LANGAN

Memorandum

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To: Francesco Cerrai – City of Philadelphia Department of Public Property

From: John J.McElroy Jr., PhD, P.E. – LANGAN
Tim Garrett, PLA, ASLA – LANGAN

Info: Jayne Spector, PLA, LEED AP, ASLA – LANGAN

Date: 8 October 2019

Re: Summary of Test Pit Exploration
Miles Mack Playground
Philadelphia, Pennsylvania
LANGAN Project No.: 220104104

This memorandum presents the results of LANGAN's geotechnical engineering study for the existing retaining wall along the southern boundary of the basketball court at Miles Mack Playground in Philadelphia, Pennsylvania. The purpose of this study was to explore and evaluate the existing retaining wall in an effort to better understand the wall's construction and foundation, as well as to classify the wall's bearing and retained soils. This work was performed in accordance with LANGAN's ASR-2 dated 14 May 2019.

Subsurface Exploration

LANGAN attempted four test pits on 3 September 2019. Test pits TP-1 through TP-3 were located adjacent to the retaining wall, with two located at the top of the wall and one at the base of the wall. Test pit TP-4 was located on the west side of the basketball court playing surface. The test pits were completed by Uni-Tech with a Bobcat E-20 mini-excavator. All test pits were conducted under the full-time supervision of a LANGAN field engineer.

All but one test pit, TP-2, encountered a concrete slab immediately beneath the asphalt surface. The concrete slab at the three test pit locations could not be removed and were abandoned. At completion, test pit TP-2 was backfilled with excavated materials. All test pit surfaces were restored using cold-patch asphalt.

The test pit locations are shown on Figure 1. Test pit logs for all test pits are provided in Attachment A. A sketch of the footing observed in test pit TP-2, including construction material, elevations, depths and soil stratigraphy, are also included in Attachment A. Photographs documenting the test pits are provided in Attachment B. Descriptions of the observations obtained in each test pit are summarized below.

Test Pit TP-1

Test pit TP-1 was performed on the high side of the retaining wall near the eastern limit of observed wall deflection. The test pit was performed at the location of a large surface crack that is suspected to be the result of settlement. The test pit surface consisted of two inches of asphalt pavement and was immediately underlain by a concrete slab. The concrete slab could not be removed and the thickness of the slab could not be determined. Photographs 5 and 6 in Attachment B depict test pit TP-1.

Test Pit TP-2

Test pit TP-2 was performed on the low side of the retaining wall at the point of the wall alignment where the most severe wall deflection was observed. The surface layer consisted of three inches of asphalt pavement and two inches of subbase stone. A layer of fill was encountered beneath the surficial layer extending to a depth of 1.75 feet and consisted of reddish brown medium to fine sand with varying amounts of silt, mica, slate, and brick. The fill was underlain by native decomposed mica schist rock consisting of brown, tan, orange-brown, reddish brown, black, and white fine sand with varying amounts of silt, gravel, and mica.

The below-grade portion of the wall beneath the upper brick wall consisted of three courses of concrete masonry unit (CMU) blocks above a single course of brick. The wall was observed bearing on a 12-inch-thick concrete footing. The upper brick wall itself extended below ground surface by a single course of brick before transitioning to the CMU blocks. No structural connection between the lower CMU block wall and the upper brick wall could be discerned. Photographs 1 through 4 in Attachment B depict test pit TP-2.

Test Pit TP-3

Test pit TP-3 was performed on the high side of the retaining wall on the west side of the wall alignment. The test pit was attempted at the location of a crack in the capstone on the wall. The test pit surface consisted of four inches of asphalt pavement and was immediately underlain by a concrete slab. The excavation contractor attempted to cut through the concrete slab with a demolition saw and discovered the concrete slab was at least 4.5 inches thick (full depth of the blade). The concrete slab could not be removed and the thickness of the slab could not be determined. Photograph 7 in Attachment B depicts test pit TP-3.

Test Pit TP-4

Test pit TP-4 was performed in near the center of the westernmost basketball court at the location of a large north-to-south crack in the pavement. The test pit surface consisted of three inches of asphalt pavement and was immediately underlain by a concrete slab. The excavation contractor attempted to cut through the concrete slab with a demolition saw and discovered the concrete slab was at least 4.5 inches thick (full depth of the blade). The concrete slab could not be removed and the thickness of the slab could not be determined. A thin flexible membrane was encountered between the asphalt and the concrete slab on the western portion of the test pit, beneath the alignment of the large north-to-south crack. Photographs 8 and 9 in Attachment B depict test pit TP-4.

Evaluation and Recommendations

The movement/rotation of the wall appears to be localized to the western end of the wall alignment. We observed separation between the edge of the paved surface on the basketball court and the brick wall itself. Without knowing the condition of the backfill behind the wall, it is difficult to pinpoint the cause of the wall movement.

Due to the presence of the extensive concrete slab below the asphalt layer of the basketball courts (likely the former playing surface), it was not possible to determine the nature of the backfill materials behind the failing retaining wall nor if there was any type of drainage system behind the wall to relive hydrostatic pressure. We suspect the backfill soils are similar in nature to what was discovered in TP-2 and are more fine-grained and not very permeable. As such, it is our opinion that the retaining wall is tilting as a result of excess lateral earth and water pressures that are beyond the wall's design capacities. Also, the design and age of the wall seem to be a factor. The wall mortar is cracked throughout and the bond between mortar and bricks have broken loose and fallen out at several locations. There are also sections where the upper portion of the wall has laterally displaced several inches relative to the lower portion of the wall. These failures seem to indicate that the wall is unreinforced or just lightly reinforced causing the wall to fail and move.

As a temporary measure, we suggest installing weep holes in the wall to help relieve any buildup of hydrostatic pressure behind the wall. Four-inch diameter weep holes, placed four inches above the playground surface and at 20 feet maximum center-to-center spacing along the full length of the wall are recommended. A filter sock (3/8-inch gravel encased in filter fabric) should be placed within each weep hole in order to prevent soil mining of the wall backfill soil. The weep holes should be covered with a stainless steel mesh cover.

Another interim repair we suggest is to repair loose and missing mortar joints, replacing missing bricks, and sealing the joint between the wall and asphalt surface, and sealing the cracks in the concrete cap. We also recommend prohibiting vehicles from driving on the basketball court within 4 feet of the wall to prevent overloading the wall.

Ultimately, we recommend replacement of the existing retaining wall and replacement with a new wall system that has adequate structural capacity and has been designed for the loads and earth pressures. It should also have provisions for adequate drainage to eliminate hydrostatic pressures against the backside of the wall.

We believe that repairing the damaged and cracked asphalt of the basketball courts at the back side of the wall is prudent to reduce the water infiltration in the backfill materials thereby also reducing the possibility of excess hydrostatic pressure against the backside of the wall. We recommend the use of a geosynthetic paving fabric such as Mirafi MPG100 glass filament reinforced paving composite for this purpose. This product is intended to be used as reinforcement of asphalt, repairing longitudinal cracks, and full-width repair of asphalt surfaces.

Recommended Additional Exploration

We recommend that an additional subsurface exploration be performed on the high side of the retaining wall to determine the condition and composition of the wall backfill material. We recommend a series of six 10-foot deep standard penetration test (SPT) borings, four located on the west side of the basketball court where the wall was observed to be rotating and two on the east side of the basketball court beyond the control joint where the majority of the wall rotation was observed. Refer to Figure 2 for our recommended boring locations. We can provide a proposal for performing the borings and evaluating the results.

FIGURES

1. TEST PITS WERE PERFORMED BY UNI-TECH ON 3 SEPTEMBER 2019 UNDER THE FULL-TIME SUPERVISION OF A LANGAN ENGINEER.
2. THIS DRAWING IS PART OF LANGAN'S GEOTECHNICAL MEMORANDUM (PROJECT NO. 220104104) DATED 30 SEPTEMBER 2019 AND SHOULD BE USED IN CONJUNCTION WITH THAT MEMORANDUM ONLY.
3. THE BASE PLAN FOR THIS DRAWING IS TAKEN FROM "EXISTING CONDITIONS", DATED 18 APRIL 2019 BY RODRIGUEZ, FOR LANGAN ENGINEERING.

LEGEND

TP-1 TEST PIT PERFORMED BY LANGAN

20 0 5 10 20
SCALE: 1 INCH = 20 FEET

LANGAN
Langan Engineering and Environmental Services, Inc.
1818 Market Street, Suite 3300
Philadelphia, PA 19103
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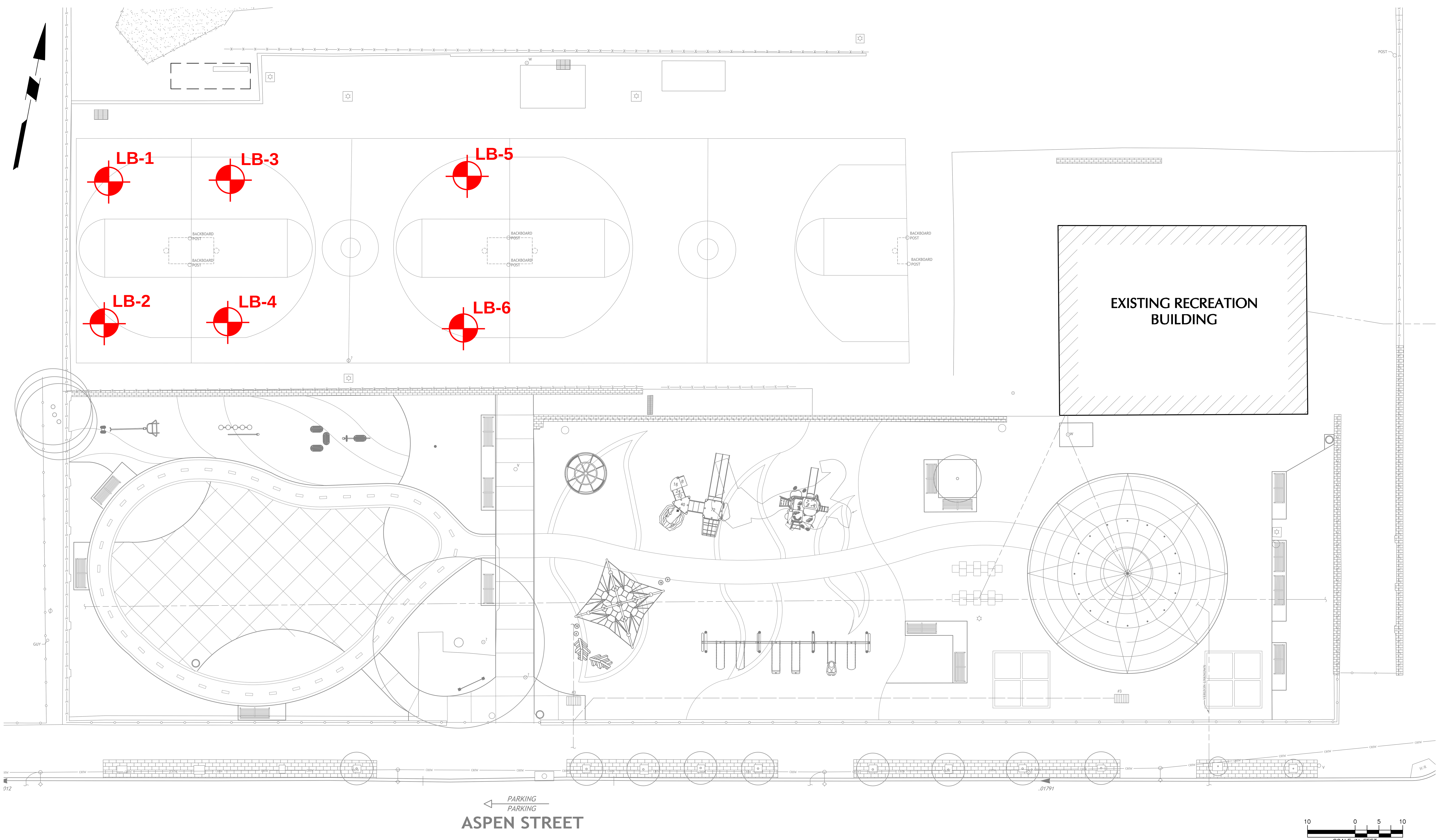
Project	Drawing Title	Project No.	Figure
MILES MACK PLAYGROUND 732 N 36TH STREET PHILADELPHIA PHILADELPHIA COUNTY PENNSYLVANIA	TEST PIT LOCATION PLAN	220104104 Date: 30 SEPTEMBER 2019 Drawn By: JP Checked By: JMG	1 Sheet of

Filename: \\langan.com\data\PHL\Data1\220104104\Project Data\CAD\04\SheetFiles\Geotech\220104104-BL101-0101.dwg Date: 9/26/2019 Time: 19:58 User: jplotkin Style Table: Langan.stb Layout: ANSIB-BL



LEGEND

EXISTING 1 FT MINOR CONTOURS	PROPERTY BOUNDARY
EXISTING 5 FT MAJOR CONTOURS	EXISTING STORM SEWER
6.9 EXISTING SPOT ELEVATION	EXISTING GAS LINE
EXISTING UTILITY POLE	EXISTING FENCE LINE
EXISTING STORM SEWER/INLET	EXISTING WATER MAIN
EXISTING SIGN	EXISTING DRAINAGE PIPE
EXISTING LIGHT POLES	EXISTING ELECTRIC
FIRE HYDRANT	EXISTING SANITARY SEWER
EXISTING TREE	

FIGURE 2
PROPOSED BORING LOCATION PLAN
LANGAN ENGINEERING
8 OCTOBER 2019

LEGEND

LB-1 PROPOSED 10-FOOT-DEEP SOIL BORING

REVISIONS

ISSUE	DATE	REVISIONS

PHILADELPHIA MANETO

PENNSYLVANIA ONE CALL SYSTEM, INC.
925 Irwin Run Road
West Mifflin, Pennsylvania
15122 – 1078

PENNSYLVANIA ONE CALL SYSTEM, INC. 1-800-242-1776 STOP-CALL BEFORE YOU DIG!

BEFORE YOU DIG ANYWHERE IN PENNSYLVANIA! CALL 1–800–242–1776
NON–MEMBERS MUST BE CONTACTED DIRECTLY
PA LAW REQUIRES THREE WORKING DAYS NOTICE TO UTILITIES BEFORE YOU EXCAVATE, DRILL, BLAST OR DEMOLISH

PA ONE-CALL NUMBER (FOR DESIGN ONLY):

PPR PROJECT COORDINATOR: NICHOLAS UPMEYER

LAND. ARCH. SEAL:

90% CD SET
NOT FOR CONSTRUCTION

SIGNATURE | DATE SIGNED

CIVIL ENG. SEAL:

PRIMARY CONSULTANT:
LANGAN
Langan Engineering and Environmental Services, Inc.
1818 Market Street, Suite 3300
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SUB–CONSULTANT:
Chestnut Engineering
2 E Lancaster Ave - 2nd Fl.
Ardmore, PA 19003
Phone: (610) 642-1750
www.chestnut-engineering.com

CONSULTANT PROJECT NUMBER

SUB–CONSULTANT:
Rodriguez Consulting
1301 N 2nd Street
Philadelphia, PA 19122
Phone: (215) 839-8087
www.RodriguezConsulting.biz

CONSULTANT PROJECT NUMBER

CITY OF PHILADELPHIA
PHILADELPHIA PARKS AND RECREATION
1515 ARCH STREET
11TH FLOOR, ONE PARKWAY BUILDING

PPR PROJECT NUMBER 10-19-4395-01

PROJECT TITLE:
IMPROVEMENTS TO MILES MACK PLAYGROUND
732 N 36TH ST, PHILADELPHIA, PA

DRAWING TITLE:

PPR PROJECT NO.:	10-19-4395-01
CONSULTANT PROJECT NO.:	220104104
DATE:	08/30/2019
SCALE:	1"=10'
DRAWN BY:	JM
CHECKED BY:	TG/JS

DRAWING NO.:

NOTE: ALL DIMENSIONS AND CONDITIONS SHALL BE VERIFIED BY THE CONTRACTOR AT THE SITE BEFORE PROCEEDING WITH THE WORK.

ATTACHMENT A

Test Pit Logs

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LOG OF TEST PIT TP-1

SHEET 1 OF 1

PROJECT: Miles Mack Playground	PROJECT NO.: 220104104
LOCATION: Philadelphia, PA	ELEVATION AND DATUM: 83.2
EXCAVATION CONTRACTOR: Uni-Tech	DATE: 9/3/19 — COMPLETION DEPTH: 2"
EXCAVATION EQUIPMENT: Bobcat E20 mini excavator	OBSERVED WATER LEVEL DATA: N/E

ELEV.	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE NO LOC	SAMPLE TYPE	REMARKS
	2" ASPHALT				Start at 10:45 AM
	End of test pit at 2"	1			Sawcut through asphalt Concrete slab below asphalt, thickness unknown
		2			Restored pavement with cold patch asphalt
		3			Stop at 12:00 PM
		4			
		5			
		6			
		7			
		8			
		9			
		10			
		11			
		12			
		13			
		14			
		15			
		16			

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LOG OF TEST PIT TP-2 SHEET 1 OF 1

PROJECT	PROJECT NO.
Miles Mack Playground	220104104
LOCATION	**ELEVATION AND DATUM**
Philadelphia, PA	80.3
EXCAVATION CONTRACTOR	**DATE** 9/3/19 — **COMPLETION DEPTH** 4'-0"
Uni-Tech	
EXCAVATION EQUIPMENT	**OBSERVED WATER LEVEL DATA**
Bobcat E20 mini excavator	N/E

ELEV.	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE NO LOC	SAMPLE TYPE	REMARKS
	3" ASPHALT				Start at 11:05 AM
	2" Subbase STONE	1			Sawcut through asphalt
	Brown, reddish brown m-f SAND, some Silt, trace mica, trace slate, trace brick (dry-moist) [FILL]	2			See attached sketch for foundation cross section
	Brown, tan, orange-brown, red-brown, black, & white fine SAND, some silt, some fine gravel, trace mica (dry-moist) [DECOMPOSED MICA SCHIST]	3			Backfilled with excavated materials. Restored pavement with cold patch asphalt. Stop at 12:00 PM
	End of test pit at 4'-0"	4			
		5			
		6			
		7			
		8			
		9			
		10			
		11			
		12			
		13			
		14			
		15			
		16			

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LOG OF TEST PIT TP-3 SHEET 1 OF 1

PROJECT: Miles Mack Playground	PROJECT NO. 220104104
LOCATION: Philadelphia, PA	ELEVATION AND DATUM: 82.8
EXCAVATION CONTRACTOR: Uni-Tech	DATE: 9/3/19 — COMPLETION DEPTH: 4"
EXCAVATION EQUIPMENT: Bobcat E20 mini excavator	OBSERVED WATER LEVEL DATA: N/E

ELEV.	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE NO LOC	SAMPLE TYPE	REMARKS
	4" ASPHALT End of test pit at 4"	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16			Start at 12:30 PM Sawcut through asphalt Concrete slab below asphalt, thickness > 4.5" (depth of sawcut blade) Restored pavement with cold patch asphalt Stop at 1:00 PM

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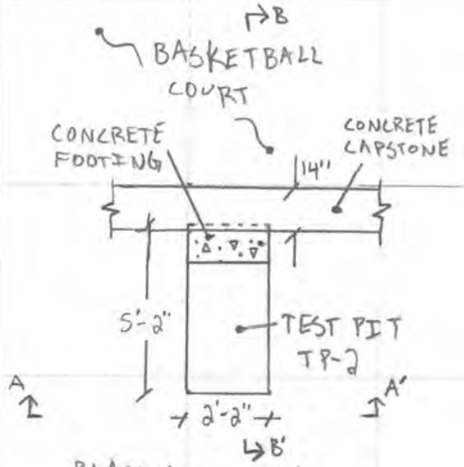
LOG OF TEST PIT TP-4 SHEET 1 OF 1

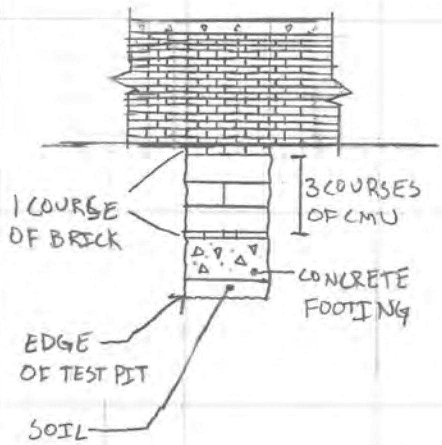
PROJECT: Miles Mack Playground	PROJECT NO.: 220104104
LOCATION: Philadelphia, PA	ELEVATION AND DATUM: 82.5
EXCAVATION CONTRACTOR: Uni-Tech	DATE: 9/3/19 — COMPLETION DEPTH: 3"
EXCAVATION EQUIPMENT: Bobcat E20 mini excavator	OBSERVED WATER LEVEL DATA: N/E

ELEV.	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE NO LOC	SAMPLE TYPE	REMARKS
	3" ASPHALT End of test pit at 3"	0–16			start at 1:15 PM Sawcut through asphalt Concrete slab below asphalt, thickness >4.5" (depth of sawcut blade) Rubber membrane sandwiched between asphalt & concrete extending beyond west side of test pit (into large surface crack) Restored pavement with cold patch asphalt Stop at 1:30 PM



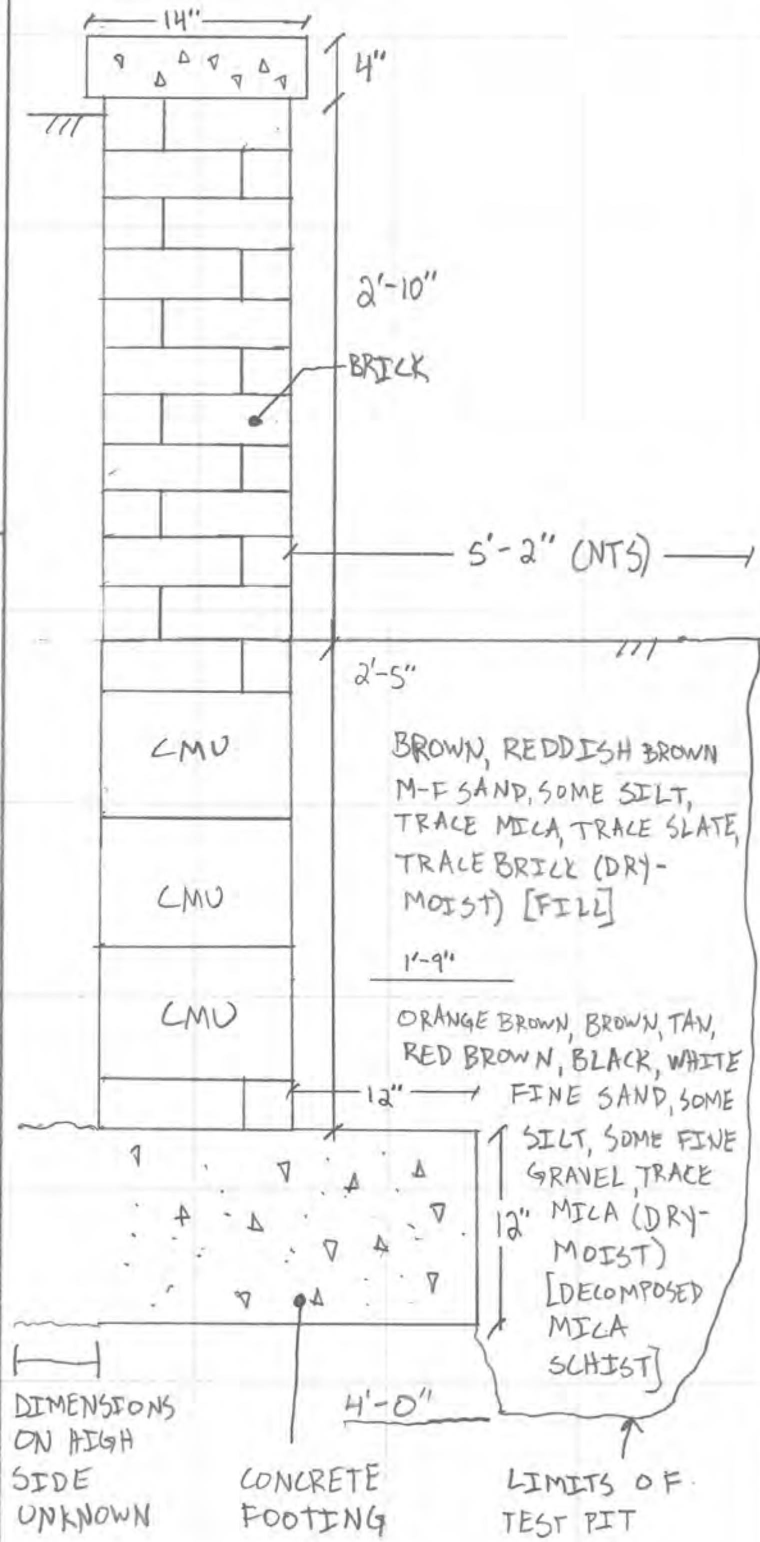
PLAN VIEW ↑N

1" = 5'



FRONT FACE ELEVATION

A-A' 1" = 5'



SECTION VIEW B-B' 1" = 1'

Miles Mack Playground	BY JP DATE 9/26/19	PROJ. NO. 220104104
TP-2 Foundation	CKD. DATE	SHEET OF

LANGAN

ATTACHMENT B

Test Pit Photos

Photo 1: Side of excavation on low side of wall. Brick and fill visible in upper 21 inches.

Photo 2: Three courses of CMU block below above-ground brick wall, on top of one course of brick, on top of concrete footing

Photo 3: Concrete footing, 12 inches thick and 12 inches protrusion from face of block wall

Photo 4: Top view of test pit on low side of wall

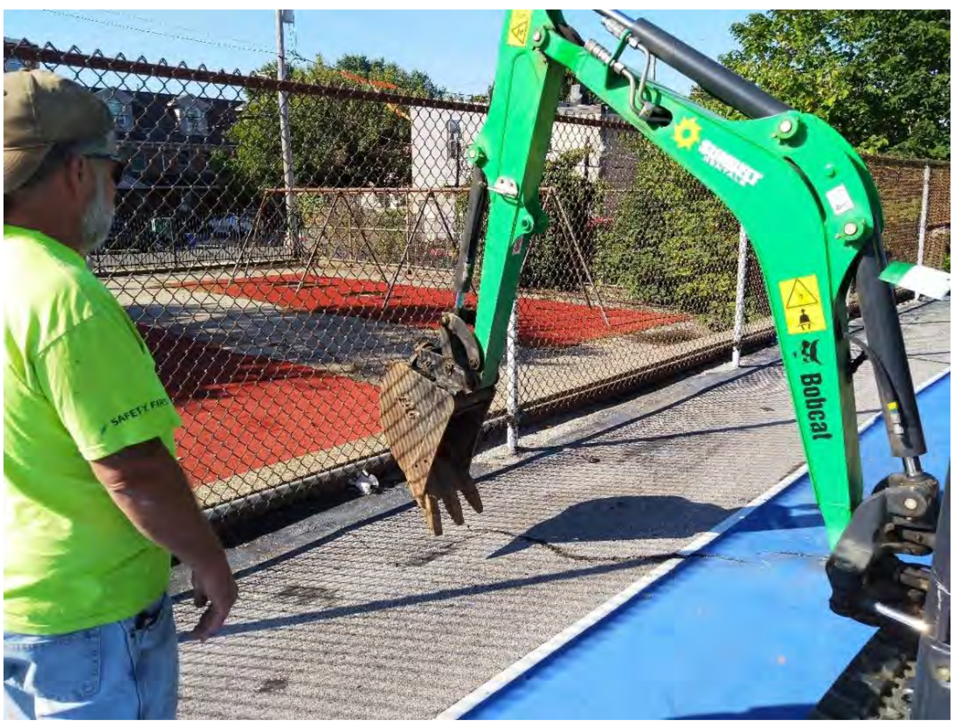


Photo 5: First test pit on high side of wall intended to be excavated at crack in asphalt

Photo 6: First test pit on high side of wall: 2 inches of asphalt underlain by concrete slab

Photo 7: Second test pit on high side of wall: 4 inches of asphalt underlain by a concrete slab. Sawcut concrete slab, thickness unknown (at least 4 inches depth of cut)

Photo 8: Third test pit on high side of wall

Photo 9: Rubber membrane sandwiched between asphalt (3 inches) and concrete, possible patch over preexisting crack in concrete (suspected location below crack shown in asphalt in previous photo)