger to 5ft
				2						
				3						
				4						
		Reddish brown GRAVEL, some clay, some silt, some f-c sand with brick pieces (moist)[FILL]		5	S-1	SS	17	32 / 19 / 11 / 9	30	S-1 at 5ft
				6						
		Reddish brown sandy CLAY, some gravel, trace silt, with roots and wood pieces (wet)[FILL]		7	S-2	SS	2	9 / 7 / 8 / 15	15	S-2 at 7ft
				8						
				9						
		Dark brown to black silty f-c SAND, trace gravel, with wood pieces and brick pieces (wet)[FILL]		10	S-3	SS	4	15 / 12 / 12 / 10	24	Drive casing to 10.0ft. Drill to 10.0ft. S-3 at 10ft
				11						
				12						
				13						
				14						
		Reddish brown to dark gray clayey f-c SAND, some silt, trace angular gravel, with wood pieces (wet)[FILL]		15	S-4	SS	4	7 / 2 / 5 / 5	7	Drive casing to 15.0ft. Drill to 15.0ft. S-4 at 15ft
		▼		16						
				17						
	+3.5	?—?—?—?		18						
				19						
				20						

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Log of Boring **LB-11 (OW)** Sheet 2 of 2

Project	Project No.
New Union County Government Complex	100889101
Location	**Elevation and Datum**
61-99 West Grand Street	Approx el. 21.5

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+1.5	DECOMPOSED ROCK in form of reddish brown SILT, trace rock pieces, trace clay (wet)[DECOMPOSED ROCK]		20	S-5	SS	4	18 31 50/2	50/2	Drive casing to 20.0ft. Drill to 20.0ft. S-5 at 20ft. Reddish brown shale in spoon tip
	-0.5	Reddish brown SHALE [ROCK]	7:12	22	C-1	NX Core	REC=51"/60" =85%	RQD=9"/60" =15%		Drive casing to 22.0ft. Hard drilling. C-1 at 22ft
			9:07	23						
			7:56	24						
			12:35	25						
			9:46	26						
	-5.5	End of boring at 27 ft.		27						Bottom of boring at 5/19/2021 11:55 AM. Installed permanent groundwater level observation well to 20ft upon completion. Consisting of 10ft of screened PVC and 10ft of solid riser.
				28						
				29						
				30						
				31						
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

N-Value (Blows/ft) scale: 10 20 30 40

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Log of Boring **LB-12** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 23.5
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/24/2021 — Date Finished: 05/25/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 20 ft — Rock Depth: 9 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 6 — Undisturbed - — Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 9	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks
	+23.5			0					10 20 30 40	Started Drilling at 5/24/2021 12:35 PM
	+23.0	Asphalt								
	+22.5	Reddish brown CLAY, trace silt (moist)[CL]		1						S-1 at 1ft
				2	S-1	SS	20	6 6 4 5	10	
	+20.5	Reddish brown SILT, some clay, trace f-m sand (moist)[ML]		3						S-2 at 3ft
				4	S-2	SS	18	7 5 10 15	15	
		Reddish brown SILT, some f-c sand, trace clay, trace gravel (moist)[ML]		5						S-3 at 5ft. Drill to 5.0ft
				6	S-3	SS	20	8 18 18 20	36	
		Reddish brown SILT, trace clay, trace f-c sand, trace rock pieces (moist)[ML]		7						S-4 at 7ft
				8	S-4	SS	24	20 22 30 20	52	
	+14.5	DECOMPOSED ROCK in form of reddish brown f-c SAND, some silt (moist)[DECOMPOSED ROCK]		9						Drive casing to 9.0ft. Drill to 9.0ft. S-5 at 9ft
				10	S-5	SS	12	15 43 69 50/2	112	
		DECOMPOSED ROCK in form of reddish brown f-c SAND, some silt, some gravel (moist)[DECOMPOSED ROCK]		11	S-6	SS	2	50/2	50/2	Odor Drill to 11.0ft. S-6 at 11ft
				12						
				13						
				14						
	+8.5			15						Drill to 15.0ft. C-1 at 15ft
			5:57	16						
			5:33	17						
		Reddish brown SHALE [ROCK]	4:54	18	C-1	NX Core	REC=59"/60" =98%	RQD=18.5"/60" =31%		
			4:40	19						
			2:57	20						
	+3.5	End of boring at 20 ft.		21						Bottom of boring at 5/25/2021 7:20 AM. Boring grouted upon completion. Surface patched with concrete.
				22						
				23						

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Log of Boring **LB-13** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 21
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/25/2021 — Date Finished: 05/25/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 23 ft — Rock Depth: 15 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 7 — Undisturbed - — Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 18	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks
	+21.0			0						
	+20.5	Asphalt								Started Drilling at 5/25/2021 10:46 AM. S-1 at 0ft
		Reddish brown to dark brown f-c SAND, some clay, trace silt, trace gravel, with concrete pieces and brick pieces (moist)[FILL]			S-1	SS	5	7 8 6 18	14	
		Reddish brown to dark brown f-c SAND, some silt, trace clay, trace gravel, with concrete pieces (moist)[FILL]		2	S-2	SS	8	11 8 31 14	39	S-2 at 2ft
	+17.0	Reddish brown SILT, trace f-m sand (moist)[ML]		4	S-3	SS	6	9 10 5 6	15	Drive casing to 4.0ft. Drill to 4.0ft. S-3 at 4ft
		Reddish brown SILT, some clay, trace f-m sand, trace gravel (moist)[ML]		6	S-4	SS	3	7 5 6 11	11	S-4 at 6ft
	+13.0	Brown CLAY, some silt, trace f-m sand (wet)[CL]		8	S-5	SS	8	6 5 4 4	9	Drive casing to 8.0ft. Drill to 8.0ft. S-5 at 8ft q_u=1.00 tsf (PP)
		Brown CLAY, some silt, some f-m sand, trace gravel (wet)[CL]		10	S-6	SS	5	3 3 3 4	6	S-6 at 10ft q_u=.50 tsf (PP)
	+6.0	DECOMPOSED ROCK in form of reddish brown silty f-c SAND, some rock pieces (wet)[DECOMPOSED ROCK]		12						
				14						
				16	S-7	SS	16	59 55 100	155	Drive casing to 15.0ft. Drill to 15.0ft. Odor. S-7 at 15ft
	+3.0	Reddish brown to gry SHALE [ROCK]	4:23	18	C-1	NX Core	REC=60"/60" =100%	RQD=29"/60" =48%		Drive casing to 18.0ft. Drill to 18.0ft. C-1 at 18ft
			6:21							
			6:32	20						1inch decomposed rock in the form of clay
			8:58							
			9:59	22						
	-2.0	End of boring at 23 ft.								Bottom of boring at 5/25/2021 12:35 PM. Boring grouted upon completion. Surface patched with concrete.
				24						
				25						

N-Value (Blows/ft) axis: 10 20 30 40

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Log of Boring **LB-14** Sheet 1 of 2

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 18.5
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/19/2021 — Date Finished: 05/19/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 26 ft — Rock Depth: 20 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 8 — Undisturbed - — Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 20	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description
	+18.5	
	+18.0	Asphalt
		Reddish brown SILT, some f-c sand, trace clay, trace black gravel (moist)[FILL]
		Reddish brown SILT, some f-c sand, trace clay, trace gravel, with brick pieces (moist)[FILL]
		Reddish brown SILT, some clay, some f-c sand, trace gravel, with brick pieces and concrete pieces (moist)[FILL]
		Reddish brown silty CLAY, some f-c sand, trace gravel, with brick pieces and concrete pieces (moist)[FILL]
		Reddish brown to gray f-c SAND, some silt, trace clay, trace gravel, with brick pieces and concrete pieces (wet)[FILL]
		Grayish brown to tan f-c SAND, some silt, trace gravel (wet)[FILL]
	+7.5	Reddish brown SILT, some clay, trace f-m sand (wet)[ML]
		Grayish brown SILT, some clay, trace f-m sand (wet)[ML]
		[wc=21.9%; LL=20, PL=17, PI = 3]
	-1.5	

Coring (min)

Depth Scale: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Sample Data

Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)
S-1	SS	10	17 16 13 11	29
S-2	SS	11	9 13 15 12	28
S-3	SS	20	18 18 33 25	51
S-4	SS	16	18 9 11 10	20
S-5	SS	3	10 3 3 3	6
S-6A	SS	6	3 3 4	7
S-6B			5	
S-7	SS	22	1 1 2 3	3

N-Value (Blows/ft): 10 20 30 40

Remarks

(Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)

Started Drilling at 5/19/2021 11:57 AM. S-1 at 0ft
3 inches asphalt

S-2 at 2ft

Drive casing to 4.0ft. Drill to 4.0ft. Concrete encountered move boring 2ft north. S-3 at 4ft

S-4 at 6ft

Drive casing to 8.0ft. Drill to 8.0ft. S-5 at 8ft

S-6 at 10ft
q_u=.75 tsf (PP)

Drive casing to 15.0ft. Drill to 15.0ft. S-7 at 15ft
q_u=.50 tsf (PP)

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Log of Boring **LB-14** Sheet 2 of 2

Project	Project No.
New Union County Government Complex	100889101
Location	**Elevation and Datum**
61-99 West Grand Street	Approx el. 18.5

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-1.5	Reddish brown silty CLAY, trace f-c sand, trace rock pieces (wet)[DECOMPOSED ROCK]		20	S-8	SS	22	54 50/2	50/2	Drive casing to 20.0ft. Drill to 20.0ft. S-8 at 20ft C-1 at 21ft
	-2.5	Reddish brown SHALE [ROCK]	5:50 8:28 4:59 4:37 5:31	21 22 23 24 25	C-1	NX Core	REC=60"/60" =100%	RQD=30"/60" =50%		
	-7.5	End of boring at 26 ft.		26						Bottom of boring at 5/19/2021 1:57 PM. Boring grouted upon completion. Surface patched with concrete.
				27						
				28						
				29						
				30						
				31						
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

N-Value (Blows/ft) scale: 10 20 30 40

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Log of Boring **LB-15** Sheet 1 of 2

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 21.5
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/25/2021 — Date Finished: 05/26/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 27 ft — Rock Depth: 22 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 8, Undisturbed 1, Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 15	Water Level (ft.): First ▽ - , Completion ▼ - , 24 HR. ▼ -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; Shelby Tube; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+21.5									
	+21.0	Asphalt		0						Started Drilling at 5/25/2021 1:24 PM. S-1 at 0ft
		Reddish brown to dark brown silty f-c SAND, some gravel, trace clay, with brick pieces, and concrete pieces (moist)[FILL]		1	S-1	SS	10	7 11 7 6	18	
		Reddish brown to dark brown CLAY, some silt, some f-c sand, some gravel, with brick pieces, and concrete pieces (moist)[FILL]		2	S-2	SS	4	25 50/2	50/2	S-2 at 2ft
		Brown silty CLAY, some f-c sand, trace gravel (moist)[FILL]		3 4	S-3	SS	8	2 4 50/2	50/2	Drive casing to 4.0ft. Drill to 4.0ft. S-3 at 4ft. Spoon bouncing q_u=.50 tsf (PP)
		Reddish brown CLAY, some silt, trace f-c sand (moist)[FILL]		5 6	S-4	SS	3	37 8 6 9	14	Drill to 6.0ft. S-4 at 6ft q_u=1.50 tsf (PP)
		Gray f-c SAND, trace clay, trace gravel, with wood pieces, brick pieces and concrete pieces (moist)[FILL]		7 8	S-5	SS	10	28 36 25 19	61	Stopped Drilling for the day at 5/25/2021 1:58 PM. Started Drilling for the day at 5/26/2021 7:06 AM. Drive casing to 8.0ft. Drill to 8.0ft. S-5 at 8ft S-6 at 10ft
		White to gray f-c SAND, trace clay, trace gravel, with brick pieces and concrete pieces (moist) [FILL] [wc=28%; passing #200 = 22%]		9 10	S-6	SS	16	16 13 8 7	21	
	+6.5	Reddish brown CLAY, some f-c sand, trace silt (moist)[CL]		11 12 13 14 15	S-7	SS	12	2 3 6 3	9	Drive casing to 15.0ft. Drill to 15.0ft. S-7 at 15ft q_u=.75 tsf (PP)
		Reddish brown CLAY, some f-c sand, trace silt (moist)[CL] [wc=24.5%; LL=29, PL=19, PI=10]		16 17	U-1	ST	24			U-1 at 17ft
		Reddish brown silty CLAY, trace f-m sand, trace gravel (wet)[CL]		18 19 20	S-8	SS	17	8 15	50	S-8 at 19ft q_u=2.50 tsf (PP)

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Log of Boring **LB-15** Sheet 2 of 2

Project	Project No.
New Union County Government Complex	100889101
Location	**Elevation and Datum**
61-99 West Grand Street	Approx el. 21.5

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+1.5			20	S-8	SS	17	35 61	10 20 30 40	
	-0.5			21						
				22	C-1	NX Core	REC=60"/60" =100%	RQD=28"/60" =47%		Drill to 22.0ft. C-1 at 22ft
		Reddish brown to gray SHALE [ROCK]	5:02	23						
			3:59	24						
			5:05	25						
			5:27	26						
			5:32	27						
	-5.5	End of boring at 27 ft.		28						Bottom of boring at 5/26/2021 9:04 AM. Boring grouted upon completion. Surface patched with concrete.
				29						
				30						
				31						
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

APPENDIX B

Logs of 2021 Langan Site Borings

LANGAN

Log of Boring **SLB-1** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 30.5
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/27/2021 — Date Finished: 05/27/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 13 ft — Rock Depth: 4 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 4 — Undisturbed - — Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 4	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks
	+30.5			0						Started Drilling at 5/27/2021 8:17 AM. S-1 at 0ft
	+30.0	Asphalt								
		Reddish brown to gray clayey f-c SAND, some silt, trace gravel, with wood pieces (moist)[FILL]		1	S-1	SS	3	6, 4, 5, 6	9	
		Reddish brown CLAY, some silt, some f-c sand, with wood pieces (moist)[FILL]		2						S-2 at 2ft
	+26.5			3	S-2	SS	9	9, 11, 10, 14	21	
		DECOMPOSED ROCK in form of reddish brown SILT, trace clay, trace f-m sand, some rock pieces (moist)[DECOMPOSED ROCK]		4	S-3	SS	11	10, 56, 50/2	50/2	Drive casing to 4.0ft. Drill to 4.0ft. S-3 at 4ft
				5						
				6	S-4	SS	1	50/2	50/2	Drill to 6.0ft. S-4 at 6ft
		DECOMPOSED ROCK in form of reddish brown GRAVEL, trace silt (wet)[DECOMPOSED ROCK]		7						
	+22.5			8						Drill to 8.0ft. C-1 at 8ft
		Reddish brown SHALE [ROCK]	6:13	9	C-1	NX Core	REC=53"/60" =88%	RQD=11"/60" =18%		
			8:32	10						
			11:53	11						
			16:26	12						
			14:14	13						
	+17.5	End of boring at 13 ft.		14						Bottom of boring at 5/27/2021 10:00 AM. Boring grouted upon completion. Surface patched with concrete.
				15						
				16						
				17						
				18						
				19						
				20						

N-Value (Blows/ft) scale: 10 20 30 40

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Log of Boring **SLB-2** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 31
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 06/07/2021 — Date Finished: 06/07/2021
Drilling Equipment: CME-55 Rubber Track Mounted Drill Rig	Completion Depth: 20 ft — Rock Depth: 2 ft
Size and Type of Bit: 3-7/8in Tricone Roller Bit	Number of Samples: Disturbed 7 — Undisturbed - — Core 1
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 4	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Mike Tarter
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rodrigo Fernandez Santoyo
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+31.0			0						
	+30.5	CONCRETE								Started Drilling at 8:16 AM on 6/7/2021. Drilled through approximately 6-inch-thick concrete slab with drag bit. S-1 at 0.5ft. S-2 at 2ft
		Reddish brown sandy SILT, trace f-m sand, trace fine gravel (dry) [FILL]		1	S-1	SS	14	3 5 8	8	
	+29.0	Reddish brown SILT, some rock fragments, trace f-c sand (dry) [DECOMPOSED ROCK]		2	S-2	SS	10	19 37 50/3	50/3	
	+27.0			3	S-3	SS	4	70/4	70/4	Drove casing to 4.0ft. Drilled to 4.0ft. Hard drilling. Reddish brown wash. S-3 at 4ft
		Reddish brown ROCK FRAGMENTS, trace silt, trace f-c sand (moist) [PROBABLE ROCK]		4						
				5	S-4	SS	2	80/3	80/3	Drilled to 6.0ft. Reddish brown wash. S-4 at 6ft. Spoon bouncing. Wet from drilling fluid.
		Reddish brown ROCK FRAGMENTS, some silt, trace f-c sand (wet) [PROBABLE ROCK]		6						
				7	S-5	SS	3	100/3	100/3	Drilled to 8.0ft. Reddish brown wash. S-5 at 8ft. Spoon bouncing. Wet from drilling fluid.
		Reddish brown ROCK FRAGMENTS, silty f-c SAND, trace clay (wet) [PROBABLE ROCK]		8						
				9	S-6	SS	4	80/4	80/4	Drilled to 10.0ft. Reddish brown wash. S-6 at 10ft. Spoon bouncing. Wet from drilling fluid.
		Reddish brown ROCK FRAGEMENTS, some silt, trace f-c sand (wet) [PROBABLE ROCK]		10						
				11						
				12						
				13						
				14						
	+16.0			15						Drilled to 15.0ft. Reddish brown wash. S-7 at 15ft, 50/0". C-1 at 15ft
			2:48	16						
			4:41	17						
		Reddish brown to gray SHALE; close fracture spacing; massive [ROCK]	4:50	18	C-1	NX CORE	REC=56"/60" =93%	RQD=29"/60" =48%		
			7:50	19						
			3:41	20						
	+11.0	End of boring at 20'		21						Finished drilling at 10:15 AM on 6/7/2021. Boring grouted upon completion and surface patched with concrete.
				22						

\\LANGAN.COM\DATA\PAR\DATA1\100889101\PROJECT DATA_DISCIPLINE\GEOTECHNICAL\GINTLOGS\100889101_ENTERPRISE.GPJ ... 7/16/2021 6:51:46 AM ... Report: Log - LANGAN

LANGAN

Log of Boring **SLB-3** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 35
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/20/2021 — Date Finished: 05/20/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 18 ft — Rock Depth: 5 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 4 — Undisturbed - — Core 2
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 5	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks
	+35.0			0						Started Drilling at 5/20/2021 10:31 AM
	+34.5	Concrete								
		Reddish brown SILT, trace clay, trace f-m sand with roots and wood pieces (moist)[FILL]		1	S-1	SS	6	30 14 7 11	21	S-1 at 1ft
	+32.0	Reddish brown SILT, trace clay, trace f-c sand, trace gravel (moist)[ML]		2	S-2	SS	12	12 23 29 20	52	S-2 at 3ft
	+30.0	DECOMPOSED ROCK in form of reddish brown SILT, trace clay, trace f-m sand, trace gravel (moist)[DECOMPOSED ROCK]		3	S-3	SS	10	18 30 50/2	50/2	S-3 at 5ft. Drive casing to 5.0ft. Drill to 5.0ft
		DECOMPOSED ROCK in form of reddish brown SILT, some f-m sand, some gravel, trace clay (moist)[DECOMPOSED ROCK]		4	S-4	SS	7	100		Drill to 7.0ft. S-4 at 7ft
	+27.0			5						Drill to 8.0ft. C-1 at 8ft
			12:10	6						
		Reddish brown SHALE; with light grey mudstone in fractures [ROCK]	10:55	7	C-1	NX Core	REC=56"/60" =93%	RQD=15"/60" =25%		
			8:15	8						
			6:34	9						
			7:54	10						
			5:49	11						C-2 at 13ft. C-2 at 13ft
			5:52	12						
		Reddish brown SHALE [ROCK]	6:31	13	C-2	NX Core	REC=58"/60" =97%	RQD=14"/60" =23%		
			7:01	14						
			9:13	15						
	+17.0			16						
		End of boring at 18 ft.		17						Bottom of boring at 5/20/2021 1:01 PM. Boring grouted upon completion. Surface patched with concrete.
				18						
				19						
				20						

LANGAN

Log of Boring **SLB-4** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 28.5
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/27/2021 — Date Finished: 05/27/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 18.2 ft — Rock Depth: 15 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 8 — Undisturbed - — Core -
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 8	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale
	+28.5		0
	+28.0	Asphalt	
		Dark gray to black f-c SAND, some silt, trace angular gravel (moist)[FILL]	1
		Dark gray to black f-c SAND, some silt, some angular gravel (moist)[FILL]	2
			3
	+24.5	Reddish brown SILT, some f-c sand, trace clay, trace gravel (moist)[ML]	4
			5
	+22.5	Reddish brown silty CLAY, some f-c sand, trace gravel (moist)[CL]	6
		[wc=16.6%; LL=32, PL=17, PI=15]	7
		Reddish brown CLAY, trace silt, trace f-c sand, trace gravel (moist)[CL]	8
			9
		Reddish brown CLAY, some f-m sand, trace silt, trace gravel (moist)[CL]	10
			11
			12
			13
			14
	+13.5		15
		Reddish brown to gray SILT, some f-c sand, trace clay, some rock pieces (moist)[DECOMPOSED ROCK]	16
			17
	+10.3		18
		End of boring at 18.2ft.	19
			20

Sample Data					N-Value (Blows/ft) 10 20 30 40
Number	Type	Recov. (in)	Penetr. resist BL/6in		
S-1	SS	9	17 16 16 9		32
S-2	SS	7	7 4 8 6		12
S-3	SS	8	4 6 8 10		14
S-4	SS	18	13 11 14 14		25
S-5	SS	10	15 18 15 17		33
S-6	SS	18	15 21 28 21		49
S-7	SS	12	25 43 50/2		50/2
S-8	SS	0	50/2		50/2

Remarks

(Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)

Started Drilling at 5/27/2021 10:06 AM. S-1 at 0ft

S-2 at 2ft

Drive casing to 4.0ft. Drill to 4.0ft. S-3 at 4ft

S-4 at 6ft

Drive casing to 8.0ft. Drill to 8.0ft. S-5 at 8ft
q_u=1.00 tsf (PP)

S-6 at 10ft
q_u=1.50 tsf (PP)

Drill to 15.0ft. S-7 at 15ft

Drill to 18.0ft. S-8 at 18ft
Bottom of boring at 5/27/2021 12:57 PM. Boring grouted upon completion. Surface patched with concrete.

LANGAN

Log of Boring **SLB-5** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 22
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/26/2021 — Date Finished: 05/26/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 15 ft — Rock Depth: Not Determined
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 4 — Undisturbed - — Core -
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 4	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale
	+22.0		0
	+21.5	Asphalt	
		Dark brown to black f-c SAND, some silt, some gravel, with brick pieces and concrete pieces (moist)[FILL]	1
		Reddish brown SILT, trace clay, trace f-m sand, trace gravel (moist)[FILL]	2 3
		Reddish brown CLAY, some silt, trace f-m sand, trace gravel (moist)[FILL]	4 5
		Reddish brown CLAY, some silt, trace f-m sand, trace gravel, with roots, concrete pieces and brick pieces (moist)[FILL]	6 7
	+14.0	CONCRETE	8 9 10 11 12 13
	+9.0	VOID	13 14 15
	+7.0	End of boring at 15 ft.	15 16 17 18 19 20

Sample Data

Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)
S-1	SS	10	10 23 15 19	38
S-2	SS	16	13 23 25 22	48
S-3	SS	17	10 10 10 9	20
S-4	SS	13	29 41 50/2	50/2

N-Value (Blows/ft): 10 20 30 40

Remarks
(Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)

Started Drilling at 5/26/2021 10:43 AM. S-1 at 0ft

S-2 at 2ft

Drive casing to 4.0ft. Drill to 4.0ft. S-3 at 4ft

S-4 at 6ft

Drill to 13.0ft. Loss of drilling mud.

Bottom of boring at 5/26/2021 11:48 AM. Boring plugged and grouted upon completion. Surface patched with concrete.

LANGAN

Log of Boring **SLB-6** Sheet 1 of 1

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 20
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/26/2021 — Date Finished: 05/26/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 23.2 ft — Rock Depth: 20 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 9 — Undisturbed - — Core -
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 20	Water Level (ft.): First - — Completion - — 24 HR. -
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)
	+20.0		0					
	+19.5	Asphalt						
		Reddish brown clayey SILT, trace f-m sand, with concrete pieces (moist)[FILL]		S-1	SS	7	11, 10, 38, 11	48
		Reddish brown to black f-c SAND, some gravel, trace silt, with brick pieces (moist)[FILL]	2	S-2	SS	3	9, 7, 8, 8	15
		Reddish brown CLAY, some silt, some gravel, trace f-m sand (wet)[FILL]	4	S-3	SS	3	4, 7, 5, 3	12
		Reddish brown CLAY, some silt, trace f-m sand, trace gravel (wet)[FILL]	6	S-4	SS	12	3, 2, 4, 6	6
		Reddish brown CLAY, some silt, trace f-m sand, trace gravel (wet)[FILL]	8	S-5	SS	2	3, 2, 3, 4	5
		Reddish brown CLAY, some silt, trace f-m sand, trace gravel (wet)[FILL]	10	S-6A / S-6B	SS	8	4, 4, 4, 11	8
		Reddish brown to black silty CLAY, some gravel, trace f-m sand, with wood pieces and brick pieces (wet)[FILL]	12					
	+5.0		14					
		SPOON TIP: BRICK Piece		S-7	SS	1	21, 50/2	50/2
		POSSIBLE FILL	16					
	0.0		18					
		DECOMPOSED ROCK in form of reddish brown fine-coarse SAND, trace gravel (moist)[DECOMPOSED ROCK]	20	S-8	SS	3	100	
	-3.0		22					
	-3.2	Reddish brown SHALE FRAGMENT [PROBABLE ROCK]		S-9	SS	1	50/2	50/2
		End of boring at 23.17 ft.	24					
			25					

Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)

- Started Drilling at 5/26/2021 9:20 AM. S-1 at 0ft
- S-2 at 2ft
- Drive casing to 4.0ft. Drill to 4.0ft. S-3 at 4ft
- S-4 at 6ft
- Drive casing to 8.0ft. Drill to 8.0ft. S-5 at 8ft q_u=1.00 tsf (PP)
- S-6 at 10ft q_u=.50 tsf (PP)
- Drive casing to 15.0ft. Drill to 15.0ft. S-7 at 15ft
- Drive casing to 20.0ft. Drill to 20.0ft. S-8 at 20ft
- Drill to 23.0ft. S-9 at 23ft. Spoon bouncing
- Bottom of boring at 5/26/2021 10:22 AM. Boring grouted upon completion. Surface patched with concrete.

LANGAN

Log of Boring **SLB-7** Sheet 1 of 2

Project: New Union County Government Complex	Project No.: 100889101
Location: 61-99 West Grand Street	Elevation and Datum: Approx el. 21.5
Drilling Company: Craig Geotechnical Drilling Co., Inc.	Date Started: 05/26/2021 — Date Finished: 05/27/2021
Drilling Equipment: CME-75 Drill Rig	Completion Depth: 25.2 ft — Rock Depth: 25 ft
Size and Type of Bit: 2-7/8in Tricone Roller Bit	Number of Samples: Disturbed 8 — Undisturbed 1 — Core -
Casing Diameter (in): 4"- diameter steel — Casing Depth (ft): 8	Water Level (ft.): First ▽ — Completion ▼ — 24 HR. ▼
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Eric Delmeier
Sampler: 2-inch-diameter split spoon; Shelby Tube	Field Engineer: Rebecca Blocker
Sampler Hammer: Safety — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+21.5		0						Started Drilling at 5/26/2021 12:01 PM. S-1 at 0ft
	+21.0	Asphalt							
		Reddish brown f-c SAND, some silt, some gravel (dry)[FILL]	1	S-1	SS	12	8 14 13 16	27	
		Reddish brown to black f-c SAND, some silt, some gravel, some clay, with brick pieces (moist)[FILL]	2	S-2	SS	14	11 9 11 8	20	S-2 at 2ft
		[wc=14.3%; passing #200 = 30%]	3						
		Reddish brown CLAY, trace f-m sand (moist)[FILL]	4	S-3	SS	12	3 3 5 6	8	Drive casing to 4.0ft. Drill to 4.0ft. S-3 at 4ft q_u=2.50 tsf (PP)
		Brown silty CLAY, some f-m sand (wet)[FILL]	5						
			6	S-4	SS	5	9 50/2	50/2	S-4 at 6ft
			7						
			8						Drive casing to 8.0ft. Drill to 8.0ft
	+12.5		9	S-5	SS	0	50/2	50/2	S-5 at 9ft
		No Recovery	10						
		POSSIBLE CONCRETE	11						
			12						
			13						
			14						
	+6.5		15						
		Reddish brown silty CLAY, trace f-m sand (wet)[FILL]	16	S-6	SS	6	3 4 4 4	8	Drill to 15.0ft. S-6 at 15ft q_u=1.25 tsf (PP)
		Reddish brown silty CLAY, trace f-m sand (wet)[FILL]	17	U-1	ST	23			Drill to 17.0ft. U-1 at 17ft
			18						
	+2.5		19	S-7	SS	17	11 18	71	S-7 at 19ft
		Dark brown SILT, trace clay, trace f-m sand (wet)[ML]	20						
	+1.5								

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Log of Boring **SLB-7** Sheet 2 of 2

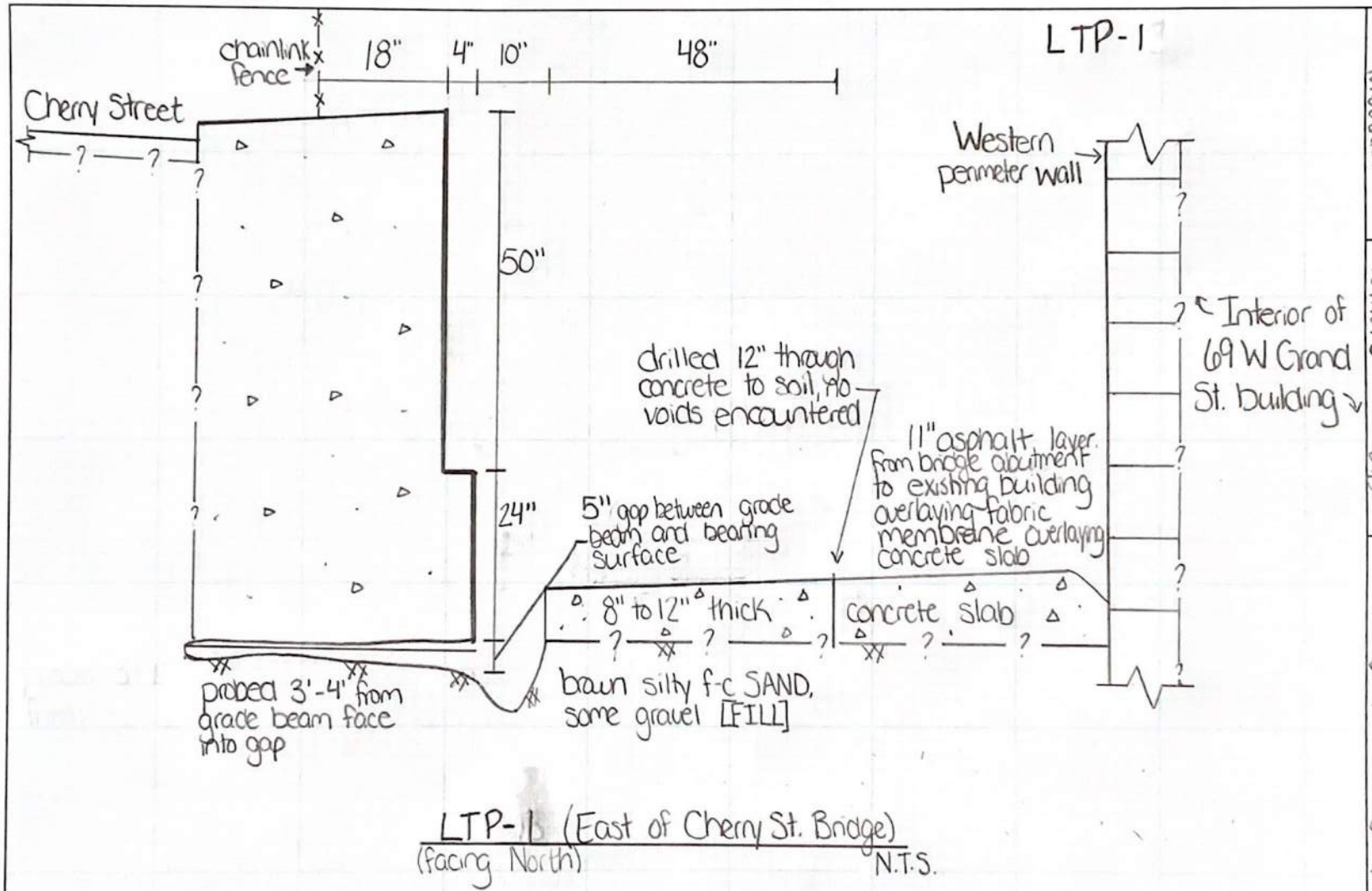
Project	Project No.
New Union County Government Complex	100889101
Location	**Elevation and Datum**
61-99 West Grand Street	Approx el. 21.5

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+1.5		20	S-7	SS	17	53 50/2	71	Started Drilling for the day at 5/27/2021 7:20 AM. Stopped Drilling for the day at 5/27/2021 2:02 PM Drill to 22.0ft
		PROBABLE DECOMPOSED ROCK	21						
			22						
			23						
			24						
	-3.7		25	S-8	SS	0	50/2	50/2	Drill to 25.0ft. S-8 at 25ft. Spoon bouncing Bottom of boring at 5/27/2021 7:46 AM. Boring grouted upon completion. Surface patched with concrete.
		End of boring at 25.2 ft.	26						
			27						
			28						
			29						
			30						
			31						
			32						
			33						
			34						
			35						
			36						
			37						
			38						
			39						
			40						
			41						
			42						
			43						
			44						
			45						

N-Value (Blows/ft) scale: 10 20 30 40

APPENDIX C

Log of 2021 Langan Test Pit LTP-1



LTP-1 (East of Cherry St. Bridge)
(facing North) N.T.S.

PROJ NO 100889101
SHEET 1 OF
BY KLB DATE 5/24/21
CKD DATE
Union County Government Complex
Elizabeth, NJ

LANGAN

TEST PIT LTP-1

Notes:

1. Test pit LTP-1 was excavated on May 24, 2021 by ATA Construction using hand operated tools between the Eastern face of the Cherry St bridge abutment and the existing western perimeter wall of the structure at 69 W Grand St Elizabeth, NJ.
2. The area of the test pit is south of a retaining wall structure and approximately 15 feet (ft) higher than the ground surface to the north of the retaining wall.
3. The entire area was covered in asphalt and shrubs. The asphalt was in good condition and sloped away from the existing building and to a weep hole in the retaining wall to the north.
4. The contractor removed the shrubs prior to excavating the test pit.
5. An 11-inch thick layer of asphalt covered the surface from the bridge abutment to the existing building.
6. The test pit was excavated 3 ft below the surface of the asphalt layer, and groundwater was not encountered.
7. An 8-inch to 12-inch thick concrete layer was encountered under the asphalt 10-inches from the grade beam and continued to the existing building's exterior wall. The concrete sloped away from the existing building. The concrete within 5 inches of the existing structure's wall was chipped at an angle
8. A fabric waterproofing membrane was encountered between the asphalt and the concrete slab.
9. The test pit exposed the bottom of the concrete grade beam which was approximately 19-inches below the ground surface. There was a 5-inch gap between the bottom of the grade beam and the bearing soil beneath it.
10. A steel rod was used to probe 36-inches to 48 inches (west) from the grade beam face under the grade beam. The rod probed 36-inches to the north and 48-inches to the south.
11. The test pit was backfilled using the excavated materials.

APPENDIX D

Select Photographs of Test Pit LTP-1

LTP-1: Adjacent to the eastern edge of the Cherry Street Bridge Abutment (facing north)

LTP-1: Concrete bridge abutment and grade beam (facing north)

LTP-1: Concrete bridge abutment and grade beam (facing west)

LTP-1: Existing void beneath concrete grade beam (facing west)

APPENDIX E

2021 Laboratory Testing Results

TerraSense, LLC
Geotesting Laboratory

07/16/2021
TerraSense Project Number: 7920-135

Bahadir Eksioglu
Project Manager
Langan
300 Kimball Drive
Parsippany, NJ 07054

Dear Mr. Eksioglu:

Re: Laboratory Test Results for Union County Governmental Complex

The purpose of this letter is to present the results of the laboratory tests performed on the samples delivered to the TerraSense laboratory on 06/15/21. Testing was performed based on the assignment dated 06/15/21 by R. Blocker.

Test Results

Test results are reported on the accompanying test pages.

Test Comments

Testing was performed in general accordance to the ASTM or other methods as listed on the test pages. Deviations from the test standards are noted on these pages.

Limitations

Our professional services for this project have been performed in accordance with generally accepted engineering practices; no other warranty, expressed or implied, is made.

Sample Disposition

If we do not receive other instructions from you within thirty days, this material will be disposed of.

If you have any questions concerning the test results reported in this letter, please call us.

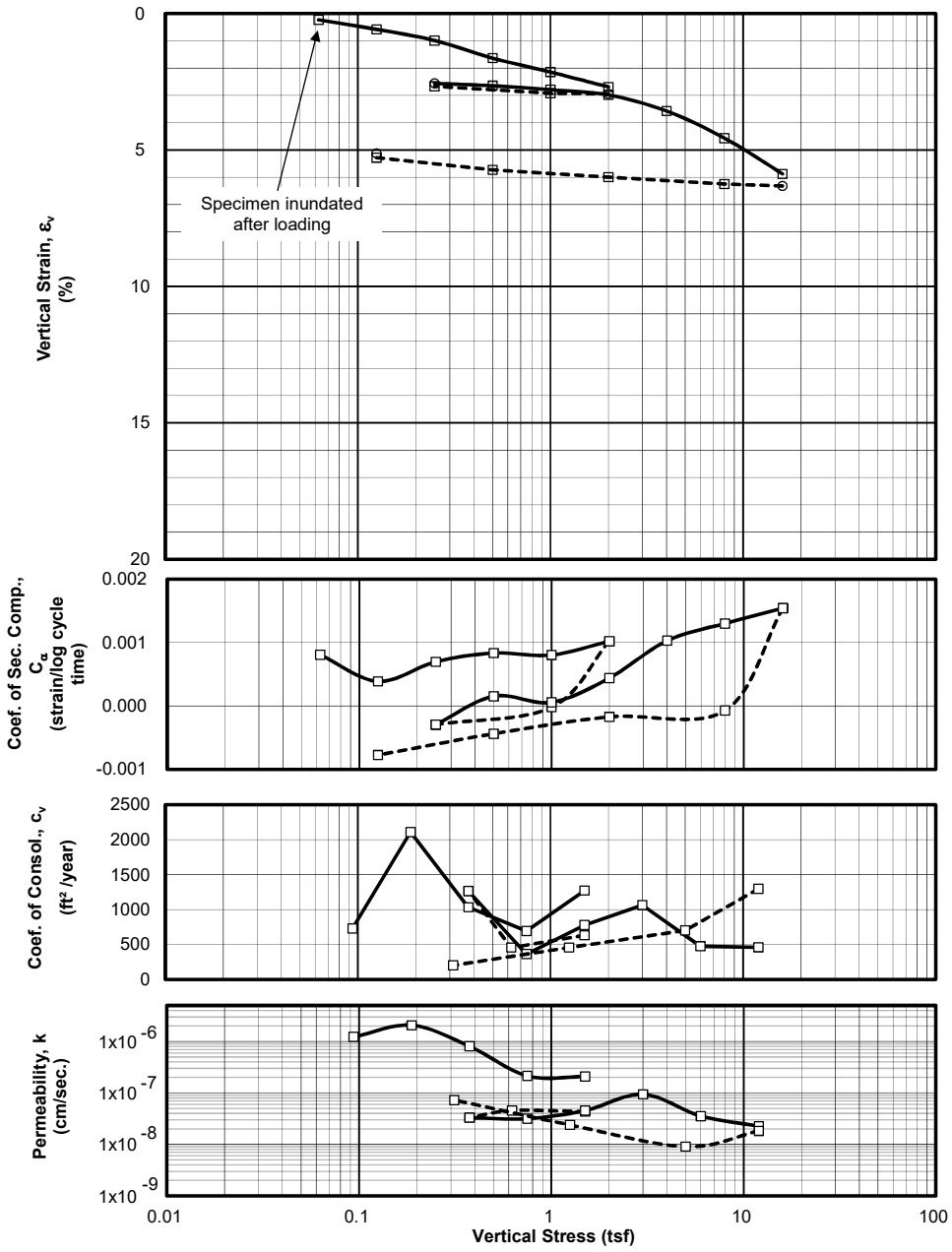
Sincerely,
TerraSense, LLC.
Rosella Thomas
Rosella Thomas
Managing Member

Enclosure:

Langan Engineering #100889101
Union County Governmental Complex
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS								CONSOLIDATION			REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	TEST ID (-)	INITIAL CONDITIONS VOID RATIO (-)	INITIAL CONDITIONS SATUR-ATION (%)	
LB-2	S-4	6-8	17.3	32	17	15	CL							
LB-6	S-3	5-7	17.9	35	17	18	CL							
LB-8	S-4	6-8	13.4				SP-SM	12						
LB-9	S-2	2-4	17.1	29	16	13	CL							
LB-10	S-3	4-6	12.0				SM	18.2						
LB-10	U-1	13.5-15.5							130.6					
LB-10	U-1	13.65	20.9											
LB-10	U-1A	13.9	17.0	18	17	1	SM		128.9	110.1	C21178	0.480	93	
LB-10	U-1	14.2	20.0											
LB-10	U-1	14.4	19.9											
LB-14	S-7	15-17	21.9	20	17	3	ML							
LB-15	S-6	10-12	28.0				SM	22						
LB-15	U-1	17-19							128.7					
LB-15	U-1	17.3	19.6											
LB-15	U-1	17.85	22.4											
LB-15	U-1B	18.15	24.5	29	19	10	CL		127.6	102.4	C21179	0.627	104	
LB-15	U-1	18.4	24.0											
SLB-4	S-4	6-8	16.6	32	17	15	CL							
SLB-7	S-2	2-4	14.3				SC	30						

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.



SAMPLE INFORMATION

Boring:	LB-10
Sample:	U-1A
Depth:	13.90 feet
Elevation:	
Type:	3-inch thin wall tube
Description:	SM, brown silty sand

LL = 18, PL = 17, PI = 1

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.60	inch
Diameter:	2.50	inch

Initial water content:	17.0	%
Initial total unit weight:	128.9	pcf
Initial dry unit weight:	110.1	pcf
Initial void ratio:	0.480	
Initial degree of saturation:	93	%
Final water content:	16.2	%
Final total unit weight:	133.2	pcf
Final dry unit weight:	114.6	pcf
Final void ratio:	0.422	
Final degree of saturation:	100	% (assumed specific gravity = 2.61)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	3.9 (Range: 3.0 to 4.3)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.044
Compression Index (void ratio per log cycle stress):	0.065
Swell Ratio (strain per log cycle stress):	0.004
Swell Index (void ratio per log cycle stress):	0.006
Recompression Ratio (strain per log cycle stress):	0.006
Recompression Index (void ratio per log cycle stress):	0.009
Remarks:	

LEGEND: □ End of primary o End of Stage ——— Loading - - - - - - - Unloading

Test Date: 6/22/21 Tested By: CMJ Checked By: GET

Langan Engineering Project No. 100889101	Union County Governmental Complex	ONE DIMENSIONAL CONSOLIDATION TEST Boring: LB-10 Depth: 13.90 feet
TerraSense, LLC	Project No. 7920-135	July 2021

PROJECT:	Union County						
PROJECT NO.:	7920-135	Initial height:	0.603	inch	Final height:	0.579	inch
BORING:	LB-10	Initial water content:	17.0	%	Final water content:	16.2	%
SAMPLE:	U-1A	Initial dry density:	110.1	pcf	Final dry density:	114.6	pcf
TEST:	C21178	Initial total density:	128.9	pcf	Final total density:	133.2	pcf
DEPTH, feet:	13.9	Initial saturation:	93	%	Final saturation:	100	%
BY:	CMJ	Initial void ratio:	0.480		Final void ratio:	0.422	
TEST DATE:	6/22/2021				Final strain:	3.9	%

EQUIPMENT:

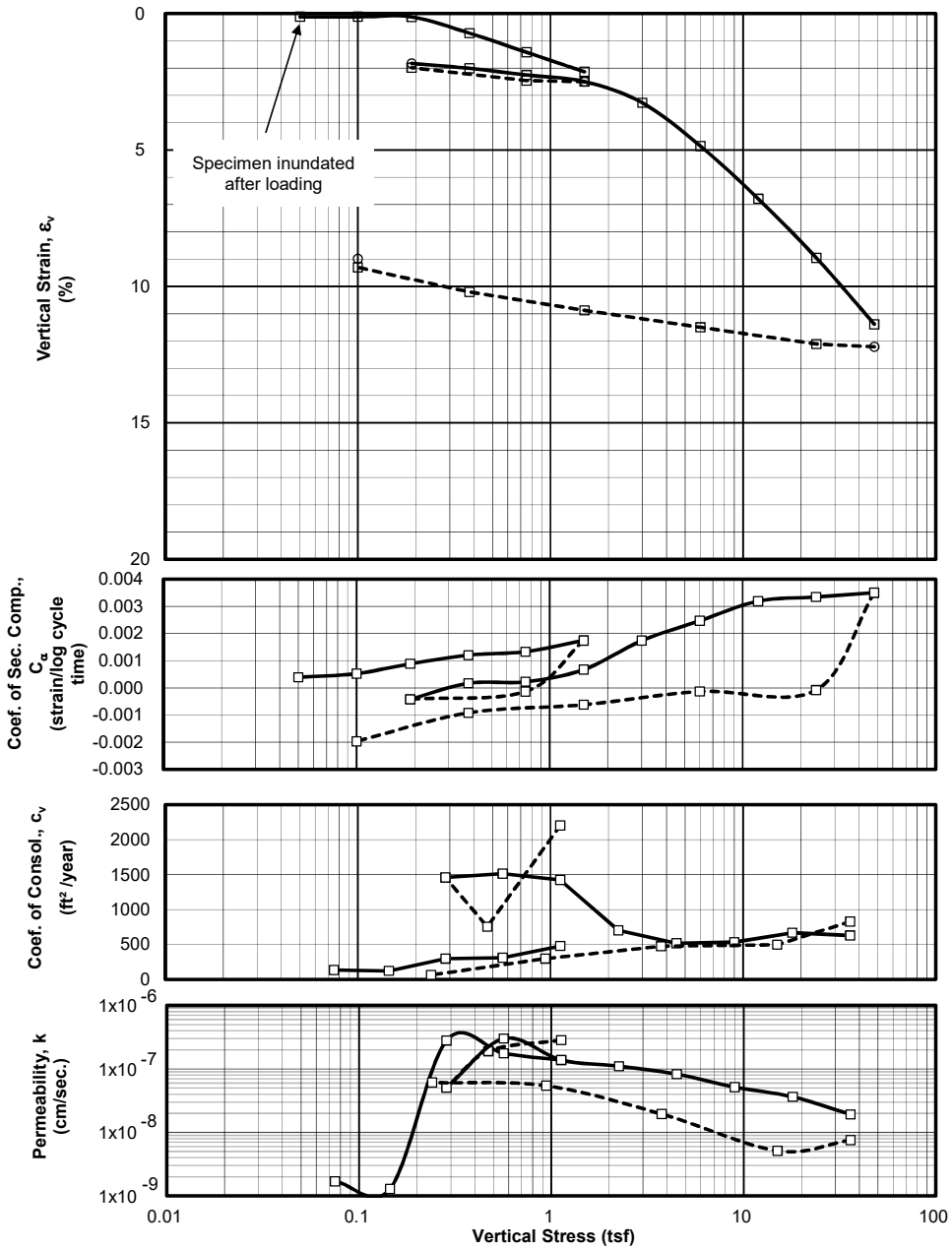
SPECIMEN DESCRIPTION: SM, brown silty sand

Load Frame No.: 3

Ring Diameter: 2.5 inch

G	LL	PL	PI
2.61	18	17	1

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft²/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0014	0.229	0.477	0.322	0.475	41	0.0008	27	4E-08
2	0.125	0.0035	0.579	0.471	0.712	0.469	728	0.0004	18	1E-06
3	0.250	0.0059	0.985	0.465	1.217	0.462	2109	0.0007	31	2E-06
4	0.500	0.0098	1.632	0.456	1.836	0.453	1033	0.0008	39	8E-07
5	1.00	0.0129	2.144	0.448	2.325	0.446	693	0.0008	98	2E-07
6	2.00	0.0162	2.687	0.440	2.944	0.436	1272	0.0010	184	2E-07
7	1.00	0.0176	2.915	0.437	2.917	0.437	632	0.0000	438	4E-08
8	0.250	0.0161	2.667	0.441	2.559	0.442	455	-0.0003	302	5E-08
9	0.500	0.0159	2.645	0.441	2.713	0.440	1265	0.0002	1155	3E-08
10	1.00	0.0168	2.790	0.439	2.808	0.438	363	0.0001	346	3E-08
11	2.00	0.0180	2.984	0.436	3.104	0.434	779	0.0004	515	5E-08
12	4.00	0.0215	3.570	0.427	3.819	0.423	1062	0.0010	341	9E-08
13	8.00	0.0275	4.562	0.413	4.856	0.408	475	0.0013	403	4E-08
14	16.0	0.0354	5.873	0.393	6.318	0.387	458	0.0015	610	2E-08
15	8.00	0.0377	6.248	0.388	6.253	0.387	1295	-0.0001	2137	2E-08
16	2.00	0.0361	5.991	0.391	5.945	0.392	702	-0.0002	2339	9E-09
17	0.500	0.0345	5.730	0.395	5.638	0.397	455	-0.0004	575	2E-08
18	0.125	0.0318	5.279	0.402	5.124	0.404	201	-0.0008	83	7E-08



SAMPLE INFORMATION

Boring:	LB-15
Sample:	U-1B
Depth:	18.15 feet
Elevation:	
Type:	3-inch thin wall tube
Description:	CL, brown lean clay

LL = 29, PL = 19, PI = 10

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.60	inch
Diameter:	2.50	inch

Initial water content:	24.5	%
Initial total unit weight:	127.6	pcf
Initial dry unit weight:	102.4	pcf
Initial void ratio:	0.627	
Initial degree of saturation:	104	%
Final water content:	18.8	%
Final total unit weight:	131.9	pcf
Final dry unit weight:	111.0	pcf
Final void ratio:	0.502	
Final degree of saturation:	100	% (assumed specific gravity = 2.67)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	4.4 (Range: 4.0 to 5.3)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.076
Compression Index (void ratio per log cycle stress):	0.124
Swell Ratio (strain per log cycle stress):	0.008
Swell Index (void ratio per log cycle stress):	0.013
Recompression Ratio (strain per log cycle stress):	0.008
Recompression Index (void ratio per log cycle stress):	0.013
Remarks:	

LEGEND: □ End of primary o End of Stage ——— Loading - - - - - - - Unloading

Test Date: 6/23/21 Tested By: CMJ Checked By: GET

Langan Engineering Project No. 100889101	Union County Governmental Complex	ONE DIMENSIONAL CONSOLIDATION TEST Boring: LB-15 Depth: 18.15 feet
TerraSense, LLC	Project No. 7920-135	July 2021

PROJECT:	Union County						
PROJECT NO.:	7920-135	Initial height:	0.601	inch	Final height:	0.554	inch
BORING:	LB-15	Initial water content:	24.5	%	Final water content:	18.8	%
SAMPLE:	U-1B	Initial dry density:	102.4	pcf	Final dry density:	111.0	pcf
TEST:	C21179	Initial total density:	127.6	pcf	Final total density:	131.9	pcf
DEPTH, feet:	18.15	Initial saturation:	104	%	Final saturation:	100	%
BY:	CMJ	Initial void ratio:	0.627		Final void ratio:	0.502	
TEST DATE:	6/23/2021				Final strain:	7.7	%

EQUIPMENT:

Load Frame No.: 1

Ring Diameter: 2.5 inch

SPECIMEN DESCRIPTION: CL, brown lean clay

G	LL	PL	PI
2.67	29	19	10

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft²/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.050	0.0007	0.116	0.625	0.126	0.625	106	0.0004	43	7E-08
2	0.100	0.0007	0.118	0.625	0.261	0.623	133	0.0005	2368	2E-09
3	0.190	0.0007	0.121	0.625	0.249	0.623	120	0.0009	2822	1E-09
4	0.380	0.0043	0.717	0.616	0.952	0.612	295	0.0012	32	3E-07
5	0.750	0.0085	1.418	0.604	1.661	0.600	308	0.0013	53	2E-07
6	1.50	0.0128	2.134	0.592	2.496	0.587	476	0.0017	105	1E-07
7	0.750	0.0147	2.455	0.587	2.418	0.588	2204	-0.0001	234	3E-07
8	0.190	0.0119	1.986	0.595	1.827	0.598	753	-0.0004	119	2E-07
9	0.380	0.0121	2.008	0.595	2.054	0.594	1460	0.0002	866	5E-08
10	0.750	0.0135	2.251	0.591	2.333	0.589	1514	0.0002	152	3E-07
11	1.50	0.0150	2.493	0.587	2.704	0.583	1422	0.0007	310	1E-07
12	3.00	0.0197	3.273	0.574	3.697	0.567	702	0.0017	192	1E-07
13	6.00	0.0292	4.858	0.548	5.676	0.535	518	0.0025	189	8E-08
14	12.0	0.0408	6.790	0.517	7.958	0.498	532	0.0032	311	5E-08
15	24.0	0.0538	8.952	0.482	9.733	0.469	668	0.0033	555	4E-08
16	48.0	0.0684	11.385	0.442	12.212	0.429	629	0.0035	987	2E-08
17	24.0	0.0728	12.111	0.430	12.100	0.430	828	-0.0001	3304	8E-09
18	6.00	0.0690	11.493	0.440	11.463	0.441	494	-0.0001	2912	5E-09
19	1.50	0.0654	10.880	0.450	10.658	0.454	474	-0.0006	734	2E-08
20	0.380	0.0613	10.202	0.461	10.021	0.464	297	-0.0009	165	5E-08
21	0.100	0.0559	9.302	0.476	8.984	0.481	63	-0.0020	31.13	6E-08

APPENDIX F

2021 Corrosion Testing Results

LANGAN

CORROSION POTENTIAL EVALUATION

Project:	**New Union County Government Complex**	**Location:**	**LB-14**
Location:	**Elizabeth, NJ**	**Sample:**	**Composite**
Job Number:	**100889101**	**Depth:**	**0'-6'**

CORROSION POTENTIAL FOR GRAY & DUCTILE CAST IRON-PIPE

Ref: ASTM A674-18 1 megaohm-cm= 1,000,000 ohm-cm

Soil Characterisitics	Laboratory Test Results	Points
Resistivity (ohm-cm)	1390	10
pH	7.9	0
Redox Potential (mV)	484	0
Sulfides (Positive, Trace, Negative)	Positive	3.5
Moisture (Poor, Fair, or Good)	Poor	2
	Total Points:	15.5

CORROSIVE

total points > 10 corrrosive

total points < 10 non-corrrosive

TABLE X1.1 Soil Test Evaluation[A]

Soil Characteristics	Points
Resistivity, ohm-cm (based on water-saturated soil-box):	
<1500	10
≥1500 to 1800	8
>1800 to 2100	5
>2100 to 2500	2
>2500 to 3000	1
>3000	0
pH:	
0–2	5
2–4	3
4–6.5	0
6.5–7.5	0[B]
7.5–8.5	0
>8.5	3
Redox potential:	
> +100 mV	0
+50 to +100 mV	3.5
0 to +50 mV	4
Negative	5
Sulfides:	
Positive	3.5
Trace	2
Negative	0
Moisture:	
Poor drainage, continuously wet	2
Fair drainage, generally moist	1
Good drainage, generally dry	0

[A] Ten points = corrosive to or ductile iron pipe; protection is indicated.
[B] If sulfides are present and low (<100 mv) or negative redox potential results are obtained, three points shall be given for this range.

CONCRETE REQUIREMENTS

Ref 1: ACI 318, Part 3, Chapter 4 1kg=1,000g=1,000,000mg
Ref 2: NAVFAC DM 7.2 pg 146

Water Soluble Sulfate in Soil (mg/kg or ppm)	Water Soluble Sulfate in Soil (% by weight)	Exposure Type	Cement Type
287	0.0287	Negligible	**Type I**

to convert mg/kg (ppm) to weight ratio divide by 1,000,000 and to obtain % ratio multiply by 100

Ref 1: ACI 318, Part 3, Chapter 4

0.00 to 0.10, Negligible and Type I Cement

0.10 to 0.20, Moderate, and Type II Cement (typical for seawater)

0.20 to 2.00, Severe, and Type V Cement

over 2.00, Very Severe, and Type V Cement with pozzolan

Ref 2: NAVFAC DM 7.2 pg 146

if Sulfates in soil greater than 0.5%, or more than 1200 ppm in groundwater, need Type V Cement

Ref 3:FHWA GEC 4 Ground Anchors page 136

Determine Sulfate content par AASHTO T-290. For Sulfate content between 0.1% and 0.2% use Type II cement, For Sulfate content between 0.2% and 22% use Type V cement and Sulfate content gretaer than 2% use Type V plus pozzolan.

CRITICAL VALUES FOR GROUND AGGRESSIVENESS

Ref: FHWA DP-68-IR, as summarized in Fang (1991)

Test	Laboratory Test Results	Reference Standard	Critical Values	Critical?
Resistivity	1390	ASTM G57	below 2000 ohm/cm	**YES**
pH	7.9	ASTM G51	below 4.5	**NO**
Sulfate	287	CalDOT 407	above 500 ppm	**NO**
Chlorides	221	CalDOT 422	above 100ppm	**YES**

BDL : Below detectable limits

CORROSION POTENTIAL EVALUATION

Project:	**New Union County Government Complex**	**Location:**	**SLB-4**
Location:	**Elizabeth, NJ**	**Sample:**	**Composite**
Job Number:	**100889101**	**Depth:**	**0'-6'**

CORROSION POTENTIAL FOR GRAY & DUCTILE CAST IRON-PIPE

Ref: ASTM A674-18 1 megaohm-cm= 1,000,000 ohm-cm

Soil Characterisitics	Laboratory Test Results	Points
Resistivity (ohm-cm)	1480	10
pH	8.5	0
Redox Potential (mV)	539	0
Sulfides (Positive, Trace, Negative)	Positive	3.5
Moisture (Poor, Fair, or Good)	Poor	2
Total Points:		15.5

CORROSIVE

total points > 10 corrrosive

total points < 10 non-corrrosive

TABLE X1.1 Soil Test Evaluation[A]

Soil Characteristics	Points
Resistivity, ohm-cm (based on water-saturated soil-box):	
<1500	10
≥1500 to 1800	8
>1800 to 2100	5
>2100 to 2500	2
>2500 to 3000	1
>3000	0
pH:	
0–2	5
2–4	3
4–6.5	0
6.5–7.5	0[B]
7.5–8.5	0
>8.5	3
Redox potential:	
> +100 mV	0
+50 to +100 mV	3.5
0 to +50 mV	4
Negative	5
Sulfides:	
Positive	3.5
Trace	2
Negative	0
Moisture:	
Poor drainage, continuously wet	2
Fair drainage, generally moist	1
Good drainage, generally dry	0

[A] Ten points = corrosive to or ductile iron pipe; protection is indicated.
[B] If sulfides are present and low (<100 mv) or negative redox potential results are obtained, three points shall be given for this range.

CONCRETE REQUIREMENTS

Ref 1: ACI 318, Part 3, Chapter 4 1kg=1,000g=1,000,000mg
Ref 2: NAVFAC DM 7.2 pg 146

Water Soluble Sulfate in Soil (mg/kg or ppm)	Water Soluble Sulfate in Soil (% by weight)	Exposure Type	Cement Type
189	0.0189	Negligible	**Type I**

to convert mg/kg (ppm) to weight ratio divide by 1,000,000 and to obtain % ratio multiply by 100

Ref 1: ACI 318, Part 3, Chapter 4

0.00 to 0.10, Negligible and Type I Cement

0.10 to 0.20, Moderate, and Type II Cement (typical for seawater)

0.20 to 2.00, Severe, and Type V Cement

over 2.00, Very Severe, and Type V Cement with pozzolan

Ref 2: NAVFAC DM 7.2 pg 146

if Sulfates in soil greater than 0.5%, or more than 1200 ppm in groundwater, need Type V Cement

Ref 3:FHWA GEC 4 Ground Anchors page 136

Determine Sulfate content par AASHTO T-290. For Sulfate content between 0.1% and 0.2% use Type II cement, For Sulfate content between 0.2% and 22% use Type V cement and Sulfate content gretaer than 2% use Type V plus pozzolan.

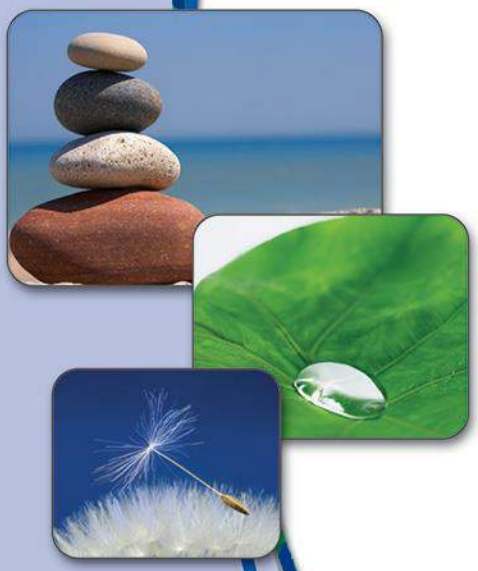
CRITICAL VALUES FOR GROUND AGGRESSIVENESS

Ref: FHWA DP-68-IR, as summarized in Fang (1991)

Test	Laboratory Test Results	Reference Standard	Critical Values	Critical?
Resistivity	1480	ASTM G57	below 2000 ohm/cm	**YES**
pH	8.5	ASTM G51	below 4.5	**NO**
Sulfate	189	CalDOT 407	above 500 ppm	**NO**
Chlorides	275	CalDOT 422	above 100ppm	**YES**

BDL : Below detectable limits

eurofins | Environment Testing America



ANALYTICAL REPORT

Eurofins TestAmerica, Edison
777 New Durham Road
Edison, NJ 08817
Tel: (732)549-3900

Laboratory Job ID: 460-237892-1
Client Project/Site: Union County Government Complex
100889101

For:
Langan Engineering & Environmental Srvcs
300 Kimball Drive
4th Floor
Parsippany, New Jersey 07407

Attn: Rebecca Blocker

Authorized for release by:
7/13/2021 11:39:20 AM
Grace Chang, Project Manager II
(732)593-2579
Grace.Chang@Eurofinset.com

Designee for

Patricia Grieco, Senior Project Manager
(732)593-2507
Patricia.Grieco@Eurofinset.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Definitions/Glossary

Client: Langan Engineering & Environmental Srvcs
Job ID: 460-237892-1
Project/Site: Union County Government Complex 100889101

Qualifiers

General Chemistry

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
H3	Sample was received and analyzed past holding time.
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.
U	Indicates the analyte was analyzed for but not detected.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 460-237892-1

Laboratory: Eurofins TestAmerica, Edison

Narrative

CASE NARRATIVE

Client: Langan Engineering & Environmental Srvcs

Project: Union County Government Complex 100889101

Report Number: 460-237892-1

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

It should be noted that samples with elevated Reporting Limits (RLs) as a result of a dilution may not be able to satisfy customer reporting limits in some cases. Such increases in the RLs are unavoidable but acceptable consequence of sample dilution that enables quantification of target analytes or interferences which exceed the calibration range of the instrument.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 7/1/2021 3:45 PM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 30.0º C.

Receipt Exceptions

The following samples were received at the laboratory outside the required temperature criteria: SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2). There was no cooling media present in the cooler. The client was contacted regarding this issue, and the laboratory was instructed to proceed withl analysis.

The following samples were received outside of holding time for Sulfide: SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2). The lab was instructed to proceed with the analysis by the client on 07/06/2021.

The following samples were received at the laboratory without a sample collection time documented on the chain of custody and container: SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2). The client was contacted, and the laboratory was instructed to use a sample collection time of 12:00am.

Note: All samples which require thermal preservation are considered acceptable if the arrival temperature is within 2C of the required temperature or method specified range. For samples with a specified temperature of 4C, samples with a temperature ranging from just above freezing temperature of water to 6C shall be acceptable. Samples that are hand delivered immediately following collection may not meet these criteria, however they will be deemed acceptable according to NELAC standards, if there is evidence that the chilling process has begun, such as arrival on ice, etc.

SPECIFIC CONDUCTANCE

Samples SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2) were analyzed for specific conductance in accordance with SM 2510B. The samples were leached on 07/07/2021 and analyzed on 07/07/2021.

The following samples were received outside of holding time: SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2).

The procedure for Specific Conductance, Resistivity by Method 9050A, SM2510B is applicable to liquid samples and has been modified to

Job ID: 460-237892-1 (Continued)

Laboratory: Eurofins TestAmerica, Edison (Continued)

provide the enclosed results on the soil matrix. The modification involves a DI leach of the soil followed by electrometric measurement of the leachate. The values provided are a measure of the leachable components <conductance, resistance> for a given mass to volume of water, rather than the conductance_or_resistivity of the soil itself.

No difficulties were encountered during the specific conductance analysis.

All quality control parameters were within the acceptance limits.

Resistivity was detected in method blank MB 460-788847/8 at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Refer to the QC report for details.

REDUCTION-OXIDATION (REDOX) POTENTIAL

Samples SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2) were analyzed for Reduction-Oxidation (REDOX) Potential in accordance with SM 2580B Oxidation Reduction Potential. The samples were leached on 07/08/2021 and analyzed on 07/08/2021.

No difficulties were encountered during the redox analysis.

All quality control parameters were within the acceptance limits.

TOTAL SULFIDE

Samples SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2) were analyzed for total sulfide in accordance with EPA SW-846 Method 9030B/9034. The samples were prepared and analyzed on 07/08/2021.

Sulfide failed the recovery criteria high for the MS of sample 460-237891-1 in batch 460-789192.

Sulfide failed the recovery criteria high for the MSD of sample 460-237891-1 in batch 460-789192.

Refer to the QC report for details.

Sulfide failed the recovery criteria high for the MSD of sample 460-237891-1 in batch 460-789192.

Refer to the QC report for details.

No other difficulties were encountered during the sulfide analysis.

All other quality control parameters were within the acceptance limits.

ASTM SULFATE

Samples SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2) were analyzed for ASTM Sulfate in accordance with EPA SW846 Method 9038 by ASTM Leach D3987-85. The samples were leached on 07/08/2021 and analyzed on 07/12/2021.

No difficulties were encountered during the ASTM Sulfate analysis.

All quality control parameters were within the acceptance limits.

CORROSIVITY (PH)

Samples SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2) were analyzed for corrosivity (pH) in accordance with EPA SW-846 Method 9045D. The samples were analyzed on 07/08/2021.

No difficulties were encountered during the corrosivity (pH) analysis.

All quality control parameters were within the acceptance limits.

ASTM CHLORIDE

Samples SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2) were analyzed for ASTM Chloride in accordance with 9251

Job ID: 460-237892-1 (Continued)

Laboratory: Eurofins TestAmerica, Edison (Continued)

by ASTM Leach D3987-85. The samples were leached on 07/08/2021 and analyzed on 07/12/2021.

No difficulties were encountered during the chloride analysis.

All quality control parameters were within the acceptance limits.

PERCENT SOLIDS/PERCENT MOISTURE

Samples SLB-4 Comp-1 (460-237892-1) and LB-14 Comp-2 (460-237892-2) were analyzed for percent solids/percent moisture in accordance with EPA Method CLPISM01.2 (Exhibit D) Modified. The samples were analyzed on 07/07/2021.

No difficulties were encountered during the %solids/moisture analysis.

All quality control parameters were within the acceptance limits.

Client Sample ID: SLB-4 Comp-1
Lab Sample ID: 460-237892-1
Date Collected: 05/27/21 00:00
Matrix: Solid
Date Received: 07/01/21 15:45

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.5	HF			SU			07/08/21 16:06	1
Corrosivity	8.5	HF			SU			07/08/21 16:06	1
Temperature	23.5	HF			Degrees C			07/08/21 16:06	1
Total Chloride	275	H	99.9	66.4	mg/Kg			07/12/21 13:37	1
Percent Moisture	10.3		1.0	1.0	%			07/07/21 15:43	1
Percent Solids	89.7		1.0	1.0	%			07/07/21 15:43	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Resistivity	0.00148	H	0.000100	0.000100	Mohm-cm			07/07/21 10:41	1
Oxidation Reduction Potential	539				millivolts			07/08/21 15:14	1

General Chemistry - ASTM Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfate	189	H	99.9	48.4	mg/Kg			07/12/21 13:52	1

Client Sample ID: SLB-4 Comp-1
Lab Sample ID: 460-237892-1
Date Collected: 05/27/21 00:00
Matrix: Solid
Date Received: 07/01/21 15:45
Percent Solids: 89.7

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	3.5	U H H3	11.1	3.5	mg/Kg	☼	07/08/21 12:02	07/08/21 16:39	1

Client Sample ID: LB-14 Comp-2
Lab Sample ID: 460-237892-2
Date Collected: 05/19/21 00:00
Matrix: Solid
Date Received: 07/01/21 15:45

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.9	HF			SU			07/08/21 16:07	1
Corrosivity	7.9	HF			SU			07/08/21 16:07	1
Temperature	23.6	HF			Degrees C			07/08/21 16:07	1
Total Chloride	221	H	100	66.4	mg/Kg			07/12/21 13:37	1
Percent Moisture	13.5		1.0	1.0	%			07/07/21 15:43	1
Percent Solids	86.5		1.0	1.0	%			07/07/21 15:43	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Resistivity	0.00139	H	0.000100	0.000100	Mohm-cm			07/07/21 10:41	1
Oxidation Reduction Potential	484				millivolts			07/08/21 15:16	1

General Chemistry - ASTM Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfate	287	H	100	48.4	mg/Kg			07/12/21 13:50	1

Client: Langan Engineering & Environmental Srvcs
Job ID: 460-237892-1
Project/Site: Union County Government Complex 100889101

Client Sample ID: LB-14 Comp-2
Lab Sample ID: 460-237892-2
Date Collected: 05/19/21 00:00
Matrix: Solid
Date Received: 07/01/21 15:45
Percent Solids: 86.5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	3.6	U H H3	11.6	3.6	mg/Kg	☼	07/08/21 12:02	07/08/21 16:39	1

Lab Chronicle

Client: Langan Engineering & Environmental Srvcs
Job ID: 460-237892-1
Project/Site: Union County Government Complex 100889101

Client Sample ID: SLB-4 Comp-1
Lab Sample ID: 460-237892-1
Date Collected: 05/27/21 00:00
Matrix: Solid
Date Received: 07/01/21 15:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
ASTM Leach	Leach	D3987-85			789228	07/08/21 15:00	JDP	TAL EDI
ASTM Leach	Analysis	9038		1	789816	07/12/21 13:52	RAK	TAL EDI
Total/NA	Analysis	9045D		1	789204	07/08/21 16:06	YAH	TAL EDI
Total/NA	Leach	D3987-85			789228	07/08/21 15:00	JDP	TAL EDI
Total/NA	Analysis	9251		1	789817	07/12/21 13:37	RAK	TAL EDI
Total/NA	Analysis	Moisture		1	788904	07/07/21 15:43	NZP	TAL EDI
Soluble	Leach	DI Leach			788875	07/07/21 09:40	MMC	TAL EDI
Soluble	Analysis	SM 2510B		1	788847	07/07/21 10:41	MMC	TAL EDI
Soluble	Leach	DI Leach			789194	07/08/21 09:00	YAH	TAL EDI
Soluble	Analysis	SM 2580B		1	789195	07/08/21 15:14	YAH	TAL EDI

Client Sample ID: SLB-4 Comp-1
Lab Sample ID: 460-237892-1
Date Collected: 05/27/21 00:00
Matrix: Solid
Date Received: 07/01/21 15:45
Percent Solids: 89.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	9030B			789119	07/08/21 12:02	YAH	TAL EDI
Total/NA	Analysis	9034		1	789192	07/08/21 16:39	YAH	TAL EDI

Client Sample ID: LB-14 Comp-2
Lab Sample ID: 460-237892-2
Date Collected: 05/19/21 00:00
Matrix: Solid
Date Received: 07/01/21 15:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
ASTM Leach	Leach	D3987-85			789228	07/08/21 15:00	JDP	TAL EDI
ASTM Leach	Analysis	9038		1	789816	07/12/21 13:50	RAK	TAL EDI
Total/NA	Analysis	9045D		1	789204	07/08/21 16:07	YAH	TAL EDI
Total/NA	Leach	D3987-85			789228	07/08/21 15:00	JDP	TAL EDI
Total/NA	Analysis	9251		1	789817	07/12/21 13:37	RAK	TAL EDI
Total/NA	Analysis	Moisture		1	788904	07/07/21 15:43	NZP	TAL EDI
Soluble	Leach	DI Leach			788875	07/07/21 09:40	MMC	TAL EDI
Soluble	Analysis	SM 2510B		1	788847	07/07/21 10:41	MMC	TAL EDI
Soluble	Leach	DI Leach			789194	07/08/21 09:00	YAH	TAL EDI
Soluble	Analysis	SM 2580B		1	789195	07/08/21 15:16	YAH	TAL EDI

Client Sample ID: LB-14 Comp-2
Lab Sample ID: 460-237892-2
Date Collected: 05/19/21 00:00
Matrix: Solid
Date Received: 07/01/21 15:45
Percent Solids: 86.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	9030B			789119	07/08/21 12:02	YAH	TAL EDI
Total/NA	Analysis	9034		1	789192	07/08/21 16:39	YAH	TAL EDI

Laboratory References:

TAL EDI = Eurofins TestAmerica, Edison, 777 New Durham Road, Edison, NJ 08817, TEL (732)549-3900

Accreditation/Certification Summary

Client: Langan Engineering & Environmental Srvcs
Job ID: 460-237892-1
Project/Site: Union County Government Complex 100889101

Laboratory: Eurofins TestAmerica, Edison

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
New Jersey	NELAP	12028	06-30-22

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
9045D		Solid	Corrosivity
9045D		Solid	Temperature
Moisture		Solid	Percent Moisture
Moisture		Solid	Percent Solids
SM 2510B		Solid	Resistivity
SM 2580B		Solid	Oxidation Reduction Potential

Method Summary

Client: Langan Engineering & Environmental Srvcs
Job ID: 460-237892-1
Project/Site: Union County Government Complex 100889101

Method	Method Description	Protocol	Laboratory
9034	Sulfide, Acid Soluble and Insoluble (Titrimetric)	SW846	TAL EDI
9038	Sulfate, Turbidimetric	SW846	TAL EDI
9045D	pH	SW846	TAL EDI
9251	Chloride	SW846	TAL EDI
Moisture	Percent Moisture	EPA	TAL EDI
SM 2510B	Conductivity, Specific Conductance	SM	TAL EDI
SM 2580B	Reduction-Oxidation (REDOX) Potential	SM	TAL EDI
9030B	Sulfide, Distillation (Acid Soluble and Insoluble)	SW846	TAL EDI
D3987-85	ASTM Leaching Procedure	ASTM	TAL EDI
D3987-85	Leaching Procedure	ASTM	TAL EDI
DI Leach	Deionized Water Leaching Procedure	ASTM	TAL EDI

Protocol References:

ASTM = ASTM International

EPA = US Environmental Protection Agency

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL EDI = Eurofins TestAmerica, Edison, 777 New Durham Road, Edison, NJ 08817, TEL (732)549-3900

Sample Summary

Client: Langan Engineering & Environmental Srvcs
Job ID: 460-237892-1
Project/Site: Union County Government Complex 100889101

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
460-237892-1	SLB-4 Comp-1	Solid	05/27/21 00:00	07/01/21 15:45	
460-237892-2	LB-14 Comp-2	Solid	05/19/21 00:00	07/01/21 15:45	

LANGAN CHAIN OF CUSTODY RECORD/ ANALYSIS REQUEST 237892

Page__ of __

Proj. Name: Union County Government Complex
Site Location: 60-99 West Grand St Elizabeth, NJ
Proj. No: 100889101
Auth. By: Rebecca Blocker
Phone No.: 973-520-3490

Sampled By: Rebecca Blocker
Company: Langan Engineering and Environmental Services

Location	Sample Number	Depth	Date	Sample Type	No. of Cont.	Sieve Analysis	Corrosion Suite*	COMMENTS
SLB-4	comp-1	0-6ft	5/27/21	SS	1		X	1
LB-14	comp-2	0-6ft	5/19/21	SS	1		X	2

ANALYSIS REQUESTED

460-237892 Chain of Custody

*Corrosion suite should test for the following:
-Resistivity
-Redox Potential
-Sulfides
-Sulfates
-Chlorides
-pH
-Water Content

Total No. of Containers: 2

Relinquished By: M. B
Date: 6/30/21 1135 MB

Test specifications/other instructions:
Please send results to rblocker@langan.com, ayoda@langan.com, beksioglu@langan.com

Laboratory Name & Address: Test America, 777 Durham Road, Edison, NJ

Received By: Susie Arnold 6/30/21 1135
Received By: Susie Arnold 6/30/21 1545

NO CS IR#9 30.5/30.8°C NO ICE PER Client

Eurofins TestAmerica Edison
Receipt Temperature and pH Log

Job Number: 137892

Number of Coolers: 1 IR Gun # 9

Cooler Temperatures

	RAW	CORRECTED		RAW	CORRECTED		RAW	CORRECTED
Cooler #1:	30.5 ℃	30.8 ℃	Cooler #4:	℃	℃	Cooler #7:	℃	℃
Cooler #2:	℃	℃	Cooler #5:	℃	℃	Cooler #8:	℃	℃
Cooler #3:	℃	℃	Cooler #6:	℃	℃	Cooler #9:	℃	℃

TALS Sample Number	Ammonia (pH<2)	COD (pH<2)	Nitrate Nitrite (pH<2)	Metals* (pH<2)	Hardness (pH<2)	Pest (pH 5-9)	EPH or QAM (pH<2)	Phenols (pH<2)	Sulfide (pH>9)	TKN (pH<2)	TOC (pH<2)	Total Cyanide (pH>12)	Total Phos (pH<2)	Other	Other

If pH adjustments are required record the information below:

Sample No(s). adjusted: _____

Preservative Name/Conc.: _____ Volume of Preservative used (ml): _____

Lot # of Preservative(s): _____ Expiration Date: _____

The appropriate Project Manager and Department Manager should be notified about the samples which were pH adjusted.

** Samples for Metal analysis which are out of compliance must be acidified at least 24 hours prior to analysis.*

Initials: LS **Date:** 6/30/21

Login Sample Receipt Checklist

Client: Langan Engineering & Environmental Srvcs

Job Number: 460-237892-1

Login Number: 237892
List Number: 1
Creator: Rivera, Kenneth

List Source: Eurofins TestAmerica, Edison

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	No ice per client request.
Cooler Temperature is acceptable.	False	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	False	Refer to Job Narrative for details.
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	False	No date or time on COC or sample containers
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

ATTACHMENT A

Historic Topographic Maps

Union County Governmental Complex
61-99 West Grand Street
Elizabeth, NJ 07208

Inquiry Number: 6510269.4
May 26, 2021

EDR Historical Topo Map Report

with QuadMatch™

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Historical Topo Map Report

05/26/21

Site Name:

Union County Governmental C
61-99 West Grand Street
Elizabeth, NJ 07208
EDR Inquiry # 6510269.4

Client Name:

Langan Engineering
300 Kimball Drive, 4th Floor
Parsippany, NJ 07054-2172
Contact: Rebecca Blocker

EDR Topographic Map Library has been searched by EDR and maps covering the target property location as provided by Langan Engineering were identified for the years listed below. EDR's Historical Topo Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topo Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the late 1800s.

Search Results:

P.O.# NA
Project: 100889101

Coordinates:

Latitude:	40.666516 40° 39' 59" North
Longitude:	-74.21961 -74° 13' 11" West
UTM Zone:	Zone 18 North
UTM X Meters:	565961.99
UTM Y Meters:	4502030.99
Elevation:	28.79' above sea level

Maps Provided:

2014
1995
1981
1967
1955
1947
1925
1905
1900
1898
1891

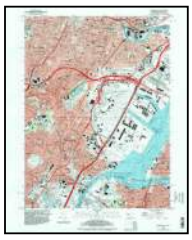
Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

2014 Source Sheets

Elizabeth
2014
7.5-minute, 24000

1995 Source Sheets



Elizabeth
1995
7.5-minute, 24000
Aerial Photo Revised 1995

1981 Source Sheets

Elizabeth
1981
7.5-minute, 24000
Aerial Photo Revised 1976

1967 Source Sheets

Elizabeth
1967
7.5-minute, 24000
Aerial Photo Revised 1966

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1955 Source Sheets

Elizabeth
1955
7.5-minute, 24000
Aerial Photo Revised 1953

1947 Source Sheets

Elizabeth
1947
7.5-minute, 24000
Aerial Photo Revised 1941

1925 Source Sheets

Staten Island
1925
15-minute, 62500

1905 Source Sheets

Passaic
1905
30-minute, 125000

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1900 Source Sheets

Staten Island
1900
15-minute, 62500

1898 Source Sheets

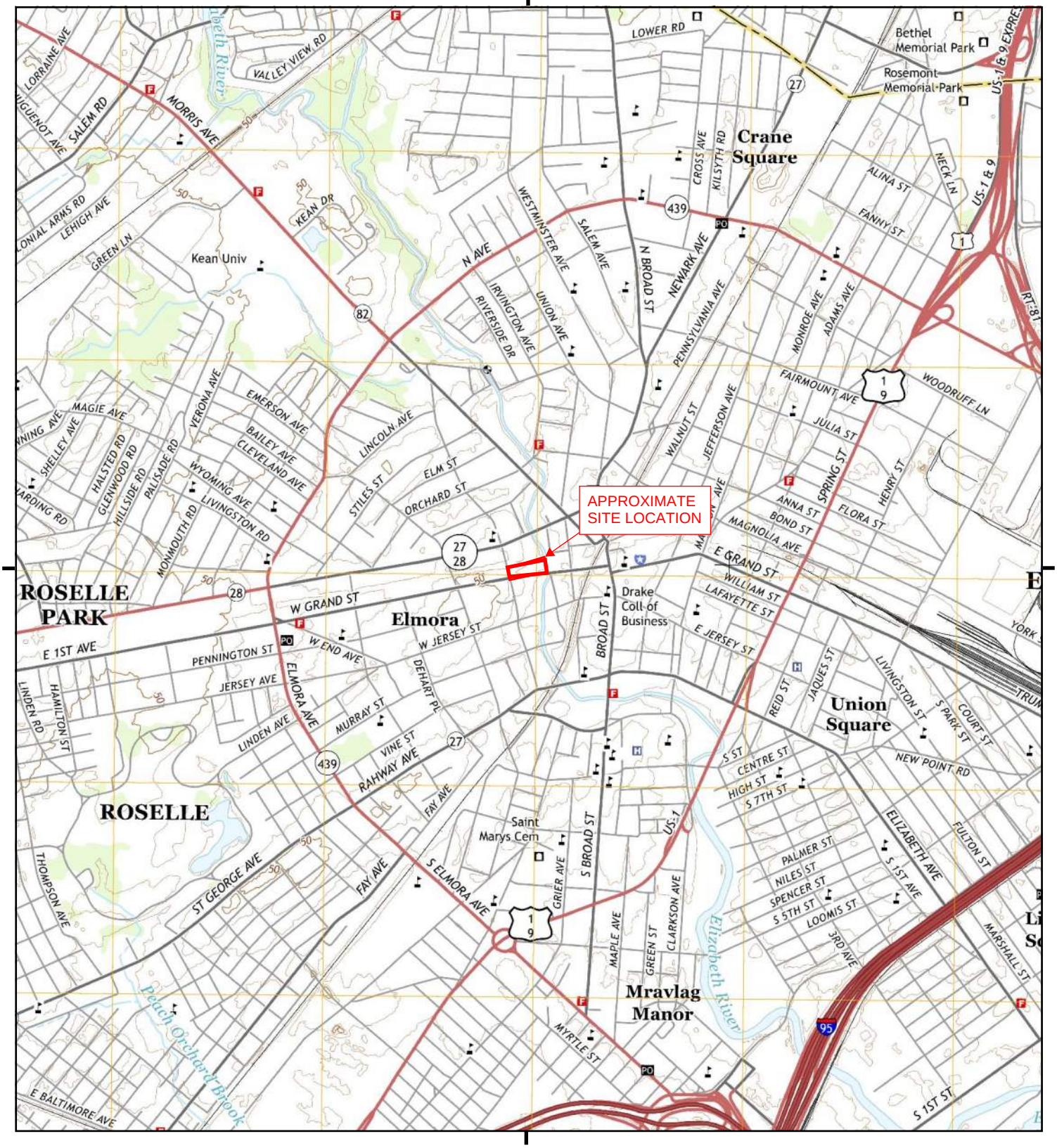
Staten Island
1898
15-minute, 62500

1891 Source Sheets

STATEN ISLAND
1891
15-minute, 62500

Historical Topo Map

2014



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

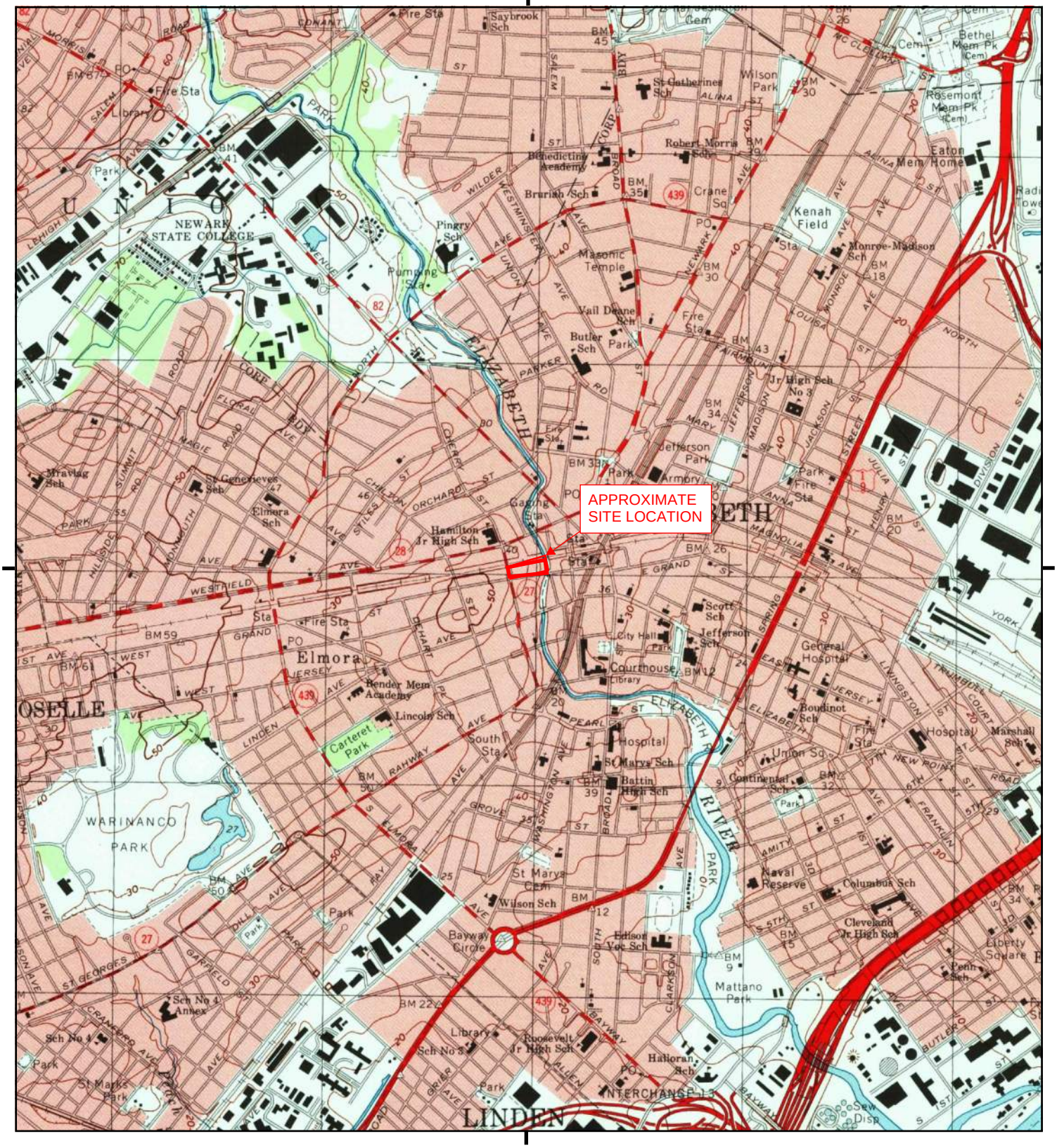
TP, Elizabeth, 2014, 7.5-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N

Historical Topo Map

1995



This report includes information from the following map sheet(s).

NW N NE
W E
SW S SE

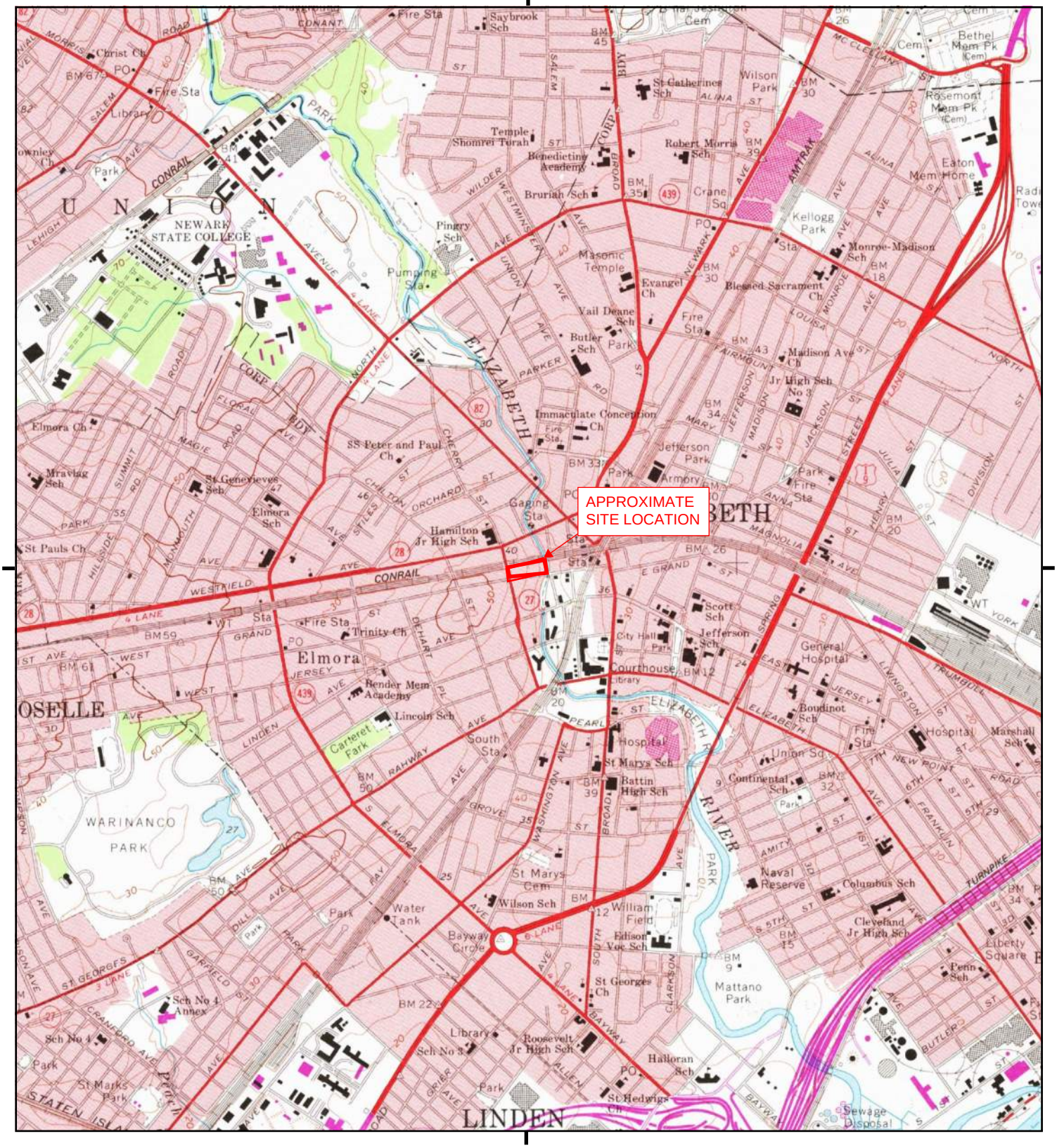
TP, Elizabeth, 1995, 7.5-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N

Historical Topo Map

1981



This report includes information from the following map sheet(s).

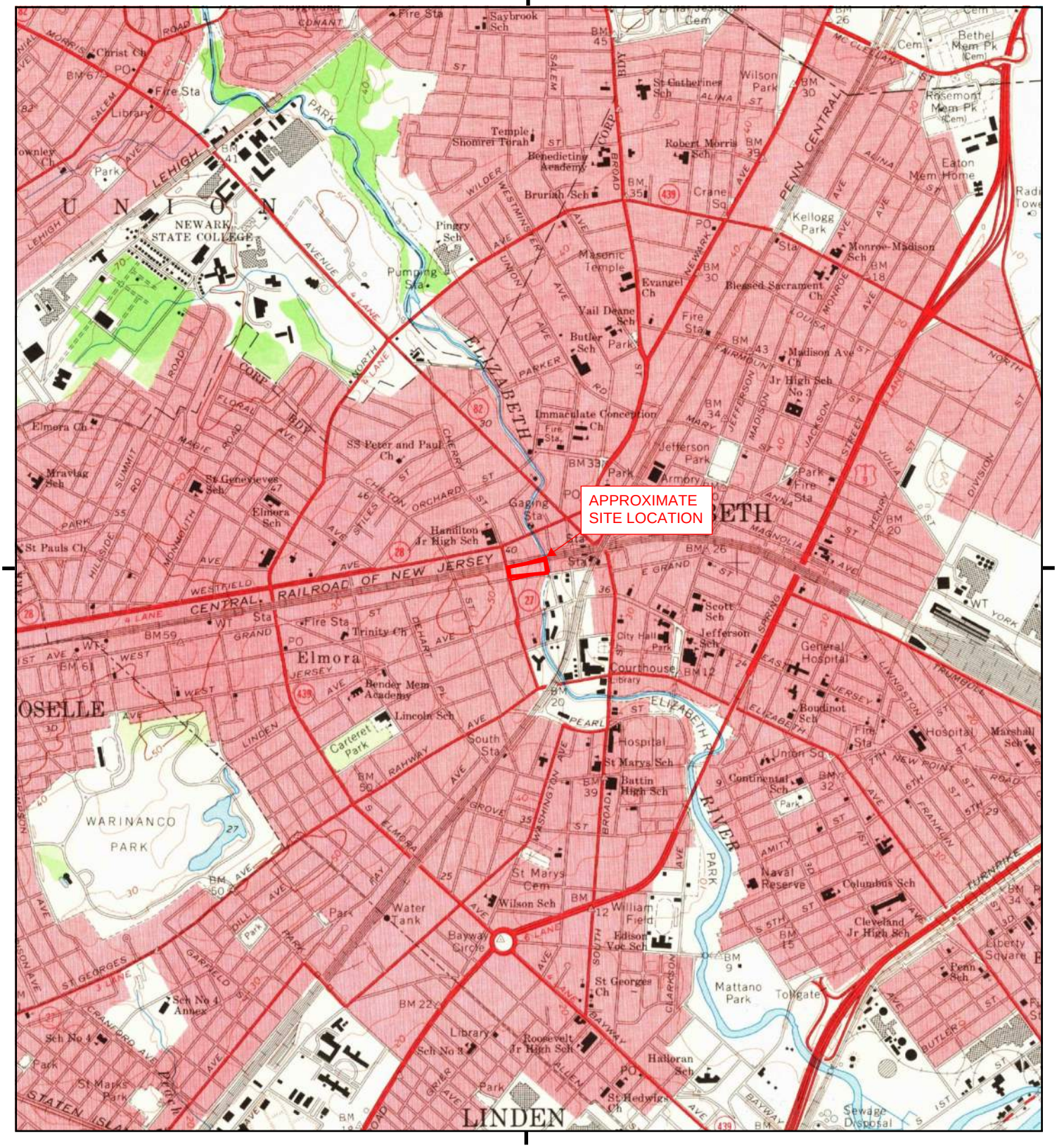
0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, Elizabeth, 1981, 7.5-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N



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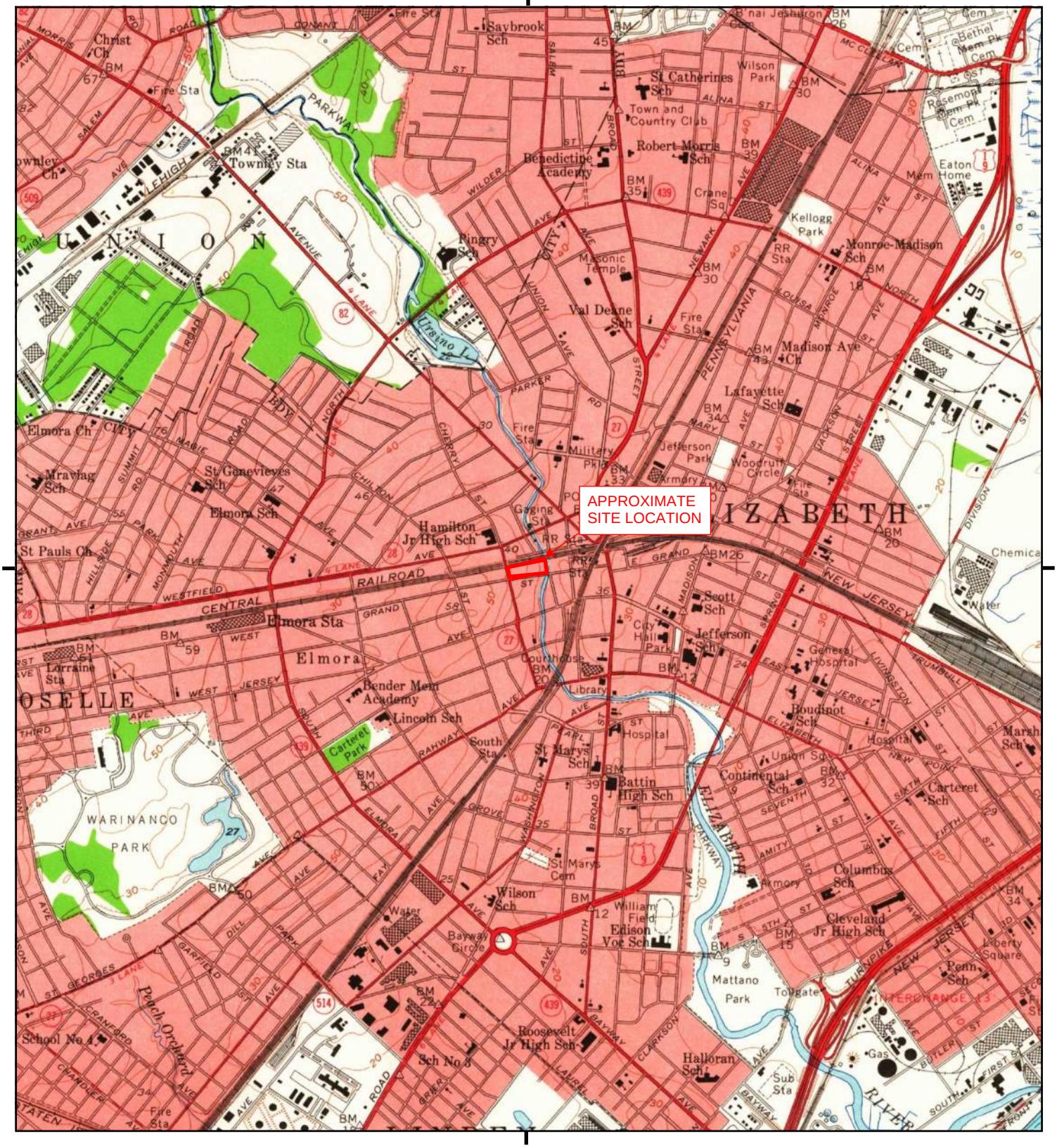
0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, Elizabeth, 1967, 7.5-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N



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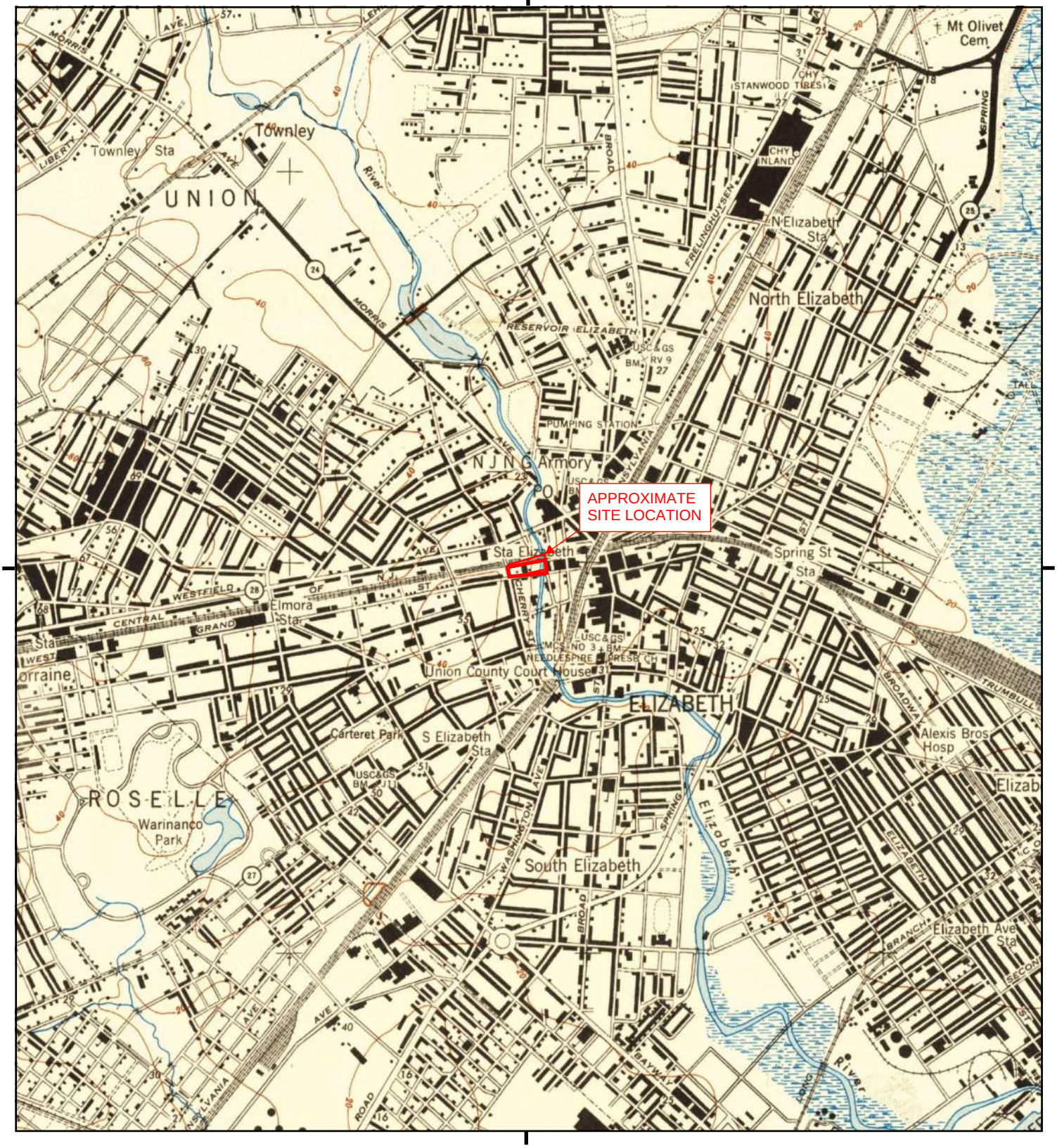
0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, Elizabeth, 1955, 7.5-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N



This report includes information from the following map sheet(s).

NW N NE
W E
SW S SE

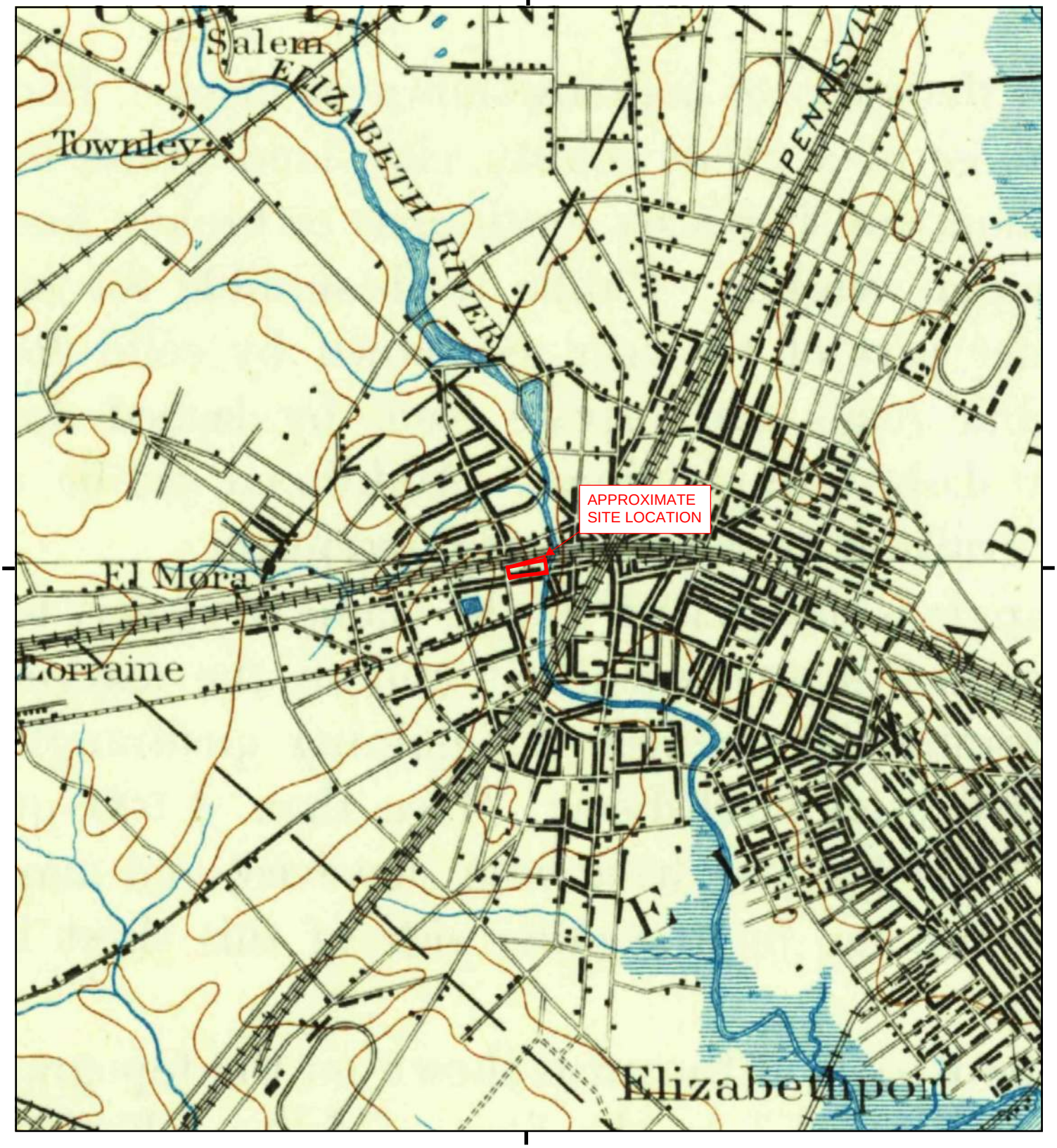
TP, Elizabeth, 1947, 7.5-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N

Historical Topo Map

1925



This report includes information from the following map sheet(s).

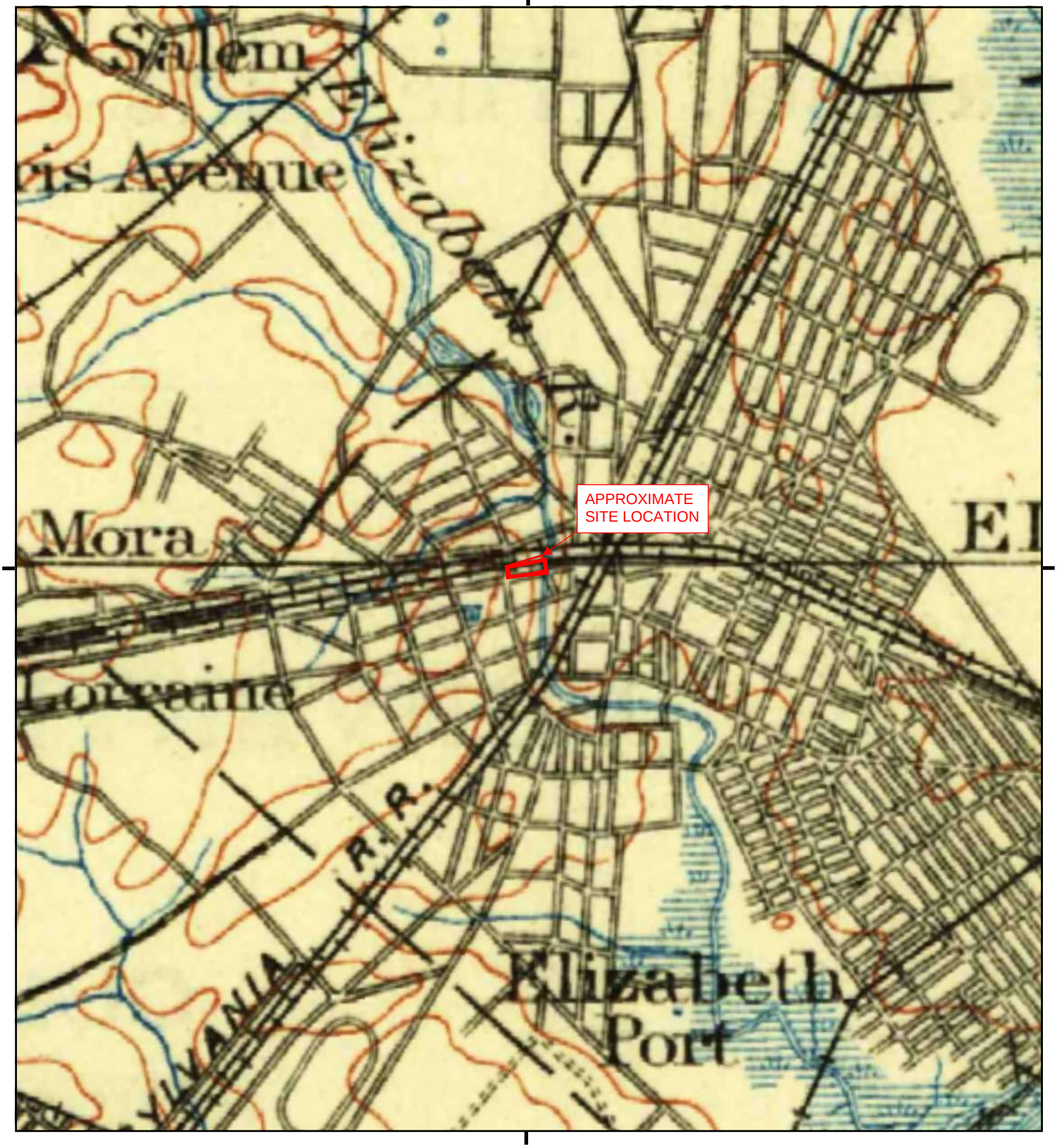
0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, Staten Island, 1925, 15-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

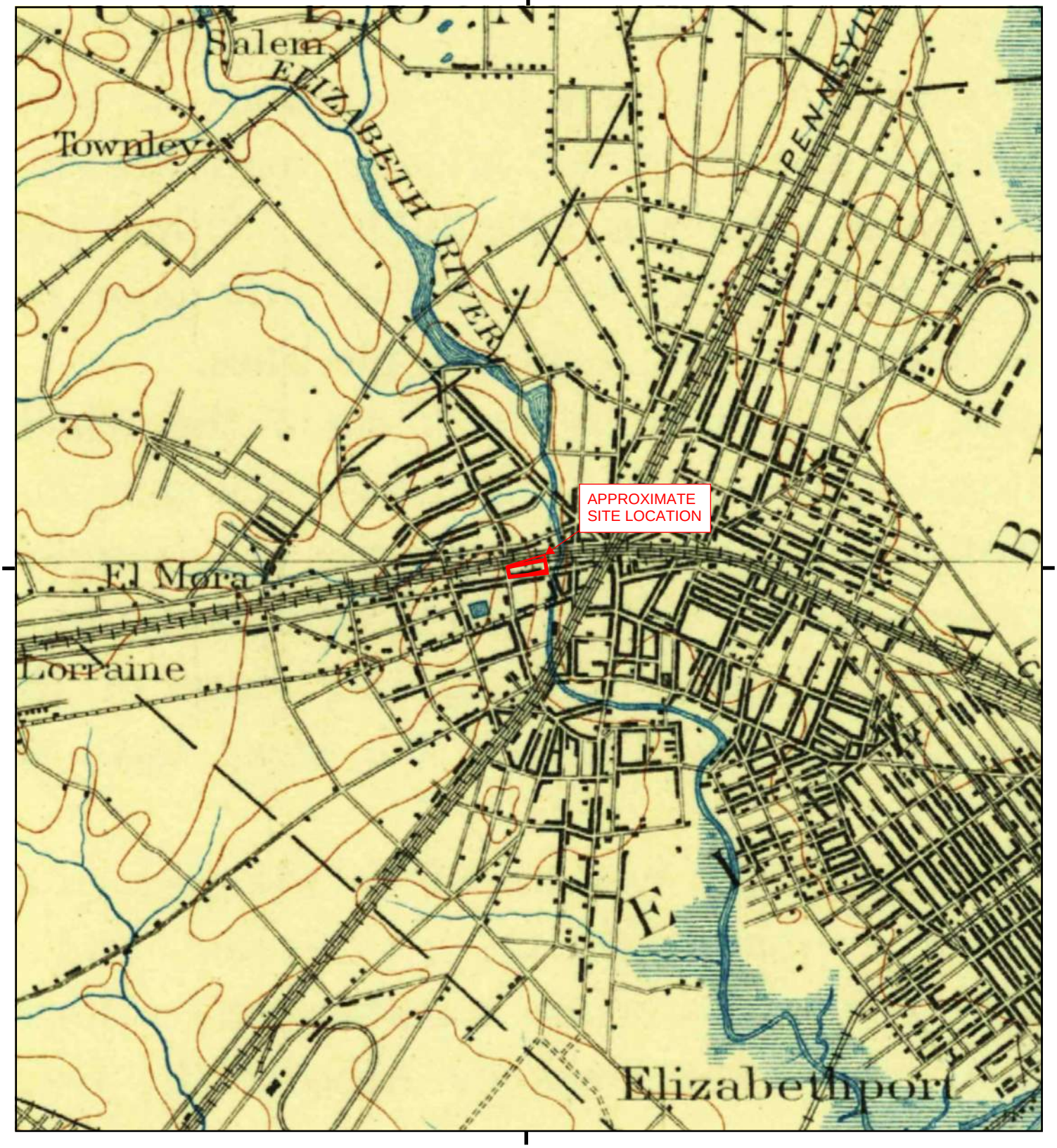
TP, Passaic, 1905, 30-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N

Historical Topo Map

1900



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

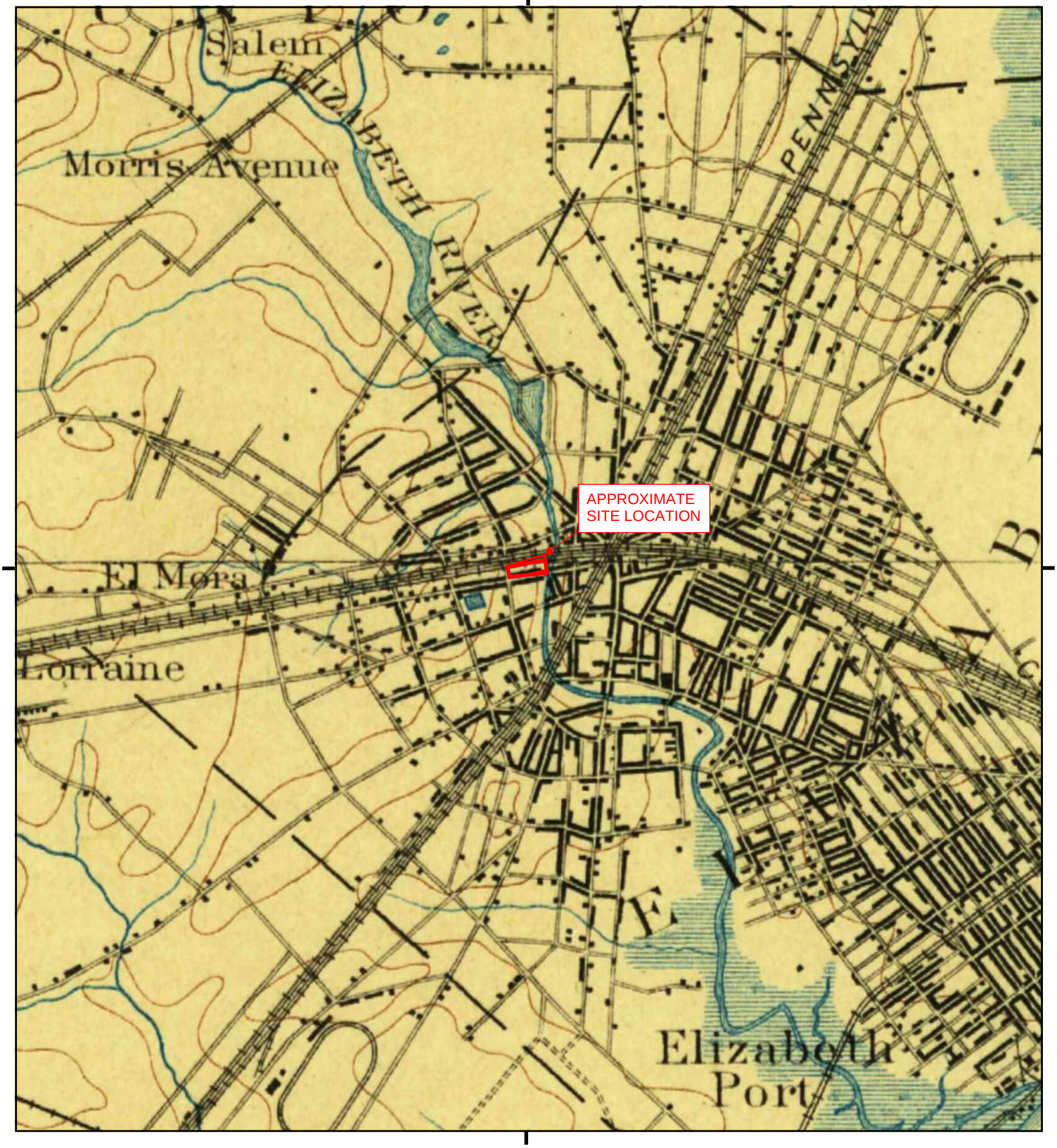
TP, Staten Island, 1900, 15-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N

Historical Topo Map

1898



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

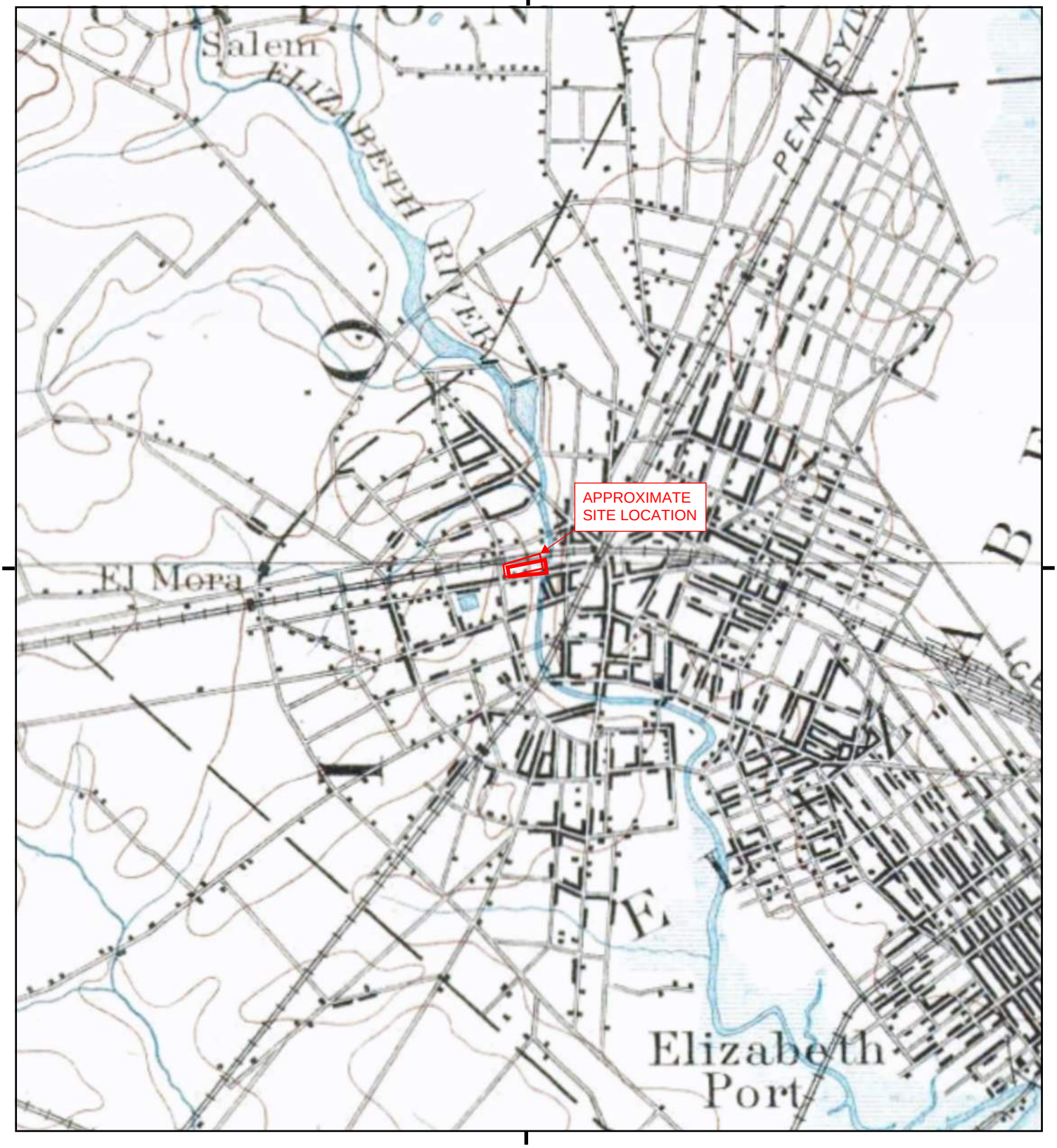
TP, Staten Island, 1898, 15-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N

Historical Topo Map

1891



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, STATEN ISLAND, 1891, 15-minute

SITE NAME: Union County Governmental Complex
ADDRESS: 61-99 West Grand Street
Elizabeth, NJ 07208
CLIENT: Langan Engineering

N

ATTACHMENT B

Historic Aerial Photographs

INQUIRY #: 6510269.8

YEAR: 2017

= 500'

N

EDR


APPROXIMATE
SITE LOCATION
INQUIRY #: 6510269.8
YEAR: 2013
= 500'
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EDR


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YEAR: 2010
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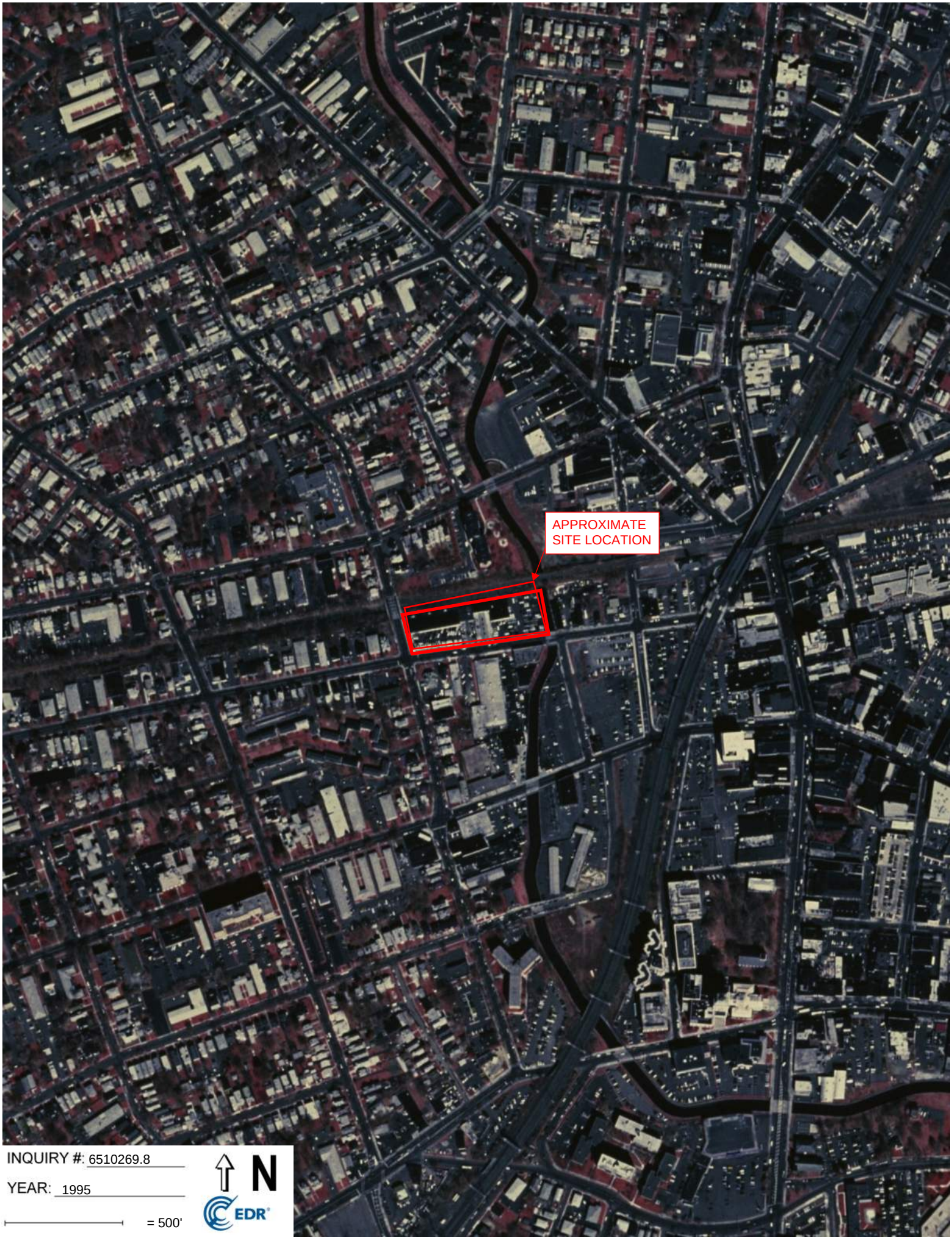

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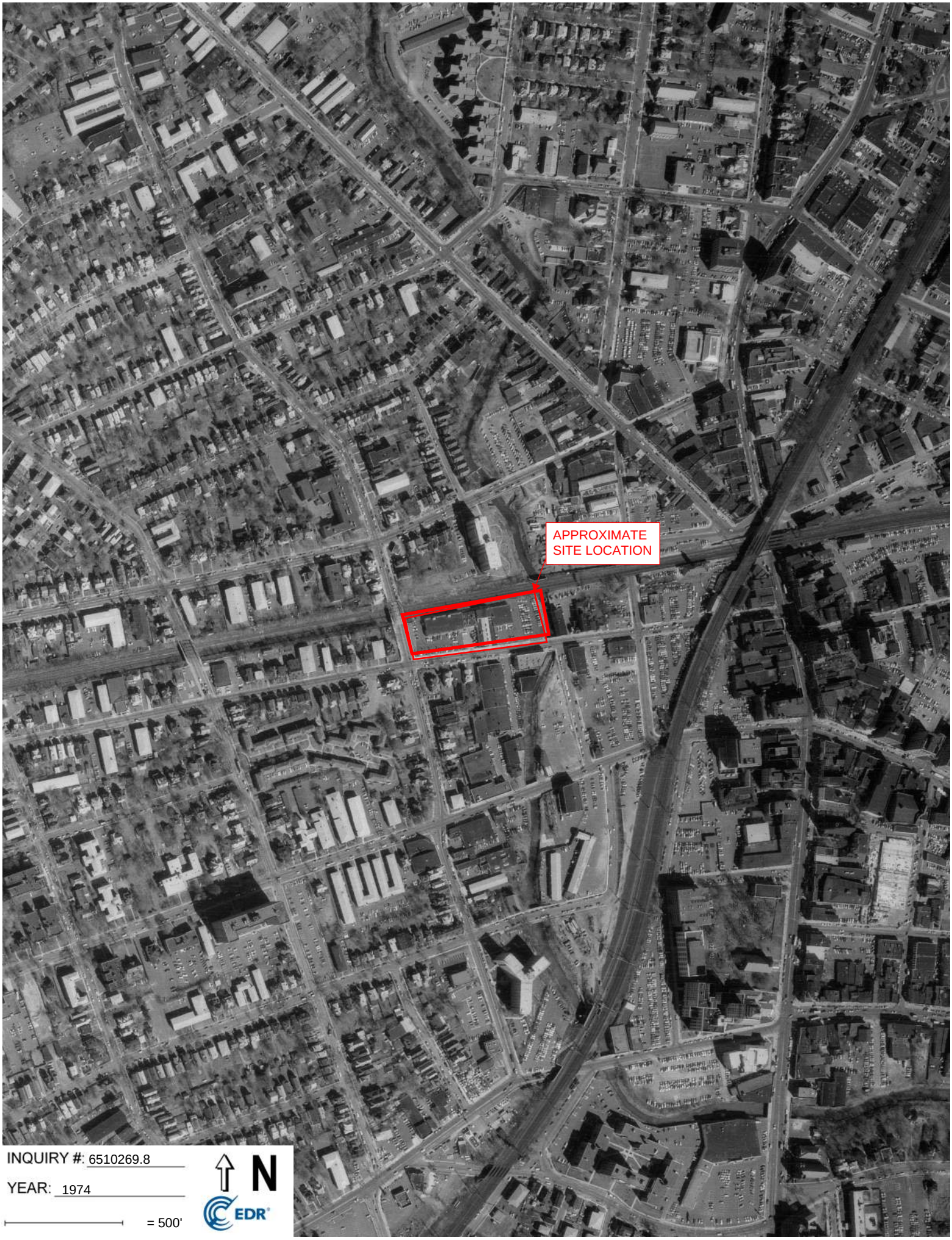
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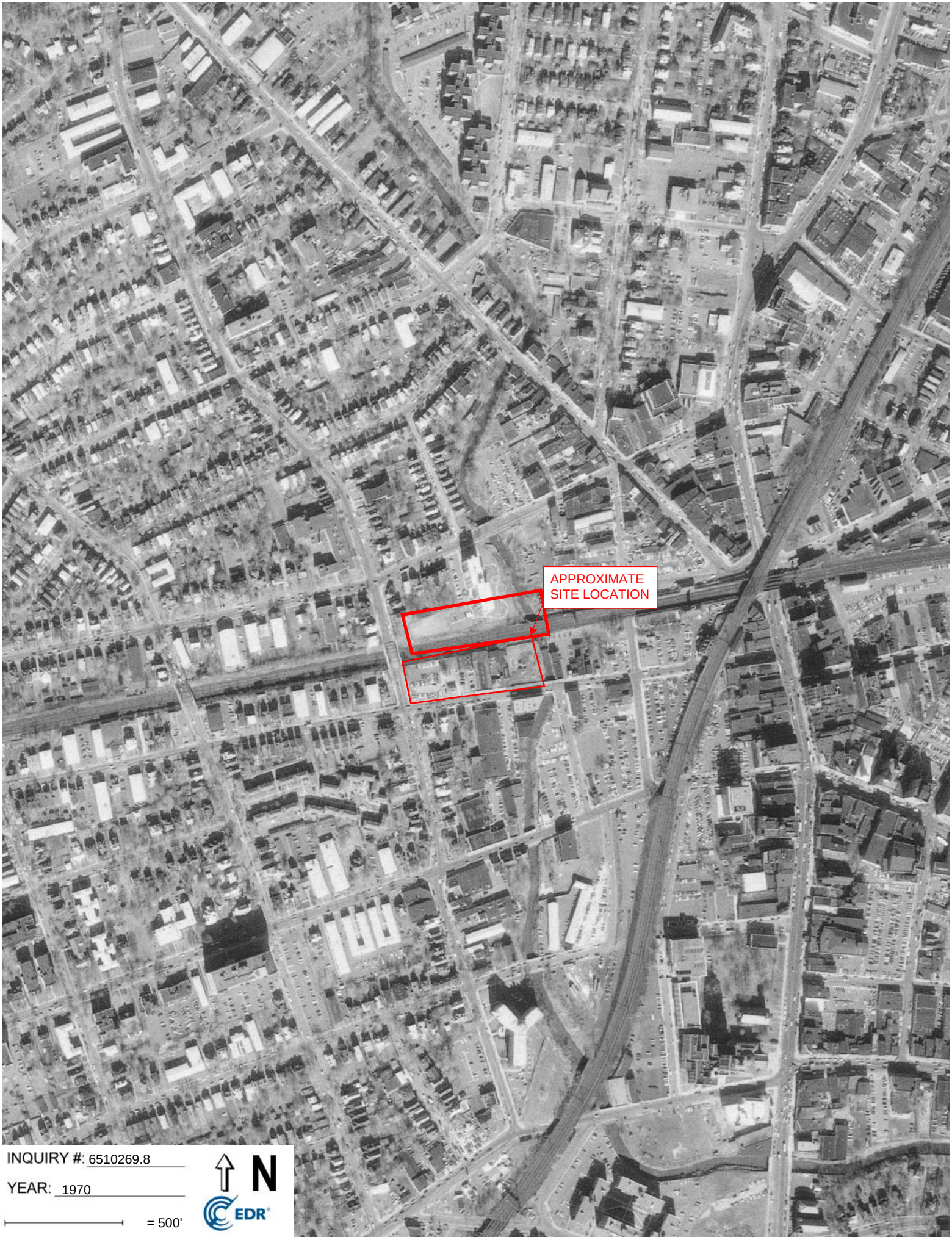

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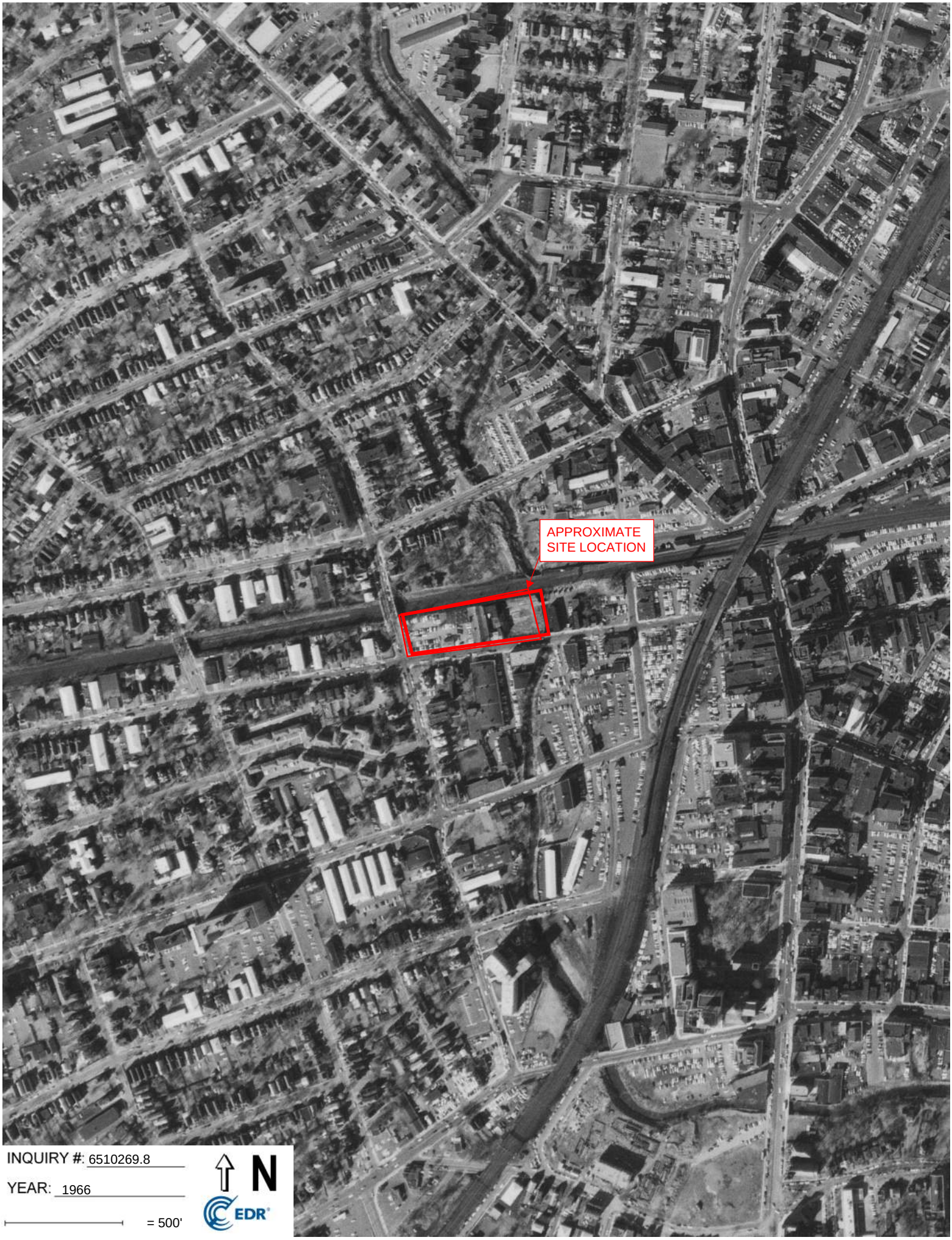

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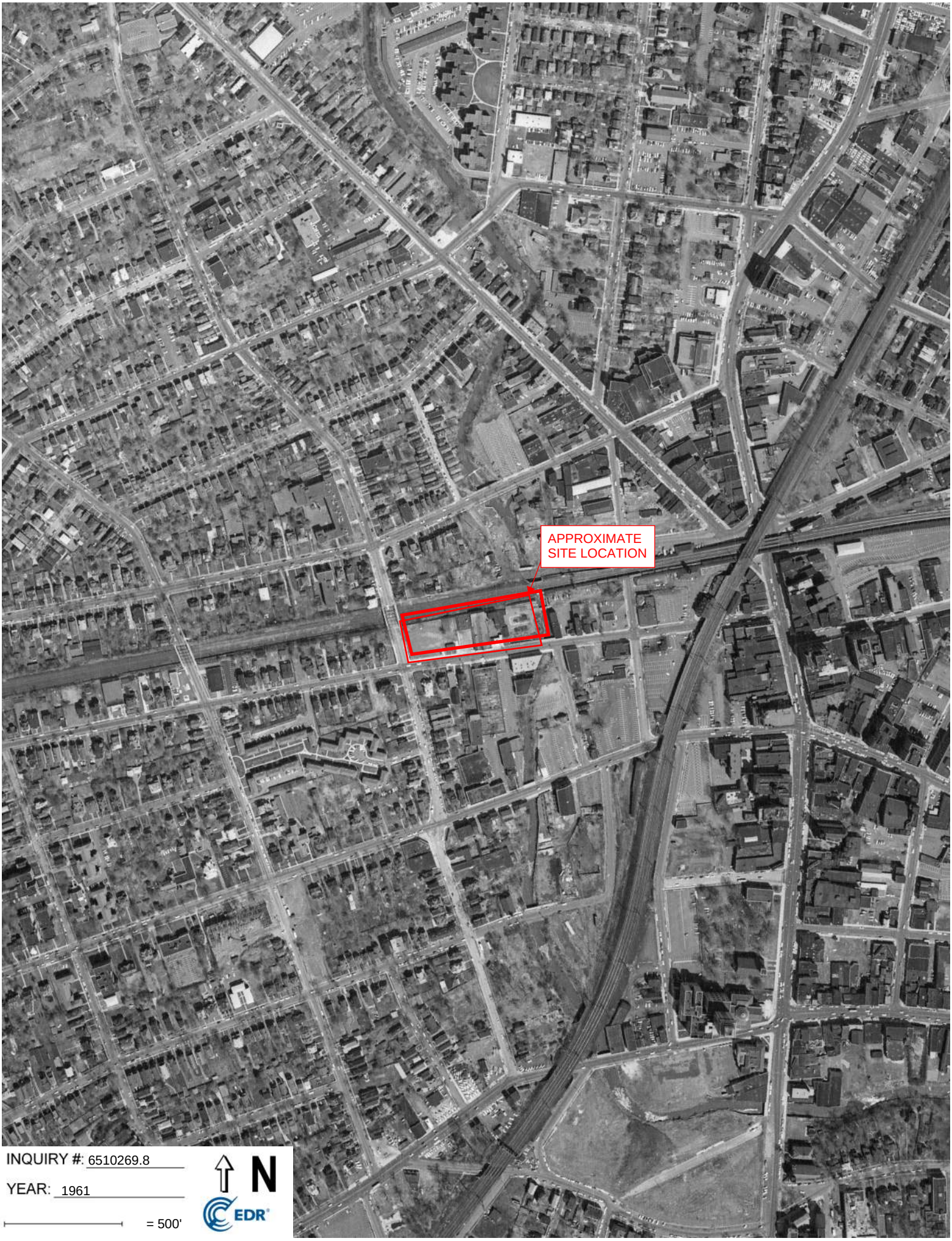

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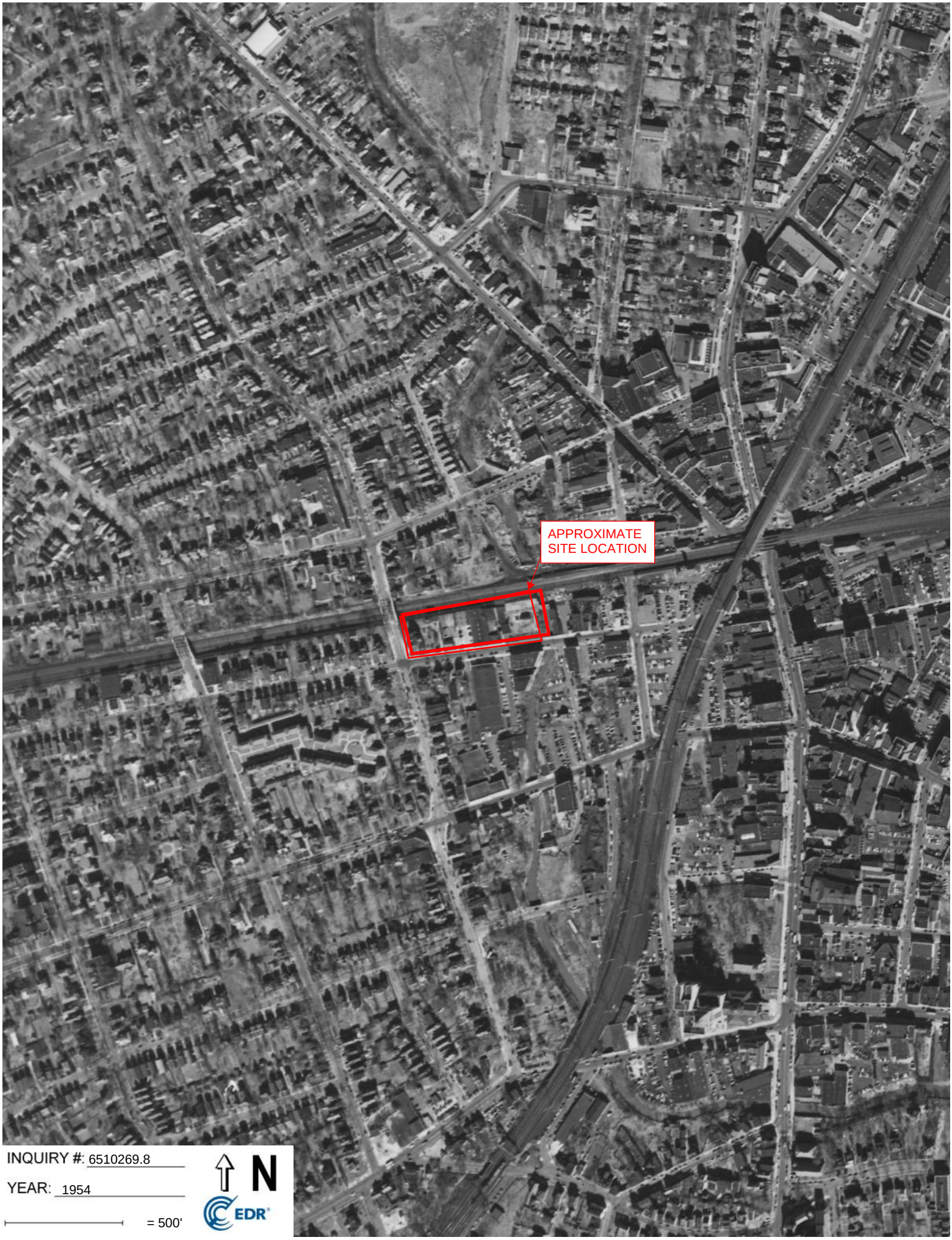

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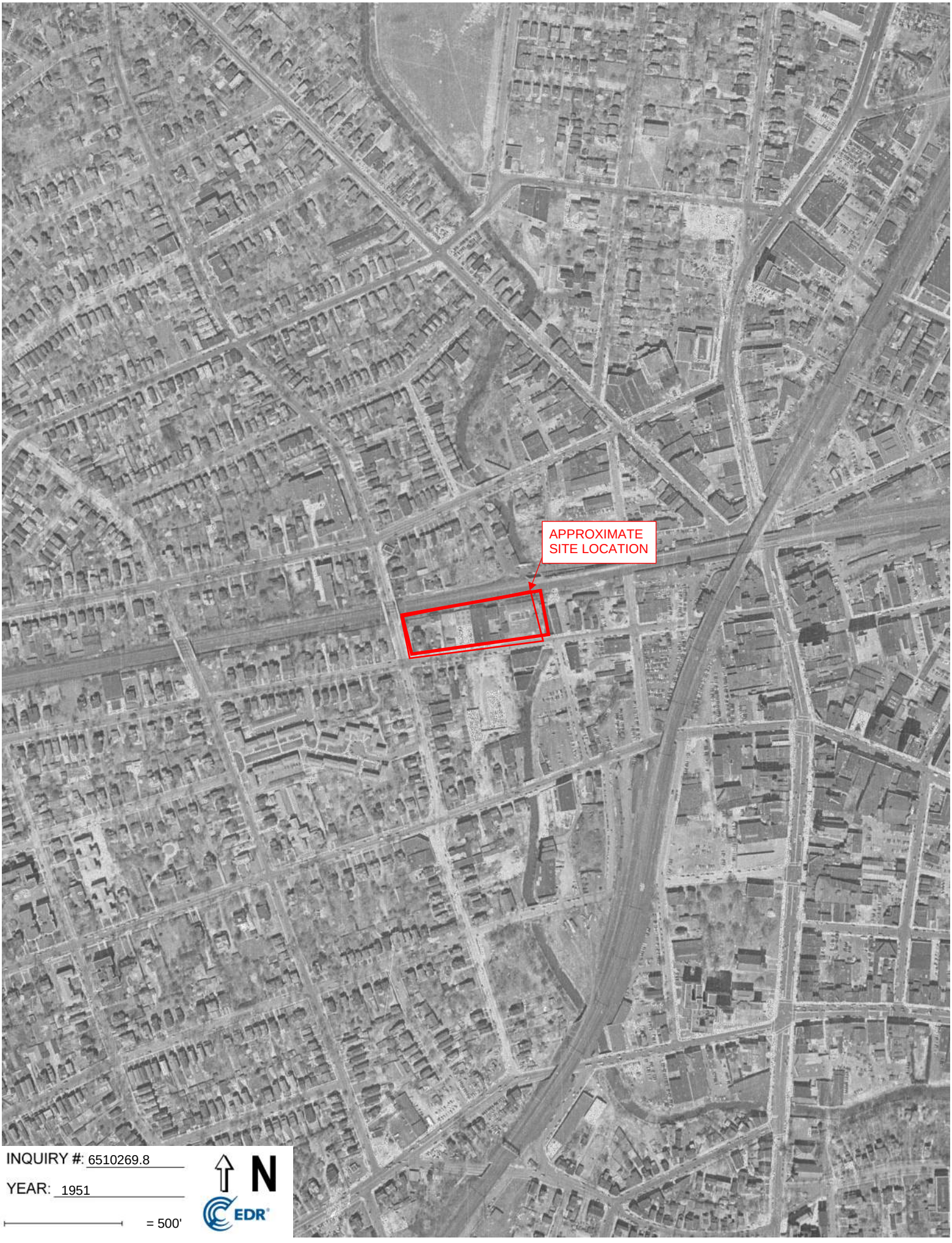

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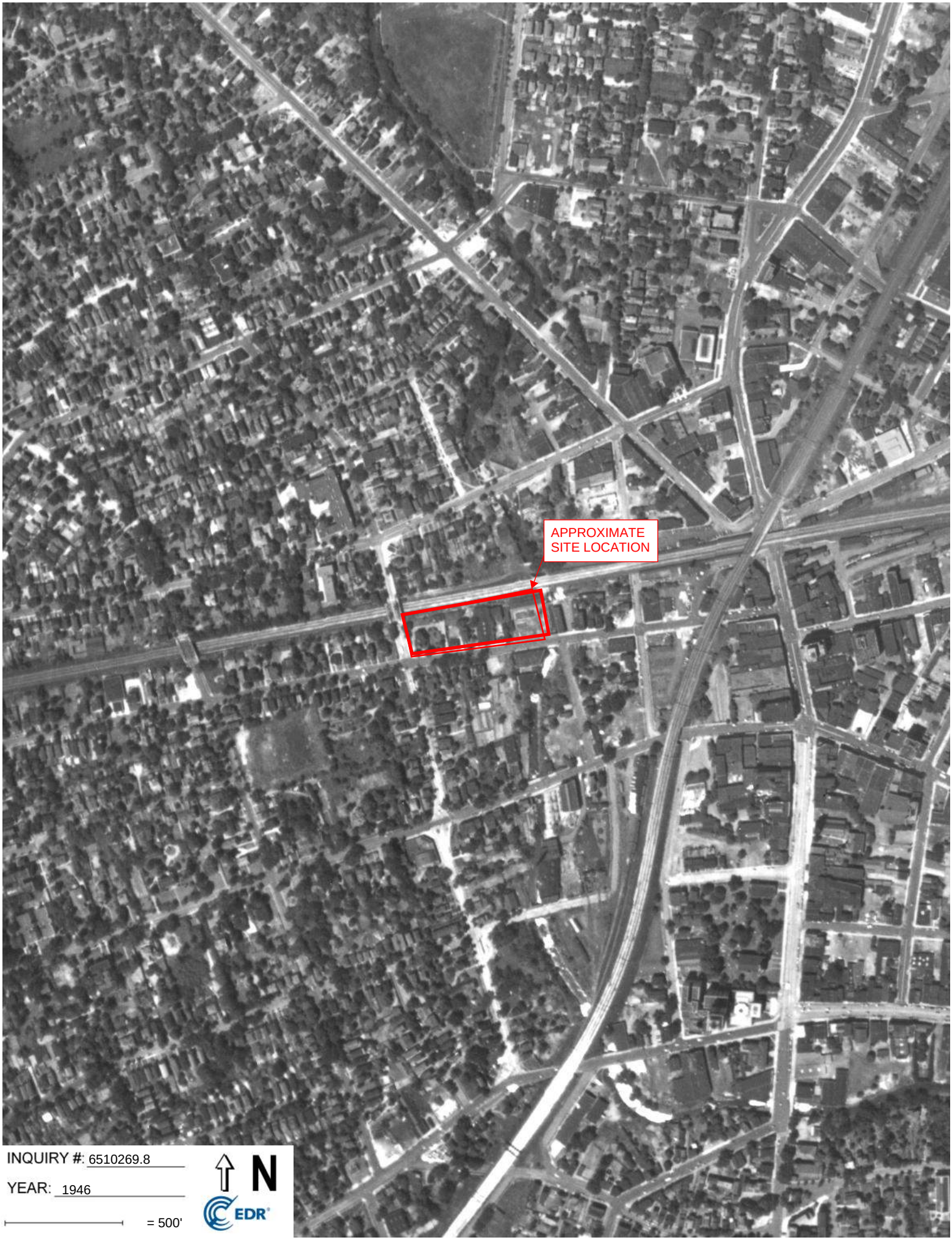

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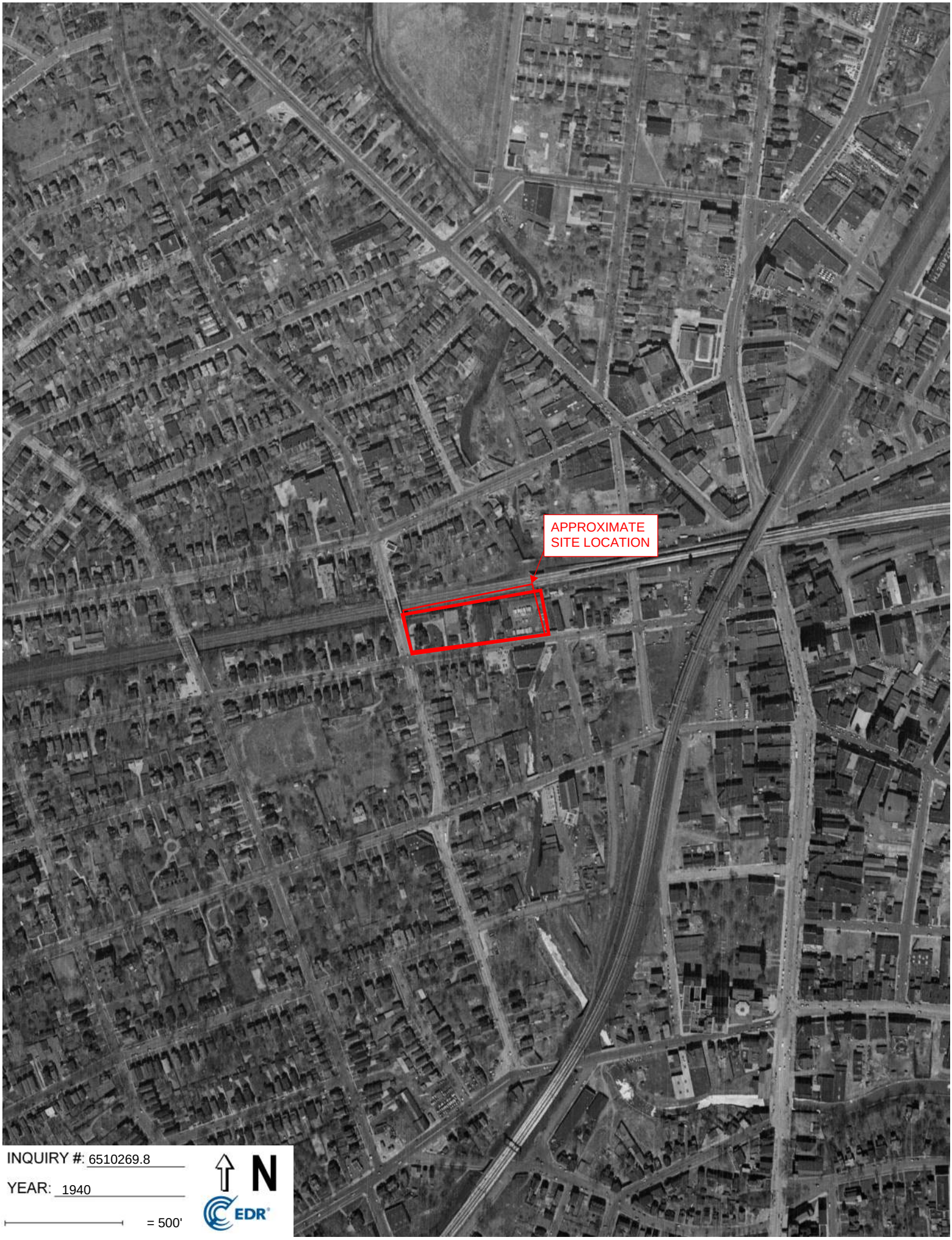
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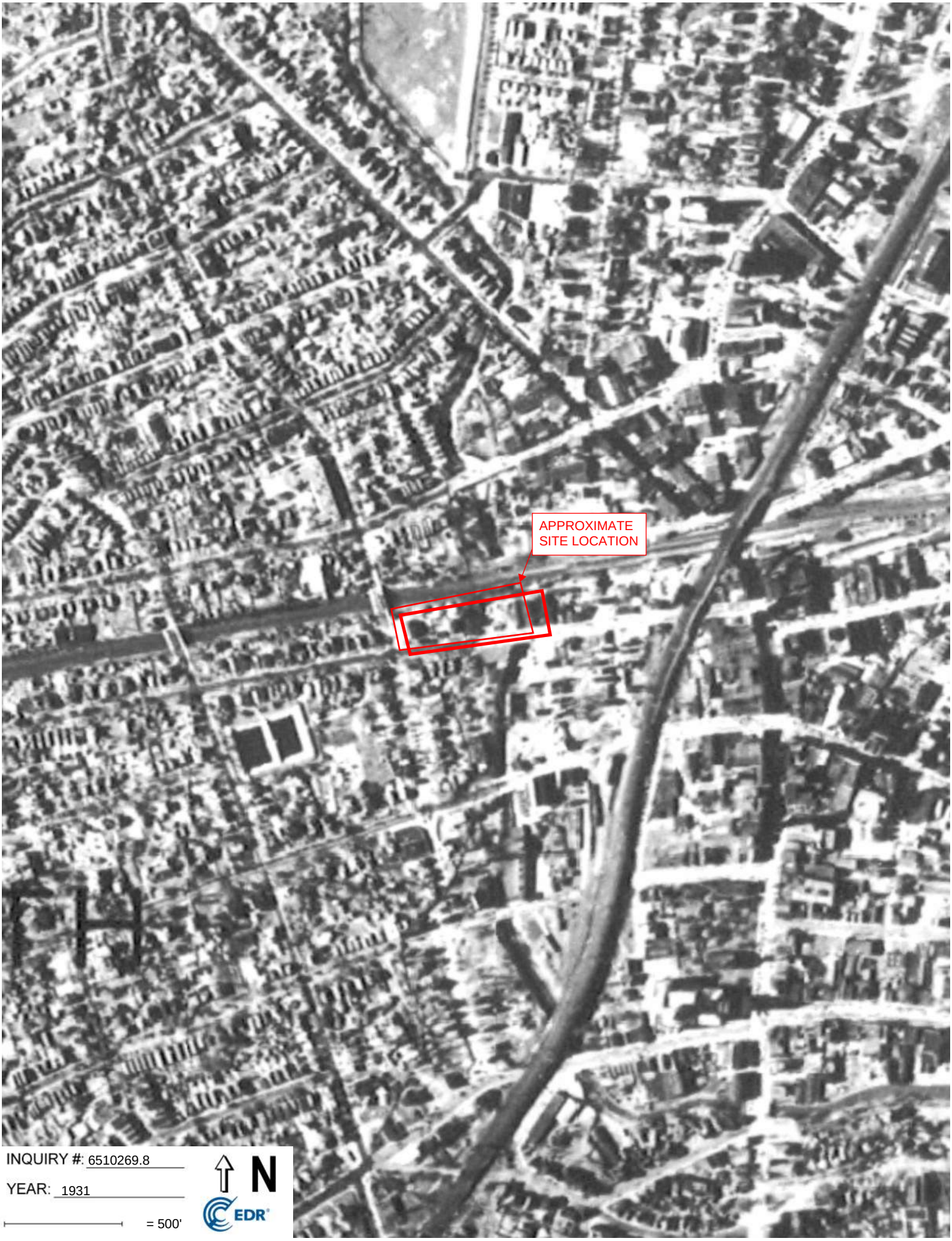

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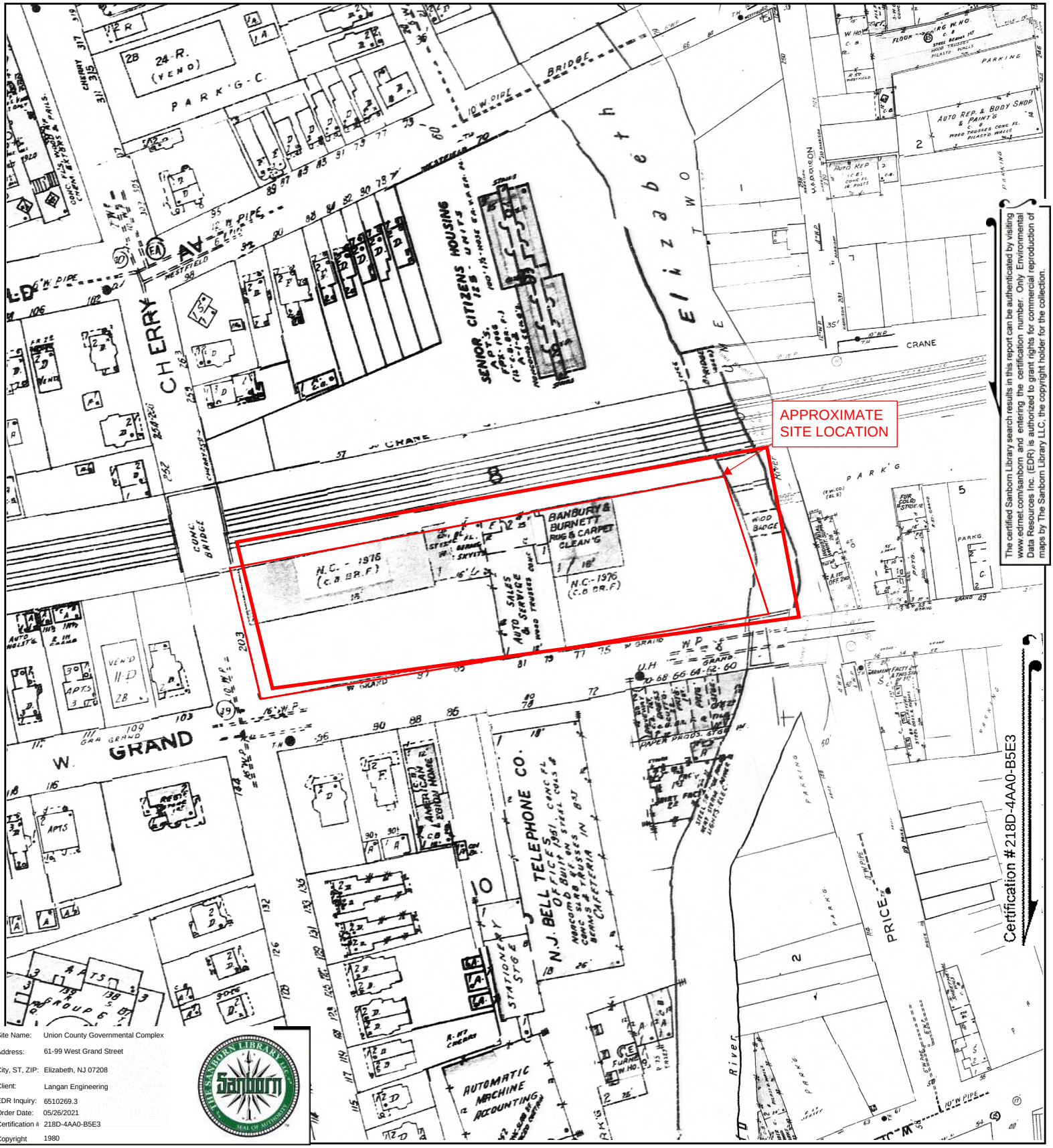
ATTACHMENT C

Sanborn Maps



Site Name:	Union County Governmental Complex
Address:	61-99 West Grand Street
City, ST, ZIP:	Elizabeth, NJ 07208
Client:	Langan Engineering
EDR Inquiry:	6510269.3
Order Date:	05/26/2021
Certification #:	218D-4AA0-B5E3
Copyright	1980

This Certified Sanborn Map combines the following sheets.
Outlined areas indicate map sheets within the collection.

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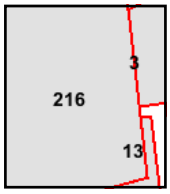

Volume 2, Sheet 216
Volume 1, Sheet 13
Volume 1, Sheet 3

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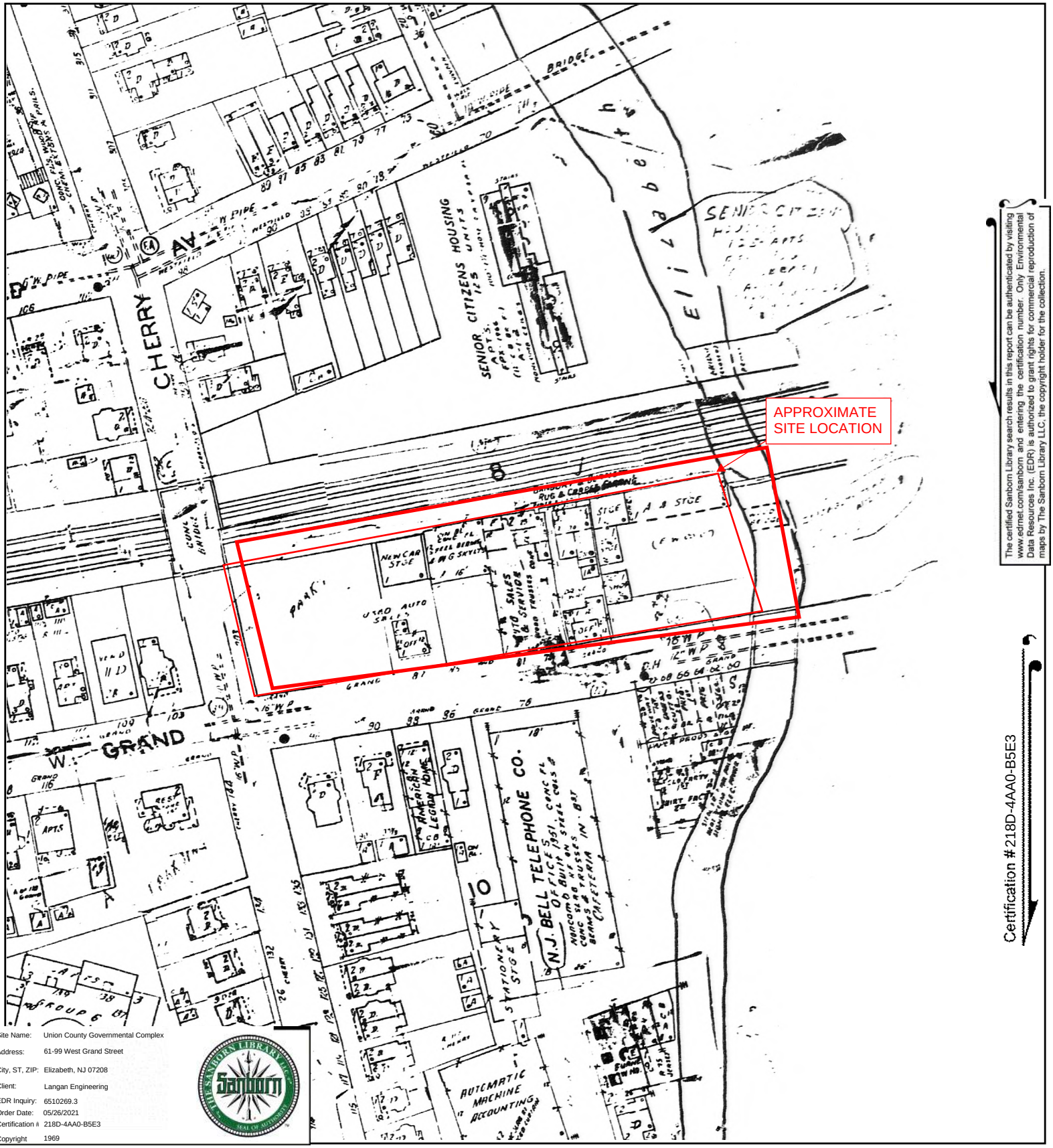

Certification #218D-4AA0-B5E3

Site Name:	Union County Governmental Complex
Address:	61-99 West Grand Street
City, ST, ZIP:	Elizabeth, NJ 07208
Client:	Langan Engineering
EDR Inquiry:	6510269.3
Order Date:	05/26/2021
Certification #:	218D-4AA0-B5E3
Copyright	1969

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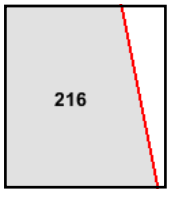

Volume 2, Sheet 216

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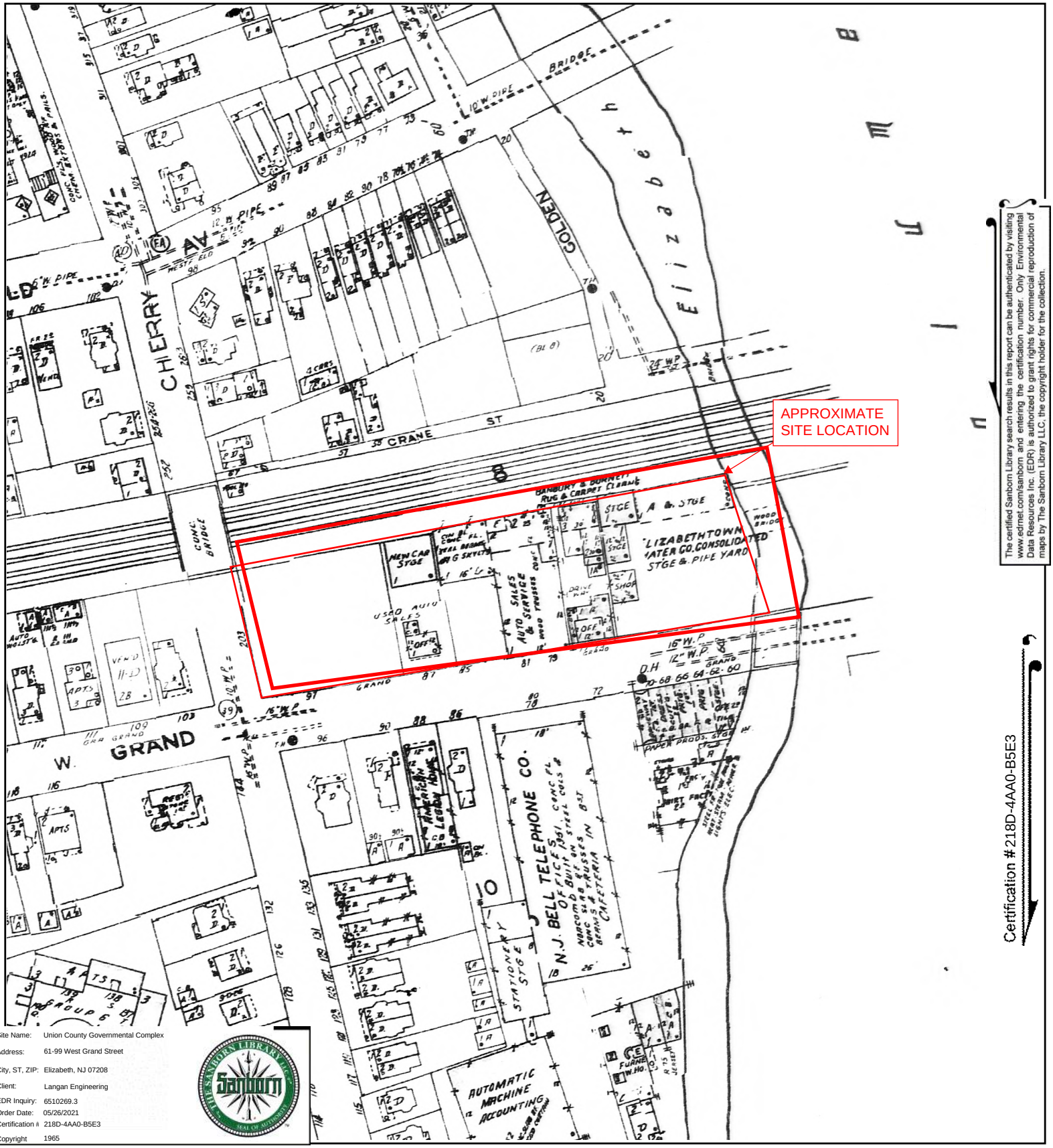

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Site Name:	Union County Governmental Complex
Address:	61-99 West Grand Street
City, ST, ZIP:	Elizabeth, NJ 07208
Client:	Langan Engineering
EDR Inquiry:	6510269.3
Order Date:	05/26/2021
Certification #:	218D-4AA0-B5E3
Copyright	1965

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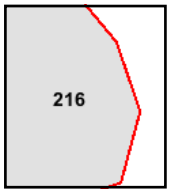

Volume 2, Sheet 216

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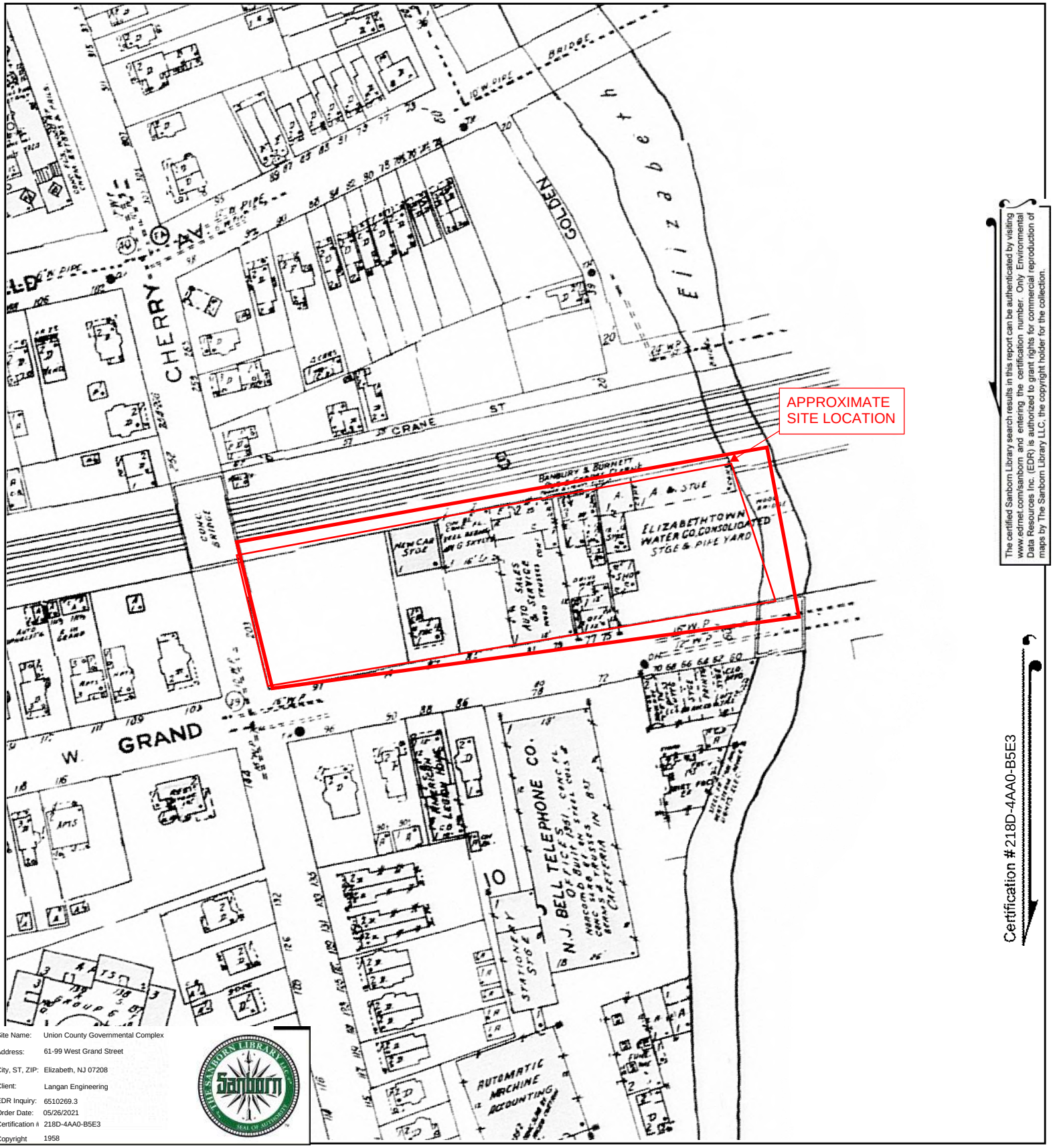

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Site Name:	Union County Governmental Complex
Address:	61-99 West Grand Street
City, ST, ZIP:	Elizabeth, NJ 07208
Client:	Langan Engineering
EDR Inquiry:	6510269.3
Order Date:	05/26/2021
Certification #	218D-4AA0-B5E3
Copyright	1958

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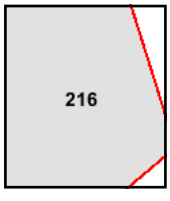

Volume 2, Sheet 216

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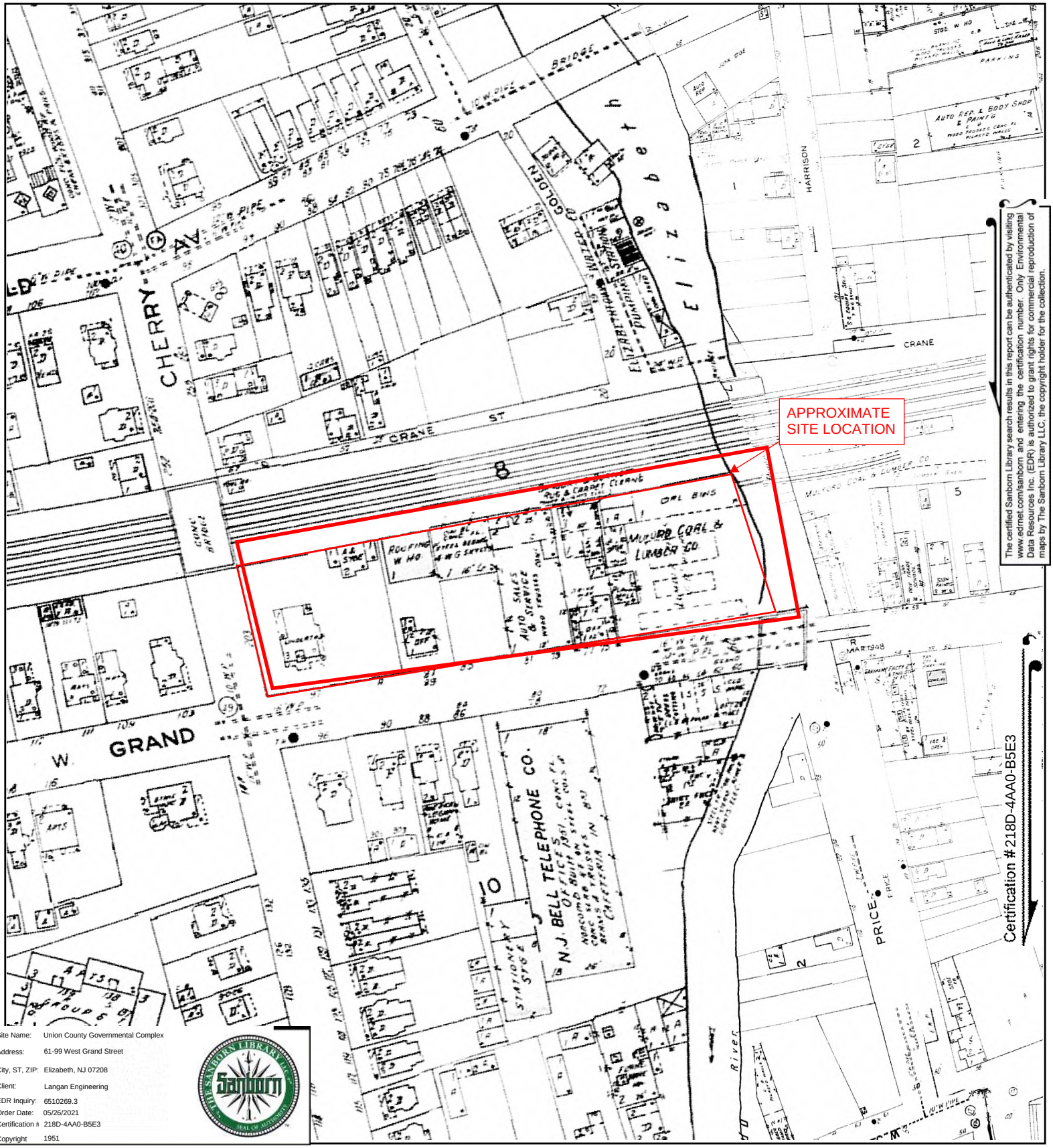

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Address:	61-99 West Grand Street
City, ST, ZIP:	Elizabeth, NJ 07208
Client:	Langan Engineering
EDR Inquiry:	6510269.3
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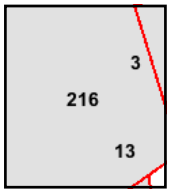

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Volume 1, Sheet 3
Volume 2, Sheet 216

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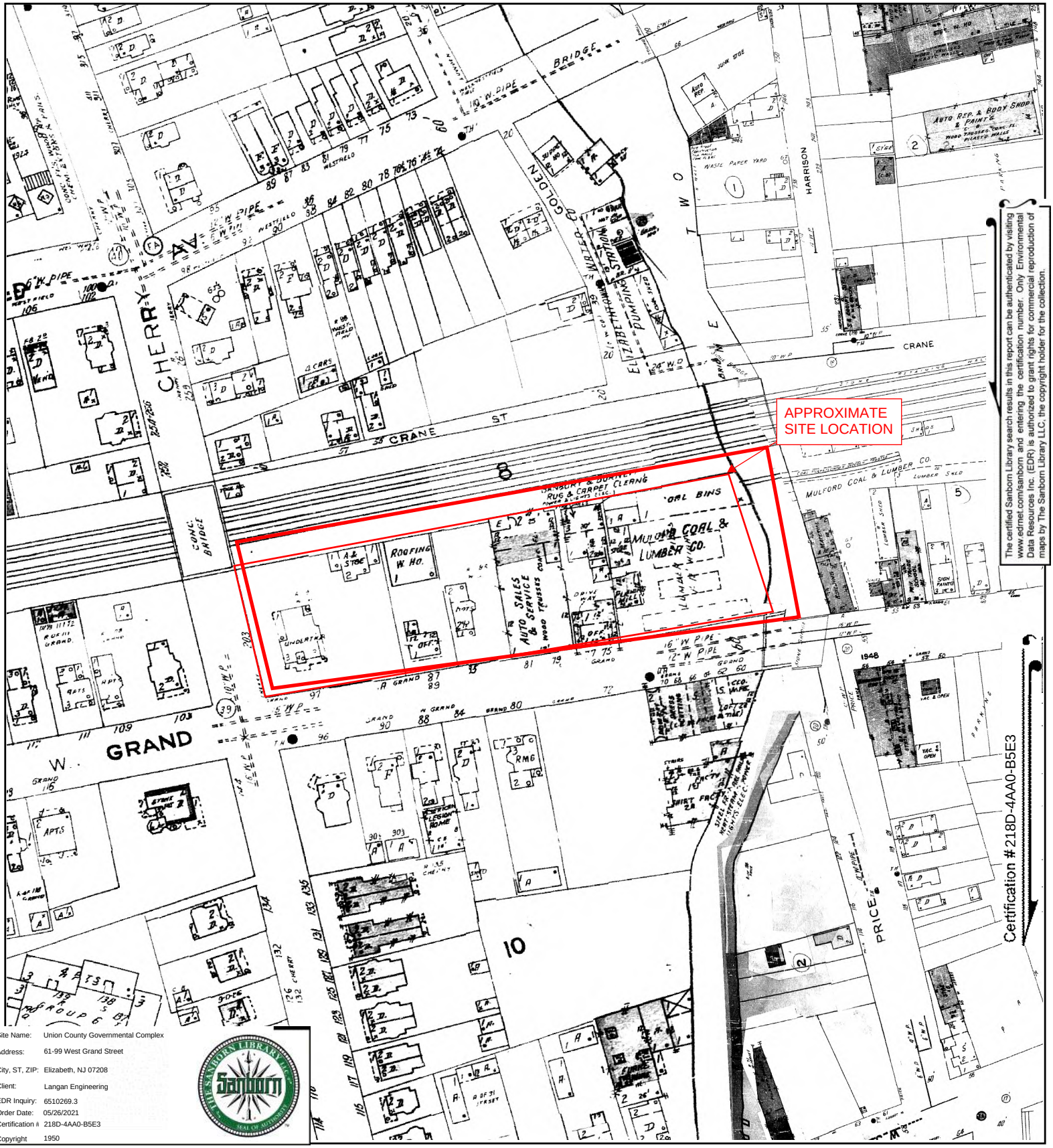

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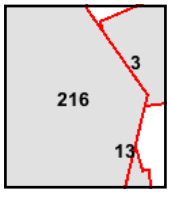

Volume 2, Sheet 216
Volume 1, Sheet 13
Volume 1, Sheet 3

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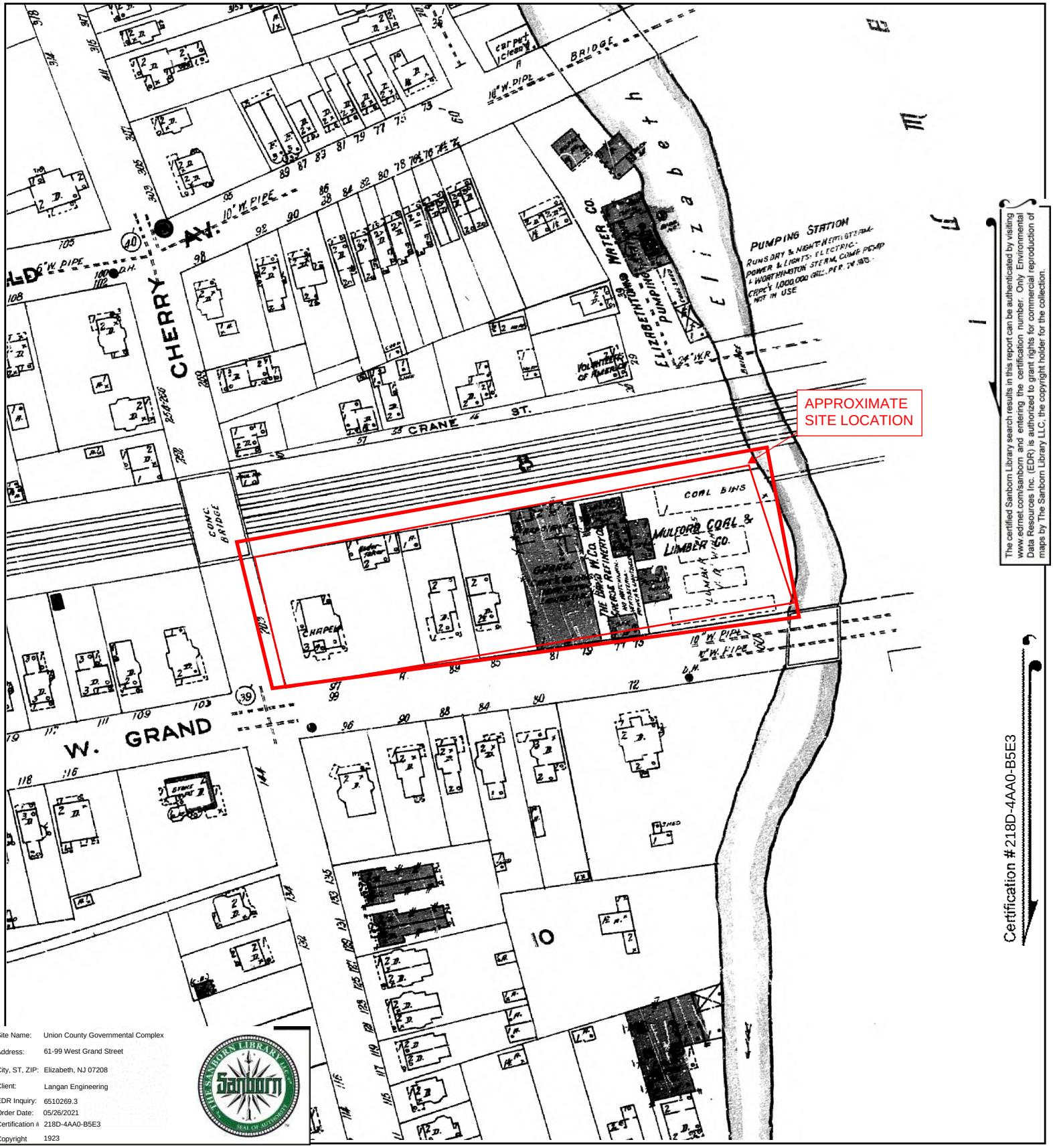

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City, ST, ZIP:	Elizabeth, NJ 07208
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Copyright	1923

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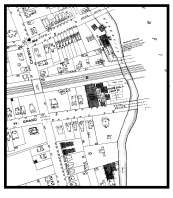

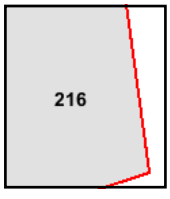

Volume 2, Sheet 216

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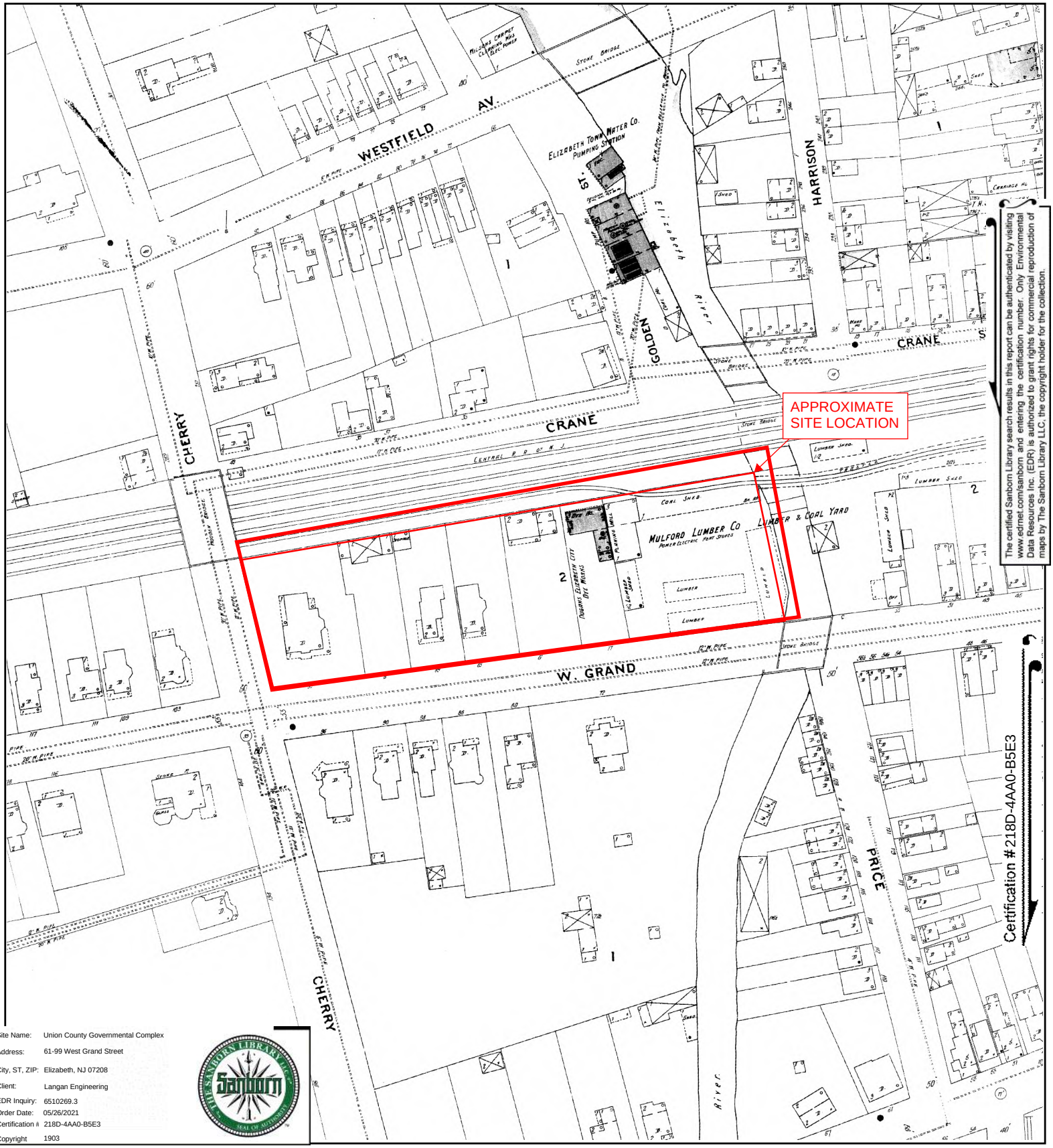

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Address:	61-99 West Grand Street
City, ST, ZIP:	Elizabeth, NJ 07208
Client:	Langan Engineering
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Order Date:	05/26/2021
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Copyright	1903

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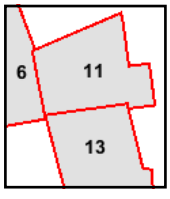

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Volume 1, Sheet 11
Volume 1, Sheet 6

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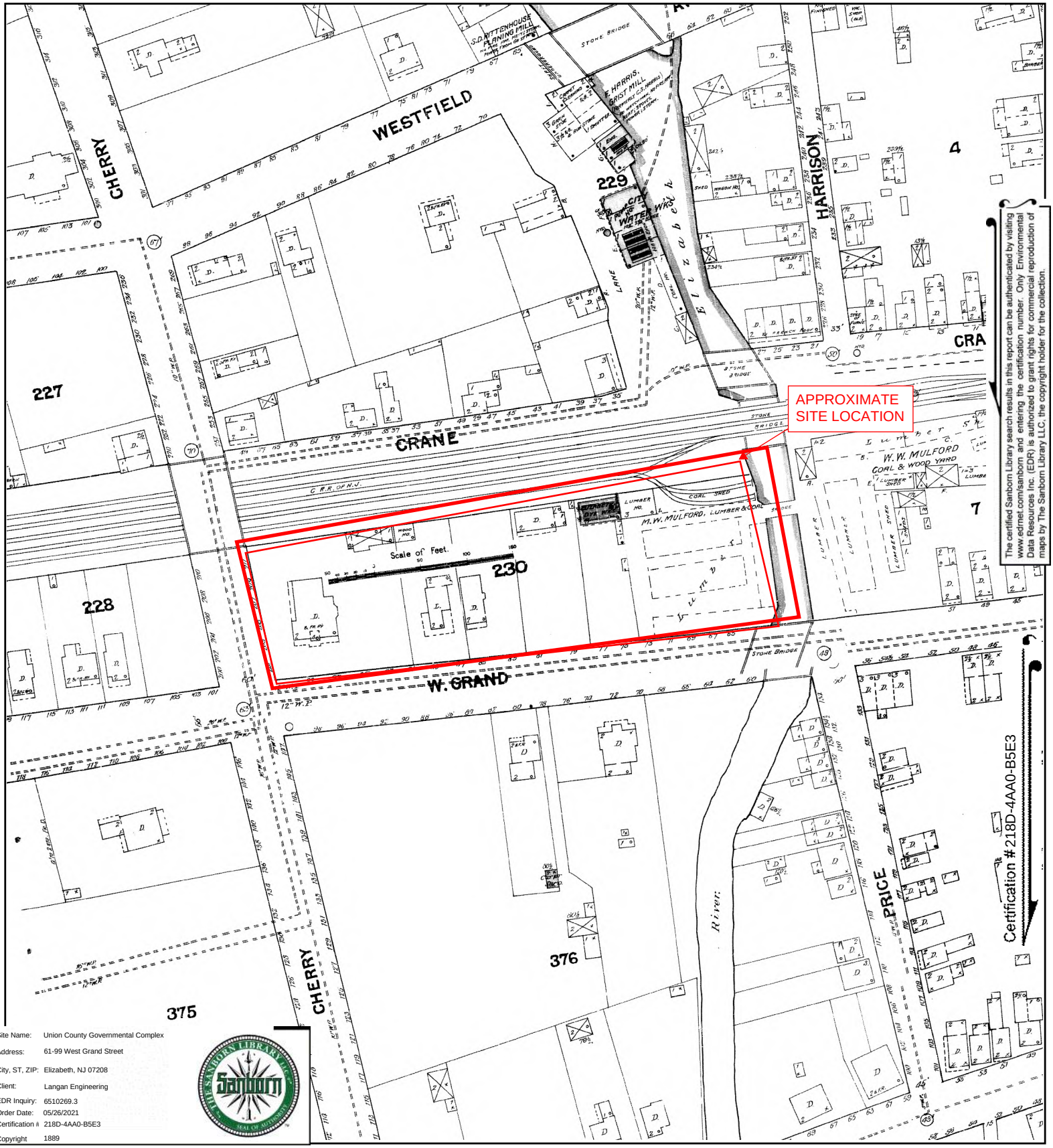

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Address:	61-99 West Grand Street
City, ST, ZIP:	Elizabeth, NJ 07208
Client:	Langan Engineering
EDR Inquiry:	6510269.3
Order Date:	05/26/2021
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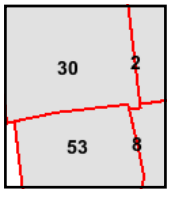


Volume 1, Sheet 53
Volume 1, Sheet 30
Volume 1, Sheet 8
Volume 1, Sheet 2

0 Feet 150 300 600

N

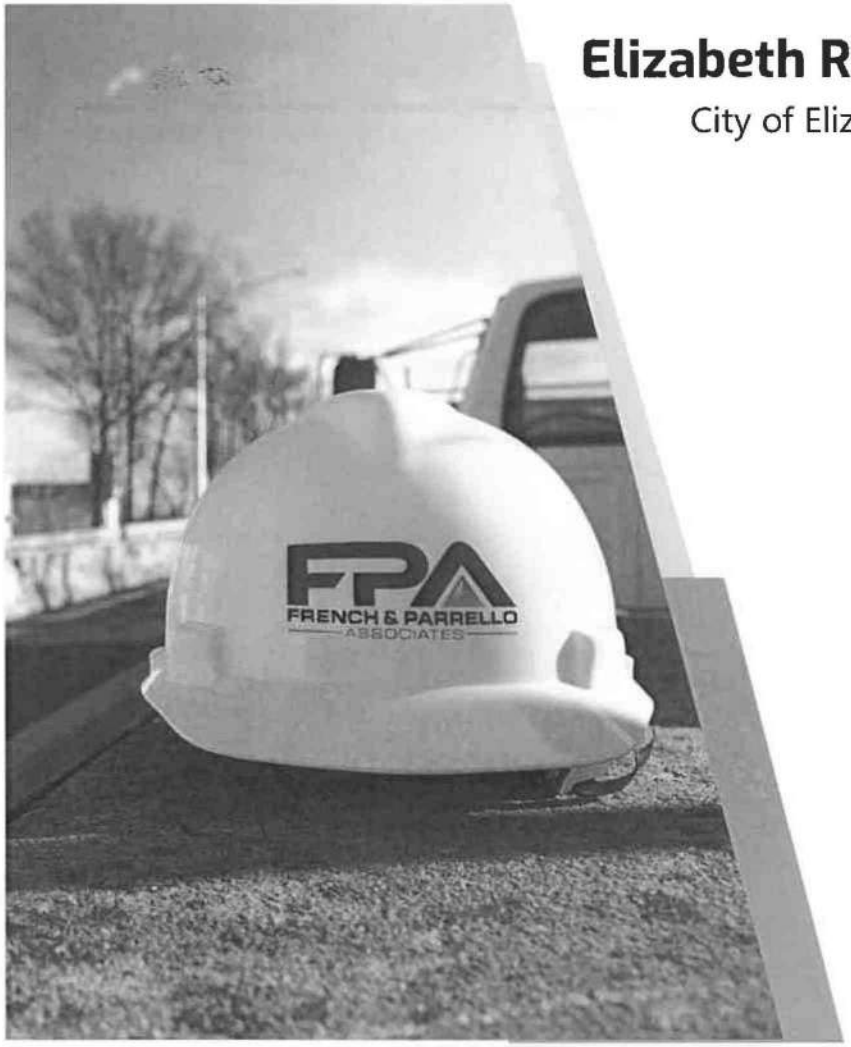
ATTACHMENT D

Report of Subsurface Exploration & Geotechnical Engineering Assessment by French & Parrello Associates (FPA) and dated 12 November 2019

FRENCH & PARRELLO ASSOCIATES

Advancing Our Client's Vision
IMPROVING OUR WORLD

Report of Subsurface Exploration & Geotechnical Engineering Assessment



Elizabeth Redevelopment Project

City of Elizabeth, Union County, New Jersey

Mr. Daniel P. Sullivan
Executive Director
UNION COUNTY IMPROVEMENT AUTHORITY
1499 Routes 1 & 9 North
Rahway, New Jersey 07065

November 12, 2019
FPA No. 4232.001R1

1800 Route 34, Suite 101 • Wall, NJ • 07719 • T 732.312.9800 • F 732.312.9801
Camden, NJ • Hackettstown, NJ • New York, NY• King of Prussia, PA
fpaengineers.com

FRENCH & PARRELLO ASSOCIATES

Corporate Office
1800 Route 34, Suite 101, Wall, New Jersey 07719
Regional Offices
King of Prussia, Pennsylvania
Hackettstown, New Jersey
Camden, New Jersey
New York, New York

November 12, 2019

Mr. Daniel P. Sullivan
Executive Director
UNION COUNTY IMPROVEMENT AUTHORITY
1499 Routes 1 & 9 North
Rahway, New Jersey 07065

Re: Report of Preliminary Subsurface Exploration
& Geotechnical Engineering Assessment
Elizabeth Redevelopment Project
City of Elizabeth, Union County, New Jersey
FPA No. 4232.001R1

Dear Mr. Sullivan:

INTRODUCTION

This report presents the results of our Preliminary Subsurface Exploration and Geotechnical Engineering Assessment performed in connection with the proposed Redevelopment Project in the City of Elizabeth, Union County, New Jersey. The property encompasses approximately 2.38 acres and is designated as Block 6, Lot 1589 on the City of Elizabeth Tax Map. The project site is located within a rectangular lot bounded by West Grand Street to the south, Cherry Street to the west, the Elizabeth River to the east and residential/commercial properties to the north. The regional location of the project site is presented on Drawing No. 1, "Regional Location Plan."

The initially proposed development consists of two individual office buildings separated by a parking garage in the middle. However, there is an alternate layout under consideration that would include office buildings in the western and central portion of the site with at-grade parking adjacent to the Elizabeth River. The specific details of the structures are not known at this time; however, based on project related correspondences, the office buildings will each occupy a plan area of approximately 18,000 square feet while the parking garage will occupy a plan area of approximately 25,000 square feet. Based upon our review of the "Boundary & Topographic Survey" prepared by Gary A. Veenstra, PLS Land Surveyor dated July 24, 2019, the existing grades at the site vary from approximately elevation +16 feet at the southeast portion of the site adjacent to the Elizabeth River to elevation +42 feet at the western portion of the site near the intersection of Cherry Street and West Grand Street. The proposed site grades and building elevations were unavailable at the time this report was prepared but we anticipate minor to moderate regrading will be necessary to achieve final site grades and building elevations.

The purpose for our involvement on the project at this time was to perform a Geotechnical Engineering Assessment to facilitate the planning, design and construction of the proposed redevelopment project. Our scope of services included technical observation of 6 test borings, engineering evaluation of the subsurface conditions and the preparation of this preliminary geotechnical engineering report. Our services were performed in general accordance with our proposal dated September 4, 2019.

SUBSURFACE EXPLORATION

French & Parrello Associates (FPA) observed the performance of 6 test borings on October 7 and October 8, 2019 to characterize the subsurface conditions within the vicinity of the proposed redevelopment. The test borings were field located based off correlation with existing site features. All field work was performed under the full-time technical observation by a representative of FPA. The approximate as-drilled test boring locations are presented on Drawing No. 2, "Test Boring Location Plan."

The test borings, designated as B-1 through B-6, were advanced to depths ranging from approximately 15 feet to 25 feet below the existing grade using mud rotary drilling procedures and rock coring techniques. Soil samples were obtained from within the boreholes by advancing a standard 2-inch diameter split-spoon sampler in accordance with ASTM Test Method D-1586, The Standard Penetration Test. The rock samples were obtained using a diamond-tipped NX-sized core barrel. All soil samples were classified in the field using the Burmister Soil Classification System. The rock samples were classified in accordance with their geologic origin and assigned a Rock Quality Designation (RQD) value. The soil and rock samples were returned to our in-house soils laboratory for further review and will be stored for a period of 60 days from the date of this report.

The depth to groundwater was estimated based on the observed moisture content of the retrieved soil samples. Details of the drilling procedures, soil classifications, groundwater depths and Standard Penetration Test results are presented on the test boring logs in Appendix A.

SITE CONDITIONS

Regional Geology

Based on our review of published geologic literature pertaining to the project region, the in-situ material consists of glacial ground moraine deposited during the Wisconsin glaciation. The in-situ soils should consist of material ranging from clay to gravel with occasional cobble and boulders. Silts predominate, but some areas are characterized by intermingled deposits of stratified silty sands. The underlying bedrock formation consists of Shale and is usually encountered at depths in excess of 20 feet throughout the area.

Subsurface Conditions

The soil conditions encountered during our subsurface exploration consisted of surficial fills and residual soil deposits underlain by Shale bedrock. The surficial fills were encountered from the existing ground surface to a depth of approximately 15 feet within Borings B-3 and B-6 and to depths ranging from approximately 2 foot to 6 feet within the remaining test borings. The surficial fills were composed of coarse to fine sand and gravel intermixed with varying amounts of clay and silt as well as debris including concrete, brick, wood, ash and slag. The fills may have been placed at some point in the past to raise the site above the flood plain associate with the Elizabeth River. The cohesive deposits were composed of clay and silt intermixed with moderate to minor amounts of coarse to fine sand and gravel. Completely weathered to slightly weathered Shale bedrock was encountered within the test borings at depths ranging from approximately 10 feet to 25 feet below the existing ground surface. Based on the results of the Standard Penetration Testing, the consistency of the surficial fill soils ranged from very soft to firm and the cohesive soils ranged from firm to hard. The RQD values of the recovered rock cores varied from 41% to 70% which indicates the quality of the rock may be described as poor to fair.

The static groundwater level was encountered within test boring B-3 and B-6 at a depth of approximately 12 feet below the existing ground surface, corresponding to elevation +11 feet and +8.5 feet, respectively. Perched groundwater was also noted within Boring B-2 at a depth of approximately 8 feet below existing grade, corresponding to elevation +24 feet. Seasonal and storm related fluctuations in the groundwater level, as well as the presence of perched groundwater within cohesive soils, should be anticipated. For a more detailed description of the subsurface conditions encountered, please refer to the test boring logs in Appendix A.

Seismicity

We have reviewed the guidelines presented in the New Jersey Edition of the 2015 International Building Code (IBC) regarding seismic design. Based upon our review, we offer the following site characterization parameters:

Short Period Spectral Acceleration (S_s) 0.274g
Spectral Acceleration @ 1 Second (S_1) 0.071g
Site Class ..... D

DISCUSSION & RECOMMENDATIONS

General

Based on the results our subsurface exploration and subsequent geotechnical engineering evaluation, it is our opinion that the proposed office buildings and parking garage may be founded on conventional shallow foundations provided the recommendations presented herein are incorporated into the foundation design. The results of our subsurface exploration indicate the presence of uncontrolled fills and very soft surficial cohesive soils within the eastern portion

of the site (Borings B-3 and B-6). This will necessitate the implementation of a ground improvement program including rammed aggregate pies (e.g. geopiers) should the initial plan be selected which includes an office structure within the area of Borings B-3 and B-6. Should the alternate site layout be chosen and the building structures are situated approximately 130 feet west of the Elizabeth River bulkhead, then we do not anticipate extraordinary foundation systems will need to be incorporated into the design of the buildings. Commentary on rammed aggregate piers are presented later in this report.

Removal and replacement of the unsuitable soils was considered; however, due to the depth of removal (approximately 17 feet) relative to the groundwater depth and the understanding of the environmentally impacted soil within this area, the option was immediately excluded as a viable alternative.

Shallow Foundations

Shallow foundations bearing on native soil material, compacted structural fills or improved with rammed aggregate piers may be designed for a net allowable bearing pressure of 4,000 psf. We recommend that continuous footings and isolated column footings be a minimum of 24 inches and 36 inches in width, respectively. In accordance with IBC regulations, the bottom of all reinforced concrete foundations exposed to outside ambient temperatures should extend to a minimum depth of 36 inches below the proposed grade for frost protection.

We estimate that footings loaded to the recommended allowable static bearing pressure will undergo less than approximately one inch of total settlement. We anticipate that post construction differential settlements will be less than ½ inch over a horizontal distance of 50 feet.

Foundation Excavation and Subgrade Preparation

We anticipate that the contractor may utilize conventional earth excavating equipment for performing excavations within in-situ soil deposits. We recommend that all excavations be hand trimmed, in a workmanlike manner, and that the footing subgrades be compacted using a walk-behind, vibratory roller to further densify the subsoils and delineate soft regions. The footing subgrade should be free of soft soil, water or any other objectional material. We anticipate that removal of loose fills at the foundation subgrade level and replacement with imported structural fills will be required within the area of test boring B-4 where the surficial fill extends to a depth of approximately 6 feet below the existing ground surface. Alternately, the footings in this area may be lowered to bear on native soil. We recommend that the foundation subgrade preparation process be monitored by FPA, such that soft areas may be delineated, their impact on the proposed construction evaluated, and remediate, if necessary.

A vibratory plate compactor may be used in areas where space and access are limited. Any areas exhibiting excessive yielding should be over-excavated and backfilled using material meeting the gradational requirement of Type "G" fill. Fills should be placed in maximum 12 inch lifts and compacted to a minimum of 95 percent of their maximum dry density as determined by ASTM

Test Method D-1557, The Modified Proctor Test. The lift thickness should be reduced if the selected compaction equipment does not result in adequate compaction.

Due to the presence of fine-grained material at the anticipated subgrade level, we recommend that the foundation subgrades be over-excavated to allow for the placement of 6 inches of NJDOT No. 57 Coarse Graded Aggregate. The coarse graded aggregate will serve as a work mat to preclude disturbance of the subgrade due to construction and inclement weather and will facilitate in-trench dewatering, if necessary. The gradational requirements for NJDOT No. 57 Coarse Graded Aggregate and Type "G" fill are presented in Appendix B.

Floor Slabs

Provided that the required earthwork is accomplished in accordance with the recommendations contained in this report, it is our opinion that a modulus of subgrade reaction of 175 pci will be suitable for use in the structural design of the concrete slabs. We recommend that a minimum 4 inch thick layer of NJDOT No. 57 Coarse Graded Aggregate be placed immediately below the floor slabs to provide uniform support.

Site Preparation & Earthwork

Prior to placing any structural fills, the ground surface should be stripped of all asphalt, concrete and surficial debris. The exposed subgrade should be compacted using a minimum 10-ton, smooth drum, vibratory roller to densify loose subgrade soils near the surface and to identify any soft soil that may require remediation. We recommend that fills required under footings and slabs of the proposed building consist of imported material meeting the gradational requirements of Type "G" fill.

We note that the borings encountered primarily silt and clay from approximately 2 feet to 6 feet below the existing ground surface. We recommend that the primarily silt and clay material removed from the excavations for foundations or site utilities be used as fill in non-structural or landscaped areas. These soils are moisture sensitive which are easily softened and disturbed when exposed to precipitation. It should be expected that these soils will require careful moisture conditioning, including reworking to aerate and dry these materials, to obtain the optimal moisture content for proper compaction to the minimum densities required.

Compacted fill placed to raise site grades for support of footings and slabs should be placed in horizontal loose lifts 12 inches or less in thickness. Fill that will support foundations and floor slabs should be compacted to a minimum of 95 percent of their maximum dry density as determined by ASTM Test Method D-1557, The Modified Proctor Test. Fill materials placed in non-structural areas for general grading purposes outside the limits of structural elements should be compacted to a minimum of 90 percent of their maximum dry density per ASTM D-1557. The surface of all compacted fill subgrades should be graded or sloped to provide gravity drainage of surface run-off. In addition, the surface of all prepared subgrades should be thoroughly

compacted at the end of each work day to seal the surface and minimize softening that may result from precipitation.

Ground Improvement Measures – Rammed Aggregate Piers

Should the buildings be proposed within the area of Borings B-3 and B-6, we recommend that the in-situ subsurface material be improved to allow for the buildings to be supported on conventional shallow foundations. Rammed aggregate piers may be installed to improve the support capabilities of the soft fine-grained deposits and uncontrolled fills to allow for the use of shallow foundations for building structures within the eastern portion of the site. To minimize the generation of spoils, we recommend that the displacement process be utilized to construct the elements. The displacement process utilizes a mandrel that is vibrated to the bottom of the zone of improvement and each element is then filled from the bottom-up with coarse graded aggregate. The coarse graded aggregate is placed in controlled lifts and compacted utilizing a hydraulic impact hammer. We recommend that an open-graded aggregate be utilized below the groundwater table. We recommend that the design and installation of the rammed aggregate piers be specified on a performance basis to achieve an allowable bearing pressure of 4,000 psf. For preliminary planning, we estimate the rammed aggregate piers will be on the order of 20 feet deep relative to the existing grade. We note that there are several reputable, specialty contractors which service the geographic area.

ADDITIONAL SUBSURFACE EXPLORATIONS

We note the recommendation to site the eastern-most building structure no closer than approximately 130 feet from the Elizabeth River bulkhead is based on 2 test borings (B-3 and B-6) as well as the location of the current building structure. To reduce the recommended buffer distance of 130 feet, we suggest that additional borings be performed to further delineate the extent of the unsuitable soil conditions which necessitate the implementation of the ground improvement program. Furthermore, the test borings performed as part of this assessment where for due-diligence purposes. Additional test borings should be performed prior to final design and to satisfy building code requirements.

CLOSING & LIMITATIONS

The recommendations contained herein are contingent upon subsurface conditions remaining consistent with those encountered during our subsurface exploration. They are also contingent upon the basis that all foundation related aspects of construction, including ground improvement, stripping, controlled fill operation, foundation excavation and subgrade preparation, be observed by a representative of FPA. This is to observe compliance with the design concepts and specifications and to allow design changes in the event that subsurface conditions differ from those anticipated prior to construction.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands, chemically hazardous, or biologically toxic materials in the soil, surface water, groundwater or air, on or below or around the site.

Services performed by FPA during this project have been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, expressed or implied, and no warranty or guarantee is included or intended in the services provided.

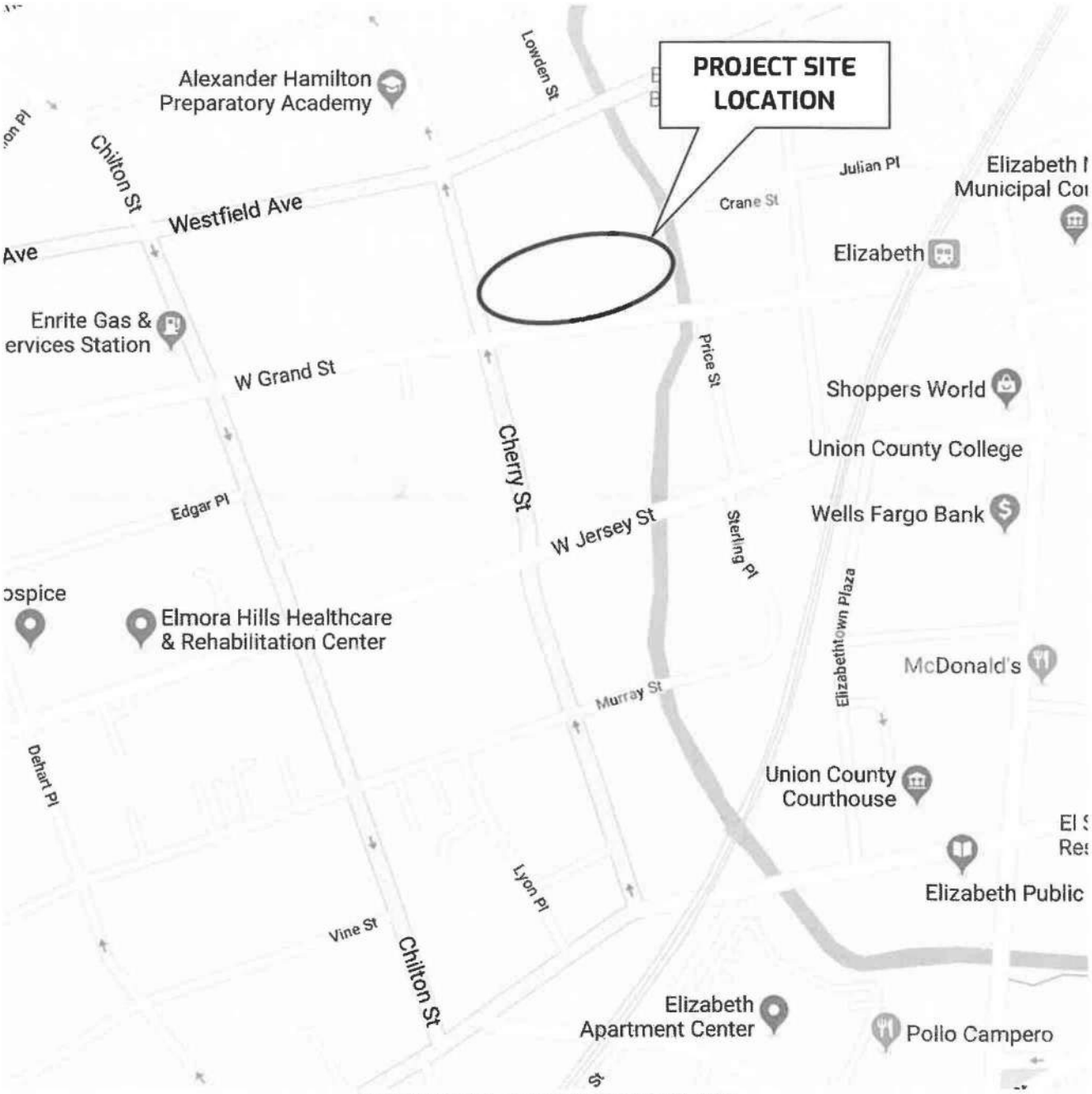
Should you have any questions or if we can be of service to you in the future, please feel free to contact us.

Sincerely,

FRENCH & PARRELLO ASSOCIATES

Joseph M. Tierney, PE
Project Consultant, Manager of Geotechnical Services

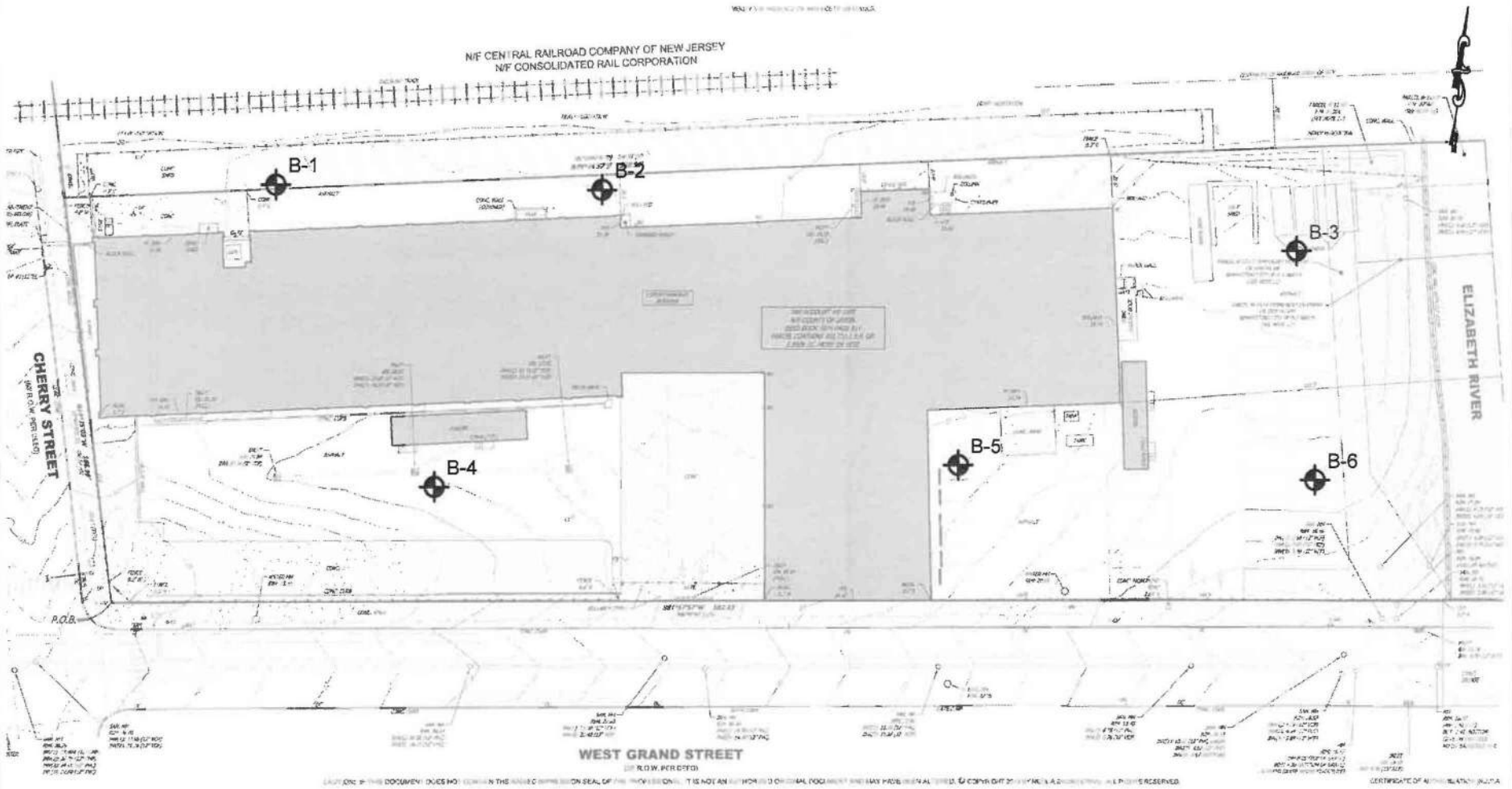
JMT/HDR



REGIONAL LOCATION PLAN

ELIZABETH REDEVELOPMENT PROJECT
CITY OF ELIZABETH, UNION COUNTY, NEW JERSEY

SCALE:	DATE:	JOB NO.:	DRAWING NO.:
NTS	NOVEMBER 2019	4232.001	1



LEGEND:

⊕ TEST BORING LOCATION

FRENCH & PARRELLO ASSOCIATES

Corporate Office
1800 Route 34, Suite 101
Wall, NJ 07719
732.312.9800

Regional Offices
Hackettstown, NJ
New York, NY

TEST BORING LOCATION PLAN

FOR

ELIZABETH REDEVELOPMENT PROJECT

ELIZABETH
UNION COUNTY, NEW JERSEY

DATE:	SCALE:	DRAWING #
OCTOBER 2019	APPROX. 1"=40'	2
DRAWN BY: HDR	PROJECT NUMBER: 4232.001	

APPENDIX A
Test Boring Logs

BURMISTER SOIL CLASSIFICATION SYSTEM

A. Cohesionless Soils: Particle Size Definitions

Soil	Fraction	U.S. Standard Sieve	Actual Sizes
Gravel	coarse	3 in. to 1 in.	76 mm to 25 mm
	medium	1 in. to 3/8 in.	25 mm to 9.5 mm
	fine	3/8 in. to No. 10	9.5 mm to 2.0 mm
Sand	coarse	No. 10 to No. 30	2.0 mm to 0.6 mm
	medium	No. 30 to No. 60	0.6 mm to 0.25 mm
	fine	No. 60 to No. 200	0.25 mm to 0.75 mm
Silt		< No. 200	< 0.075 mm

B. Terms Describing Gradation of Cohesionless Soils

Written Description	Symbol/Designation	Defining Proportions
coarse, medium to fine	cmf	all fractions > 10%
coarse to medium	cm	< 10% fine
medium to fine	mf	< 10% coarse
coarse	c	< 10% medium and fine
medium	m	< 10% coarse and fine
fine	f	< 10% coarse and medium

Note: Use (+) for upper limit and (-) for lower limit.

C. Cohesive Soils: Terms Describing Plasticity

Soil	Plasticity Index	Workability	Plasticity Description
SILT	0	--	Non-Plastic
Clayey SILT	1 to 5	1/4 in. thread	Slightly Plastic
SILT & CLAY	5 to 10	1/8 in. thread	Low Plasticity
CLAY & SILT	10 to 20	1/16 in. thread	Medium Plasticity
Silty CLAY	20 to 40	1/32 in. thread	High Plasticity
CLAY	>40	1/64 in. thread	Very High Plasticity

D. Terms Describing Overall Composition of Soil

Written Proportion	Proportion Symbol	Proportion Percent by Weight
and	a	35 to 50
some	s	20 to 35
little	l	10 to 20
trace	t	1 to 10

Note: Use (+) for upper limit and (-) for lower limit.

TEST BORING LOG

ELIZABETH REDEVELOPMENT PROJECT
CITY OF ELIZABETH, UNION COUNTY, NEW JERSEY
(FPA PROJECT NO. 4232.001)

BORING NO.: B-1
SHEET 1 OF 1

DATE STARTED: 10/8/2019
DATE FINISHED: 10/8/2019
DEPTH OF WATER: Dry
LOCATION: See Plan
GROUND ELEVATION: +31'±
GROUND WATER ELEV.: N/A

DRILLING TECHNIQUE: Mud Rotary
HAMMER TYPE: 140 lb. Automatic Trip Hammer, 30 Inch Drop

DEPTH FEET	SAMPLE DEPTH	SPT BLOW COUNTS (PER 6")	STRATA	DESCRIPTION OF SOIL
	S-1	X – 8 – 28 – 15	*Fill*	S-1 TOP 3": **Asphalt**. BOT 21": Red-Brown & Dark Grey **CLAY & SILT**, some⁻ cmf⁺ Gravel, little⁺ cmf Sand. (fill)
	0-2'			
	S-2	17 – 51 – 50/1" – X		S-2 Light Grey c⁺mf **GRAVEL**, little cmf Sand, little Silt. (fill, 6" Concrete Slab at approx. 3.5')
	2-4'			
--- 5'---	S-3	15 – 6 – 16 – 28	*Residual Soil*	S-3 Red-Brown **CLAY & SILT**, some⁺ c⁺mf Gravel, little⁺ cmf Sand.
	4-6'			
	S-4	27 – 21 – 34 – 35		S-4 Red-Brown & Grey-Brown **CLAY & SILT**, some⁻ cmf Gravel, little⁺ cmf⁺ Sand. (varved, completely decomposed Shale)
	6-8'			
	S-5	22 – 53 – 57 – 50/1"		S-5 Red-Brown **CLAY & SILT**, little⁺ cmf Gravel, little⁺ cmf⁺ Sand. (completely decomposed Shale)
---10'---	8-10'			
	S-6	50/1" – X – X – X	*Weathered Shale*	S-6 Same as **S-5**
	10-10.1'			
	RUN 1	REC.: 83%		RUN 1 Red-Brown closely jointed, completely weathered **SHALE**. (w/ few 1-2" intrusions of Clay & Silt)
---15'---	10.1-15'	RQD: 41%		
				END OF BORING @ 15'
---20'---				
---25'---				
---30'---				
---35'---				

SOILS ENGINEER: J TIERNEY, PE
DRILLING INSPECTOR: H. RIOS, EIT

CONTRACTOR: CRAIG TEST BORING
DRILLER: N. BEEHLER

The information shown hereon indicates the subsurface conditions encountered at the specific boring location on the date(s) of drilling. Subsurface conditions are likely to vary across the project site. Interpretation of the subsurface data shall be at the discretion of the user.

TEST BORING LOG

ELIZABETH REDEVELOPMENT PROJECT
CITY OF ELIZABETH, UNION COUNTY, NEW JERSEY
(FPA PROJECT NO. 4232.001)

BORING NO.: B-2
SHEET 1 OF 1

DATE STARTED: 10/8/2019
DATE FINISHED: 10/8/2019
DEPTH OF WATER: 8'±*
LOCATION: See Plan
GROUND ELEVATION: +31'±
GROUND WATER ELEV.: N/A

DRILLING TECHNIQUE: Mud Rotary
HAMMER TYPE: 140 lb. Automatic Trip Hammer, 30 Inch Drop

DEPTH FEET	SAMPLE DEPTH	SPT BLOW COUNTS (PER 6")	STRATA	DESCRIPTION OF SOIL
	S-1 0-2'	X – 7 – 9 – 10	*Fill*	S-1 TOP 3": **Asphalt.** BOT 21": Red-Brown & Tan-Brown **CLAY & SILT**, some⁻ cmf Gravel, little⁺ cmf Sand. (fill)
	S-2 2-4'	12 – 6 – 5 – 5		S-2 Red-Brown **CLAY & SILT**, little⁺ mf⁺ Gravel, little cmf Sand.
--- 5'---	S-3 4-6'	6 – 6 – 10 – 10		S-3 Red-Brown **CLAY & SILT**, some⁻ cmf⁺ Gravel, little⁺ cmf⁺ Sand.
	S-4 6-8'	6 – 6 – 10 – 10	*Residual Soil*	S-4 Same as **S-3**.
---10'---	S-5 8-10'	1 – 2 – 6 – 10		S-5 Red-Brown **CLAY & SILT**, some cm⁺f Gravel, little⁺ c⁺mf Sand.
	S-6 10-12'	9 – 14 – 27 – 33		S-6 Red-Brown & Grey-Brown **CLAY & SILT**, some⁻ cmf⁺ Gravel, little⁺ cmf⁺ Sand. (varved, completely decomposed Shale)
---15'---				
	S-7 15-17'	65 – 50/3" – X – X		S-7 Red-Brown & Grey-Brown **CLAY & SILT**, some cmf Gravel, little cmf Sand. (completely decomposed Shale)
---20'---			*Weathered Shale*	*Difficult Drilling 18-20'*
	S-8 20-22'	51 – 50/2" – X – X		S-8 Same as **S-7**.
---25'---				*Difficult Drilling 20.5-25'*
	S-9 25-27'	50/1" – X – X – X		S-9 Red-Brown c⁺mf **GRAVEL**, trace⁺ Clay & Silt, trace⁺ cmf Sand. (completely decomposed Shale)
				END OF BORING @ 25.1'
---30'---				** Possible perched water.*
---35'---				

SOILS ENGINEER: J TIERNEY, PE
DRILLING INSPECTOR: H. RIOS, EIT

CONTRACTOR: CRAIG TEST BORING
DRILLER: N. BEEHLER

TEST BORING LOG

ELIZABETH REDEVELOPMENT PROJECT
CITY OF ELIZABETH, UNION COUNTY, NEW JERSEY
(FPA PROJECT NO. 4232.001)

BORING NO.: B-3
SHEET 1 OF 1

DATE STARTED: 10/7/2019
DATE FINISHED: 10/7/2019
DEPTH OF WATER: 12'±*
LOCATION: See Plan
GROUND ELEVATION: +23'±
GROUND WATER ELEV.: +11'±

DRILLING TECHNIQUE: Mud Rotary
HAMMER TYPE: 140 lb. Automatic Trip Hammer, 30 Inch Drop

DEPTH FEET	SAMPLE DEPTH	SPT BLOW COUNTS (PER 6")	STRATA	DESCRIPTION OF SOIL
	S-1 0-2'	X – 6 – 8 – 8		S-1 TOP 3": **Asphalt**. BOT 21": Brown **CLAY & SILT**, little⁺ cmf⁺ Gravel, little cmf Sand. (fill)
	S-2 2-4'	50 – 50/1" – X – X		S-2 Blue-Grey cm⁺f **GRAVEL**, and⁻ cmf⁺ Sand, little⁺ Silt. (fill, w/ some pieces of slag)
--- 5'---	S-3 4-6'	5 – 2 – 2 – 5		S-3 TOP 6": Same as **S2**. BOT 18": Red-Brown **CLAY & SILT**, some cmf⁺ Gravel, little⁺ cmf Sand. (fill)
	S-4 6-8'	1 – 1 – 1 – 4	*Fill*	
	S-5	WOH – WOH – 2 – 2		S-4 Red-Brown **CLAY & SILT**, little⁺ cmf⁺ Gravel, little cmf Sand. (fill)
---10'---	8-10'			
	S-6 10-12'	11 – 82 – 33 – 15		S-5 Same as **S-4**. *Small Recovery* S-6 Light Yellow-Brown cmf⁺ **SAND**, some⁺ cmf⁺ Gravel, little Silt. (fill)
---15'---				
	S-7 15-17'	2 – 3 – 9 – 8		S-7 Red-Brown & Tan-Brown **CLAY & SILT**, little⁻ cmf⁺ Sand, trace⁺ f Gravel.
---20'---			*Residual Soil*	
	S-8 20-22'	9 – 9 – 20 – 34		S-8 Red-Brown c⁺mf **GRAVEL**, some c⁺mf Sand, little⁻ Clay & Silt.
---25'---				*Difficult Drilling 23-25'*
	S-9 25-25.1'	50/1" – X – X – X	*Weathered Shale*	S-9 Red-Brown **CLAY & SILT**, and⁻ cmf Gravel, little⁻ cmf Sand. (completely decomposed Shale)
	RUN 1 25.1-30'	REC.: 83% RQD: 41%		RUN 1 Red-Brown closely jointed, weathered **SHALE**.
---30'---				END OF BORING @ 30' ** Possible perched water.*
---35'---				

SOILS ENGINEER: J TIERNEY, PE
DRILLING INSPECTOR: H. RIOS, EIT

CONTRACTOR: CRAIG TEST BORING
DRILLER: N. BEEHLER

The information shown hereon indicates the subsurface conditions encountered at the specific boring location on the date(s) of drilling. Subsurface conditions are likely to vary across the project site. Interpretation of the subsurface data shall be at the discretion of the user.

TEST BORING LOG

ELIZABETH REDEVELOPMENT PROJECT
CITY OF ELIZABETH, UNION COUNTY, NEW JERSEY
(FPA PROJECT NO. 4232.001)

BORING NO.: B-4
SHEET 1 OF 1

DATE STARTED: 10/7/2019
DATE FINISHED: 10/7/2019
DEPTH OF WATER: Dry
LOCATION: See Plan
GROUND ELEVATION: +29.5'±
GROUND WATER ELEV.: N/A

DRILLING TECHNIQUE: Mud Rotary
HAMMER TYPE: 140 lb. Automatic Trip Hammer, 30 Inch Drop

DEPTH FEET	SAMPLE DEPTH	SPT BLOW COUNTS (PER 6")	STRATA	DESCRIPTION OF SOIL
	S-1	X – 3 – 6 – 6	*Fill*	S-1 TOP 4": **Asphalt**. BOT 20": Red-Brown **CLAY & SILT**, little^{+} mf^{+} Gravel, little f Sand. (Fill)
	0-2'			
	S-2	7 – 9 – 14 – 13		S-2 Red-Brown **CLAY & SILT**, some^{-} cmf^{+} Sand, little^{+} cmf^{+} Gravel.
	2-4'			
--- 5'---	S-3	13 – 11 – 32 – 62		S-3 Red-Brown **CLAY & SILT**, some^{-} c^{+}mf Gravel, little cmf Sand. (Fill)
	4-6'			
	S-4	76 – 68 – 50/3" – X	*Residual Soil*	S-4 Red-Brown **CLAY & SILT**, some^{-} c^{+}mf Gravel, little cmf Sand.
	6-8'			
	S-5	76 – 68 – 50/3" – X		S-5 Same as **S-4**.
---10'---	8-10'			
	S-6	67 – 87 – 50/3" – X		S-6 Same as **S-4**.
	10-12'			
---15'---	S-7	50/2" – X – X – X	*Weathered Shale*	S-7 Red-Brown c^{+}mf **GRAVEL**, little^{+} cmf Sand, little Clay & Silt. (completely decomposed Shale)
	15-15.1'			
	RUN 1	REC.: 100%		RUN 1 Red-Brown closely jointed, weathered **SHALE**. (w/ few 1-2" intrusions of Clay & Silt)
---20'---	15.1-20'	RQD: 42%		END OF BORING @ 20'
---25'---				
---30'---				
---35'---				

SOILS ENGINEER: J TIERNEY, PE
DRILLING INSPECTOR: H. RIOS, EIT

CONTRACTOR: CRAIG TEST BORING
DRILLER: N. BEEHLER

The information shown hereon indicates the subsurface conditions encountered at the specific boring location on the date(s) of drilling. Subsurface conditions are likely to vary across the project site. Interpretation of the subsurface data shall be at the discretion of the user.

TEST BORING LOG

ELIZABETH REDEVELOPMENT PROJECT
CITY OF ELIZABETH, UNION COUNTY, NEW JERSEY
(FPA PROJECT NO. 4232.001)

BORING NO.: B-5
SHEET 1 OF 1

DATE STARTED: 10/7/2019
DATE FINISHED: 10/7/2019
DEPTH OF WATER: Dry
LOCATION: See Plan
GROUND ELEVATION: +24.5'±
GROUND WATER ELEV.: N/A

DRILLING TECHNIQUE: Mud Rotary
HAMMER TYPE: 140 lb. Automatic Trip Hammer, 30 Inch Drop

DEPTH FEET	SAMPLE DEPTH	SPT BLOW COUNTS (PER 6")	STRATA		DESCRIPTION OF SOIL
	S-1 0-2'	X – 7 – 6 – 4	*Fill*	S-1	TOP 4": **Asphalt**. BOT 20": Light Grey & Red-Brown **CLAY & SILT**, little+ cmf Gravel, little+ cmf Sand. (fill, w/ some pieces of ash & brick)
	S-2 2-4'	3 – 3 – 6 – 7			
--- 5'---	S-3 4-6'	4 – 8 – 10 – 11		S-2	Red-Brown **CLAY & SILT**, little+ cmf Gravel, little cmf Sand.
	S-4 6-8'	13 – 14 – 18 – 15		S-3	Red-Brown **CLAY & SILT**, some- cmf+ Gravel, little+ cmf Sand.
	S-5 8-10'	6 – 9 – 10 – 12	*Residual Soil*	S-4	Red-Brown cmf **GRAVEL**, some- cmf Sand, little Clay & Silt.
---10'---	S-6 10-12'	14 – 45 – 48 – 46		S-5	Red-Brown cmf+ **GRAVEL**, little+ cmf Sand, little+ Clay & Silt.
				S-6	Red-Brown cmf **GRAVEL**, little cmf Sand, little- Clay & Silt.
---15'---	S-7 15-17'	51 – 50/3" – X – X		S-7	Red-Brown **CLAY & SILT**, some+ cmf Gravel, little+ cmf Sand. (completely decomposed Shale)
---20'---	S-8 20-22'	50/2" – X – X – X	*Weathered Shale*	S-8	Same as **S-7**.
					Difficult Drilling 21-25'
---25'---	S-9 25-25.1'	50/1" – X – X – X		S-9	Same as **S-7**.
---30'---	RUN 1 25.1-30'	REC.: 100% RQD: 70%		RUN 1	Red-Brown moderately jointed, moderately weathered **SHALE**.
					END OF BORING @ 30'
---35'---					

SOILS ENGINEER: J TIERNEY, PE
DRILLING INSPECTOR: H. RIOS, EIT

CONTRACTOR: CRAIG TEST BORING
DRILLER: N. BEEHLER

The information shown hereon indicates the subsurface conditions encountered at the specific boring location on the date(s) of drilling. Subsurface conditions are likely to vary across the project site. Interpretation of the subsurface data shall be at the discretion of the user.

TEST BORING LOG

ELIZABETH REDEVELOPMENT PROJECT
CITY OF ELIZABETH, UNION COUNTY, NEW JERSEY
(FPA PROJECT NO. 4232.001)

BORING NO.: B-6
SHEET 1 OF 1

DATE STARTED: 10/7/2019
DATE FINISHED: 10/7/2019
DEPTH OF WATER: 12'±
LOCATION: See Plan
GROUND ELEVATION: +20.5'±
GROUND WATER ELEV.: +8.5'±

DRILLING TECHNIQUE: Mud Rotary
HAMMER TYPE: 140 lb. Automatic Trip Hammer, 30 Inch Drop

DEPTH FEET	SAMPLE DEPTH	SPT BLOW COUNTS (PER 6")	STRATA	DESCRIPTION OF SOIL
	S-1 0-2'	X – 7 – 4 – 8		S-1 TOP 3": **Asphalt.** BOT 21": Brown **CLAY & SILT**, some⁻ cmf⁺ Gravel, little⁺ cmf⁺ Sand. (fill)
	S-2 2-4'	10 – 8 – 7 – 6		S-2 Same as **S-1.**
--- 5'---	S-3 4-6'	1 – 2 – 1 – 2		S-3 Brown & Red-Brown **CLAY & SILT**, little⁺ mf Gravel, little cmf Sand. (fill)
	S-4 6-8'	WOH – 5 – 11 – 14	*Fill*	S-4 Brown **CLAY & SILT**, some⁺ cmf Gravel, little⁻ cmf⁺ Sand. (fill)
---10'---	S-5 8-10'	2 – 3 – 10 – 9		S-5 Grey-Brown **CLAY & SILT**, some cmf⁺ Gravel, little⁺ cmf Sand. (fill, w/ trace of brick & wood fibers)
	S-6 10-12'	4 – 2 – 3 – 3		S-6 Light Grey & Grey c⁺mf **SAND**, some Silt, little⁺ cmf Gravel. (fill, w/ ash)
---15'---				
	S-7 15-17'	2 – 2 – 2 – 3	*Residual Soil*	S-7 Red-Brown **CLAY & SILT**, little cmf⁺ Gravel, trace⁺ cmf Sand.
---20'---				
	S-8 20-22'	31 – 80 – 50/1" – X	*Weathered Shale*	S-8 Red-Brown cmf **GRAVEL**, little⁺ cmf Sand, little Clay & Silt. (completely decomposed Shale) *Difficult Drilling 24-25'*
---25'---				
	S-9 25-25.1'	50/1" – X – X – X		S-9 Red-Brown **CLAY & SILT**, and⁻ cmf Gravel, little⁻ cmf Sand. (completely decomposed Shale)
---30'---				END OF BORING @ 25.1'
---35'---				

SOILS ENGINEER: J TIERNEY, PE
DRILLING INSPECTOR: H. RIOS, EIT

CONTRACTOR: CRAIG TEST BORING
DRILLER: N. BEEHLER

The information shown hereon indicates the subsurface conditions encountered at the specific boring location on the date(s) of drilling. Subsurface conditions are likely to vary across the project site. Interpretation of the subsurface data shall be at the discretion of the user.

APPENDIX B
Gradational Requirements

Allowable Gradational Envelope

AASHTO M43

Standard Sizes of Coarse Aggregate Size No. 57

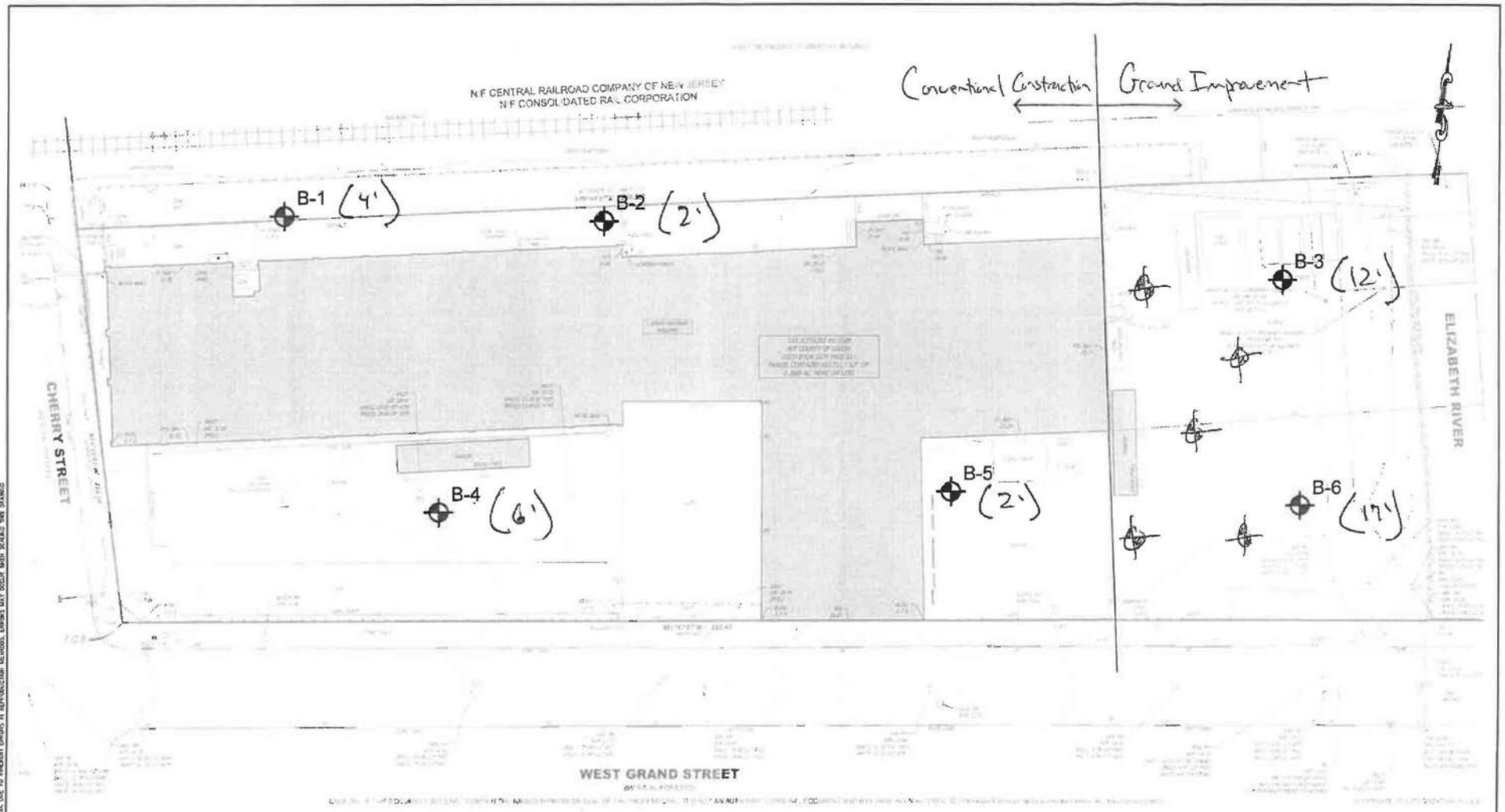
U.S. Standard Sieve Size	Percent Finer by Weight
1 ½"	100
1"	95 - 100
½"	25 - 60
No. 4	0 - 10
No. 8	0 - 5

Allowable Gradational Envelope

Type "G" Fill

GRANULAR FILL

U.S. Standard Sieve Size	Percent Finer By Weight
2"	100
1"	80 – 100
3/8"	70 – 100
No. 10	50 – 100
No. 30	30 – 85
No. 60	15 – 65
No. 200	5 - 15



LEGEND:

TEST BORING LOCATION

(#) Depth of Fill and/or Unsuitable Soil

Additional Borings to Delineate Fills JMT 11/8/19

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New York, NY

TEST BORING LOCATION PLAN
FOR
ELIZABETH REDEVELOPMENT PROJECT
ELIZABETH
UNION COUNTY, NEW JERSEY

DATE:	SCALE:	DRAWING #
OCTOBER 2019	APPROX. 1"=40'	2
DRAWN BY: HDR	PROJECT NUMBER: 4232.001	

EXHIBIT 5

Preliminary Information for Design of Project

Pinnacle

West Grand Street Redevelopment Plan
City of Elizabeth

The project consists of the new construction of two separate 90,000 sf usable office buildings on a single site in Elizabeth.

The existing site is on the corner of West Grand Street and Cherry Street. The rear of the property is adjacent to New Jersey Transit Property and the one side is adjacent to the Elizabeth River.

An existing one story, 50,000 sf building occupied by the Motor Vehicle Department for Union County is to be demolished by the developer TBD as part of the redevelopment plan in order for the new work to proceed. The work will also include all required environmental remediation for the building and site.

The proposed new buildings are intended to have an identical footprint at the lower and upper levels of approximately 22,500 sf. Each building is intended to include 90,000 sf of usable office space for a total of 180,000 sf of usable office space. The height of the new buildings is planned to be between 5 to 7 stories.

The use of the two buildings will be to relocate existing County office departments to include Social Services and County Administration for consolidation onto this one single site location.

The space planning and allocation of different departments within the two buildings has not yet been completed.

The ground floor of both buildings will include lobby and core spaces. The total square footage of both office buildings A & B to include the core spaces will be approximately 225,000sf.

The site will include 120 parking spaces both at grade and under the two buildings. All other parking will be provided off site at other locations that are not a part of this project. There will be a pickup/drop off in front of both buildings.

Exterior materials anticipated for the design will include a masonry screening system of stone and or brick and glass curtain wall – soffit materials are anticipated to be linear metal. Anticipated coloration is similar to the Family Court, which is located at 10 Cherry Street, to create visual connection to County facilities.

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