SUPPLEMENTAL SITE INVESTIGATION WORK PLAN
TO SUPPORT
HUMAN HEALTH AND ECOLOGICAL
RISK ASSESSMENT ACTIVITIES
PARK PARCEL/MASHAPAUG COVE

FORMER GORHAM MANUFACTURING FACILITY
333 ADELAIDE AVENUE
PROVIDENCE, RHODE ISLAND
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NOVEMBER 2005

MACTEC PN: 3650-05-0041.01

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AVS/SEM	acid volatile sulfides/simultaneously extracted metals
COCs	constituents of concern
COPC	constituents of potential concern
DCE	1,2-dichloroethene
DO	dissolved oxygen
EM	electromagnetic
GPS	Global Positional System
GZA	Goldberg Zoino & Associates
HLA	Harding Lawson Associates
MACTEC	MACTEC Engineering and Consulting, Inc.
MS/MSD	matrix spike/matrix spike duplicate
ug/L	microgram per liter
OHM	oil or hazardous materials
PAH	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
ppm	parts per million
QA/QC	quality assurance/quality control
RAWP	Remedial Action Work Plan
RIDEM	Rhode Island Department of Environmental Management

RIDOH	Rhode Island Department of Health
SVOCs	semivolatile organic compounds
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene
Textron	Textron, Inc.
TOC	total organic carbon
TPH	total petroleum hydrocarbons
URI	University of Rhode Island
USEPA	U. S. Environmental Protection Agency
USTs	underground storage tanks
VOCs	volatile organic compounds

1. INTRODUCTION

This Work Plan describes activities that will be undertaken to address data gaps and support completion of the human health and ecological risk assessment for the Park Parcel at the former Gorham Manufacturing Site located at 333 Adelaide Avenue, Providence, Rhode Island (hereafter referred to as "the Site" or "the Property"). Figure 1 shows the regional site location. Pursuant to Rule 8.00 (Risk Management) of the Remediation Regulations this Work Plan has been submitted to Rhode Island Department of Environmental Management (RIDEM) for approval on behalf of Textron, Inc. (Textron) by MACTEC Engineering and Consulting, Inc. (MACTEC, formerly Harding Lawson Associates [HLA]). This work plan identifies investigation activities designed to collect the information concerning nature and extent of contamination necessary to support human health and ecological risk assessments for the Park Parcel and the adjacent Mashapaug Cove. This work plan also includes a survey of the Cove for potential presence of drums.

Figure 2 is a map of the Property at 333 Adelaide Avenue, which includes the Park Parcel adjacent to Mashapaug Cove as well as the upland area where the former manufacturing took place. As part of the redevelopment of the Property, the City has subdivided an eight-acre portion of the Site adjacent to Mashapaug Pond (referred to hereafter as the "Park Parcel"). As shown on Figure 2, the City plans to develop and maintain this parcel as a park with a walking trail that meanders through the wooded/vegetated parcel from the western shore to the eastern shore of the Cove. A YMCA facility is proposed for the western portion of the Property while retail stores and a gas station have been constructed on the eastern portion of the Property. Construction of a high school is currently proposed for the area of the Property between the proposed YMCA facility and the existing retail establishments.

This Work Plan proposes to investigate potential site impacts on Mashapaug Cove, which is immediately adjacent to the Park Parcel. Upon completion of this investigation, it will be determined if additional investigation of Mashapaug Pond, beyond the Cove area, is necessary for delineation of nature and extent and to assess risks potentially associated with the Site.

In 1999, a Method 1 risk assessment (consistent with the Remediation Regulations) that was conducted for all of the property except the Park Parcel identified remedial requirements for

continued industrial/commercial use of the Property. An agreement between Textron and the City of Providence, who took possession of the Property, identified Textron's responsibility as cleanup to industrial/commercial land use requirements for the Property. Subsequently, a Remedial Action Work Plan (RAWP) was submitted in 2001 that identified the plan to achieve the industrial/commercial remedial requirements. Some components of the RAWP have been completed, others are on-going, and some will be implemented during redevelopment of the Property.

In 2002, a Work Plan for a risk assessment for the Park Parcel was submitted to RIDEM for review and approval. Subsequent to discussion with RIDEM representatives concerning their comments on the Work Plan, in August 2004, a Method 3 risk assessment (consistent with the Remediation Regulations) for the proposed use of the Park Parcel as a passive recreational area (MACTEC, 2004) was submitted to RIDEM for review and approval. Although no formal comments have been received on the document, based on recent discussions with RIDEM, the scope of the Park Parcel risk assessment should be expanded to evaluate human health and ecological risk for Mashapaug Pond, and in particular, Mashapaug Cove. A proposed Work Plan for the expanded risk assessment for the Park Parcel and Mashapaug Pond will be submitted to RIDEM following a review of this supplemental site investigation of the Cove.

This Work Plan identifies data collection activities to support the evaluation of the potential human health risks associated with the development, maintenance and recreational use of the proposed park and the potential risk associated with site-related constituents of concern (COC) (as identified in previous investigative reports and the approved RAWP) to ecological receptors in the cove. The human health risk assessment will identify the potential human receptors and associated exposure profiles based on the existing and most recently proposed land uses for the former manufacturing area and the Park Parcel.

The supplemental site investigation results will be incorporated into an expanded risk assessment for the Park Parcel. The expanded Risk Assessment will be used, consistent with the Remediation Regulations, to identify remedial requirements (if any) associated with site-related COCs in the surface water and sediments of Mashapaug Cove. The results of the survey for drums within the Cove will also be assessed to determine if any additional action is necessary.

2. GENERAL SITE INFORMATION

2.1 SITE HISTORY

The former Gorham Silver manufacturing site (the Property) was a 37-acre parcel of land where Gorham Silver engaged in the manufacture of silverware, both sterling and plated, and bronze castings from approximately 1890 to 1986. Operations included casting, rolling, polishing, lacquering, forging, plating, annealing, soldering, degreasing, machining, and melting. Vapor degreasers reportedly used trichloroethene (TCE), tetrachloroethene (PCE), and 1,1,1-trichloroethane (1,1,1-TCA). The Property is shown in Figure 2 as the area north of Adelaide Avenue. The Property includes the former manufacturing area (the southern portion of the property) as well as the Western Peninsula, the area bordering the southern and eastern portions of Mashapaug Cove, and further to the north, the northeast portion of the Property. Other than some historical groundwater pumping wells used for industrial purposes, no industrial or commercial activities are known to have occurred along the banks and shore of Mashapaug Pond or Mashapaug Cove, including the Western Peninsula. Fill material from the former manufacturing area extends to some portions of the pond's bank area, particularly along the southern shore of Mashapaug Cove.

In 1967, the business and Property were purchased by Textron. and operated as a division of that company until 1986, when Textron relocated the Gorham Division and sold the Property to the Winoker Group. The Winoker Group subsequently sold the Property to another group of investors, the Adelaide Development Corporation, which in turn sold the Property to the Seaman Equity Group. In 1990, Seaman defaulted on its taxes and the City of Providence foreclosed. The City of Providence currently owns the Property.

The Property, particularly the former manufacturing facility, has been the subject of environmental investigations and remedial activities beginning in 1985. In 1995, a Remedial Investigation Report (ABB-ES, 1995a) and a Supplemental Remedial Investigation Report (ABB-ES, 1995b) were prepared to assess site conditions, including the Park Parcel and Mashapaug Cove. A Supplemental Investigation Report (HLA, 1998a) was prepared in 1998 for the Park Parcel. In 1999, a Site Investigation Summary Report and Risk Assessment (HLA, 1999) was

prepared and submitted to RIDEM and in 2000, HLA prepared a Response to RIDEM Comments on the Site Investigation Summary Report and Risk Assessment (HLA, 2000).

In November 2002 MACTEC submitted a Method 3 Risk Assessment Work Plan (MACTEC, 2002) to RIDEM to assess the Park Parcel of the Property. Following review comments from RIDEM in September 2003, MACTEC submitted the Method 3 Human Health Risk Assessment – Park Parcel (MACTEC, 2004) to RIDEM in August 2004.

As shown in Figure 2, the eastern portion of the former manufacturing area has been redeveloped. This eastern portion now consists of a large supermarket, other retail stores, and a gasoline station. The area surrounding the new retail facilities is currently a paved parking lot and roadways. The western portion of the former manufacturing area has been proposed for the construction of a YMCA. Construction of a high school for the City of Providence was recently proposed for the area between the existing retail facilities and the proposed YMCA.

2.2 PHYSICAL DESCRIPTION OF PARK PARCEL AND SURROUNDING AREA

The Property is bordered to the east by railroad tracks (Figure 2). Adelaide Avenue and a residential neighborhood bound the Property to the south. To the north and west, the Property is bounded by Mashapaug Pond and a small inlet called Mashapaug Cove. On the opposite shore of Mashapaug Pond is an industrially-zoned area.

The embankments along the southern end of Mashapaug Cove are underlain by heterogeneous fill, consisting of granular reworked soils with lesser amounts of casting sands, construction and demolition and miscellaneous debris. The fill varies in thickness from one-foot at the northern edge of the former West Parking area to 20-feet along the southern shore of the Cove embankment (Figure 2).

A large portion of the Park Parcel is currently wooded and heavily vegetated. There is approximately 30-feet of difference in elevation between the former manufacturing facility upland parcel and the lower shoreline of Mashapaug Cove. The Western Peninsula has variable elevation and is a wooded environment. The peninsula is accessible via one or more paths. The tip of the peninsula is relatively more open than the wooded areas adjacent to it. The Cove shore

area is a small, relatively flat area at the bottom of the embankment with brush and saplings. In the area of the Upper Walking Trail, there is a very steep embankment between the proposed walking trail and the shore of Mashapaug Cove. The Eastern Peninsula has trees and vegetation, but is generally more open and accessible than the areas along the Upper Walking Trail.

2.3 SUMMARY OF ENVIRONMENTAL CONDITIONS

Environmental investigations have been carried out at the Site since 1985. The results of the earlier investigations were summarized in the Remedial Investigation Report (ABB-ES, 1995a). Subsequent environmental investigations by MACTEC have been documented in submittals to RIDEM which include a Supplemental Investigation Report (ABB-ES, 1995b). In December 1998 a Supplemental Site Investigation Report (HLA, 1998b) specific to the Park Parcel was submitted to RIDEM and then in 1999, a Site Investigation Summary Report and Risk Assessment (HLA, 1999) was prepared and submitted to RIDEM that addressed the whole Site, including the Park Parcel and Mashapaug Cove. This report was formally approved by RIDEM in a June 15, 2001 RIDEM Remedial Decision Letter.

Soil at the Property (particularly the former manufacturing facility parcel) has been impacted by historical industrial operations. Constituents of potential concern (COPC) in soils at the Site include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and total petroleum hydrocarbons (TPH). The north bank of the Cove is an area of exposed fill material. Variable concentrations of VOCs, polynuclear aromatic hydrocarbons (PAHs), metals and TPH are associated with these fill materials.

The available information indicates that no active industrial/commercial activities (other than withdrawal of groundwater for use in manufacturing operations) were conducted within the Park Parcel. The data suggest that impacted fill from the former manufacturing facility parcel impinges upon the southerly portion of the Park Parcel. That fill material contains metals and PAHs.

Groundwater beneath the Site flows predominantly in a northerly direction and discharges into Mashapaug Cove. There is a groundwater divide approximately parallel to the eastern property boundary, in the southeastern portion of the Site. The depth to groundwater beneath the Site

ranges from approximately 3-feet along the north bank area to 30-feet below grade in the southeastern area of the Site. Historical investigations have identified low levels of VOCs (PCE, TCE and 1,1,1-TCA) in groundwater entering Mashapaug Cove along the southern shore. There are no buildings proposed in the Park Parcel; therefore, potential vapor migration from groundwater to soil gas and indoor air of occupied buildings is not a concern for the Park Parcel. This VOC Plume has also been determined not to pose an ecological risk to aquatic life within the Cove (Section 2.3; MACTEC, 2004).

Groundwater beneath the Site is classified as GB, as it has been designated as not being suitable for public or private drinking water use. As of 1995 groundwater beneath the Site was not used as a source of drinking water and there were no public or private wells within a four-mile radius of the Site (ABB-ES, 1995). The nearest public water supply is the Scituate Reservoir located approximately nine miles to the west.

Mashapaug Pond has been classified as having Class C water quality or eutrophic conditions (low dissolved oxygen and excessive algae/nutrients). According to this classification, the water is not suitable for drinking purposes; however, it is suitable, with certain restrictions, for recreational activities. In August 2002, RIDEM and Rhode Island Department of Health (RIDOH) issued a letter (RIDEM and RIDOH, 2002a) to inform the public concerning water quality in Mashapaug Pond and to identify safe uses of the pond (Appendix A). That letter concluded that fish caught from the pond are not safe to eat due to contamination by polychlorinated biphenyls (PCBs) and dioxins, that bacteria levels are apparently high following rainstorms rendering the pond unsafe for swimming, and blue-green algae found in the pond can produce toxins that can harm humans and animals that swim in or drink pond water during algal blooms, further rendering the pond unsafe for direct contact and consumption at those times. None of these conditions has been attributed to conditions at the Park Parcel itself or the former manufacturing facility.

A "Do's and Don'ts Flyer" was released by RIDEM and RIDOH (RIDEM and RIDOH, 2002b) that indicates that catch and release fishing and boating are safe activities for Mashapaug Pond (Appendix A). The flyer strongly urges people not to drink pond water, not to eat fish caught in the pond, not to swim, wade, play, or bathe in pond water, and not to boat whenever thick scum, algal mats, or foul odors occur on the pond. This advisory concerning safe uses of the pond

indicates that a park visitor would be unlikely to have significant exposures to Site-related constituents during recreational activities at the pond.

Constituents detected in sediments and surface soils adjacent to the Cove include TPH, SVOCs and metals. Sediment samples from drainage swales and erosion channels that serve as a pathway for the discharge of site materials into Mashapaug Cove showed sporadic detections of SVOCs, TPH, and some metals. Surface soil samples from low lying areas adjacent to the Cove also showed some detections of metals.

3. HISTORICAL DATA AND POTENTIAL DATA GAPS

MACTEC has reviewed soil and groundwater data collected between 1985 and 2002 for the upland portions of the former manufacturing area and the Park Parcel, and surface water and sediment in Mashapaug Cove and Mashapaug Pond. The following text includes a brief summary of pertinent surface water and sediment data from within both the Mashapaug Cove and Mashapaug Pond, groundwater discharge to Mashapaug Cove and surface soil data from along the banks of the Cove. This data was then compared to site-related constituents identified on the Site to identify potential data gaps that would support the risk assessment for this Park Parcel.

3.1 INITIAL DATA EVALUATION

The following subsection summarizes the surface water and sediment data collected related to Mashapaug Cove and Mashapaug Pond, and groundwater and surface soil associated with the banks of the Cove.

Surface Water

A summary of the surface water samples collected from Mashapaug Pond and analyses conducted is presented in Appendix B as derived from CDM's 1993 Site Inspection Report (CDM, 1993). Surface water samples were first collected by the University of Rhode Island (URI) in 1985 at two locations (Figure 3, W3 and W5) and analyzed for metals. These data were non-detect. In 1987 RIDEM collected a surface water sample from the Pond on the outside of the Site's western peninsula; low concentrations of VOCs were found in this surface water sample (11 micrograms per liter (ug/L) trans 1,2-dichloroethene (DCE), 3 ug/L 1,1,1-TCA, 19 ug/L TCE and 1 ug/L PCE, Figure 3). In 1986 Goldberg Zoino & Associates (GZA) also collected one surface water sample (Mashapaug Pond [MP]-1) in Mashapaug Cove and analyzed the sample for VOCs. It was found to contain 22 ug/L TCE and 24 ug/L of cis-1,2 DCE. GZA then collected more surface water samples from MP-1, MP-2 and two sample locations along the western and southern banks of the Cove at surface water discharge points into the Cove. VOC analysis of these samples only reconfirmed the presence of TCE at MP-1 while no VOCs were detected at the other surface water sample locations.

In 1999 MACTEC collected four surface water samples from Mashapaug Pond. One sample was collected from the Pond near the mouth of Cove (SW-1) and three from inside the Cove (SW-2, SW-

3, and SW-4) as shown on Figure 4. SW-1 was collected as a background sample to determine potential effects of groundwater discharge from the Site on surface water quality. Based on historical Pond data these samples were analyzed for VOCs. SW-1 was found to contain 3 ug/L of cis 1,2-DCE and 1 ug/L of TCE, while the surface water samples (SW-2, SW-3 and SW-4) within the Cove detected cis-1,2 DCE (4-6 ug/L) and TCE (1-2 ug/L) (Appendix C).

Nutrient data was also collected six times from throughout the Mashapaug Pond by URI between 1999 and 2001. The Narragansett Bay Commission also collected five surface water samples from Mashapaug Pond for metals analyses. A summary of this data derived from the U. S. Environmental Protection Agency (USEPA) Data Review for Mashapaug Pond, dated August 2001 (USEPA, 2001), is presented in Figure 3 and Appendix D. Cadmium and copper were found at the highest concentrations along the southwest bank of the Pond, while chromium and silver were equally distributed throughout the Pond. It should be noted that surface water sample W5, located in the deepest portion of the Pond was non-detect for metals. This data also confirmed the identification of high nutrient and fecal coliform concentrations and bacteria counts in the surface water outside the Cove; these high bacteria counts resulted in the posting of restrictions on recreational activities in Mashapaug Pond by RIDEM and RIDOH in 2002 (Appendix A).

Further investigation of Mashapaug Cove surface water was conducted by MACTEC in 1994 and 1995 to assess the potential for contamination of the Cove surface water from storm water discharge from the Site. As discussed in Subsection 2.1 and 2.2 of the August 2004 Method 3 Human Health Risk Assessment – Park Parcel (MACTEC, 2004), two water storm water samples were collected in 1994 from the north bank area during a rain event and were analyzed for VOCs, TPH and total TAL inorganics. TCE was detected in one sample (SR-001) at 8 ug/L and is likely due to precipitation that infiltrated through fill material and drained into the storm water discharge pipe (MACTEC, 2004). Low concentrations of metals were found in the storm water, while no TPH was detected.

Sediments

A summary of the sediment samples collected from Mashapaug Pond and analyses conducted is presented in Appendix B as derived from CDM's 1993 Site Inspection Report (CDM, 1993). Beginning in 1985, URI collected three sediment samples from Mashapaug Pond and one sediment sample from within Mashapaug Cove (Figure 3). These samples were analyzed for PAHs, PCBs and metals. PAHs and lead concentrations were greatest at the northern most end of Mashapaug Pond,

while PCBs were uniformly distributed throughout the entire Pond. Among the four sediment samples, the sample collected within the Cove contained the highest concentrations of cadmium, chromium, copper, nickel, silver and zinc. These analytical results are summarized on Figure 3. In 1987 RIDEM collected one sediment sample from the Pond on the outside of the Site's western peninsula; metals, VOCs and PCBs were all non-detect at this sample location (Figure 4).

Cove Bank Surface Soils

Soils found on the surface of the bank to Mashapaug Cove may be indicative of COPC found in the Cove surface water and sediment. In 1987 RIDEM collected a surface soil sample from a drainage ditch leading along the bank leading into the Cove. This soil sample was analyzed for TPH, PCBs and metals. TPH was found to be approximately 75,000 parts per million (ppm) while the PCBs and metals were non-detect (RIDEM, 1987). Surface soil sampling was also conducted by MACTEC in 1994, 1998, 2001 and 2002 that include both surface soils and surface sediment found in erosion channels along the bank that lead into the Cove (SD-001 through SD-008). Both the 1994 and 1998 surface soil analytical results for VOCs, SVOCs, TPH and metals are presented in the Supplemental Site Investigation Report Proposed Park Subdivision, dated December 1998 (HLA, 1998). Appendix E of this work plan presents a summary of the 1994 and 1998 SVOCs and metals detected in the surface soil samples along the bank of the Cove. These COPCs include TPH and PAHs and metals.

Additional surface soil sampling was conducted along the bank of the Cove in 2001 and 2002 by MACTEC. This soil sampling program is summarized and results are presented in Subsection 2.3 of the Method 3 Human Health Risk Assessment – Park Parcel (MACTEC, 2004). Samples SS-300 through SS-306 were collected from the Cove shore area (Figure 4). These surface soil samples were analyzed for VOCs, PAHs and metals and the analytical results are presented in Appendix F. Arsenic was consistent with background concentrations except for the isolated area on the northeastern shore of the Cove (BK-4). Lead was found in the surface soils along the shoreline of the Cove and copper was found at increased concentrations along the western boundary area along Mashapaug Cove (MACTEC, 2004).

Drums

RIDEM reported in 1987 the presence of a drum in Mashapaug Cove. This drum was rusted and in pieces. RIDEM collected a sample of the material within the drum and analyzed it for metals and PCBs. All compounds were non-detect (RIDEM, 1987).

3.2 CONCEPTUAL SITE MODEL

The conceptual Site model identifies potential source areas from which site related oil or hazardous materials (OHM) may have been released, the migration pathways through which OHM may have been transported and/or translocated to surface water and sediments of Mashapaug Cove, and the locations where possible exposure may occur. The conceptual Site model provides a framework for understanding sources of OHM, migration pathways, identification of potential receptors, and development of exposure profiles. A discussion of the Site and potential source areas of contamination is provided in Sections 1 and 2 of this work plan and previous reports as referenced.

Contamination at the Site is predominantly TPH, PAHs and metals in soils and sediment, and chlorinated VOCs and petroleum in groundwater. The following represents a summary of current site conditions and planned reuse for the Park Parcel as presented in the 2004 Method 3 Risk Assessment for the Park Parcel (MACTEC, 2004) and the 1999 Site Investigation Summary Report (HLA, 1999):

- Soil containing fill and other industrial residuals (collectively termed "fill") from past operations at the adjacent former industrial parcel are present in portions of the Park area.
- The entire Park Parcel does not exhibit contamination – a significant portion of the Park Parcel (approximately 50%) appears to be free of site-related fill.
- Predominant constituents of fill are metals (copper, silver, and lead), PAHs, and limited petroleum residuals.
- The TPH in soil is associated with releases from former underground storage tanks (USTs) located in the Central Portion of the Site.
- Arsenic in soil appears to be uniformly distributed in soils at the Site and does not appear to be associated with fill material. As discussed in previous reports (HLA, 1999, 2000), arsenic concentrations in uncapped soils on the undeveloped upland parcel may be representative of background concentrations found in this urban area.
- Exposed surface soils from the former UST area and exposed fill materials along the embankment could be transported in surface water runoff along the drainage swales and erosion channels along the embankment bordering the southern shore of Mashapaug Cove. Surface soil and fill could be transported and deposited in the Cove.

- Groundwater beneath the Site flows predominantly in a northerly direction and discharges to the Mashapaug Cove. The depth to groundwater beneath the Property ranges from approximately 3-feet along the north bank area to 30-feet below grade in the southeastern area of the Site.
- There is a plume containing low levels of VOCs flowing into the Cove near the southern shore. The source area of the VOC groundwater contamination is beneath former Buildings W and T, located in the south-central portion of the Property.
- Groundwater near the Park Parcel and the surface water within Mashapaug Cove was previously tested for VOCs which were determined not to be an issue with respect to migration to Mashapaug Cove (potential aquatic life concerns).

3.3 POTENTIAL RECEPTORS

Potential Human Receptors – Mashapaug Cove

Potential human receptors at Mashapaug Cove might include potentially any visitors to the Park Parcel such as neighborhood or other local residents (all age groups), high school students and employees (if the school is built), clients and employees of the proposed YMCA facility (if it is built), maintenance personnel for the Park Parcel, perhaps local recreational anglers, and possibly boaters/canoers. Depending on the reason for their visit and the final design of the proposed Park and its walking trail, receptors might have varied exposures to soil, sediments, and surface water. It is likely that potential direct contact exposure to sediments would be more likely to occur at the shoreline of the Cove, where water is very shallow, rather than in the middle of the open water area where contact with bottom sediments is actually unlikely. The Cove is very shallow, in most areas has a mucky bottom, and is heavily vegetated during the summer months. Those conditions are not condusive to recreational swimming by park visitors. In addition, advisories from RIDEM and RIDOH discourage people from contacting the surface water due to off-site, storm water related bacterial problems and nutrient-related blue-green algae blooms in the Pond (Appendix A). While recreational anglers might visit the Pond, their exposures are more likely to be associated with surface water and sediment contact rather than fish consumption. The RIDEM/RIDOH advisory indicates that fish from Mashapaug Pond should not be eaten because of dioxin and PCBs that have been detected in fish samples from the Pond.

The actual list of human receptors that would be evaluated in the expanded risk assessment as well as the exposure profiles for those receptors will be derived during the future risk assessment activities.

Potential Ecological Receptors – Mashapaug Cove

Potential ecological receptors for surface water and sediments of the Cove could potentially include aquatic and emergent plants, benthic invertebrates, amphibians, fish, reptiles, semi-aquatic wildlife, and birds. During the development of a risk assessment work plan and a habitat assessment, representative receptor groups or species will be identified as the focus of the future screening level ecological risk assessment and for a more comprehensive ecological risk assessment (if required).

3.4 DATA GAPS

In order to complete the risk assessment for the Park Parcel, including Mashapaug Cove, we reviewed the historical Site data and Mashapaug Cove/Pond data, and the potential human health and ecological receptors identified for the Park Parcel and Mashapaug Cove under the existing and expected future use scenarios. Based on this data review the following data gaps for surface water and sediment were identified that will be addressed under the proposed Supplemental Site Investigation activities. Figure 4 presents the proposed surface water and sediment sample locations.

Tables 1 and 2 present the proposed surface water and sediment sample rationale and analytical parameters. An electromagnetic (EM) survey will also be conducted to evaluate the potential presence of drums within the Cove.

Surface Water

The most recent surface water samples from the Cove were collected in 1999. The three samples collected from the Cove (SW-2, SW-3 and SW-4, Figure 4) and the one background sample collected from the boundary of the Cove (SW-1) were analyzed for VOCs. Those samples contained low levels of chlorinated solvents.

In order to evaluate potential human health and ecological risks associated with site-related constituents, an additional sampling round should be conducted, with analysis for site-related

constituents that may have or may be migrating from the Site to the Cove, including VOCs, PAHs, and metals. We are proposing to collect additional surface water samples, within the Cove (Figure 4). Cove surface water samples will be collected in locations intended to be representative of the entire Cove and will include locations that are appropriate to characterize potential impacts to surface water associated with existing discharge points (SD-002, SD-005, SD-008 and Stop & Shop storm water discharge pipe) and the location of the northern groundwater VOC plume (GZA-5, Figure 4).

Three surface water samples will be collected from outside the mouth of the Cove (SW-10 through SW-12), beyond the end of the Park Parcel, to further bound the site-related COPCs, and establish background conditions for the Cove (Figure 4). Finally, twelve surface water samples (SW-16 through SW-27) will be collected within the inner Cove to address the drainage discharge points and VOC plume nature and extent, potential near shore human health exposure and ecological exposures (SW-16 through SW-27). A total of three quality assurance/quality control (QA/QC) surface water samples will also be collected. All of these surface water samples will be analyzed for VOCs, PAHs, total and dissolved metals and hardness (Table 1).

Sediment

Only one historical sediment sample has been collected from within Mashapaug Cove. We are proposing to collect additional sediment samples, both within the Cove and immediately outside the mouth of the Cove. Sediment samples will be collected in the Mashapaug Cove immediately downgradient of the three existing erosion channel discharge points and near the storm water drainage outfall on the northern bank of the Cove. Other sediment samples will be collected along the shoreline and in the open water portion of the Cove to characterize human health and ecological receptor exposures (Figure 4).

Three sediment samples will be collected from the area immediately outside of the Cove, to further define the site-related COPCs and to establish background conditions for the Cove (SED-10 through SED-12, Figure 4). Another three sediment samples will be collected from between the peninsulas and the Property boundary (SED-13 through SED-15, Figure 4) to address nature and extent. Finally, twelve sediment samples will be collected within the inner Cove to address the 4 discharge points, VOC plume and human health and ecological exposures (SED-16 through SED-27). These sediment samples will be analyzed for PAHs, total metals, and total organic

carbon (TOC). In addition, SED-20, SED-22, SED-24 and SED-26 will be analyzed for acid volatile sulfides/simultaneously extracted metals (AVS/SEM) to address the 4 discharge points. AVS/SEM is used to determine if sufficient sulfides are present in the sediment to limit the bioavailability of metals; the toxicity of metals to ecological receptors is limited if the AVS is in excess of SEM. The rationale and summary of analytical parameters for the sediment are presented in Table 2.

The locations of sediment and surface water samples representative of human and ecological exposures for the Cove may not be completely consistent with each other. Human health exposures to surface water and sediment would most likely occur near the shoreline where wading may occur. Sediment exposure for people would almost always be limited to areas where the depth of surface water is one or two feet or less. Human exposure to sediments in the middle of the Cove would not be expected at all. Ecological aquatic receptors would be present throughout the Cove so representative exposures would not be limited to the near-shore areas for those aquatic receptors, but instead would be throughout the Cove.

It should be noted that there is a storm water management system currently in place (it drains the redeveloped portion of the property) that includes a storm water collection basin (located behind the supermarket building) and a storm water discharge outlet pipe for the system is located on the southeastern shoreline of the Cove. This storm water management system may have an impact (potentially metals and PAHs) on surface water and sediment quality within the Cove, particularly in the area of the discharge.

One assumption that is incorporated into this sampling and analysis plan design is that if the Cove has been or is being impacted by the Property, that impacts would be greater near the Cove shoreline adjacent to the former manufacturing area (southern shore of the cove) and the storm water discharge points than they would be in the portion of the Cove that is further from the former manufacturing area and storm water discharge points. At some point, conditions away from the potential source areas would likely be representative of background conditions in the Cove. These background conditions in this urban pond are likely the result of cumulative impacts of point sources and non-point sources throughout the drainage area of the Pond. Additional investigation beyond that proposed here may be necessary to determine the background

conditions and to distinguish the potentially site-related area (if there is one) from the background condition.

Drums

The EM survey will be conducted within the Cove. This will be done in a cross grid pattern (90° to each other) at approximate distances of 10-feet between each grid line. Global Positional System (GPS) will be used with the EM to track the survey points and potential findings. If metal debris/drums are identified, sediment samples will be collected in the immediate vicinity and will be analyzed for site-related COPCs including VOCs, PAHs, and thirteen Priority Pollutant Metals.

Bank Area

A visual inspection of the Park Parcel will be conducted along the bank of the Mashapaug Cove for the presence of surficial debris. If found this debris will be located by GPS, photographed and removed in an expeditious manner.

No surface soil sampling is required as the bank of the Mashapaug Cove has been adequately characterized to the top of the slope at the proposed walking trail. These prior samples include sediment (depositional sediment, not aquatic sediment) samples along the three erosion channels located along the bank of the Cove.

No sampling and analysis of fish tissue or any other biota tissue is proposed for this phase of investigation. The results of the initial phase of surface water and sediment investigation will be used, in conjunction with exposure models and food chain evaluation models, to determine if the site-related impacts (if any) to surface water and sediment have the potential to translate into a substantial ecological food chain exposure for ecological receptors (particularly semi-aquatic wildlife and birds). If the evaluation of site-related constituents in surface water and sediment concludes that food chain exposures might be substantial, additional investigation to address that issue may be proposed. With respect to fish tissue data for human health risk assessment, there is an advisory in place that indicates that fish from the pond should not be consumed. In addition, the results from the proposed surface water and sediment investigation will be used to determine if accumulation of site-related constituents in fish tissue from sediments and surface water might

potentially represent a substantial human exposure (again using modeling techniques to evaluate accumulation potential).

4. SAMPLING PROGRAM

The following text is a general description of the method and equipment to be used to collect the supplemental surface water and sediment samples from Mashapaug Cove.

4.1 SURFACE WATER

A total of 18 surface water grab samples will be collected from Mashapaug Cove as shown on Figure 4. This will include two duplicate samples and a matrix spike/matrix spike duplicate (MS/MSD) for QA/QC. Three of these samples will be collected from outside the Cove to provide a sufficient background data set for the future risk assessment (SW-10 through SW-12, Figure 4). A flat bottomed boat will be used to access Mashapaug Cove. The sampling crew will use an anchor and steel pole driven into the pond bottom, if possible, to maintain their position on the selected sampling location. GPS coordinates will be taken for each surface water sample location.

All surface water samples will be collected from the middle of the water column.

Surface water samples will be collected following the general procedures provided below:

- Measure depth of water at the sample location, being careful not to disturb the pond sediment.
- Surface water samples will be collected using either a stainless steel Bomb sampler, a Beta depth sampler or similar device; all sampling devices will be decontaminated prior to first use at each surface water sample location.
- Retrieve the sampler and fill the appropriate sample containers.
- Record the pH, specific conductivity, temperature, salinity, turbidity, dissolved oxygen (DO), sampling device used, date and time, name of samplers, etc. of the sample on the field data sheets.
- Finally, decontaminate the sampler device before reuse.

All surface water samples will be stored in laboratory-prepared sample bottles. All samples will be maintained in chain-of-custody controlled sample coolers for shipment to the laboratory. Surface water samples will be analyzed for VOCs (USEPA Method 8260b), PAHs (USEPA

Method 8270c) and filtered and unfiltered 13 Priority Pollutant Metals (Table 1). Shipment of the coolers will include a trip blank for QA/QC.

4.2 SEDIMENT

A total of 21 composite sediment samples will be collected from Mashapaug Cove as shown on Figure 4. All sediment samples will be collected from 0-6 inches in depth. This will include one duplicate sample and a MS/MSD for QA/QC. Three of these samples will be collected from outside the Cove at the same locations as the background sample locations (SED-10 through SED-12, Figure 4). These samples will provide a sufficient background data set for the future risk assessment. The sampling crew will use an anchor and steel pole driven into the pond bottom, if possible, to maintain their position on the selected sampling location. GPS coordinates will be taken for each surface water sample location.

Sediment samples will be collected following the general procedures provided below:

- Sediment samples may be collected using either an Ekman dredge (shallow areas), Ponar dredge (deep areas) or vibracore sampler. All sampling devices will be decontaminated prior to use.
- AVS/SEM samples will only be conducted at the storm water discharge points (SED-20, SED-22, SED-24 and SED-26).
- AVS/SEM samples will be collected from an undisturbed portion of one of the early grabs at the four sediment sampling locations. Care will also be taken during the sample container filling to ensure that the sediment matrix disturbance is minimized (no mixing or blending). AVS/SEM sample containers will be completely filled, leaving no headspace. After filling the AVS/SEM containers, any remaining sediment will be placed into a decontaminated stainless steel mixing bowl.
- Subsequent sediment collected for additional volume for the composite sample will be placed into the stainless steel mixing bowl and a sediment description will be recorded on the field data collection form.
- The sample will then be thoroughly homogenized by hand mixing using a decontaminated scoop or large mixing spoon. After mixing, the sample will be transferred to the appropriate sample containers.

- The type of sediment sampling device used, penetration depth of the sampler, sample recovery, water depth, sediment description, date and time, sampler names, etc. will be recorded on the sample data form.
- All sediment samples will be collected from 0-6 inches in depth' in order to obtain a quantity of sediment that is sufficient for all chemical analyses, two or more sediment cores may be collected from each of the sample locations; compositing of these samples will be conducted at the site.

All sediment samples will be stored in laboratory-prepared sample bottles and will be maintained in chain-of-custody controlled sample coolers for shipment to the laboratory. Sediment samples will be analyzed for PAHs (USEPA Method 8270c), total 13 Priority Pollutant Metals, TOC, and AVS/SEM (4 samples only). Table 2 presents the proposed sediment sampling rationale and analytical parameters. Shipment of the coolers will include a trip blank for QA/QC.

Additional sediment samples may be collected in potential drum disposal areas, if found within the Cove. These samples will be collected in the same manner as described above and will be analyzed for VOCs, PAHs, and thirteen Priority Pollutant Metals.

5. REFERENCES

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