FINAL REPORT:
PHASE 1B ARCHAEOLOGICAL ASSESSMENT FOR THE PROPOSED WATERFRONT PATHWAY PROJECT, RANDALL'S ISLAND, MANHATTAN, NEW YORK

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Chapter 1 – Introduction and Objectives

The New York City Economic Development Corporation (NYCEDC) has proposed construction of a Waterfront Pathway within a portion of land along the southern coast of Randall's Island in Manhattan, New York (Block 1819, Lot 203) (Figure 1 and Figure 2). The project area is located south-southwest of the Icahn Stadium and the Triborough Bridge, and directly north of a marshy lowland, a remnant landscape feature of the tidal channel formally known as Little Hell Gate. This report addresses the results of a Phase 1B archaeological assessment of the projected impact area of a Waterfront Pathway proposed by the New York City Economic Development Corporation.

The New York City Landmarks Preservation Commission (LPC) requested that a Phase 1B archaeological sensitivity assessment be conducted for the proposed site of the waterfront pathway the project area (LPC File Name 27671_FSO_ALS_05062011.doc; Figure 1). Prior studies on the systematic development of Randall's Island have documented chronologies and patterns of general landscape change and land-use over the course of prehistoric and historic time frames (Schuldenrein et al.: 2008; Bergoffen 2001; Rutsch and Porter 1980). These investigations have identified areas of archaeological sensitivity in the vicinity of the project area. Typically, however, the earlier investigations did not focus on the specifics of landform alteration and subsurface disturbance (although see Schuldenrein et al., 2008 for a discussion of landform relations). In the proximity of the present project footprint, a portion of the terrain directly southwest of the Triborough Bridge and Icahn Stadium was determined to have high potential for containing human burials and yard features related to the early historical development and occupation of the island.

LPC approved a geoarchaeologically based investigative strategy for testing the project area on May 6, 2011. Consistent with recommendations from earlier reports and archives, LPC concurred with recommendations that this location had potential to contain archaeological resources associated with a 19th century Potter's Field (graveyard), and that this feature potentially housed the remains of hundreds if not thousands of human bodies (Bergoffen 2001; Rutsch and Porter 1980).

Descriptive accounts of the Randall's Island Potter's Field were widely referenced in 19th century accounts and newspapers until that facility's closure in the mid 1850's. However neither documentary evidence nor limited archaeological testing furnished any indications of the precise location of burials. The geoarchaeological testing effort by Geoarcheology Research Associates (GRA) in July, 2011 attempted to assess the integrity, antiquity, composition and preservation potential of subsurface deposits that might be diagnostic of historic resources, and more specifically, mobilized sediments housing or burying human remains. A corollary objective was to test for intact Holocene sediments and paleoenvironmental features that would register potential prehistoric contexts. Field relations and known local sequences converged around the possibility of encountering estuarine and tidal stream sediments dating to 5000 years Before Present (B.P.) beneath stratified (and dateable) historic fill successions. The latter would have sealed in the former tidal strait between Randall's and Wards Island, known as "Little Hell Gate" and could conceivably furnish indications of large scale earth moving operations consistent with the operations of a historic graveyard. Rutsch and Porter's (1980) study of this portion of the island provided broad outlines of terrain modification to the southeastern coastline and indicated that the historic and prehistoric geography of this portion of the island differed significantly from that of the present.

Figure 1: Aerial photo (late 1990's) showing location of Randall's Island, New York City. The Waterfront Pathway project is shown south of Icahn Stadium.

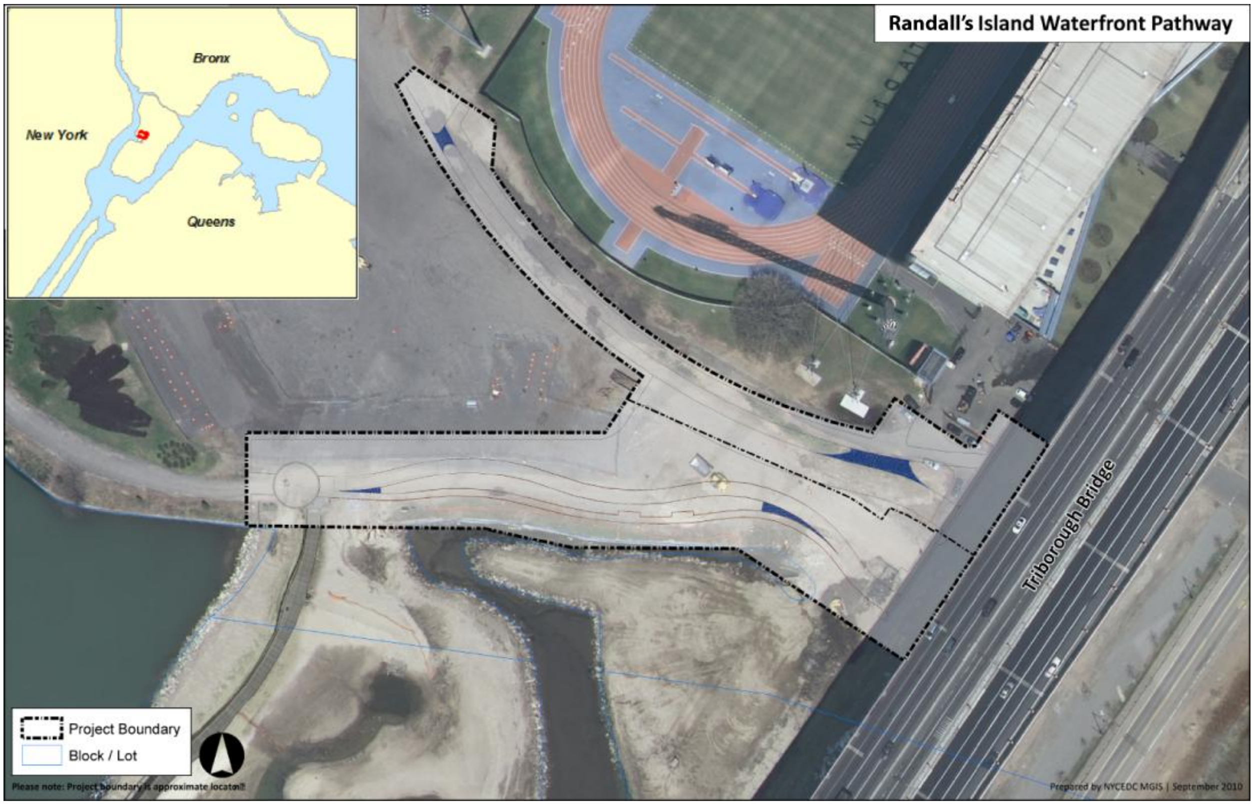

Figure 2: Detail of footprint of Waterfront Pathway project

The geoarchaeological testing program utilized a Geoprobe for limited subsurface testing to develop a site-specific model of archaeological and historic sensitivity. Even such baseline testing, that involved the distribution of 2-3" diameter boreholes aligned within the perimeters of the project boundaries, could furnish broad outlines of landform history (both locally and regionally). Detailed examination of recovered sediment matrices could be linked to natural vs. anthropogenic depositional agencies and general sequences can structure histories and preview landscape and land use chronologies. Historic maps and accounts (Bergoffen 2001) showed that the earliest documented setting was on the margins of an orchard in the early eighteenth century. The site occupied the shoreline of a tidal channel until the mid 20th century. Accordingly, recovery of subsurface deposits could inform on the transformation of the coastal setting and register indications of human landscape modification over a 200 year period, and probably earlier, with probes extending well into the thick, regionally expansive marsh-peat deposits that date to <5000 B.P. near their basal stratigraphic contacts.

The subsequent narrative of this study begins with a detailed overview of the environmental setting under investigation (Chapter 2). The historic development of the project area is then presented (Chapter 3) and is succeeded by a detailed account of the investigative methodology of the field effort (Chapter 4). In general, the methodology was designed to test for the presence vs. absence of intact subsurface deposits, to distinguish fill sequences, and to establish the depositional origins of pristine landscape elements if, indeed, these were present. Results and interpretations of the subsurface probing are discussed in Chapter 5. A concluding section (Chapter 6) synthesizes geoarchaeological results and interpretations, ultimately offering recommendations bearing on a significance determination.

Four critical objectives were targeted in the present deep testing program:

1. Determining depth and extent of historic and sub-recent landfilling;
2. Isolating intact portions of the Potter's Field cemetery and House of Refuge;
3. Exposing elements of the pre-19th century cultural and natural landscape;
4. Identifying contexts for prehistoric sites and Holocene paleo-environments

Chapter 2 – Environmental Setting

Section 2.1 Geological Setting, Land Filling and Modern Topography

Randall's Island is located east of Manhattan, south of the Bronx, and west of Queens. The island is formally part of the borough of Manhattan and is located at the confluence of the present day Harlem River and East Rivers, with Hells Gate situated directly to the northeast. Randall's Island was once separated from Wards Island and Sunken Meadows by the "Little Hell Gate" tidal strait. The eventual infilling of the Little Hell Gate channel merged the land bodies of Randall's Island, Ward's Island and Sunken Meadows into a single landform. Prior to infilling Randall's Island proper consisted of approximately 145 acres while Wards Island spanned nearly 240 acres. Currently the land mass referred to as Randall's Island occupies approximately 530 acres (Bergoffen 2001). The project area of the 2011 field investigations extended along the southwestern coastline, effectively the former shoreline of Little Hell Gate.

To the north, the island was divided from the Bronx by variously migrating (anastomosing) channels known as the Bronx Kill or Kills. The Bronx Kill was once nearly as wide as the East River at 125th Street, but only a narrow strait remains. The East River flows around the island and the western branch forms the Harlem River. The treacherous bend southwest of Wards Island is called Hell Gate. An 1851 United States Coast Guard map depicts a complex of large rocks and boulders which would have rendered the Hell Gate passage a notorious navigational hazard (Schuldenrein et al. 2008: 8).

Randall's Island is situated in the New England Upland physiographic region, a division of the Appalachian Highlands. The region has two geologic projections, or prongs, extending southward. The smaller and more easterly is the Manhattan Prong which includes Randall's Island (Rutsch and Porter 1980: 4). That feature is composed of igneous and predominantly highly metamorphosed bedrock which extends to the southern tip of Manhattan Island (Rutsch and Porter 1980: 4; Schuberth 1968: 10).

The stratigraphy of the project area was synthesized on the basis of bedrock geological mapping, surficial geology maps, and historical background research that were subsequently tested by the geoprobe field program. The bedrock of the Randall's Island is characterized by four primary rock groups (Schuldenrein et al. 2008). The majority of the island is underlain by the Manhattan Schist (Ꞓm), a grey, layered sillimanite-muscovite-biotite-kyanite schist, interfingered with stratified tourmaline-garet-plagioclase-biotite-quartz schist and gneiss with black amphibolites layers (Baskerville 1994). The Manhattan Schist cuts across the proposed site of the waterfront pathway. Another bedrock unit prominent along the central and eastern sections of the island is the Inwood marble (OЄi), which is banded and consists of a white or blue gray calcitic dolomite. The east coast of the island is dominated by the Fordham Gneiss (Yfb), locally dominated by a black and white banded facies. The black bands are comprised of quartz, plagioclase and biotite while white bands consist of garnet, quartz, plagioclase, muscovite and microline. The northwestern edge of the island is also comprised of a member of the Fordham Gneiss group; this member is a medium gray fine grained quartz, with biotite, plagioclase, and muscovite-quartz granofels. The schist is interfingered with gray biotite, muscovite, and quartz; granofels layers are thin and fissile. Intrusions of course white granite and granite pegmatite are common and often found nearest to the point contact with the adjacent geological unit (Baskerville 1994).

As noted, the surfaces of both Randall's and Ward's Islands have been extensively modified by development during the historic period. Accordingly, the surficial geology (and land cover) of Randall's and Ward's Island's is mapped entirely as fill (Schuldenrein et al. 2008; Cadwell 1991). Prior to historical landform modification the island's topography would have been undulating and rugged, conforming to the configurations of Pleistocene-age glacial advances and retreats that left expansive till plains and moraine-like features. Only residual patches of these tills are preserved regionally and evidence of their presence is discontinuous on Randall's Island. Where present, till bodies consist of heterolithic gravels, sands and clays. The surface soils of the project area invariably incorporate disturbed till matrices. Formally they are mapped as the Inwood-Laguardia-Ebbets complex of deep debris and rubble mixed with natural soil. The matrix is dominated by coarse fragments or rubble and gravels (New York City Soil Survey Staff 2005).

The earliest accounts of Randall's Island describe terrain that was largely swampland punctuated by raised bedrock (ie., granite) hills (Richmond 1872: 562). That landscape was particularly pervasive along southeastern end of the island, where marshlands marked the transition to the near shore environment. During the mid-19th century, when various charitable institutions were being constructed, the island's southern tip was dotted with farms and orchards (Schuldenrein et al. 2008). At that time, outcrops of bedrock and larger reefs along the western shoreline affected tidal movements unpredictably, presenting a severe navigational hazard to mariners. To expand shipping lanes and facilitate navigation, a series of bedrock excavations were undertaken to widen the channels and gave rise to the florescence of the shipping industry during the late 19th and 20th centuries. The blast rubble obtained through these excavations was likely used for local land rehabilitation and reclamation projects on the island. Over the long-term episodic coastline engineering and land reclamation projects account for the existing shoreline configurations and topographies (Rutsch and Porter 1980, 8).

In 1938, one of the largest of these landscaping efforts resulted in the infilling of the waterways that separated the islands from each other and from the Bronx. As noted, nearshore landfills attenuated the east branch of the East River. Two seawalls were initially extended northward from the northeast point of Ward's island and from a point near the Hellgate Bridge. These seawalls eventually encircled the island to the east (Sunken Meadow) and formed the boundary of the landfill. In the 1990's a major landfilling effort expanded the swampy terrain between the Triborough and the Hell Gate Bridges where a footbridge once existed. Currently, only a narrow inlet directly south of the project area is all that remains of Little Hell Gate (Figure 3; Figure 4; see Schuldenrein et al. 2008: 8; Bergoffen 2001: 4).

Figure 3: Overview of Randall's Island, Little Hell Gate and Wards Island

Figure 4: Field view of the remains of Little Hell Gate at the southwestern section of the project impact area.

Over the course of the 20th century, larger scaled development, changes in land-use and episodes of infilling produced extensive and thick accumulations of fill across much of Randall's Island. Stratigraphically this is registered by variable depths and distributions of landfill that cap earlier (Holocene-age) estuarine peats, tidal sands and silts. The overall extent of near shore land reclamation can be seen in Figure 5 which depicts the changes to the southwestern shoreline (upper island segment) between 1903 and 1975. It can be seen that in the early 20th century collective shoreline modifications produced an undulating terrain. By the mid 1970's the contemporary configurations of shorelines were largely in place.

Figure 6 illustrates the degree to which 150 years of discontinuous landscaping and land use engineering reconfigured the topography of the Randall's Island. The project impact area, in particular, is situated on what was formerly a graded upper bedrock surface inter-graded with a veneer of coastal deposits. The coastal margins apparently sustained seasonal marshes. An orchard once occupied the terrain extending to the near shore, although the source sediments supporting the orchard have subsequently been removed (by extensive relandscaping; see

Chapters 5 and 6). The northern section of the project footprint would have been onshore while the southernmost sections would have straddled the interface with offshore sediment.

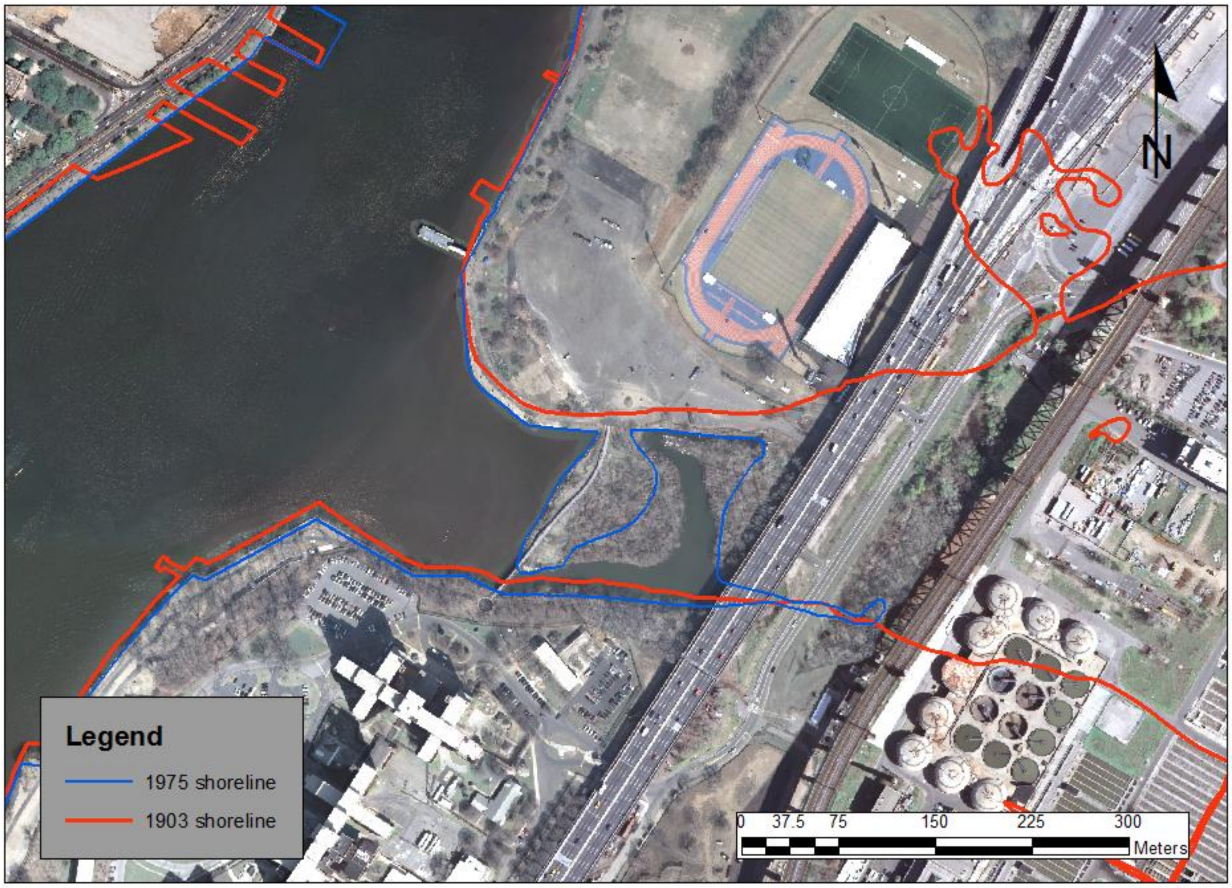

Figure 5: Sequential shoreline modifications, 20th century

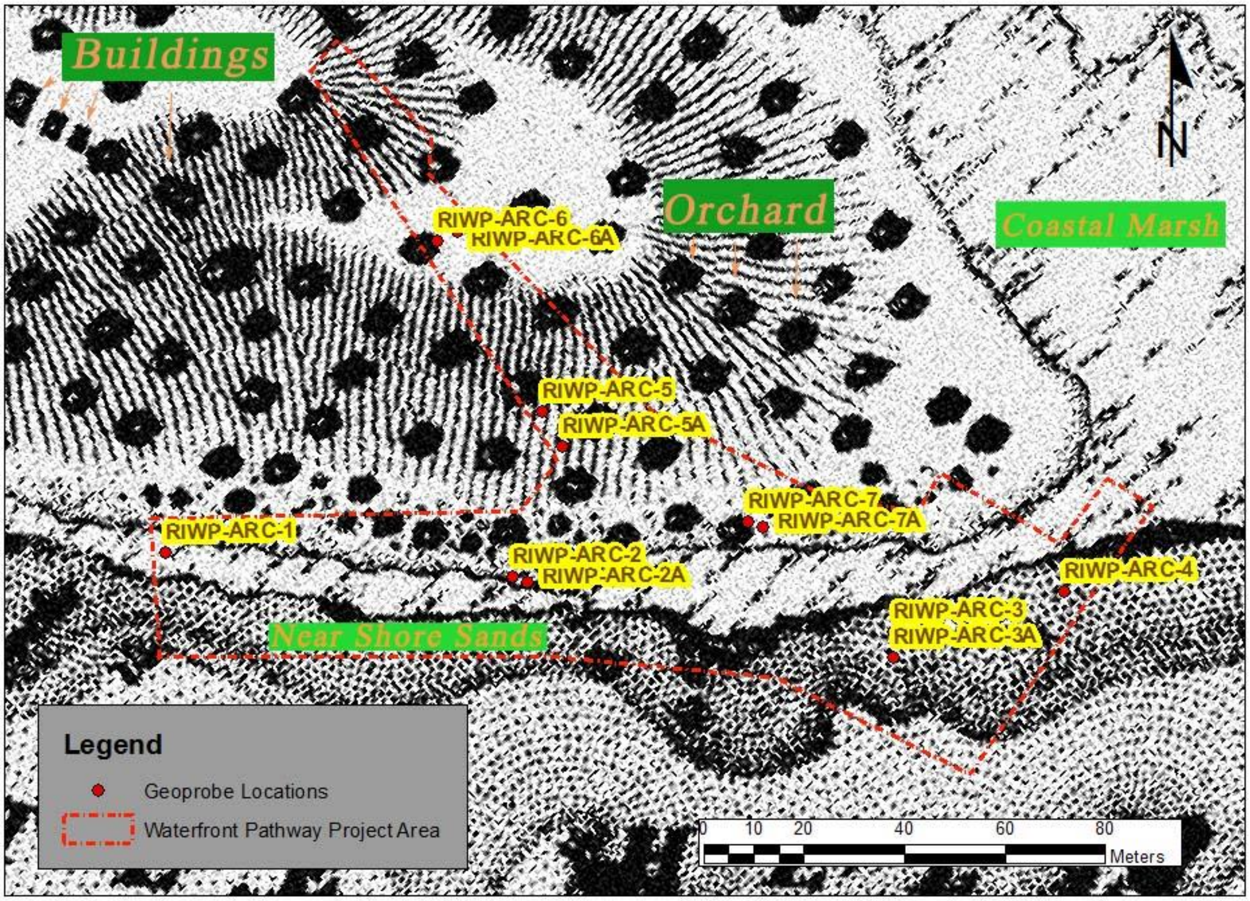

Figure 6: Superposition of Waterfront Pathway project footprint showing landforms, land use, and physiographic features on 1851 map of Randall's Island. Locations of the boreholes are depicted. (The project tract was once an orchard at the edge of the former coastal zone of Randall's Island proper. Note buildings on the northwestern edge of the project area, probably related to the orchard. Areas on the east are shown as marsh basins, while the south coast is fronted by near-shore sands.)

Section 2.2 Modern Setting

The most prominent development project on Randall’s Island over the past century was the erection of the Triborough (currently RFK) Bridge and connecting railroad bridges. The Triborough Bridge, which first opened in 1938, extends from Manhattan to Randall’s Island, lineally and approximately parallel to the northern side of the island. Topographic maps which indicate that a bedrock ridge running parallel to the northern end of Manhattan provided the basal foundation for the Triborough Bridge. While the Triborough Bridge establishes the island’s eligibility for listing on the National Register of Historic Places, the proposed project will have no impact on the Triborough Bridge (Schuldenrein et al. 2008).

Parallel to the Triborough Bridge is the New York Connecting Railroad Bridge (built between 1914-17), which crosses Randall’s Island from the Bronx and then diverges from the Triborough to cross Hell Gate as the Hell Gate Bridge. A footbridge once spanned Little Hell Gate between the Triborough and Hell Gate Bridge (Schuldenrein et al. 2008). Other structures on Randall’s Island include the offices and shops of the Triborough Bridge and Tunnel Authority, and Icahn Stadium. The facilities for the New York City Fire Department Training Academy and the Department of Environmental facility dominate Randall’s Island southeastern coast. The southwestern quarter of Randall’s Island contains extensive undeveloped tracts, parking lots and recreational parklands.

Subsurface probes have thus far furnished only limited information on developmental impacts to the island’s natural and earlier historic landscape. Soil borings taken near the Manhattan Toll Plaza at the north of Randall’s Island in conjunction with the Triborough Bridge Rehabilitation Project recorded a pristine surface elevation of 15’ (4.5 m), the top 5’ (1.5 m) of which consisted of miscellaneous fill. Below the fill, lenticular clay-silts interbedded with fine sands and silts indicated limnic and lacustrine sedimentation. Select borings from the northern end of Randall’s Island (the area currently used for recreational school fields) penetrated fills ranging in depth from 13-30’ (4-9 m). Taken together, the probe records indicate that fill depths vary appreciably across the island, such that preservation potential for natural stratigraphy in select reaches of the island is high. Finally, shallow stratigraphic profiles from the test pits excavated by Rutsch and Porter (1980) furnish supplementary subsurface information to assist in the reconstruction of the sequences.

Chapter 3 – Historical Background

Section 3.1 Prehistoric Period to the Mid-19th Century

Prehistoric Period

The map of inventoried prehistoric archaeological sites compiled by the Office of Parks, Recreation and Historic Preservation (OPRHP) records no prehistoric sites for either Randall's or Ward's Islands (Bergoffen 2001; Schuldenrein et al. 2008). Preliminary indications are that Randall's Island was largely unsettled during the historic period. In contrast, archival records show that there was considerable Native American activity along the adjacent Manhattan waterfront and in Queens County right across from Randall's Island.

Historical Perspectives Inc. (HPI 2001:11) undertook a comprehensive background study within one mile of the project area (Historical Perspectives 2001: 11) and documented the following sites:

NYSM#4064

This a campsite identified by Parker (ACP-NYRK no#) on the Manhattan shore of the Harlem River in the vicinity of the approaches to the Triborough Bridge, about 1,000 feet (0.3 km) northwest of the study lot.

NYSM#5475; OPRHP #A005-01-0027, #A005-01-0031

This is a village site (previously referenced), identified by Reginald Bolton as Ranachqua The NYSM and OPRHP locate the site(s) more generally than does Bolton, in a broad area south of 133rd Street. It extends as far west as the Bruckner Expressway, about 2,600 feet (0.8 km) northwest of the study site.

NYSM#7248

Traces of occupation (small numbers of artifacts) were recorded on site, approximately 1.0 miles (1.6 km) west of the study lot on the Manhattan shore of the Harlem River, near Park Avenue.

NYSM#4539 (ACP Quos 00#)

Here shell and kitchen *middens*, or refuse heaps, were concentrated along the East River shore, in what is now Ralph Demarco Park (north of Astoria Park), in the Ditmars area of northwestern Queens, about 3,000 feet (0.9 km) southeast of the project site (Parker 1920: 672).

These sites are clustered along the shores of major waterways, the Harlem, Bronx and East Rivers, and surround the project area in all directions. At the above sites there were shellfish beds which could have been exploited in addition to marshland resources, and small freshwater creeks. The project area featured a similar distribution of ecological resources. Although there were no freshwater creeks on the island, early maps indicate the existence of at least two small ponds which may have served as fresh water sources and tidal wetlands along the northern and western coastlines of Randall's Island at least until the late 19th century (Historical Perspectives 2001; see Appendix A, Maps 1-5)

Given its analogous ecological setting and proximity to these prehistoric sites, it is somewhat unusual that no inventoried prehistoric archaeological sites have been recorded on Randall's or Wards Islands. However, given the strong evidence for local prehistoric occupation and advantageous and similar ecological settings and resource availability, the project area should be considered to have high potential for containing subsurface prehistoric remains. However, given the generally shallow depths of these deposits (i.e., within 3 to 4 feet [1.0-1.5 m] beneath the predevelopment surface), it is highly possible that historic regrading and filling could have decimated prehistoric remains (Historical Perspectives 2001: 8).

Early Historic Period

Since its original sale to the Dutch Governor in 1637, the island's name has reflected its various landholders or tenants. The Mayrechkeniockkingh Indian Chiefs, Seyseys and Numers, sold Ward's Island (which they-called *Tekenas*) to Wouter Van Twiller in 1637. The translation of *Tekenas* is uncertain. However, several meanings are possible including forest, uninhabited track, and wild land (Schuldenrein et al. 2008 and references).

Twiller used Ward's Island only to graze livestock though he did not reside there. His cowherd was the Danish farmer Barent Jansen Blom who earned the nickname Groot Barent or Great Barent. The first European names of both Randall's and Ward's Islands were based on this man's name: Great Barent Island for Ward's; Little Barent Island for Randall's. Those names were corrupted to Great and Little Barnes or Barn Island(s), and in the 1730 Montgomerie Charter, Ward's Island appeared as Great Barn Island.

The English appropriated Ward's Island from the Dutch States General and in 1664 awarded it, along with Randall's Island, to Thomas Delavall of Harlem (d. 1682), a collector of customs. Thomas Delavall left his land to his son-in-law William Dervall. In 1687, Thomas Parcell bought

Ward's Island and it remained in his family for 75 years. It was also then called Parcell's Island. In 1767, Thomas Bohanna purchased land here and briefly gave his name to the island (Schuldenrein et al. 2008: 10).

During the Revolutionary War, Ward's Island was occupied by British troops who designated for use as an army base. Both islands were contested during the conflict and control over them was transferred from the Continental Army—George Washington established a smallpox quarantine on Randall's Island in the spring of 1776—to the British who drove the Americans out in September of that year.

Subsequent to the acquisition of Randall's Island and Sunken Meadow from the heirs of John Randel in 1835, New York City began to purchase large tracts of Ward's Island by a series of conveyances from 1851-52 and 1855.

Historical maps and documentary evidence indicate that Randall's Island did not undergo substantial development until the mid-19th century. This applies to the project area as well. According to the 1836 Colton map farm houses were constructed at around this time in conjunction with the growth of orchards on the southern section of Randall's Island (see Appendix A; Map 3).

Section 3.2 History of Randall's Island from the mid-19th Century to the Present

Randall's and Wards Island share similar histories over the past 150 years. During the mid-nineteenth century both islands had established burial grounds and institutional facilities. The emergence of these facilities is critical to this study since the present testing project was keyed to encountering deposits from them. They included the Potter's Fields, the House of Refuge, and the construction of the Triborough Bridge and related infrastructure systems.

Potter's Fields

In the early Euroamerican period, a potter's field was the burial place for the poor, the unknown, and the unclaimed dead (Bergoffen 2001: 13). By colonial times, poor African slaves, freedmen, "indigent whites" and people of Jewish faith buried their dead on the outskirts of town, commonly near the potter's workshops and tannery yards. In 1835 Jacob Lorillard petitioned to the city council that the pauper's burial ground, which had been previously relocated, be moved again to Randall's Island, which originally had been purchased by the city for this purpose (Bergoffen 2001:13; Klips 1980: 542).

Plans for a burial ground on Randall's Island passed the City Council in 1843 (Bergoffen 2001:14; Klips 1980: 542). The earliest accounts detailing the potter's field on Randall's Island also provide evidence of its likely location within the landscape. One account given by the Alms House Governors in 1850 details the burial ground and states:

> [The] field is upon a rock below the surface, so that the decomposition of human remains there interred, and the effluvia resulting from it will not sink in the ground, but the latter will exhale and taint the atmosphere. It's proximity therefore to the Nurseries…is objectionable, and at certain season dangerous (Bergoffen 2001:14; Alms House Governors 1850).

Such evidence suggests that the potter's field may have been located in proximity of shallow bedrock, a setting consistent with the topography of the island's southern coastline. The grounds are also described as being in the vicinity of a nursery. The Colton 1849 map depicts two nurseries on the island; one is labeled the "New Nursery" and the other is labeled "Nursery", with a note detailing that this building was destroyed in a fire on October 22, 1843 (see Appendix A; Map 4).

While historic maps or plans do not provide detail for the exact location of the burial ground, contemporary studies suggests that the potter's field on Randall's Island was located south of the nurseries. Specifically, they would appear to have occupied the hillside above the marshy ground at the southeastern edge of the island (Bergoffen 2001:14). This location would have brought it very close to the nursery, within less than 300 feet (100 m) of the southernmost building of that complex. Bergoffen (2001) concluded that if the potter's field had been situated here the construction of the Triborough Bridge or the installation of utility pipes and conduits would most likely have disturbed burials within the footprint of the potter's field. However there is no record of any burials found in this area, and it is unlikely that the cemetery was located west of the marsh because the House of Refuge was built there in 1854 (Geismar 2002, 1).

The Burial Ground for Paupers as it was called at the time was in 1854, in a New York Times article, described as:

> "…consisting of long and deep trenches, into which the pine coffins were packed directly on top of each other, without a spadeful of dirt between them to the high of seven, eight, and nine feet….and were never covered until the line had been completed" (Unknown 1854).

These observations converge around the strong possibility that burials to depths of 7-8 feet (2-3 m) could be encountered either beneath or within fill sediments in the area of the project footprint. No further specifications or markers are documented in the literature that had been examined in the baseline study (Bergoffen 2001). Somewhat more speculative indications of burial preservation is presented for the area west of the (Triborough) Bridge and continuing south for approximately 200 feet to the edge of the original shoreline (Bergoffen 2001: 19).

A significant anomaly was noted during the construction of the Triborough Bridge. In 1935 a set of disarticulated human bones were found at the southern end of the island during excavations for Pier 37 North. This is the second to last row of piers on Randall's Island, approximately 150 feet south of Downing Stadium (Bergoffen 2001: 15) . However there is no information about the number or kind of burials discovered here, and they could have been individual interments, perhaps unrelated to the potter's field, *sensu stricto* (Bergoffen 2001: 15).

The project footprint extends approximately 32 to 318 ft south of Icahn Stadium, and therefore related development should be considered highly sensitive for human remains. Most recent research (i.e. Bergoffen 2001; Geismar 2002) proposes that the only area on Randall's Island large enough to have housed the graveyard is the southern tip, south/southwest of Downing Stadium. Bergoffen's (2001) projections of archaeological sensitivity on Randall's Island identified the area west of the Triborough Bridge extending ca. 200 ft (60 m) and parallel to the coastline as being the high probability zone.

House of Refuge

The House of Refuge was built to the west of the burial ground and was formally situated immediately northwest of the project area (see Geismar 2002: Figure 6). Opened in 1851, the House of Refuge was appropriated by the Society for the Reformation of Juvenile Delinquents as a reformatory for wayward boys and girls. The Society was an outgrowth of the 19th-century movement to transform prisons from places of punishment to places of penitence and reform. The society originally acquired ten acres for the development of the institution, decided the 10 acres was too small a tract, and in 1851 the society acquired 36.6 acres from the city. Construction on the complex began in 1852 and took two years to complete. Rutsch and Porter (1980) note that during construction a considerable amount of blasting and grading was needed in order to prepare the southwestern corner for the construction of the complex's foundation and huge retaining walls.

The 1851 U.S.C. and G.S. map of Hell Gate and its approaches show four free-standing buildings on the southwestern-most hill on the site of the House of Refuge, and it is probable that these structures preceded the institution's construction, as they are also present in the 1836 Colton map (see Appendix A, map 3; see also Historical Perspectives 2000: Figure 5). While their actual purpose is unclear these are likely the vestiges of farmhouses along the southern coastline. Since they appear on maps after c. 1836, they may also have been used by the staff of the other institutions which preceded the House of Refuge on the island. However, it is likely that these buildings were incorporated into the House of Refuge complex or destroyed during the complex's construction.

Maps and photographs dating after 1854 show a large, formally laid out complex of 3- to 4-story brick buildings facing west toward the Harlem River and Manhattan Island, with the important central and terminal pavilions capped by domes (see Appendix A, map 6). The area of study also appears to have been regraded to form a flat expanse for the buildings and their courtyards (Historical Perspectives 2000: 11).

While the society was privately managed it received substantial state support and was subsidized by government controlled fees and taxes. At the House of Refuge, children received four hours of religious and secular instruction each day. Religious instruction was strictly evangelical Protestant. Roman Catholic clergy were excluded. In addition, there was 6~ hours of "industrial employment", *i.e.*, caning chairs and making shoes for outside contractors. Other sources record the boys producing brushes and brass nails as well. Girls made uniforms, worked in the laundry and did other domestic work. Some were eventually released to family members or friends, but most were later indentured for supervised employment, the girls as housekeepers, and the boys as farmers (Historical Perspectives, 2001; Seitz and Miller 1996:165; NYSARA, 1989: 5). Children who died while at the facility were interred at the Paupers burial ground on Randall's Island (Bergoffen 2001).

The facility was expanded in 1860. At this time the average population of inmates in the complex was between 500 and 600, but nearly a thousand were placed there during the 1860s and 70s. In 1857, the House of Refuge hosted a national convention of reformatory administrators, and at the time, had the largest reformatory population in the United States (Historical Perspectives 2001, 12). The New York State Committee on Social Agencies boasted that the "New York House of Refuge is now in the extent of its operations, the greatest reform school in the world" (Historical Perspectives 2001, 12; Seitz and Miller 1996: 165; NYSARA 1989:5).

By 1935 the House of Refuge was beginning to close due to obsolescence, and the society began to dissolve. The new prototypical juvenile delinquent institution was expected to function properly in a rural setting, and it was at this time that inmates at the house of Refuge were taken to newer facilities in the state located in Bedford, Coxsackie and Warwick, New York. The four main structures associated with the development and House of Refuge property were subsequently demolished due to development and construction of later buildings.

The archaeological contexts of the House of Refuge were broadly addressed in a previous study by Historical Perspectives (2000). They considered the possibility of preserved shaft features that might have overlapped onto the western margins of the project footprint. They note that shaft features were likely to have been located on the southwestern coastline. This is exemplified in the study's conclusion that:

> "…because most of the complex was surrounded by a high fence or wall, shaft features would have been concentrated within the fenced area to the east of the main Refuge building...This would include an area extending approximately 350 feet east of the main Refuge building and about 1,050 feet south from its northern end, extending almost to the shore of the Little Hell Gate."

Triborough Bridge and Downing Stadium

The eventual closure and removal of the House of Refuge was a precursor to changing design plans for Randall's Island in the early 20th century. In the 1930's New York City's Department of Parks and Recreation, under the directorship of Robert Moses, undertook the construction of the Triborough Bridge to link Manhattan, Queens, and the Bronx. Downing Stadium was built at around the same time, opening in 1936. All evidence indicates that the rubble from the House of Refuge had been incorporated into the general landfill and was associated with the regarded effort for construction of these new facilities (see Historical Perspectives 2001: Figure 12). Part of the massive landfill program at that time resulted in infilling to the east and south of the project site, which not only connected Randall's and Wards Islands, but increased the size of Randall's Island to 194 acres (from its original 120) by 1939 (Historical Perspectives 2001).

The development of the Triborough Bridge, Downing Stadium (now replaced), Ichan Stadium and the necessary infrastructure could have had significant impacts on the project footprint. The eastern edge of the project area lies directly parallel to the bridge, while the northern boundary of the project area abuts the southern edge of Downing Stadium. In general, the construction of Downing Stadium and the Triborough Bridge reconfigured local landforms, principally, as noted, by expanding the size of Randall's Island to the northwest and east of the project area. The present investigations explored the degree to which these impacts were registered in the specific fill sequences underlying the study zone.

Section 3.3 Summary of Land Use

Documentary evidence suggests that land use and construction activities during the 19th and 20th century most probably had effects on archaeological integrity. Preliminary indications are that large facilities, specifically the Potter's Field and the House of Refuge, would have been variously disturbed. The extent of the Potter's field disruptions are unclear; while the data suggests that the House of Refuge was destroyed, elements of structures might remain intact, but that the facility's integrity was compromised and its vestiges were probably incorporated into the regraded fill used to stabilize and construct the Triborough Bridge and Downing Stadium. It is also probable that the uppermost fill, capping the primary Bridge Construction debris, contains sediment bodies linked to late 20th century and 21st century regrading attendant to maintenance and support of more recent support facilities.

Despite the likelihood for disturbance to the project footprint, immediately adjacent to Ichan Stadium, there remains a high potential for the preservation of undisturbed resources in the southernmost and eastern section of the Waterfront Pathways project area. The southern and eastern sections of the project area do not have a history of being developed. Rather these areas should preserve a deep record of 19th and 20th century infilling. Such contexts offer strong potential for preserving archaeological and environmental resources in these sections of the project footprint. There is a moderate-high potential for finding remains of the Potter's Field, and moderate potential for locating 19th century shaft and cistern features related to the earliest construction of the House of Refuge.

Chapter 4 – 2011 Survey and Methodology

The basis for this work plan was a previously developed archival map study or Phase 1A assessment (Schuldenrein et al., 2008) and a Phase 1B Field investigation of Ward Island (Schuldenrein et al., in preparation). The Phase 1B testing effort was a geoarchaeological investigation that utilized geoprobe subsurface explorations to establish the composition of the substrate in discrete landscape settings across the island. In particular, that field effort characterized and mapped the subsurface distributions of various fill complexes and more limited sequences of paleo-environmental (ie., prehistoric age) deposits. That study is still in preparation, but the sediment complexes could be correlated with the remains of historic structures and older landscape elements.

By coupling the island-wide archival and field assessments, it was possible to formulate a measure of buried site potential, and archaeological sensitivity, based on ages and composition of various fill and natural strata for discrete portions of the island (Schuldenrein et al., in preparation). Preliminary overviews of the project area point to the setting of the Waterfront Pathway's extensions (from Broadway to the parking lot) on a somewhat unique setting on the Randall's island. It parallels the southern coastline, referenced as a potential site for the Potter's field and cemetery Bergoffen 2001). It also straddles the margins of the tidal straight between Randall's and Ward's Island. Accordingly, there is a possibility for preservation of intact estuarine and near-shore sediments beneath sequences of fill. The depths and composition of the fill sequences themselves prior to this study was not known, but the Phase 1B probes previewed significant thicknesses of multiple source grading materials (in excess of 10' or 3 m). Further, the characterizations of the fill might allow for separation and dating of source grading episodes, through diagnostic artifacts, building rubble and debris.

The formal acceptance and implementation of a geoprobe-based subsurface testing strategy is an extension of a consistent island-wide testing strategy. To sample stratigraphic sequences GRA employed a Geoprobe® coring device to penetrate and extract stratified deposits. The geoprobe had successfully penetrated the fill elsewhere across the island. It successfully established the depths and contact interfaces between the near shore and tidal surfaces, as well as pre-contact and prehistoric to historic surfaces. There is also an expectation that specific infilling episodes and re-contouring efforts could be dated and integrated to the project footprint's later history.

The geoprobe utilizes a hydraulic system to penetrate the subsurface and extract successive and continuous lengths of 2-3 foot (0.6-1.0 m) long sediment columns. The device is highly mobile and maneuverable across broad landscapes and where access is constrained by terrain and vegetation. Two-inch (2”) core sections were recovered in plastic sleeves and sealed upon retrieval. At the conclusion of fieldwork, the samples were transported to the soil-sediment facility at GRA where the sleeves were sliced open and arrayed vertically. Analysis involved detailed soil and sediment descriptions following the criteria of USDA (1994) for soils and NACSN (1983) for sediments. Sections of samples were arrayed sequentially and by depth from the top of the column. Measurements of distinct layers established a vertical sequence of deposition. Any and all archaeological materials encountered in the sediment were recorded, photographed, and catalogued.

A laterally spaced series of these cores demonstrated variability of deposition within and across the individual parcels. Depositional episodes could also be isolated. In general, the range of historic disturbances was identifiable across the tested impact area and differing episodes of fill were distinguishable. Evidence for pristine or natural (undisturbed) surfaces was identified in a single core, RIWP-ARC-1. In this instance a thin, organically enriched alluvial sediment was sampled and submitted for radiometric dating (Appendix C). It provided an age for the stratigraphic interface between bedrock regolith and the initial episode of historic infilling. The results of the field testing and core sampling are presented in the next section (Chapter 5).

The geoprobe excavations were undertaken on July 1, 2011. The original project design called for the extraction of cores at seven (7) locations along the V-shaped designed pathways (see Figure 6; Figure 7). A total of twelve (12) cores were procured since some boring locations encountered bedrock at shallow depths. At five (5) locations deeper cores were emplaced adjacent to the primary locations, these were relabeled with an “a” (example: RIWP-ARC-2A). Cores were judgmentally distributed to sample the terrain in representative manner and in conjunction with pristine landform features (ie., shoreline) as mapped on historic projections. The coordinates of core locations were recorded using a Garmin GPSMAP 60CSx unit. In the field preliminary stratigraphic properties--sediment color, composition, and structure--were described in the field, on the strength of known baseline subsurface relations from previous work (Schuldenrein et al., in preparation).

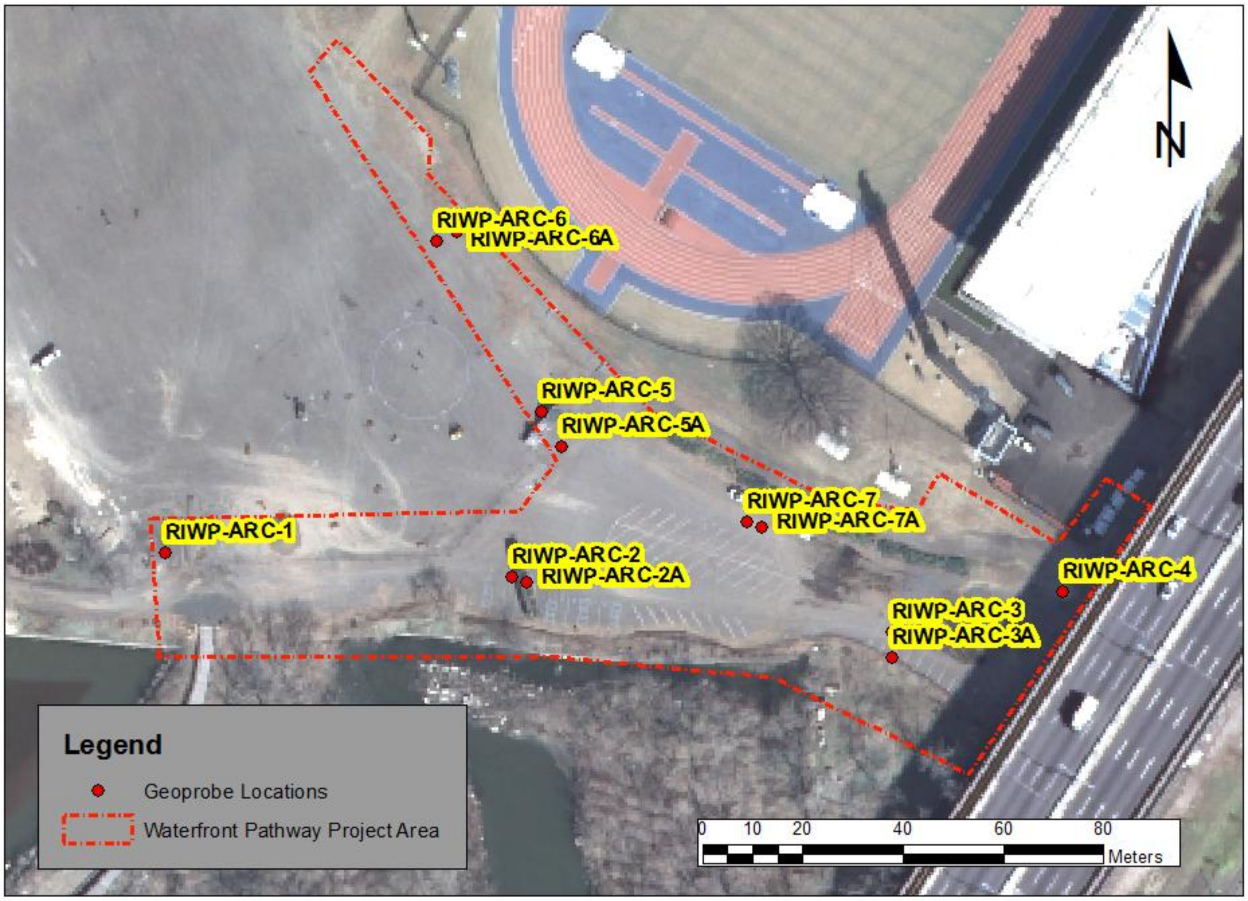

Figure 7: Project area with core locations (please note: the boundaries depicted are not to actual scale.

Chapter 5 – Results of Archaeological Testing

The alignment of the cores (Figure 7) was designed to illustrate changes in surface topographies and subsurface stratigraphies in both the coastal and the interior high terrain portions of the project footprint. It would therefore be possible to sample the project landscapes in the most comprehensive fashion and to track how episodes of infilling have altered the terrain since the 19th century. Figure 8 documents surface and subsurface topographies for the near level shoreline profile. It incorporates cores ARC-1, ARC-2A, and ARC-3. Figure 9 spans the somewhat steeper transition between the islands interior to coastal margins, as registered in cores ARC-6A, ARC-5A, and ARC-7A (Figure 9).

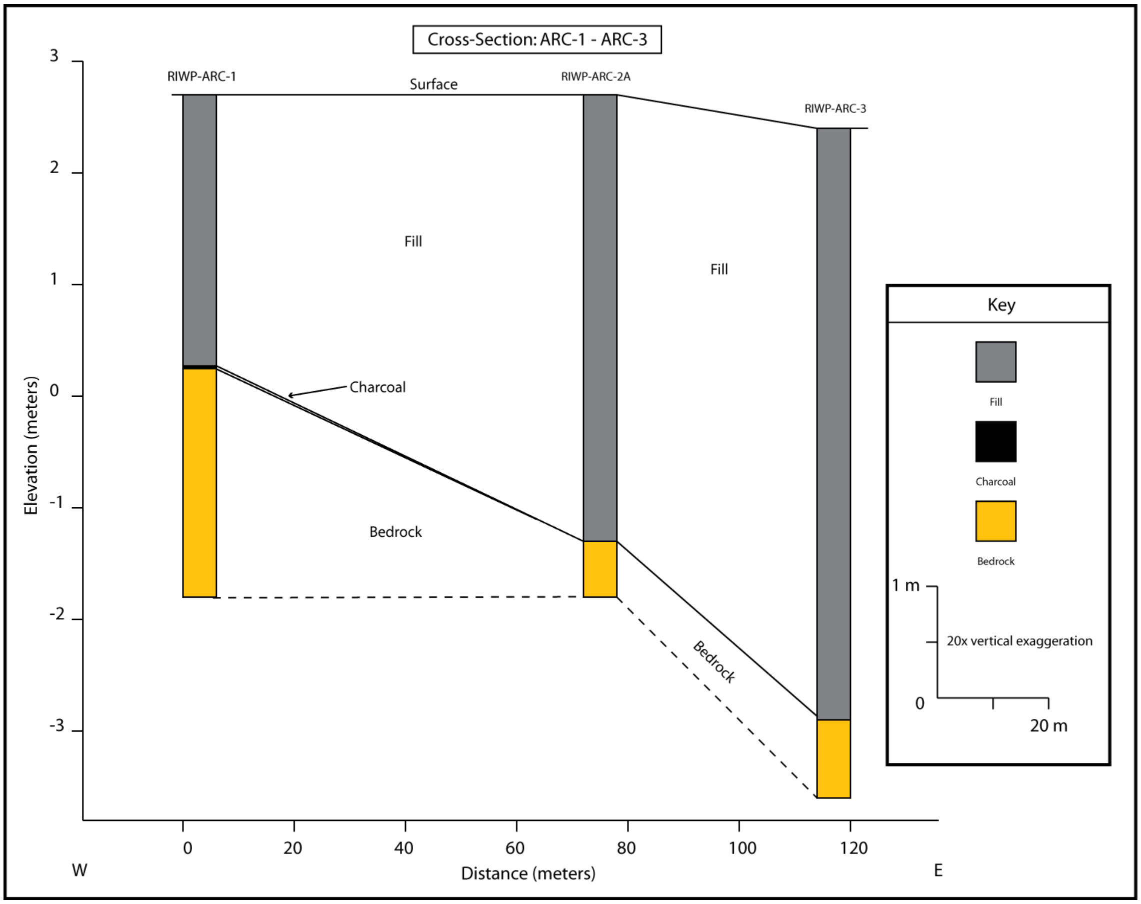

Figure 8. Stratigraphic profile of project area's southern section.

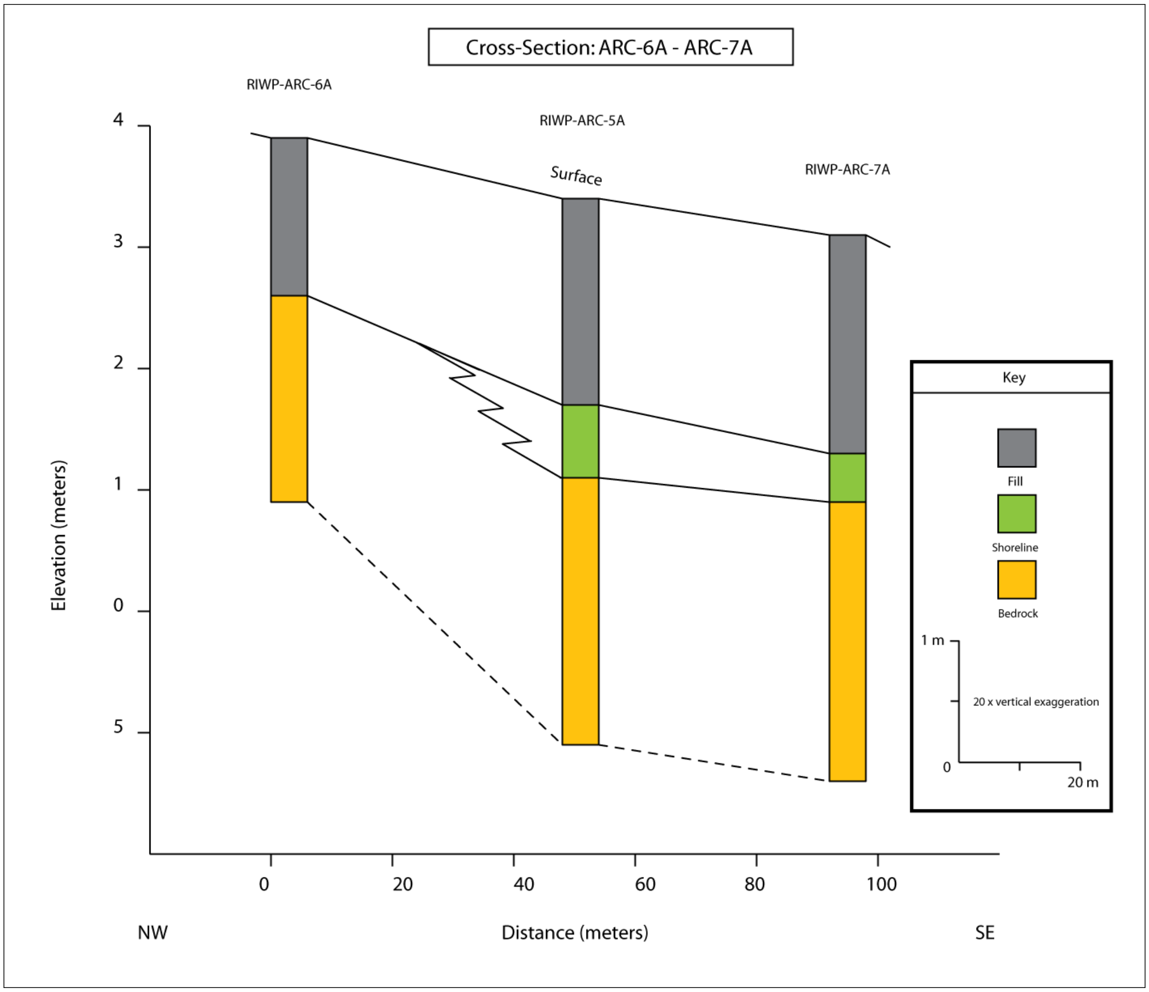

Figure 9: Stratigraphic profile of project area's northern section

The 1851 landscape map underscores the difference in landscape relations between the interior settings and the coastline, with the projection of ARC-6A occupying a clear rise on the distal (northern) portion of the project footprint and ARC-5A and 7A grading downslope to the coastline (see Figure 6). The balance of the cores sampled proximal coastal locations. All cores were emplaced to test for evidence of the historic features and the prehistoric paleo-environments.

Detailed core profiles for the individual borings are presented in Appendix B, in the form of photo composites and accompanying sedimentological tables. Table 1 is a comprehensive summary of the sequence stratigraphy on a core by core basis. Comparisons between the coastal and interior transect locations shows broadly similar depositional trends, with the primary exception of the presence of a near shore facies at select locations grading towards the coastline (Figure 9; ARC-5A and ARC-7A). The reason for the preservation of the near shore facies in more distal interior locations and not in more proximal coastal settings (ie. the shoreline locations depicted in Figure 8), as would be expected, is probably a reflection of landfilling activity. Accordingly, extensive grading in the vicinity of the southern portion of the project footprint resulted in complete stripping of prehistoric or early historic age sediments that would have incorporated evidence for pristine near-shore sedimentation. Figure 8 shows that the thickness of the fill along the southernmost portion of the footprint, reaches nearly 5 m, while the fill cap is only 3 meters in the interior. Fill thickness is considerably greater to the south because of the bedrock gradient, obviously, but the preservation of even minor depositional veneers of the former shoreline at ARC-5A and ARC-7A demonstrates that the presumably deeper native shoreline sediments to the south were completely removed over the course of historic grading activities.

Table 1: Core Descriptions

Core	**Surface Elevation (m)**	Total Depth (cm)	**Stratigraphy**
RIWP-ARC-1	2.74	450	0-242 cm is fill; 242-244 cm is charcoal; 244-450 cm is weathered schist.
RIWP-ARC-2	2.74	450	0-397 cm is fill; 397-450 cm is weathered schist.
RIWP-ARC-2A	3.05	450	0-340 cm is fill; 340-450 cm is weathered schist.
RIWP-ARC-3	2.44	600	0-537 cm is fill; 537-600 cm is weathered schist.
RIWP-ARC-4	2.44	630	0-396 cm is fill; 396-594 cm are mixed fills and estuarine deposits; 594-600 is weathered schist.
RIWP-ARC-5	3.35	300	0-136 cm is fill; 136-300 cm is weathered schist.
RIWP-ARC-5A	3.35	450	0-170 cm is fill; 170-232 cm are lacustrine deposits; 232-450 cm is weathered schist.
RIWP-ARC-6	3.96	116	0-116 cm (entire core) is fill.
RIWP-ARC-6A	3.96	300	0-136 cm is fill; 136-250 cm is weathered schist; 250-270 cm is colluvium; 270-300 cm is weathered schist.
RIWP-ARC-7	3.05	150	0-150 cm (entire core) is fill.
RIWP-ARC-7A	3.05	450	0-184 cm is fill; 184-215 cm are silty shoreline deposits; 215-450 cm is weathered schist.

A minor stratigraphic slice of the pre-modification landscape may be preserved at ARC-1, in the form of a thin (ca. 10-20 cm thick) lens of probable alluvial sediment that contained a significant organic component. This may be an estuarine lens or the residuum of a historic tidal channel. That sediment matrix was recovered and a sample was submitted for radiocarbon dating (Appendix C). The radiocarbon assay produced a conventional radiocarbon age of 190±30 B.P. (Beta-306085. 2 Sigma calibrated ages span the historic period (AD 1650-1690 to AD 1920-1950). While the radiometric determination cannot be taken as conclusive evidence for the presence of an intact component of the native environment, the sediment matrix that produced the dated material was uniform and well sorted, indicating that it was undisturbed and thus, probably a vestige of the original depositional locus.

Across the project area, subsurface probes reached depths ranging from 1.2 to 6.3 m (see Table 1). Most cores extended beneath 3 m. The most dominant stratum of the subsurface sequence was the historic fill which extended to the interface with schist bedrock in all cases except in ARC-5A and ARC-7A, where shoreline sediments were found and in ARC-1, where the estuarine matrices were identified. ARC-4 also produced an anomalous sediment that may represent interfingering of older fill and an eroded estuarine surface. Collectively then, the majority of cores verified that evidence for the prehistoric shoreline was largely removed by historic regarding and excavation activities. In isolated instances thin, basal horizons of shoreline and estuarine deposits were preserved.

Thus the most informative sediments consisted of the heterogeneous fill bodies, ranging in thickness from 1.5 to 5.5 m. Detailed observations of the fills indicated that despite their non-uniform composition, fills could be segregated on the strength of stratigraphic contacts and boundaries and, in some instances, textural criteria (see Appendix B). For this study the designation “Ap” (formally designated as plow zone OR fill by NSSC (2002) was utilized to distinguish fill. Discrete episodes of filling were offset by Arabic numeral preceding the “Ap”. As many as 8 and as few as 2 fill units were preserved in the twelve cores sampled. It was not possible to cross-correlate the fill types and individual units across the project footprint because of the limited exposure of sediment properties visible within the 2-3” diameter core. Isolated cultural materials were preserved within the fills and these were chiefly in the form of brick, bone, cinders, shell, and glass. Relatively high concentrations of cultural materials were housed in the upper and middle fills of ARC-1, ARC-2, ARC-3, ARC-4, and ARC-7A. These locations conform to the eastern half of the project footprint. As in the case of the sediment matrix, the core widths were too narrow to enable broad intra-site correlations.

Significantly, however, the parent matrices of the cultural fills with dense artifacts were not homogeneous. A lack of uniformity in sediment texture and structure would indicate that the fill strata represented admixtures of deposit from a variety of sources. They are not diagnostic of a particular activity area, which would normally present fill matrices that are somewhat better sorted and would contain parent materials of near uniform color and structural integrity. Thus the sedimentological observations indicate that the fill matrix, inclusive of the artifacts, represents mobilized fill materials that was dispersed across the landscape. That type of action represents deliberate land-filling and would be most representative of regrading activity. While episodic regrading may be in evidence within the individual cores, and more detailed analysis of sediments might isolate the extent and possibly even the time frame of such regrading (through microstratigraphic observations of the cores and correlation of glass and brick types) the net result of such an effort would not result in any significant modification to the interpretation of site formation process. It is conceivable that one, or perhaps more, of the eight filling episodes might register clearance activities attendant to the dismantling of the House of Refuge. Indications are that removal of support facilities for that structure may have occurred in stages and the superposition of fills in within several cores is consistent with staged dismantling. However, firm evidence documenting this particular activity could not be confirmed over the course of this study.

Summarily, it was not possible to distinguish any unique fill type that offered indications of a specific site location or land use history. No evidence that would confirm the presence of a Potter's Field was recovered and there were only minor suggestions that regrading might be related to the leveling of the House of Refuge. Strata of prehistoric to early historic time frames were recorded in isolated cores and these marked the interface of initial (historic) grading activities.

Chapter 6 – Conclusions and Recommendations

Four primary objectives were targeted in the present geoarchaeological investigations for the proposed Waterfront Pathway Project at Randall's Island. The degree to which these objectives were met and addressed is summarized below.

Determinations of Depth and Extent of Historic and Sub-recent Landfilling. This investigation confirmed that historic and sub-recent fills underlie the entire project footprint. These fills extend from 1.2 to 5.5 m in thickness. They represent episodic regarding episodes dating back to the mid-19th century. Discrete episodes of regarding can be identified but these cannot be unequivocally linked to specific historic features on the property.

Isolation of the Potters Field Cemetery or House of Refuge. Structural elements of these facilities could not be identified. It is probable that sediments related to the Potters field, in the form of bone-rich matrix or sediments consistent with decomposing organic remains, would be retrieved in the cores. These were not. It is probable that of the discrete fill types (n=8) some may have been associated with leveling activities from the dismantling of the House of Refuge, but it is not possible to confirm that correlation since identifiable building materials of the facility were not recovered.

Exposure of elements of the pre-19th century cultural and natural landscape. Evidence of pristine strata (near shore deposits and estuarine/tidal silts) were exposed in several cores. Their distribution was irregular and only the basal thicknesses of the natural horizons were preserved. Most of the probes revealed contact between fill and bedrock confirming that across most of the project footprint the intact shoreline and stream deposits were removed over the course of relandscaping. In one case, evidence for a pre-modern stream/estuarine setting was dated radiometrically.

Exposure of elements of the pre-19th century cultural and natural landscape. Evidence of pristine strata (near shore deposits and estuarine/tidal silts) were exposed in several cores. Their distribution was irregular and only the basal thicknesses of the natural horizons were preserved. Most of the probes revealed contact between fill and bedrock confirming that across most of the project footprint the intact shoreline and stream deposits were removed over the course of relandscaping. In one case, evidence for a pre-modern stream/estuarine setting was dated radiometrically.

Identifications of contexts for prehistoric sites and paleoenvironments. Pristine environments existed on the project footprint but the only datable evidence provided a historic determination.

Prehistoric aged sediments included near-shore sands that did not contain radiometric material. As noted, the distribution of landform elements of prehistoric age is discontinuous and relandscaping has destroyed nearly all of the evidence beneath the present landfill cap.

Summarily, the subsurface investigations at the Waterfront Pathway project area did not disclose preserved archaeological material of significance. Sustained disturbance has destroyed most evidence of the prehistoric and historic landscape. The area should be considered compromised from the perspective of cultural resources and planned development should be allowed to proceed.

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Appendix A: Historic Maps

Map 1. Viele, 1874. Map depicting original geography of New York with overlay of contemporary street grid.

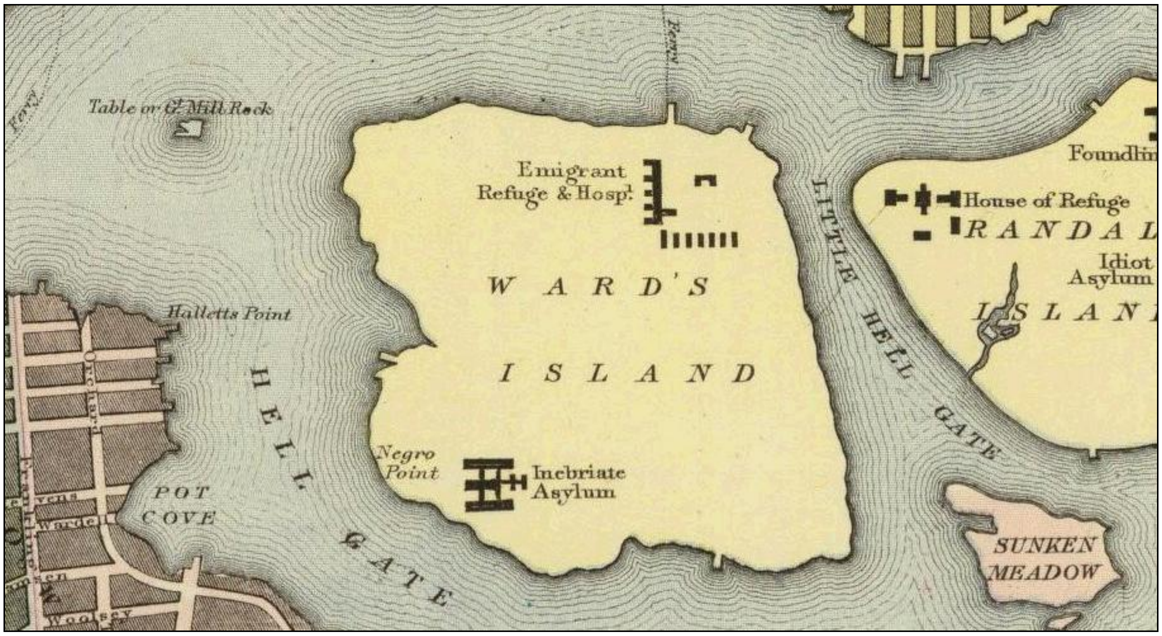
Map 2. Bridges, 1811.

Map 3. Colton, 1836.

Map 4. Colton, 1849.

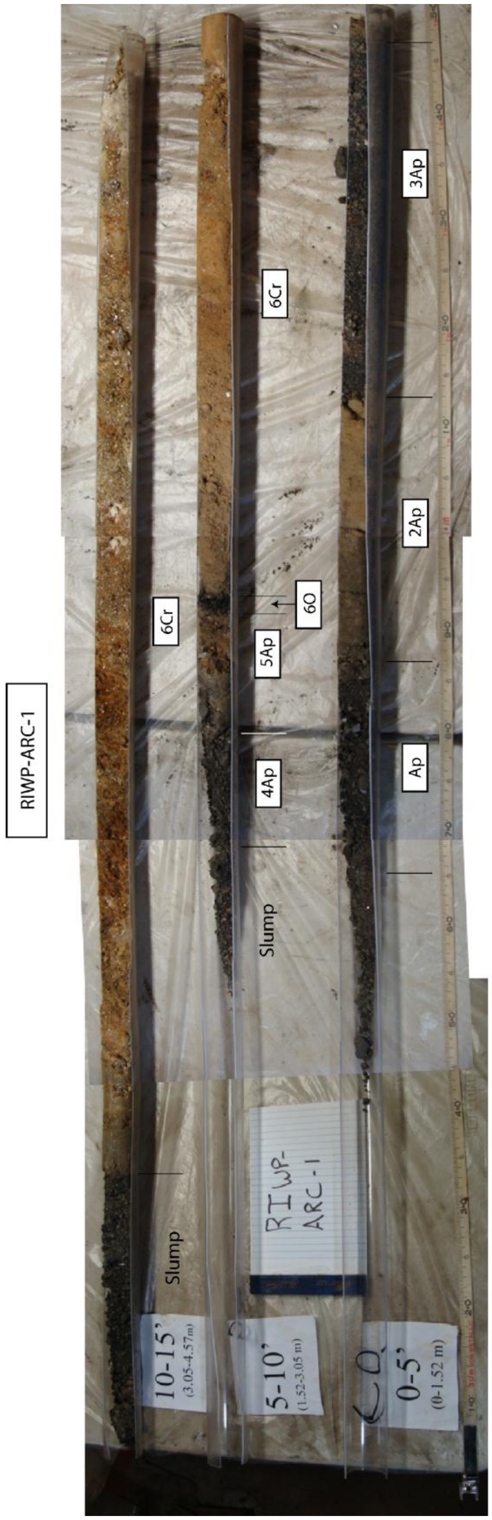
Map 5. Dripps, 1863.

Map 6. Taylor, 1879.



Map 7. Letts, 1883.

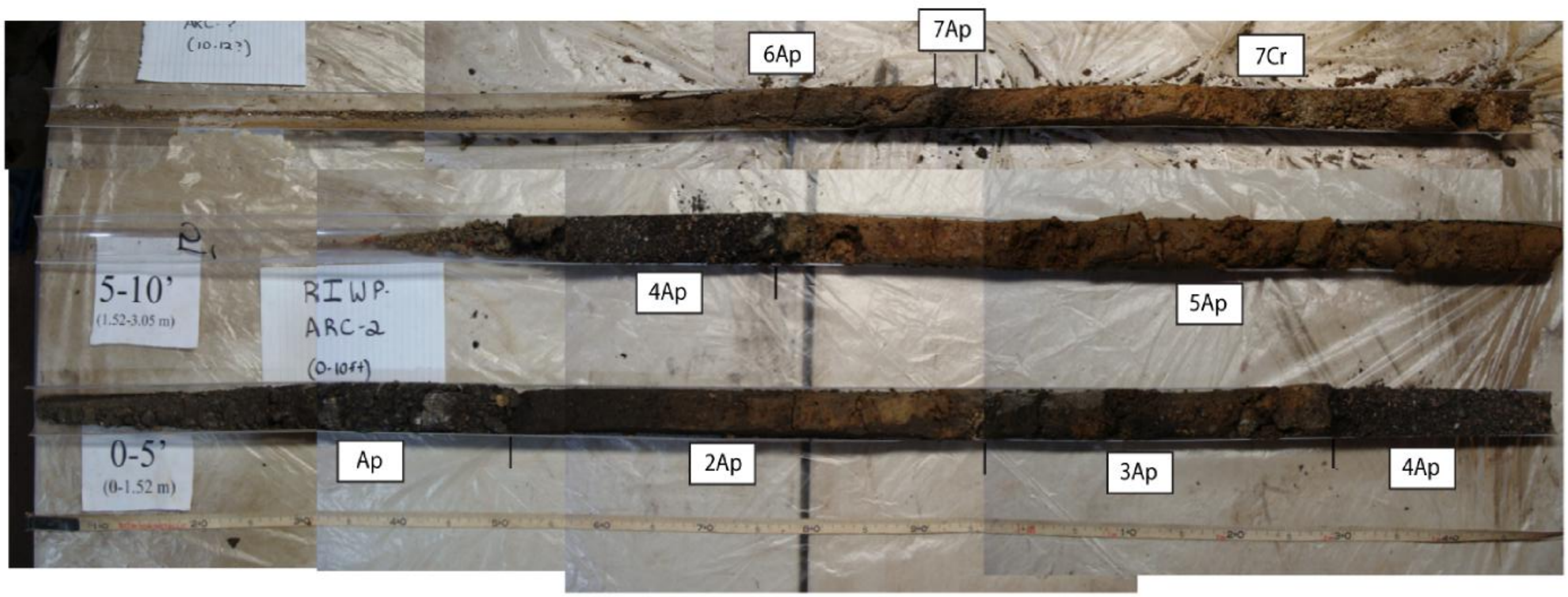
Appendix B: Core Descriptions


RIWP-ARC-1
6Cr
3Ap
2Ap
6O
5Ap
4Ap
Ap
Slump
10-15'
(3.05-4.57m)
5-10'
(1.52-3.05 m)
0-5'
(0-1.52 m)
RIWP-ARC-1

RIWP-ARC-1									
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-87	87	Ap	10YR 2/1	VGS	dist	l	c	Asphalt-gravels and cinders; few small bits of glass; poorly sorted.
Fill	87-112	25	2Ap	2.5Y 4/2 2.5Y 4/4	SiCL	dist	fi	c	2.5Y 4/2 (top) - 2.5Y 4/4 (bottom)
Fill	112-145	33	3Ap	10YR 2/1	VGS	dist	l	c	Med. brick frags throughout; bone frags (130 cm and 142 cm); cinders.
	145-217	72	4Ap	10YR 5/3	SiCL	dist	fri-fi	n/a	Poorly sorted.
Fill	217-242	25	5Ap	10YR 5/3	SiCL	mass	fri-fi	s	Poorly sorted.
Charcoal	242-244	2	6O	10YR 2/1	n/a	n/a	n/a	s	Charcoal layer
Bedrock	244-450	115	6Cr	10YR 4/6	SL	gr	fri	n/a	5YR 4/6 - Fe stains; weathered schist.

Texture:	Si=silt; L=loam; C=clay; S=sand; F=fine; V=very; G=gravel; O=organic
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic; cr=crumble
	pl=platy; dist=disturbed/nostructure
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky
Boundary Distinctness:	a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography:	w=wavy; s=smooth; a=abrupt
Miscellaneous:	n/a=not applicable

RIWP-ARC-2



6Ap
7Ap
7Cr
(10-12?)
5-10'
(1.52-3.05 m)
RIWP-
ARC-2
(0-10ft)
4Ap
5Ap
0-5'
(0-1.52 m)
Ap
2Ap
3Ap
4Ap

RIWP-ARC-2									
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-52	52	Ap	10YR 3/1	VGS	dist	l	c	Asphalt
Fill	52-98	46	2Ap	10YR 2/1	SiL	dist	fi	c	None
Fill	98-130	32	3Ap	mixed	GSiL	dist	l	c	10YR 2/1 & 10YR 4/4 - mixed; few small brick frags.
Fill	130-230	100	4Ap	10YR 3/1	VGS	dist	l	c	v. fine-fine shell frags; poorly sorted; charcoal; v. few brick and mortar frags; v. few glass frags; v. few bits of animal bone.
Fill	230-300	70	5Ap	7.5YR 4/4	SCL	mass	fri	n/a	Moderately sorted; could be fill.
Fill	300-392	92	6Ap	10YR 3/4	SiCL	dist	fi	c	None
Fill	392-397	5	7Ap	10YR 2/1	SL	dist	l-fri	s	Well sorted; v. few, medium rock frags.
Bedrock	397-450	53	7Cr	7.5YR 4/6	GSL	2gr	fri-vfi	n/a	Weathered schist; one subrounded clay ball.

Texture:	Si=silt; L=loam; C=clay; S=sand; F=fine; V=very; G=gravel; O=organic
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic
	pl=platy; dist=disturbed/nostructure
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky
Boundary Distinctness:	a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography:	w=wavy; s=smooth; a=abrupt
Miscellaneous:	n/a=not applicable

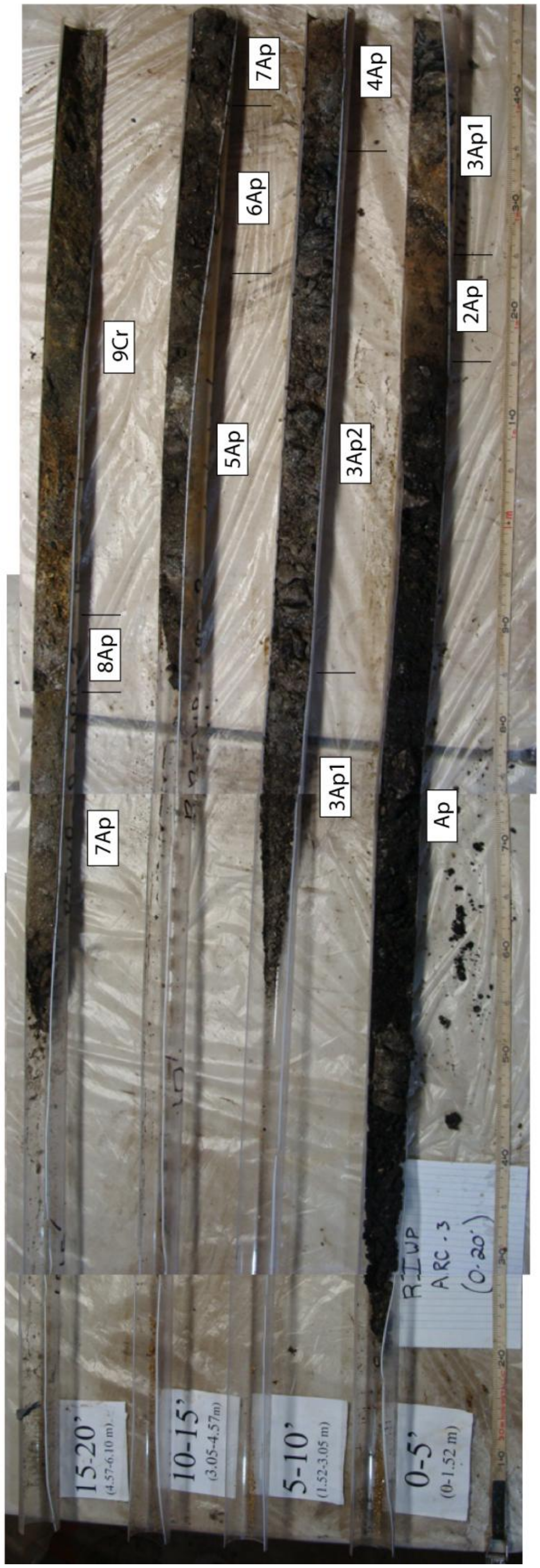
RIWP-ARC-2A


8Ap
7Ap
6Ap
5Ap
4Ap
9Cr
4Ap
3Ap
2Ap
Ap
8Ap
15-20'
(4.57-6.10 m)
5-10'
(1.52-3.05 m)
0-5'
(0-1.52 m)

RIWP-ARC-2A									
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-50	50	Ap	10YR 2/1	VGS	dist	l	c	Asphalt
Fill	50-79	29	2Ap	10YR 2/1	SiL	dist	fi	c	V. few subrounded rock frags.
Fill	79-97	18	3Ap	See Comments	VGS	dist	l	c	Broken schist in 4 cm round plates; white rind w/ dark gray middle; no matrix.
Fill	97-225	128	4Ap	2.5Y 4/3	GSiL	dist	fi	c	None
Fill	225-251	26	5Ap	2.5Y 4/3	SiL	dist	fi	c	None
Fill	251-269	18	6Ap	10YR 3/6	SiCL	dist	fi-slfi	c	Mod-poorly sorted; 1 large (4 cm) flat rock at base.
Fill	269-274	5	7Ap	10YR 6/8	VGS	dist	l	c	Crushed rock; well sorted.
Fill	274-340	26	8Ap	2.5Y 4/3	SiL	dist	fi	c	None
Bedrock	340-450	60	8Cr	10YR 5/8	GSCL	gr	fri	n/a	10YR 3/3 - Fe stain; at 422 cm rock fabric is arragnged in a horizontal fashion, everything else remains the same.

Texture:	Si=silt; L=loam; C=clay; S=sand; F=fine; V=very; G=gravel; O=organic
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic
	pl=platy; dist=disturbed/nostructure
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky
Boundary Distinctness:	a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography:	w=wavy; s=smooth; a=abrupt
Miscellaneous:	n/a=not applicable

RIWP-ARC-3

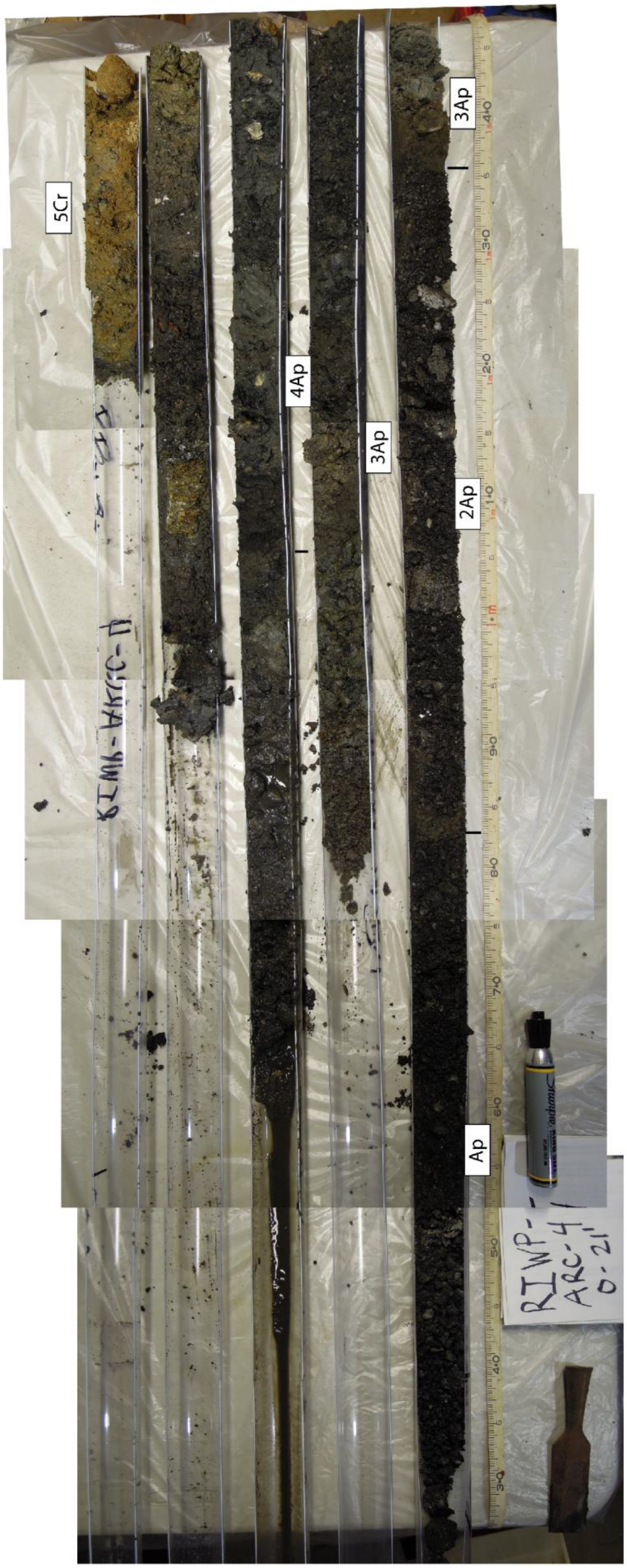


7Ap
4Ap
3Ap1
6Ap
2Ap
9Cr
5Ap
3Ap2
8Ap
3Ap1
Ap
7Ap
RIWP
ARC.3
(0-20')
15-20' (4.57-6.10 m)
10-15' (3.05-4.57m)
5-10' (1.52-3.05 m)
0-5' (0-1.52 m)

RIWP-ARC-3									
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-115	115	Ap	10YR 2/1	VGS	dist	l	c	Petroleum smell
Fill	115-125	10	2Ap	10YR 4/4	SL	dist	slfri-l	c	F. coarse brick frags.
	125-220	95	3Ap1	G1 6/N	VGS	dist	fri-l	n/a	Not gleyed (closest color).
Fill	220-289	69	3Ap2	G1 6/N	VGS	dist	l	c	Not gleyed (closest color).
Fill	289-300	11	4Ap	10YR 2/1	GSL	dist	l-slfi	n/a	None
Fill	300-424	124	5Ap	10YR 2/1	VGS	dist	l	c	None
Fill	424-440	16	6Ap	10YR 2/1	GSL	dist	l-slfi	c	F. fine brick frags; f. fine shell frags; looks burned.
Fill	440-528	88	7Ap	10YR 2/1	SL	dist	fi-h	n/a	Crushed schist.
Fill	528-537	9	8Ap	2.5Y 4/2	SL	dist	l-slfi	c	V. few gravel inclusions; f. fine brick frags.
Bedrock	537-600	63	8Cr	5Y 4/1	GSCL	3gr	fri-l	n/a	10YR 6/6 - Fe stains; fill or fluvial - (redeposited)?

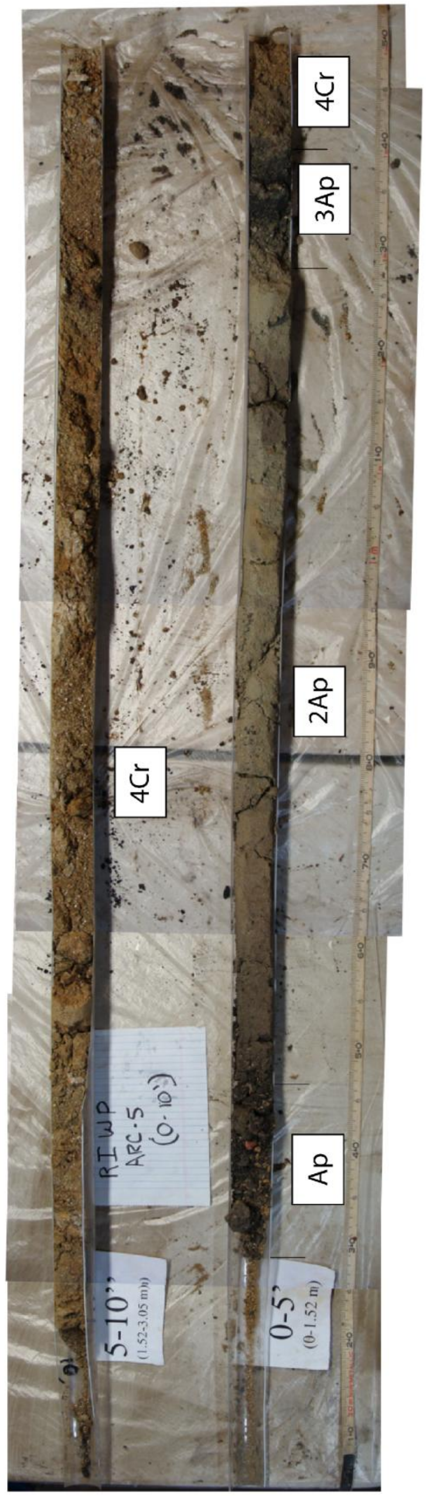
Texture:	Si=silt; L=loam; C=clay; S=sand; F=fine; V=very; G=gravel; O=organic
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic
	pl=platy; dist=disturbed/nostructure
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky
Boundary Distinctness:	a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography:	w=wavy; s=smooth; a=abrupt
Miscellaneous:	n/a=not applicable

RIWP-ARC-4



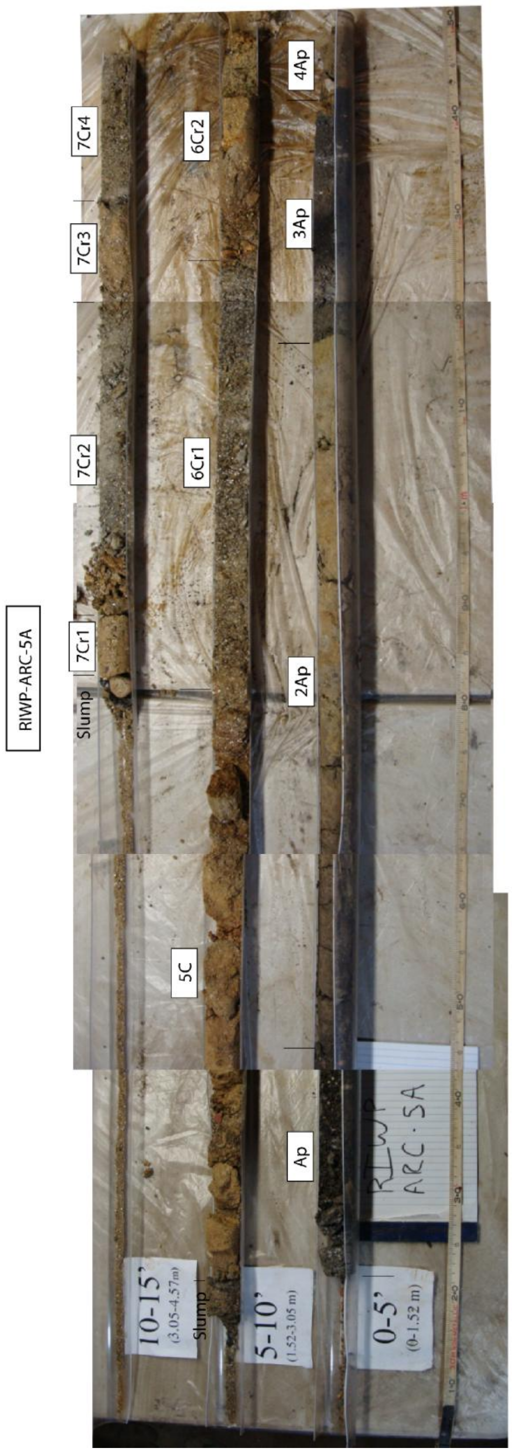
RIWP-ARC-4									
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-46	46	Ap	10YR 3/1	VGS	dist		c	Asphalt
Fill	46-128	82	2Ap	10YR 2/1	GSiL	dist	l	c	Cinders; bone frags.
Fill	128-396	268	3Ap	10YR3/1	GSiL	dist	ss	c	Common cinders; glass frags - green clear, amber; wood frags; f. fine brick frags; f. fine shells.
Estuary/Fill	396-594	198	4Ap	10YR 4/1	GSiL-CL	dist	ss	c	few ceramic; v.f. shell frags; possibly dist. Estuary deposits.
Bedrock	594-630	46	4Cr	10YR5/6	GSCL	gr	fri	n/a	Weathered schist.
Texture:	Si=silt; L=loam; C=clay; S=sand; F=fine; V=very; G=gravel; O=organic								
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse								
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic								
	pl=platy; dist=disturbed/no structure								
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky								
Boundary Distinctness:		a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp							
Boundary Topography:		w=wavy; s=smooth; a=abrupt							
Miscellaneous:	n/a=not applicable								

RIWP-ARC-5

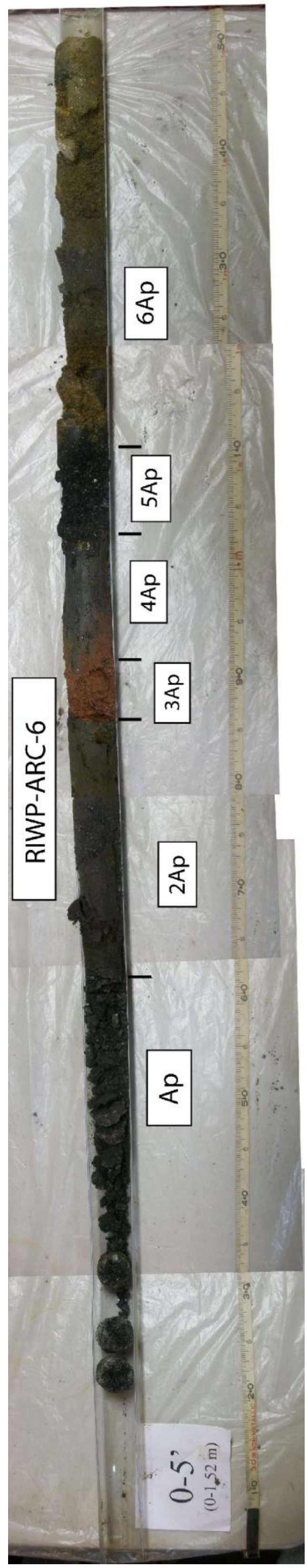


RIWP-ARC-5									
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-46	46	Ap	10YR 2/1	VGS	dist	l	c	Few med. Brick frags; asphalt
Fill	46-128	82	2Ap	2.5Y 5/2	SiCL	dist	fi	c	F. highly weathered rock frags.
Fill	128-136	8	3Ap	2.5Y 2.5/1	VGS	dist	l	c	poorly sorted; Fe concretion at base.
Bedrock	136-300	164	3Cr	2.5Y 5/3	GSCL	3gr	fri	n/a	Continued from material above (136-150 cm); Fe staining toward bottom.

Texture:	Si=silt; L=loam; C=clay; S=sand; F=fine; V=very; G=gravel; O=organic
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic
	pl=platy; dist=disturbed/nostructure
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky
Boundary Distinctness:	a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography:	w=wavy; s=smooth; a=abrupt
Miscellaneous:	n/a=not applicable


RIWP-ARC-5A
7Cr4
7Cr3
7Cr2
7Cr1
Slump
6Cr2
6Cr1
5C
4Ap
3Ap
2Ap
Ap
10-15' (3.05-4.57m)
Slump
5-10' (1.52-3.05 m)
0-5' (0-1.52 m)

RIWP-ARC-5A									
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-45	45	Ap	10YR 2/1	VGS	dist	l	c	Asphalt
Fill	45-116	71	2Ap	2.5Y 4/3	SiL	dist	vfi-h	s	F. fine rock frags.
Fill	116-140	24	3Ap	10YR 2/1	VGS	dist	l	c	Historic asphalt; cinders; petroleum smell.
Fill	140-150	10	4Ap	10YR 4/2	GSiL	dist	l	n/a	Poorly sorted.
Shoreline	150-232	82	5C	10YR 4/4	SiL	2gr	fri-l	n/a	Alternating bands of matrix and weathered schist.
Bedrock	232-300	218	5Cr1	2.5Y 7/1 2.5Y 3/1	m-cS	2gr	fri-vfi	n/a	Alternating, highly weathered schist; material darkens towards bottom; few rock frags. Fe stains-10YR 5/6. Possibly reworked material.
	300-390	10	5Cr2		SiCL	2gr	fri-vfi	g	
	390-420	30	5Cr3		SiL	2gr	fri	g	
	420-430	10	5Cr4		SiCL	2gr	fri-vfi	g	
Bedrock	430-450	20	5Cr5	10YR 4/4	SCL	2gr	fri	n/a	
Texture:	Si=silt; L=loam; C=clay; S=sand; f=fine; m=medium; c=coarse; V=very; G=gravel; O=organic								
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse								
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic								
	pl=platy; dist=disturbed/nostructure								
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky								
Boundary Distinctness:		a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp							
Boundary Topography:		w=wavy; s=smooth; a=abrupt							
Miscellaneous:	n/a=not applicable								


6Ap
5Ap
4Ap
3Ap
RIWP-ARC-6
2Ap
Ap
0-5'
(0-1.52 m)

RIWP-ARC-6	0-4 ft only								
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-60	60	Ap	10YR 2/1	VGS	dist	l	c	Asphalt
Fill	60-88	28	2Ap	10YR 3/3	SiL	dist	vfi	s	None
Fill	88-91	3	3Ap	5YR 5/8	C	dist	vh	s	Entirely composed of a single brick frag.
Fill	91-104	13	4Ap	10YR 3/3	SiL	dist	vfi	s	None
Fill	104-110	6	5Ap	10YR 2/1	SiL	dist	fi	s	Charred material; bone fragment.
Fill	110-116	6	6Ap	10YR 4/4	SiL	dist	fri-l	n/a	V. few coarse sub-angular gravels.

Texture:	Si=silt; L=loam; C=clay; S=sand; F=fine; V=very; G=gravel; O=organic
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic
	pl=platy; dist=disturbed/nostructure
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard st=sticky; ss=strongly sticky
Boundary Distinctness:	a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography:	w=wavy; s=smooth; a=abrupt
Miscellaneous:	n/a=not applicable


RIWP-ARC-6A
9Cr
8Cr
7Cr
6Cr
5Cr
Slump
4Ap
3Ap
2Ap
Ap
0-5'
(0-1.52 m)

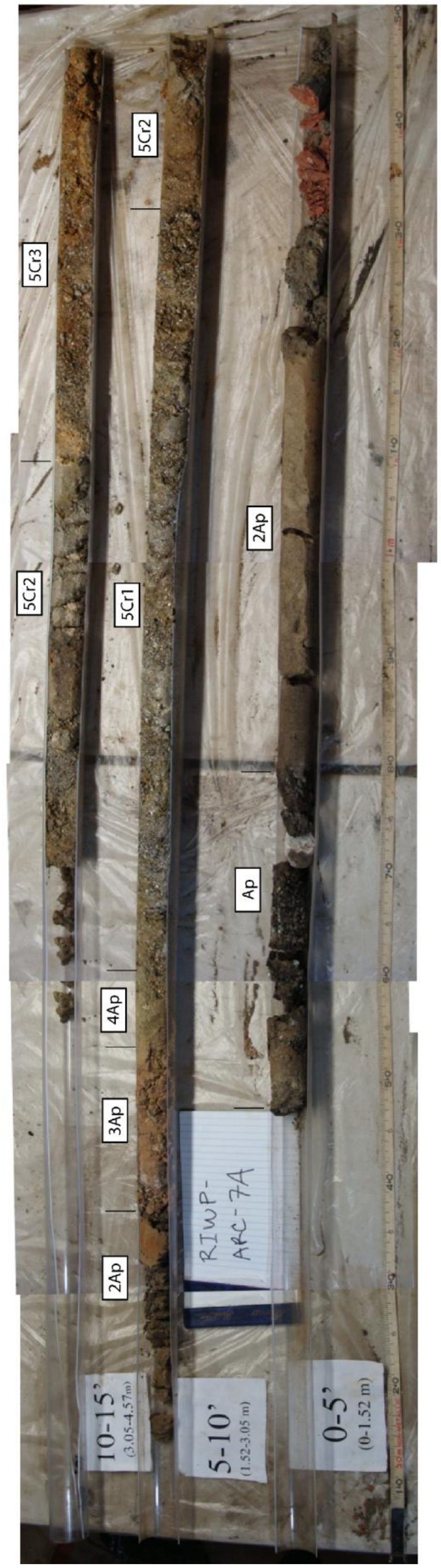
RIWP-ARC-6A									
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-53	53	Ap	10YR 2/1	VGS	dist	l	c	Asphalt
Fill	53-80	27	2Ap	2.5Y 4/2	SiL	dist	vfi	s	None
Fill	80-86	6	3Ap	2.5Y 6/3	VGS	dist	l	s	None
Fill	86-103	17	4Ap	2.5Y 3/1	VGS	dist	l	c	Historic fill.
Bedrock	103-300	197	4Cr	10YR 5/6 10YR 3/1	GSiCL	2gr	fri-slfi	n/a	Weathered schist.
Texture:	Si=silt; L=loam; C=clay; S=sand; f=fine; m=medium; c=coarse; V=very; G=gravel; O=organic								
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse								
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic								
	pl=platy; dist=disturbed/no structure								
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky								
Boundary Distinctness:		a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp							
Boundary Topography:		w=wavy; s=smooth; a=abrupt							
Miscellaneous:	n/a=not applicable								

RIWP-ARC-7

RIWP-ARC-7	Only 5 ft.								
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-90	46	Ap	10YR 2/1	VGS	dist	l	c	Asphalt
Fill	90-150	60	2Ap	2.5Y 3/2	SiL	dist	fi	n/a	Historic fill; few brick frags; few rock frags.

Texture:	Si=silt; L=loam; C=clay; S=sand; F=fine; V=very; G=gravel; O=organic
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic
	pl=platy; dist=disturbed/nostructure
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm;h=hard; st=sticky; ss=strongly sticky
Boundary Distinctness:	a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography:	w=wavy; s=smooth; a=abrupt
Miscellaneous:	n/a=not applicable

RIWP-ARC-7A


5Cr3
5Cr2
5Cr2
5Cr1
2Ap
Ap
4Ap
3Ap
2Ap
RIWP- ARC-7A
10-15' (3.05-4.57m)
5-10' (1.52-3.05 m)
0-5' (0-1.52 m)

RIWP-ARC-7A									
Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
Fill	0-78	78	Ap	10YR 2/1	VGS	dist	l	c	Asphalt
Fill	78-184	106	2Ap	2.5Y 4/2	C	dist	vfi	c	V. few rock frags up to 1 cm long; brick frag on mortar.
Shoreline	184-202	18	2C1	10YR 6/4	Si	mass	l	g	V. few subangular gravels up to 4 cm long.
Shoreline	202-215	13	2C2	5Y 6/3	SiL	mass	l	s	Mod. sorted; f. sub-angular rocks up to 5 cm long; common v. fine shell frags.
Bedrock	215-450	235	2Cr	5Y 6/3 7.5YR 4/6	GSL-GSiL	2gr	fri-fi	g	Weatherd schist; Fe staining increases towards bottom.

Texture:	Si=silt; L=loam; C=clay; S=sand; F=fine; V=very; G=gravel; O=organic
Structure:	1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
	gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky; pr=prismatic
	pl=platy; dist=disturbed/no structure
Consistence:	fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky
Boundary Distinctness:	a-abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography:	w=wavy; s=smooth; a=abrupt
Miscellaneous:	n/a=not applicable

Appendix C: Radiocarbon Dating Results

Consistent Accuracy . . .
. . . Delivered On-time

Beta Analytic Inc.
4985 SW 74 Court
Miami, Florida 33155 USA
Tel: 305 667 5167
Fax: 305 663 0964
Beta@radiocarbon.com
www.radiocarbon.com

Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

September 30, 2011

Dr. Joseph Schuldenrein
Geoarcheology Research Associates
92 Main Street
Suite 207
Yonkers, NY 10701
USA

RE: Radiocarbon Dating Result For Sample RIWP-ARC-1

Dear Joe:

Enclosed is the radiocarbon dating result for one sample recently sent to us. It provided plenty of carbon for an accurate measurement and the analysis proceeded normally. As usual, the method of analysis is listed on the report sheet and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analysis. It was analyzed with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

Thank you for prepaying the analysis. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood
Digital signature on file

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Dr. Joseph Schuldenrein — Report Date: 9/30/2011

Geoarcheology Research Associates — Material Received: 9/19/2011

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 306085	200 +/- 30 BP	-25.9 o/oo	190 +/- 30 BP

SAMPLE : RIWP-ARC-1
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1650 to 1690 (Cal BP 300 to 260) AND Cal AD 1730 to 1810 (Cal BP 220 to 140)
Cal AD 1920 to 1950 (Cal BP 30 to 0)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.9:lab. mult=1)

Laboratory number: **Beta-306085**

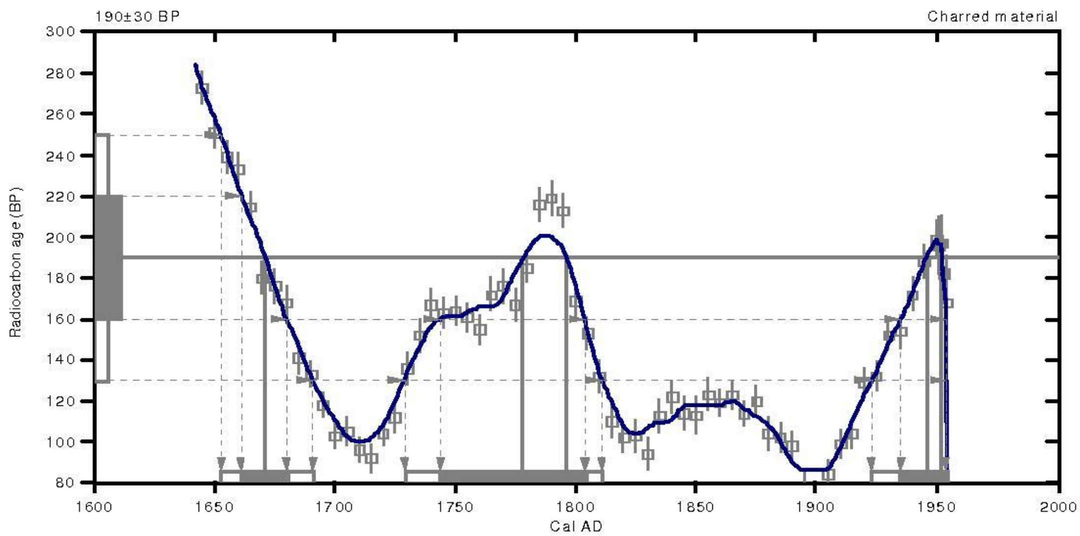
Conventional radiocarbon age: **190±30 BP**

2 Sigma calibrated results: **Cal AD 1650 to 1690 (Cal BP 300 to 260) and**
(95% probability) **Cal AD 1730 to 1810 (Cal BP 220 to 140) and**
Cal AD 1920 to 1950 (Cal BP 30 to 0)

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal AD 1670 (Cal BP 280) and
Cal AD 1780 (Cal BP 170) and
Cal AD 1800 (Cal BP 150) and
Cal AD 1950 (Cal BP 0) and
Cal AD 1950 (Cal BP 0)

1 Sigma calibrated results: Cal AD 1660 to 1680 (Cal BP 290 to 270) and
(68% probability) Cal AD 1740 to 1800 (Cal BP 210 to 150) and
Cal AD 1940 to 1950 (Cal BP 20 to 0)



References:

Database used
INTCAL04
Calibration Database
INTCAL04 Radiocarbon Age Calibration
IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

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