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Remedial Action Work Plan for Current Use of Forrest Street and Forrest Street Properties (Soil)

Final (Revision 1)

NJDEP Program Interest Number: 775706

PPG Garfield Avenue Group
Hudson County Chromate Sites
Jersey City, New Jersey

Document No. FOR-022C

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List of Acronyms, Abbreviations, and Definitions

ACO	Administrative Consent Order
AOC	Area of Concern
ARS	Alternative Soil Remediation Standard
bgs	below ground surface
CCPW	Chromate Chemical Production Waste
CCPW-related impacts	Impacts related to Chromate Chemical Production Waste, inclusive of visible impacts (i.e., Chromite Ore Processing Residue, green gray mud) and non-visible impacts (i.e., analytically detected exceedances of hexavalent chromium, antimony, total chromium, nickel, thallium, and vanadium)
COC	chain of custody
COPR	Chromite Ore Processing Residue
Cr	chromium
Cr^{+6}	hexavalent chromium
Cr^{+3}	trivalent chromium
CrSCC	Chromium Soil Cleanup Criteria
DGA	dense-graded aggregate
DIGWSSL	Default Impact to Ground Water Soil Screening Level
EDD	electronic data deliverable
EDR	Environmental Data Resources, Inc.
Eh	oxidation-reduction potential (also referred to as ORP)
El.	elevation
EPCRA	Emergency Planning and Community Right-to-Know Act
FB-H	FerroBlack®-H
FSP-QAPP	Field Sampling Plan/Quality Assurance Project Plan
ft	foot or feet
GA Group	Garfield Avenue Group
GCCM	geosynthetic cementitious composite mat
GWQC	Ground Water Quality Criterion
HASP	Health and Safety Plan
HDPE	high-density polyethylene
HEPSCD	Hudson-Essex-Passaic Soil Conservation District
IGWSRS-GAG	Site-Specific Impact to Ground Water Soil Remediation Standards
IRM	Interim Remedial Measure

JCRA	Jersey City Redevelopment Agency
JCO	Judicial Consent Order
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LSRP	Licensed Site Remediation Professional
MDL	method detection limit
mg/kg	milligrams per kilogram
MGM	million gallons per month
MGP	manufactured gas plant
MGP-related impacts	Impacts related to manufactured gas plant operations that have emanated from Site 114 onto Forrest Street and/or Forrest Street Properties
mil	millimeter
MRCE	Mueser Rutledge Consulting Engineers
MS	matrix spike
MSD	matrix spike duplicate
µg/L	micrograms per liter
NAVD88	North American Vertical Datum of 1988
NJ	New Jersey
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJGIN	New Jersey Geographic Information Network
NRDCSRS	Non-Residential Direct Contact Soil Remediation Standards
PBR	Permit-by-Rule
PI	Program Interest
PDI	Preliminary Design Investigation
PSEG	Public Service Electric and Gas Company
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RAO	Response Action Outcome
RAP	Remedial Action Permit
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan
RDCSRS	Residential Direct Contact Soil Remediation Standards

RI	Remedial Investigation
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
RPD	relative percent difference
SESCP	Soil Erosion and Sediment Control Plan
SOP	standard operating procedure
SRP	Site Remediation Program
SRS	Site Remediation Standard
SSRIR	Supplemental Soil Remedial Investigation Report
SVOC	semi-volatile organic compound
TEE	terminal excavation elevation
TEP	Technical Execution Plan
TOC	total organic carbon
TRSR	Technical Requirements for Site Remediation
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WAP	Water Allocation Permit
WUR	Water Use Registration

Executive Summary

This Remedial Action Work Plan (RAWP) has been prepared by AECOM on behalf of PPG to evaluate and propose the remedial alternatives for the portions of Forrest Street and Forrest Street Properties where full remedial excavation is not appropriate at this time based on Forrest Street Properties' current commercial/industrial use. This RAWP addresses remediation of:

- Chromate Chemical Production Waste (CCPW) and CCPW-impacted soil; and
- Soil impacted by manufactured gas plant (MGP)-related constituents associated with the former Halladay Street Gas Works MGP.

Forrest Street and Forrest Street Properties (the Site) is part of the Garfield Avenue Group (GA Group) Sites, which include Sites 114, 132, 133, 135, 137, 143, and 186, and adjacent roadways and properties (**Figure 1-1**). Site 114 is the former location of a chromite ore processing facility previously owned by PPG, and the former Halladay Street Gas Works MGP previously owned by Public Service Electric and Gas Company (PSEG). Forrest Street and Forrest Street Properties are tracked under the New Jersey Department of Environmental Protection (NJDEP) Site Remediation Program (SRP) Program Interest (PI) number 775706.

Forrest Street is located west of Halladay Street in Jersey City, New Jersey (NJ). Forrest Street Properties is comprised of the properties located at 84, 86/90, 98/100, and 108 Forrest Street in Jersey City, NJ. Forrest Street Properties is identified as Block 21501, Lots 11, 12, 14, and 15 in the Jersey City Parcel Data from the New Jersey Geographic Information Network (NJGIN), last updated October 6, 2015 (available at: https://njgin.state.nj.us/OGIS_IW; last accessed in November 2019) (**Figure 1-2**).

This RAWP addresses only the soil impacts for which PPG is responsible under the *Administrative Consent Order* (ACO) (NJDEP, 1990) and the *Partial Consent Judgment Concerning the PPG Sites* (Judicial Consent Order [JCO]) (Superior Court of New Jersey Law Division – Hudson County, 2009). PPG is responsible for visible CCPW and CCPW-related impacts.

PPG and PSEG are jointly responsible for remediation of MGP-related impacts that have emanated from Site 114 into Forrest Street and Forrest Street Properties. PSEG is taking the lead on closing out MGP-related impacts in accordance with the Licensed Site Remediation Professional (LSRP) Program under PI number G000005480, activity number LSR120001, per the July 2019 agreement between PPG and PSEG (PPG and PSEG, 2019). MGP-related information has been included in this RAWP for informational purposes only. The MGP Areas of Concern (AOCs) identified herein are superseded by MGP AOCs established by PSEG and are no longer relevant. Information required to document remediation of MGP-related impacts will be presented by PSEG in their forthcoming Remedial Action Report (RAR).

At Forrest Street, constituents covered by this RAWP include:

- Visible CCPW and hexavalent chromium (Cr^{+6});
- CCPW-related metals (antimony, total chromium [Cr], nickel, thallium, and vanadium);

- Select MGP-related semi-volatile organic compounds (SVOCs) (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and naphthalene); and
- Select MGP-related volatile organic compound (VOC) (benzene).

At Forrest Street Properties, constituents covered by this RAWP include:

- Visible CCPW and Cr^{+6};
- CCPW-related metals;
- Select MGP-related SVOCs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and naphthalene); and
- Select MGP-related VOC (benzene).

Under the ACO and JCO, PPG is not responsible for other constituents exceeding the NJDEP Soil Remediation Standards (SRS) or Default Impact to Groundwater Soil Screening Levels (DIGWSSLs) that may be present at the Site. Remediation of non-CCPW-related constituents and constituents not associated with operation of the former Halladay Street Gas Works MGP, including those associated with historic fill remaining at the Site, is the responsibility of the property owners under the LSRP program. This RAWP addresses only the soil impacts for which PPG is responsible under the ACO and JCO.

The primary remedial approach at Forrest Street and Forrest Street Properties included the excavation and removal of visible CCPW and soil with concentrations of Cr^{+6} greater than the Chromium Soil Cleanup Criteria (CrSCC), as described in the *Final Remedial Action Work Plan (Soil) Rev. 4, Garfield Avenue Group Sites, Jersey City, New Jersey* (RAWP) (GA Group RAWP) (AECOM, 2018c) and the technical memorandum entitled *Forrest Street and Forrest Street Properties – Proposed Terminal Excavation Elevations Submittal (Revision 1),* March 30, 2017 (Forrest TEE) (AECOM, 2017b). Remedial excavation and backfilling was conducted from March 2017 to September 2017, as documented in the *Draft Remedial Action Report, Forrest Street (AOC FS-1A, AOC FS-1B, AOC FS-1C, AOC FS-2A, AOC FS-2B, and AOC FS-2C) Soil*, February 2019 (Forrest Street RAR) (AECOM, 2019b) and *Draft Remedial Action Report, Forrest Street Properties (AOC FSP-1A, AOC FSP-1B, AOC FSP-2A, and AOC FSP-2B) Soil*, January 2019 (Forrest Street Properties RAR) (AECOM, 2019a).

This RAWP evaluates remedial alternatives for the portions of Forrest Street and Forrest Street Properties where excavation was not possible due to structural concerns for the buildings at 84 and 86/90 Forrest Street (Block 21501, Lots 11 and 12) and 98/100 Forrest Street (Block 21501, Lot 14) and existing nearby subsurface utilities, which are currently used for commercial purposes. For the purpose of this remedial alternative evaluation, Forrest Street and Forrest Street Properties were subdivided into multiple areas based on the current use. Within each current-use remediation area, AOCs were identified based on the contaminant type and property. The identified current-use remediation areas and associated AOCs are:

- 100 Forrest Street Offset
    - AOC FSP-1B: For CCPW-impacted soil within Lot 15
    - AOC FSP-2B: For MGP-impacted soil within Lot 15

    - AOC FSP-1C: For CCPW-impacted soil within Lot 14
    - AOC FSP-2C: For MGP-impacted soil within Lot 14
- 84 Forrest Street Building Footprint and Loading Dock
    - AOC FSP-1D: For CCPW-impacted soil within Lots 11 and 12
- Forrest Street Utility Offset
    - AOC FS-1B: For CCPW-impacted soil within Forrest Street
    - AOC FS-2B: For MGP-impacted soil within Forrest Street
    - AOC FSP-1E: For CCPW-impacted soil within Lot 14
    - AOC FSP-2E: For MGP-impacted soil within Lot 14
- 90 Forrest Street Alleyway
    - AOC FSP-1F: For CCPW-impacted soil within Lots 12 and 14
- 98/100 Forrest Street Building Footprint
    - AOC FSP-1G: For CCPW-impacted soil within Lot 14
- 100 Forrest Street Loading Dock Driveway
    - AOC FS-1C: For CCPW-impacted soil within Forrest Street
    - AOC FS-2C: For MGP-impacted soil within Forrest Street
    - AOC FSP-1H: For CCPW-impacted soil within Lot 14
    - AOC FSP-2H: For MGP-impacted soil within Lot 14
- 86/90 Forrest Street Building Footprint
    - AOC FSP-1I: For CCPW-impacted soil within Lots 11 and 12
- 90 Forrest Street Boiler Room Basement
    - AOC FSP-1J: For CCPW-impacted soil within Lot 12
- Grid GG15B
    - AOC FSP-1K: For CCPW-impacted soil within Lot 12

Areas of Concern within Forrest Street and Forrest Street Properties where full remedial excavation was previously conducted are not covered by this RAWP, including:

- Forrest Street Excavation Area
    - AOC FS-1A: For CCPW-impacted soil within the Forrest Street Excavation Area
    - AOC FS-2A: For MPG-impacted soil within the Forrest Street Excavation Area
- Forrest Street Properties Lot 15 Excavation Area
    - AOC FSP-1A: For CCPW-impacted soil within the Forrest Street Properties Lot 15 Excavation Area
    - AOC FSP-2A: For MPG-impacted soil within the Forrest Street Properties Lot 15 Excavation Area

The remedial objectives for these AOCs are the prevention of direct contact with, ingestion of, and inhalation of CCPW-related impacts and non-CCPW-related impacts emanating from Site 114 to Forrest Street and Forrest Street Properties with concentrations exceeding applicable criteria. The selected Remedial Actions for each of the current-use remediation areas (which include engineering controls and institutional controls and, in limited cases, source removal) are proposed as follows:

- 100 Forrest Street Offset (AOC FSP-1B, AOC FSP-2B, AOC FSP-1C, and AOC FSP-2C)
    - Engineering Control: 100 Forrest Street Offset high-density polyethylene (HDPE) Liner Overlain with dense-graded aggregate (DGA) and Either an Asphalt Cap or geosynthetic cementitious composite mat (GCCM)
    - Institutional Controls: Deed Notices on Lots 14 and 15
- 84 Forrest Street Building Footprint and Loading Dock (AOC FSP-1D)
    - Engineering Control: 84 Forrest Street Loading Dock Engineering Control (consisting of a new concrete block wall, an HDPE liner between the new and existing concrete block wall, an epoxy material, a protective wearing surface, and dock bumpers)
    - Institutional Controls: Deed Notice on Lots 11 and 12
- Forrest Street Utility Offset (AOC FS-1B, AOC FS-2B, AOC FSP-1E, and AOC FSP-2E)
    - Engineering Control: HDPE Liner
    - Institutional Controls: Notice in Lieu of Deed Notice on Forrest Street and Deed Notice on Lot 14
- 90 Forrest Street Alleyway (AOC FSP-1F)
    - Source Removal: Excavation in Grid EE16B
    - Engineering Control: 90 Forrest Street Alleyway Asphalt Cap
    - Institutional Controls: Deed Notices on Lots 12 and 14
- 98/100 Forrest Street Building Footprint (AOC FSP-1G)
    - Engineering Control: 98/100 Forrest Street Existing Concrete Cap
    - Engineering Control: Seal Cracks/Breaches in 100 Street Forrest Concrete Retaining Wall
    - Institutional Controls: Deed Notice on Lot 14
- 100 Forrest Street Loading Dock Driveway (AOC FS-1C, AOC FS-2C, AOC FSP-1H, AOC FSP-2H)
    - Engineering Control: 100 Forrest Street Loading Dock Driveway Existing Asphalt and Concrete Cap
    - Institutional Controls: Notice in Lieu of Deed Notice on Forrest Street and Deed Notice on Lot 14
- 86/90 Forrest Street Building Footprint (AOC FSP-1I)
    - Engineering Control: 86/90 Forrest Street Existing Concrete Cap
    - Institutional Controls: Deed Notice on Lots 11 and 12

- 90 Forrest Street Boiler Room Basement (AOC FSP-1J)
    - Engineering Control: 90 Forrest Street Boiler Room Basement Engineering Control (consisting of an HDPE dimpled membrane, drainage system, and epoxy coating)
    - Institutional Controls: Deed Notice on Lot 12
- Grid GG15B (AOC FSP-1K)
    - Source Removal: Excavation in Grid GG15B

The selected remedial alternatives for these AOCs are appropriate for Forrest Street Properties' current commercial use and will be effective in protecting human health and the environment. Upon implementation of these Remedial Actions, PPG will prepare and submit an RAR and request that NJDEP grant a Consent Judgment Compliance Letter for the property's current use once the deed notices and notice in lieu of deed notice are filed and the Remedial Action Permit (RAP) is implemented. Once the Consent Judgment Compliance Letter is granted, PPG will implement the permit conditions under the LSRP program, rather than under the JCO program.

Prior to the future residential use of Forrest Street Properties, PPG will conduct a remedial excavation to address CCPW-impacted soil which is currently inaccessible due to the current use. It is anticipated that remaining MGP-impacted soil will be addressed via engineering controls (capping) and institutional controls (deed notices and notice in lieu of deed notice). The future residential-use remediation will be conducted under the existing site-wide GA Group RAWP (AECOM, 2018c) in accordance with the February 8, 2007 NJDEP memorandum entitled *Chromium Moratorium* (NJDEP, 2007) under the LSRP program. Following completion of the future residential-use remediation, PPG will update the deed notices and notice in lieu of deed notice, RAR, and RAP. PPG's LSRP will then issue a Response Action Outcome (RAO) for the residential use of the properties.

1.0 Introduction

This Remedial Action Work Plan (RAWP) has been prepared by AECOM on behalf of PPG to evaluate and propose the remedial alternatives for the portions of Forrest Street and Forrest Street Properties where full remedial excavation is not appropriate based on Forrest Street Properties' current commercial use. This RAWP addresses remediation of:

- Chromate Chemical Production Waste (CCPW) and CCPW-impacted soil; and
- Soil impacted by manufactured gas plant (MGP)-related constituents associated with the former Halladay Street Gas Works MGP.

Forrest Street and Forrest Street Properties (the Site) is part of the Garfield Avenue Group (GA Group) Sites, which include Sites 114, 132, 133, 135, 137, 143, and 186, and adjacent roadways and properties (**Figure 1-1** and **Figure 1-2**). Site 114 is the former location of a chromite ore processing facility previously owned by PPG, and the former Halladay Street Gas Works MGP previously owned by Public Service Electric and Gas Company (PSEG). Forrest Street and Forrest Street Properties are tracked under the New Jersey Department of Environmental Protection (NJDEP) Site Remediation Program (SRP) Program Interest (PI) number 775706.

On behalf of PPG, AECOM has prepared and submitted a series of remedial strategy documents to the NJDEP for soil located at Forrest Street and Forrest Street Properties. The following documents have presented the remediation strategy for soil located at Forrest Street and Forrest Street Properties:

- The approved *Remedial Action Work Plan (Soil) Rev. 4, Garfield Avenue Group Sites, Jersey City, Hudson County, New Jersey (Final)* (GA Group RAWP), submitted on September 27, 2018 (AECOM, 2018c). This RAWP presented excavation and disposal as the selected Remedial Action for soil impacts.
- The Technical Memorandum: *Forrest Street and Forrest Street Properties – Proposed Terminal Excavation Elevations Revision 1* (Forrest TEE), submitted on March 30, 2017 (AECOM, 2017b). The Forrest TEE Revision defined the proposed extent of excavation in Forrest Street and adjacent properties (Forrest Street Properties). This TEE proposed deferral of remedial excavation within the Forrest Street Properties building footprints.
- The Technical Memorandum: *Forrest Street Properties – Supplemental Proposed Terminal Excavation Elevations Submittal* (Forrest Supplemental TEE), submitted on April 14, 2017 (AECOM, 2017c). The Forrest Supplemental TEE defined the proposed extent of excavation for select grids within Forrest Street Properties.
- The *Technical Execution Plan (Revision 1), Forrest Street and Forrest Street Properties Soil Excavation, Jersey City, New Jersey* (Forrest TEP), submitted on March 23, 2017 (AECOM, 2017a). The Forrest TEP proposed a limit of excavation that defers remedial excavation within prescribed distances from the buildings and utilities to protect the structural integrity of the buildings and utilities (**Figure 1-3**). The soils located within the prescribed distances from the buildings and utilities are known as "the support of excavation offset areas."

On February 3, 2017, Weston Solutions (Weston, the Site Administrator's Technical Consultant) and the NJDEP provided comments via email regarding Revision 0 of the Forrest TEE (Weston, 2017a)

and Revision 0 of the Forrest TEP (Weston, 2017b) that directed PPG to develop a RAWP to address soil impacts that were not accessible for remedial excavation due to Forrest Street Properties' current-use, as described in the Forrest TEE and Forrest TEP. In accordance with the Weston/NJDEP comments, AECOM has prepared this RAWP on behalf of PPG to address soil impacts in areas adjacent to or within the footprints of the Forrest Street buildings, hereafter referred to as "the current-use remediation areas." The current-use remediation areas are identified in **Section 5** of this RAWP.

1.1 Objectives

The objectives of this RAWP are to:

- Provide an assessment of the area within the Forrest Street building footprints;
- Assess the efficacy of Interim Remedial Measures (IRMs) present in the 90 Forrest Street Boiler Room Basement and at the 84 Forrest Street Loading Dock;
- Assess methods to address soil impacts within the current-use remediation areas; and
- Present a remedial approach that is acceptable to the property owners and NJDEP.

1.2 Remedial Action Work Plan Requirements

This RAWP was prepared in accordance with the following requirements:

- *Technical Requirements for Site Remediation*, New Jersey Administrative Code (N.J.A.C.) 7:26E et seq. (NJDEP, 2005);
- Appendix A of the *Administrative Order on Consent in the Matter of Hudson County Chromate Chemical Production Waste Sites and PPG Industries, Inc*., July 19, 1990, also referred to as the Administrative Consent Order (ACO) (ACO, 1990);
- *Partial Consent Judgment Concerning the PPG Sites*, June 26, 2009, also referred to as the Judicial Consent Order (JCO) (Superior Court of New Jersey Law Division – Hudson County, 2009);
- The February 8, 2007 NJDEP memorandum entitled *Chromium Moratorium* (NJDEP, 2007); and
- *Interim Chromium Soil Cleanup Criteria Memorandum* (NJDEP, 2008).

As specified in email correspondence from Tom Cozzi, NJDEP, Subject: *Meeting Summary, Wednesday, May 17*, dated May 23, 2017 (NJDEP, 2017), the RAWP was originally submitted in three phases. Consistent with Tom Cozzi's letter, the submittal phases encompassed the following areas:

- Phase 1: The 100 Forrest Street Offset and the 84 Forrest Street Building Footprint and Loading Dock;
- Phase 2: The Forrest Street Utility Offset and the 90 Forrest Street Alleyway, including the northwest corner of 86/90 Forrest Street; and
- Phase 3: The 90 Forrest Street Boiler Room Basement and 86/90 Forrest Street Building Footprint and 98/100 Forrest Street Building Footprint.

1.3 Organization of Document

This RAWP is organized as follows:

- **Section 1** provides the introduction, objectives, and requirements for this RAWP;
- **Section 2** includes the goals and applicable remediation standards;
- **Section 3** provides background information;
- **Section 4** summarizes previous investigations and Remedial Actions;
- **Section 5** describes the current-use remediation areas;
- **Section 6** presents and evaluates remedial alternatives;
- **Section 7** presents a summary of selected Remedial Actions;
- **Section 8** presents additional detail on implementation of the selected Remedial Actions;
- **Section 9** provides the references cited in this RAWP; and
- **Appendices A** through **O** provide supplemental supporting information.

2.0 Goals and Applicable Remediation Standards

2.1 Remedial Goals

The goal of the Remedial Actions proposed by this RAWP is the prevention of direct contact with, ingestion of, and inhalation of, Site Impacts (as defined in **Section 2.2**).

For Forrest Street Properties' current use, protection of human health and the environment will be achieved by the installation of engineering controls, institutional controls, and, in limited cases, source removal. Once the selected current-use remedies are implemented, PPG will prepare and submit a Remedial Action Report (RAR). Following NJDEP approval of the RAR, the deed notices and notice in lieu of deed notice will be filed, and a corresponding Remedial Action Permit (RAP) will be implemented. Upon implementation of the RAP, PPG will request closure of the Areas of Concern (AOCs) associated with the RAWP through NJDEP's issuance of a Consent Judgment Compliance Letter for the property's current use.

Prior to the future residential use of the property, PPG will conduct additional remediation, as described in **Section 7.3**.

2.2 Site Impacts

PPG's responsibility to remediate soil impacts located on Forrest Street and Forrest Street Properties is set forth in the 1990 ACO and 2009 JCO and includes CCPW-related impacts and non-CCPW-related impacts emanating from Site 114 to Forrest Street and Forrest Street Properties. CCPW-related impacts include the presence of visible CCPW, chromium (Cr) efflorescence in and on the surface of concrete (blooming), and hexavalent chromium (Cr^{+6}) and CCPW metals (antimony, total Cr, nickel, thallium, and vanadium) concentrations exceeding applicable criteria. CCPW-related impacts and non-CCPW-related impacts emanating from Site 114 to Forrest Street and Forrest Street Properties with concentrations exceeding applicable criteria are referred to herein as "Site Impacts".

The non-CCPW-related impacts emanating from Site 114 to Forrest Street and Forrest Street Properties are associated with the Former Halladay Street Gas Works MGP on Site 114. These impacts have been evaluated as documented in the following submittals:

- August 26, 2016 memorandum from AECOM to NJDEP entitled *North of Forrest Street Area – Evaluation of Non-CCPW-Related Compounds Emanating from Site 114 (Revision 1)* (2016 Forrest Emanating-From Memorandum) (AECOM, 2016b). On behalf of NJDEP, Weston conditionally concurred with the 2016 Forrest Emanating-From Memorandum on November 17, 2016 (Weston, 2016).
- August 2018 *Supplemental Soil Remedial Investigation Report – Soil, Garfield Avenue Group Non-Residential Chromate Chemical Production Waste Sites – 114, 132, 133, 135, 137, 143, and Adjacent Properties and Roadways, Final Revision 1, PPG Garfield Avenue Group, Hudson County Chromium Sites, Jersey City, New Jersey* SSRIR), (AECOM, 2018a), as approved by NJDEP on October 22, 2018 (NJDEP, 2018).
- October 2, 2017 memorandum from AECOM to NJDEP entitled *Response to NJDEP/Weston's Comments on PPG's ACO/JCO Site Parameters List (Revision 0)* (AECOM, 2017e), which presented the table entitled *PPG's Parameters – NJ PPG Chrome Remediation Sites per the ACO/JCO* (ACO/JCO Parameters List). On behalf of NJDEP,

Weston concurred with the ACO/JCO Parameter List on November 30, 2017 (Weston, 2017c).

- September 20, 2018 memorandum from AECOM to NJDEP entitled *Forrest Street and Forrest Street Properties Emanating-From Parameters (Revision 1)* (2018 Forrest Emanating-From Memorandum) (AECOM, 2018b), which identifies two non-CCPW-related compounds (naphthalene and benzene) emanating from Site 114 that were not previously identified in the ACO/JCO Parameters List. This memorandum serves as an addendum to the 2016 Forrest Emanating-From Memorandum and the ACO/JCO Parameters List. On behalf of NJDEP, Weston concurred with the 2018 Forrest Emanating-From Memorandum on November 5, 2018 (Weston, 2018b).

This RAWP addresses only the soil impacts for which PPG is responsible under the ACO and JCO. PPG is responsible for CCPW and CCPW-related impacts.

PPG and PSEG are jointly responsible for remediation of MGP parameters including those emanating from Site 114. PSEG is taking the lead on closing out MGP-related impacts in accordance with the Licensed Site Remediation Professional (LSRP) Program under PI number G000005480, activity number LSR120001, per the July 2019 agreement between PPG and PSEG (PPG and PSEG, 2019). MGP-related information has been included in this RAWP for informational purposes only. The MGP AOCs identified herein are superseded by MGP AOCs established by PSEG and are no longer relevant. Information required to document remediation of MGP-related impacts will be presented by PSEG in their forthcoming RAR.

At Forrest Street, constituents covered by this RAWP include:

- Visible CCPW and Cr^{+6};
- CCPW-related metals (antimony, total Cr, nickel, thallium, and vanadium);
- Select MGP-related semi-volatile organic compounds (SVOCs) (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and naphthalene); and
- Select MGP-related volatile organic compound (VOC) (benzene).

At Forrest Street Properties, constituents covered by this RAWP include:

- Visible CCPW and Cr^{+6};
- CCPW-related metals;
- Select MGP-related SVOCs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and naphthalene); and
- Select MGP-related VOC (benzene).

Under the ACO and JCO, PPG is not responsible for other constituents exceeding the NJDEP Soil Remediation Standards (SRS) or Default Impact to Groundwater Soil Screening Levels (DIGWSSLs) that may be present at the Site. Remediation of non-CCPW-related constituents and constituents not associated with operation of the former Halladay Street Gas Works MGP, including those associated with historic fill remaining at the Site, is the responsibility of the property owners under the LSRP

program. This RAWP addresses only the soil impacts for which PPG is responsible under the ACO and JCO.

2.3 Remediation Standards

The soil remediation standards applicable to identified AOCs at Forrest Street and Forrest Street Properties, including the current-use remediation areas, for Cr^{+6} and trivalent chromium (Cr^{+3}) are the NJDEP Chromium Soil Cleanup Criteria (CrSCC): 20 milligrams per kilogram (mg/kg) for Cr^{+6} and 120,000 mg/kg for Cr^{+3}. The applicable soil remediation standards for CCPW-metals and non-CCPW Parameters Emanating from Site 114 to Forrest Street and Forrest Street Properties are the Residential Direct Contact Soil Remediation Standards (RDCSRS) or the Alternative Soil Remediation Standard (ARS) (applicable to vanadium only), the Non-Residential Direct Contact Soil Remediation Standards (NRDCSRS), and the DIGWSSL, or the Site-Specific Impact to Ground Water Soil Remediation Standards (IGWSRS-GAG), where applicable. Analytical results for soil and concrete samples collected in Forrest Street and Forrest Street Properties are compared to the standards, soil screening levels, and cleanup criteria on **Table 2-1**. Applicable soil remediation standards, soil screening levels, and cleanup criteria are also presented in **Table 2-2** through **Table 2-9**, which present the analytical data.

IGWSRS-GAG for antimony and nickel were developed and proposed in the SSRIR (AECOM, 2018a), which AECOM submitted, on behalf of PPG, to NJDEP on August 29, 2018. NJDEP approved the SSRIR on October 22, 2018. Documentation of NJDEP's acceptance of the IGWSRS-GAG for antimony and nickel, and of NJDEP's acceptance of the ARS for vanadium is provided in **Appendix A**.

3.0 Background Information

This section provides background information specific to Forrest Street and Forrest Street Properties within the GA Group Sites. For a detailed description of the conditions in the GA Group Sites, and for a description of the nature and extent of soil impacts in the GA Group Sites, refer to the 2012 *Remedial Investigation Report - Soil* (RIR) (AECOM, 2012), the GA Group RAWP (AECOM, 2018c), and the 2018 SSRIR (AECOM, 2018a).

3.1 Site Location, Description, and History

Forrest Street is located west of Halladay Street in Jersey City, New Jersey (NJ). Forrest Street Properties is comprised of the properties located at 84, 86/90, 98/100, and 108 Forrest Street in Jersey City, NJ. Forrest Street Properties is identified as Block 21501, Lots 11, 12, 14, and 15 in the Jersey City Parcel Data from the New Jersey Geographic Information Network (NJGIN), last updated October 6, 2015 (available at: https://njgin.state.nj.us/OGIS_IW; last accessed in November 2019) (**Figure 1-2**).

Forrest Street is part of Phase 4 (Roadways) and Forrest Street Properties are part of Phase 5 (Off Site Properties) of the GA Group Sites, which are in a commercial and residential area on Garfield Avenue in Jersey City, NJ (**Figure 1-1**). This area of Jersey City is characterized as urban. Site 199, the New Jersey Transit Light Rail, and Berry Lane Park are located north and northwest of Forrest Street Properties. Site 114 is located to the south of Forrest Street. Residences are located to the west, across Garfield Avenue, and to the east and north of the New Jersey Transit Light Rail.

The extents of the current-use remediation areas are described in **Section 5**, and include the following:

- 100 Forrest Street Offset (Block 21501, Lots 14 and 15);
- 84 Forrest Street Building Footprint and Loading Dock (Block 21501, Lots 11 and 12);
- Forrest Street Utility Offset (a portion of Forrest Street);
- 90 Forrest Street Alleyway (Block 21501, Lots 12 and 14)
- 98/100 Forrest Street Building Footprint (Block 21501, Lot 14) (including the 100 Forrest Street Loading Dock Driveway [a portion of Forrest Street and Block 21501, Lot 14]);
- 86/90 Forrest Street Building Footprint (Block 21501, Lots 11 and 12)
- 90 Forrest Street Boiler Room Basement (Block 21501, Lot 12)
- Grid GG15B (Block 21501, Lot 14)

Lots 11, 12, and 14 within Block 21501 are currently used as commercial properties. The Block 21501, Lot 15 property is currently vacant land used for access to 100 Forrest Street. Based on the review of historical aerial photographs, it is possible that grading and/or disturbance occurred at Lot 15 prior to the remediation in that area. Also, an aerial photograph from 2006 shows trailers being stored on the Lot 15 property.

PPG acknowledges shared responsibility with Honeywell International, Inc. for the remediation of Site 199 as agreed to in the September 2011 Consent Judgment; however, Site 199 is not included in the GA Group Sites and is outside the scope of this RAWP.

3.1.1 Historical Operations

A historical review of Forrest Street Properties was conducted and included an assessment of Sanborn maps and historical aerial photographs provided by Environmental Data Resources, Inc. (EDR) and aerial photographs provided by other sources (TX Aero & Robinson Aerial Surveys). A total of nine Sanborn Maps for the period of 1896 to 2006, six aerial photographs for the period of 1940 to 1989, and eight aerial photographs for the period of 1943 to 2006 were reviewed to assess historical development for Forrest Street Properties.

3.1.1.1 Review of Sanborn Maps

Four commercial properties, located at 84 to 100 Forrest Street (Block 21501, Lots 11, 12, 14 and 15) were reviewed for this RAWP. Sanborn Maps covering the years 1896 to 2006 were assessed to provide information pertaining to historical usage of these properties (**Appendix B**). A description of the historical property usages within these lots, based on the Sanborn Maps, is included below.

Block 21501 Lot 11

The 1896 and 1911 Sanborn Maps showed this property as a residential dwelling. The 1951 Sanborn Map shows the property with a building labeled as “BDL. W. Ho.” The property is shown as vacant on the 1979, 1989, and 1990 Sanborn Maps. By 1993, a building is shown on the property labeled as a “non-combustible concrete block building” constructed in 1991. The same structure appears on the maps from the period of 1994 through 2006.

Block 21501 Lot 12

The 1896 Sanborn Map shows this property as vacant and undeveloped. In 1911, the property was occupied by Moore Brother’s Publishing Company. The 1951 through 1995 Sanborn Maps show “Moore Bro’s” as replaced by a large building constructed in 1917. A boiler room on the west side of the large building constructed in 1917 was erected prior to 1951. This boiler room is the present-day location of two sumps (east and west sumps) where chromium-impacted groundwater was identified. A third sump (south sump) is located on the side of the south wall of the basement in a former office space. The building appears on the Sanborn Maps from 1995 through 2006.

Block 21501 Lot 14

The 1896 Sanborn Map shows this property as vacant, undeveloped, and also part of the former Van Horne Street, which ran perpendicular to Forrest Street. By 1911, Van Horne Street was eliminated, and the lot remained vacant and undeveloped. The 1951 Sanborn Map shows the property as being developed in 1917 with the Colonial Molasses Company (Molasses Factory) building occupying the space. By 1979, Colonial Molasses Company had been replaced by Pedegreed *[sic]* Seed Company, and an addition had been added to the building’s western exterior wall (100 Forrest Street). The building remains unchanged based on the maps from 1979 through 2006.

Block 21501 Lot 15

The 1896 through 2006 Sanborn Maps show the subject property as vacant and undeveloped.

3.1.1.2 Review of Aerial Photographs

Historical aerial photographs were reviewed to provide information pertaining to historical land use for Forrest Street Properties (**Appendix C**). Of the eight aerial photographs from EDR for the period of 1943 to 2006, the 1976 and 1985 aerial photographs were not used due to poor quality. The remaining six EDR aerial photographs, for the period of 1940 to 1989, were reviewed to assess historical development of Forrest Street Properties. A description of the historical property usages within these lots, based on the aerial photographs, is included below.

Block 21501 Lot 11

The lot appears vacant beginning in the 1940 aerial photograph. A small building is visible in the 1943 and 1951 aerial photos. The lot appears vacant from 1953 until 1989. In the 1989 aerial photograph, a building that appears to be an extension of the building (commercial structure) on Lot 12 is present; this building is seen in the aerial photographs from the period of 1989 through 2006.

Block 21501 Lot 12

The 1940 through 2006 aerial photographs show a commercial structure on Lot 12 that appears relatively unchanged throughout that timeframe.

Block 21501 Lot 14

The 1940 and 1943 aerial photographs show a commercial structure on Lot 14 that remains unchanged during that timeframe. A possible materials storage area appears on the west side of the building in the 1951 and 1953 aerial photos. This storage area is replaced by a building addition (100 Forrest Street) in the 1961 aerial photo; the building addition appears on the aerial photos through 2006.

Block 21501 Lot 15

This property is vacant land with some shrubbery according to the 1940 to 2006 aerial photographs. Possible grading and/or disturbance of the Lot are visible on the 1943, 1969, 1994, and 1995 aerial photographs. A few trailers are stored on the property in the 2006 aerial photograph.

3.1.1.3 Assessment of Building Footprints

The chromate chemical production facility formerly located on Site 114 was active from approximately 1911 to 1963, during which time fill containing CCPW or CCPW-impacted soil could potentially have been used as fill for properties within Forrest Street Properties. The potential for CCPW or CCPW-impacted soil to be present beneath building footprints are assessed in **Section 5**.

3.2 Topography and Drainage

The Forrest Street Properties have little topographic relief, with ground surface elevations generally ranging from 11 to 13 feet (ft) in the North American Vertical Datum of 1988 (NAVD88). The Skyways property (Block 21501, Lot 15) slopes downward from elevation (El.) 25 ft NAVD88 toward Forrest Street, which is at approximately El. 11 ft NAVD88 (**Figure 1-2**). Directly west of the 100 Forrest Street building, there is a drainage swale that collects surface water runoff from the Skyways property and the 100 Forrest Street building roof and channels it towards Forrest Street, where storm water is collected by a combined sewer catch basin.

3.3 Geology

The area lies within the glaciated section of the Piedmont Physiographic Province, along the eastern edge of the Newark Basin (Killam Associates, 1988). The following subsections describe the regional and localized area geology.

3.3.1 Regional Geology

The regional geology includes unconsolidated sediments of Recent and Pleistocene age. According to the New Jersey Geologic Survey, these sediments include alluvial, estuarine, eolian (windblown), and glacial lacustrine deposits, as well as glacial till of late Wisconsin age. Throughout the region, the Triassic age bedrock of the Newark Group (Lockatong and Stockton formations) is comprised of non-marine sedimentary rocks, consisting mainly of sandstone, mudstone, and conglomerate. A diabase sill (i.e., the Palisades Sill) intruded into the Lockatong formation approximately 200 million years ago.

3.3.2 Garfield Avenue Group Geology

The GA Group Sites are located on miscellaneous fill material that was used to reclaim the salt marsh in this area during the construction of this portion of Jersey City. The estuarine native soils beneath the fill material include an organic meadow mat layer and a thick sequence of unconsolidated natural material. The major geologic units beneath the GA Group Sites, from top to bottom, include:

- A non-native fill layer (the shallow zone);
- Native soils consisting of sand, silty sand, and clays (the intermediate zone), generally separated from the fill by organic sediments or meadow mat;
- Till directly above the bedrock, underlying sand with occasional gravel lenses, generally separated from the intermediate zone by a layer of lower hydraulic conductivity silts and clayey silts (the deep zone); and
- Bedrock of the Lockatong and Stockton Formations with a diabase sill intruding into the Lockatong formation along the western edge of the Project Area (the bedrock zone).

3.3.3 Forrest Street Geology

Forrest Street and Forrest Street Properties are slightly higher in elevation than the rest of the GA Group Sites. Although the north of Forrest Street Properties includes fill material overlying native sands and silts, most of this area was not part of the salt marsh. Therefore, the fill in this location is generally thinner and less debris-laden than the material used on Site 114. The meadow mat is generally not present north of Forrest Street and the fill is in direct contact with the underlying native soil. Soil borings within Forrest Street Properties did not extend beyond the intermediate zone, so the depth and thickness of the deep zone and the depth to bedrock were not field-verified but are expected to be similar to the characteristics identified on adjacent Site 114.

3.4 Hydrogeology and Groundwater Flow

The groundwater elevation (above which is the unsaturated zone) for Forrest Street Properties was estimated as the 50th percentile groundwater elevation from ten monitoring wells located on or adjacent to Forrest Street Properties gauged between February 2007 and December 2016. The estimated groundwater elevation for Forrest Street Properties is El. 6.1 ft NAVD88 (**Appendix D**).

The groundwater elevation (above which is the unsaturated zone) for Forrest Street was estimated as the 50th percentile groundwater elevation from seven monitoring wells located on or adjacent to Forrest Street gauged between December 2003 and December 2016. The estimated groundwater elevation for Forrest Street is El. 6.3 ft NAVD88 (**Appendix D**).

Information on the hydrogeology of the GA Group Sites can be found in the GA Group RAWP (AECOM, 2018c). Local groundwater flow information is presented in the Technical Memorandum: *FOR-005 Additional Forrest Street Remedial Investigation – Soil & Groundwater* (Forrest Street Technical Memorandum) (AECOM, 2016a).

4.0 Previous Investigations and Remedial Actions

4.1 Summary of Previous Investigations

The initial Forrest Street and Forrest Street Properties Remedial Investigation (RI) activities were implemented between 2003 and 2006 to identify, characterize, and delineate Site Impacts. Additional RIs were conducted in 2011, 2012, 2013, 2014, and 2015 based upon the identification of chromium-impacted water in two sumps located in the former boiler room basement at 90 Forrest Street during a September 2011 Site inspection. These RIs resulted in the advancement of 84 soil borings; excavation of four test pits; installation of 15 groundwater monitoring wells; and collection and analysis of 24 concrete samples, 1,465 soil samples, and 389 groundwater samples.

The results of RI activities implemented at Forrest Street and Forrest Street Properties are summarized in the SSRIR (AECOM, 2018a), as approved by NJDEP (NJDEP, 2018).

A preliminary design investigation (PDI) was conducted in the Forrest Street roadway in June 2016. Based on identified data gaps, a supplemental PDI program was conducted in October 2016. In accordance with the *Updated Method to Determine Compliance with Chromium Policy* (NJDEP, 2013), soil borings were advanced in each grid within Forrest Street and soil samples were collected at 2-ft intervals and analyzed for Cr^{+6}, pH, and oxidation-reduction potential (Eh).

A PDI was conducted within Forrest Street Properties from August to September 2016. Based on the data gaps identified during this investigation, a supplemental PDI was conducted within Forrest Street Properties from November 2016 to February 2017. The Forrest Street Properties PDI and supplemental PDI programs were focused on areas with known CCPW-related impacts and areas where delineation of non-CCPW-related impacts that were identified during RIs was required; therefore, advancing a boring in every remediation grid was not required (AECOM, 2016c).

Remedial Investigation and PDI data were collected in accordance with the previously issued *Field Sampling Plan/Quality Assurance Project Plan PPG Non-Residential and Residential Chromium Sites, Hudson County, New Jersey* (AECOM, 2010a), as amended for the GA Group RAWP, (AECOM, 2018c). No significant events or seasonal variations influenced the sampling procedures or analytical results of these soil investigations.

The results of the Forrest Street and Forrest Street Properties PDIs were presented in the Forrest TEE and the results of the supplemental PDI for Forrest Street properties are presented in the Forrest Supplemental TEE. The Forrest TEE and Forrest Supplemental TEE were approved by NJDEP on May 25, 2017 and August 31, 2017, respectively.

4.2 Summary of Previous and Ongoing Remediation

The excavation of Site Impacts, as described in the Forrest TEE and Forrest TEP, commenced on the Skyways property and in Forrest Street on March 27, 2017 and was completed on August 4, 2017. The results of the Skyways property and Forrest Street excavations is presented in the Forrest Street Properties RAR (AECOM, 2019a) and the Forrest Street RAR (AECOM, 2019b), respectively.

Sections of the current-use remediation areas have been addressed concurrently with the restoration of the Forrest Street roadway and the Skyways property as described in **Sections 6** and **7** of this RAWP.

4.3 Remedial Action Work Plan Dataset

The tables and figures included in this RAWP present the laboratory analytical results and visual observations of CCPW previously presented in the SSRIR, Forrest TEE, and Forrest Supplemental TEE, as well as post-excavation confirmation sampling analytical results. Locations where CCPW was visually observed are presented on **Figure 4-1**. Analytical results are presented on **Table 2-2** through **Table 2-9** and **Figure 4-2** through **Figure 4-9**. The laboratory electronic data deliverables (EDDs) passed submission and have been logged into the NJDEP database, as documented in **Appendix E**.

Laboratory analytical data reports, data validation memoranda, and soil boring logs provided in the SSRIR, Forrest TEE, and Forrest Supplemental TEE are not being resubmitted as attachments to this RAWP. Analytical data packages and data validation memoranda for post-excavation confirmation samples and the Professional Land Survey certified excavation as-built survey were included as components of the previously issued Forrest Street Properties RAR (AECOM, 2019a) and Forrest Street RAR (AECOM, 2019b) and will be included as part of the future RARs for Forrest Street Properties and Forrest Street current-use remediation areas covered by this RAWP.

4.3.1 Supplemental Groundwater Investigation

At the request of Weston/NJDEP, PPG/AECOM conducted a supplemental groundwater investigation to support the remedial alternatives analysis for the 98/100 Forrest Street Building Footprint and 86/90 Forrest Street Building Footprint. This groundwater investigation included the following activities:

- Sampling existing monitoring wells and sumps located at Forrest Street and Forrest Street Properties from September 25 through September 28, 2017; and
- Installing monitoring well 114-MW44A within the 98/100 Forrest Street building on October 30, 2017 and sampling the well on November 11, 2017.

On December 19, 2017 PPG/AECOM submitted the results of the supplemental groundwater investigation to NJDEP via an email submittal that included a figure that presented monitoring well locations, tabulated groundwater sampling results, graphs, and boring logs (AECOM, 2017i). The email submittal is provided in **Appendix F**. 114-MW44A monitoring well documentation is provided in **Appendix G**.

4.4 Reliability of Data: Data Validation and Usability

4.4.1 Data Validation

Data validation was performed by AECOM to evaluate whether the analytical data collected to demonstrate compliance with the RAWP objectives were scientifically defensible, properly documented, of known quality, and met RAWP objectives. Data validation included the review of analytical procedures, quality control (QC) results, calibration procedures, data reduction, and completeness of the laboratory data packages as specified in the *Soil Remedial Investigation Work Plan – Sites 114, 132, 133, 135, 137, 143 and Site 186* (Soil RIWP) (AECOM, 2011) and the *Field Sampling Plan/Quality Assurance Project Plan PPG Non-Residential and Residential Chromium Sites, Hudson County, New Jersey* (FSP-QAPP) (AECOM, 2010a). Deficiencies noted were communicated to the laboratory and resolutions were documented in the previously submitted data validation reports. If appropriate, data were qualified for use as described later in this section.

The previously submitted laboratory data packages were reviewed in accordance with the FSP-QAPP, the NJDEP validation Standard Operating Procedures (SOPs) for Cr^{+6} and inorganic data, and United States Environmental Protection Agency (USEPA) Region 2 metals, VOC, and SVOC validation guidelines. The following NJDEP validation guidelines served as the basis for the actions taken during validation:

- NJDEP Office of Data Quality *SOP 5.A.10, Rev 3* (September 2009)*, SOP for Analytical Data Validation of Hexavalent Chromium – for USEPA SW-846 Method 3060A, USEPA SW-846 Method 7196A and USEPA SW-846 Method 7199* (NJDEP, 2009); and
- NJDEP Office of Data Quality *SOP 5.A.16, Rev 1* (May 2002), *Quality Assurance Data Validation of Analytical Deliverables for Inorganics* (based on USEPA SW-846 Methods) (NJDEP, 2002).

Where USEPA Region 2 inorganic and organic validation guidelines were also used in assessing metals, benzene, and SVOCs, the most current guidance in effect at the time of validation was used; the specific revision used is listed in each previously issued validation memorandum. The link to USEPA Region 2 validation guidance on the USEPA website is shown below:

- https://www.epa.gov/quality/region-2-quality-assurance-guidance-and-standard-operating-procedures (last accessed in November 2019).

The level of validation ranged from a comprehensive validation according to the NJDEP guidelines to a limited validation based on QC summary information or completeness reviews, depending on the analyte and matrix. The validation procedures for the Cr^{+6} data included full validation, which involved a comprehensive review of both summary forms and raw data, whereas the metals, benzene, and SVOC data received limited validation. Limited validation for metals, benzene, and SVOC data was based on information provided by the laboratory on their QC summary forms and did not include raw data review. At a minimum, limited validation included the following data elements:

- Agreement of analyses conducted with chain-of-custody (COC) requests;
- Holding times and sample preservation;
- Method blanks/field equipment blanks/trip blanks;
- Surrogate spike recoveries;
- Laboratory control samples (LCS) or equivalent results;
- Matrix spike (MS)/matrix spike duplicate (MSD) results;
- Laboratory duplicate results;
- Field duplicate results; and,
- Quantitation limits and sample results (limited to evaluating dilutions and re-analyses).

Full validation was conducted on the Cr^{+6} data. Full validation included each of the data elements listed for limited validation along with review of calibration data and raw data, and spot check for verification of calculations.

Validation reports were prepared for each data package that was validated. The reports summarize the samples reviewed, parameters reviewed, non-conformance with the established criteria, and

validation actions (including application of data qualifiers) presented in accordance with the NJDEP "hit list" format. Validation data qualifiers were based on the USEPA Region 2 validation guidelines for organic data and the NJDEP validation SOPs for the Cr^{+6} and inorganic data. The qualifiers used in data validation consisted of the following:

J Indicates the result was an estimated value; the associated numerical value was an approximate concentration of the analyte in the sample. J+ or J- is used when the direction of bias can be determined.

U Indicates the analyte was not detected in the sample above the sample reporting limit.

UJ Indicates the analyte was not detected above the reporting limit and the reporting limit was approximate.

UB The analyte concentration is less than or equal to three (3) times the concentration in the associated method/preparation blank. The presence of the analyte in the sample is negated due to laboratory blank contamination.

JB The analyte concentration is greater than three (3) times, but less than or equal to ten (10) times the concentration in the associated method/preparation blank. The presence of that analyte in the sample is considered "real" but the concentration is quantitatively qualified due to method blank contamination.

R The sample result was rejected due to serious deficiencies; the presence or absence of the analyte could not be confirmed.

RA The sample result was rejected due to NJ-specific data validation QC requirements; however, the result is usable for project objectives. Refer to the Data Quality and Usability section of the data validation report for further information.

4.4.2 Data Usability Assessment

Soil samples collected to demonstrate compliance with the remedial objectives were sent to Test America Laboratories (formerly Severn Trent Laboratories) in Edison, NJ (NJ certification 12028) or SGS-Accutest Laboratories in Dayton, New Jersey (NJ Certification 12129). The analyses were performed in accordance with USEPA- and NJDEP-approved analytical protocols. Quality assurance analytical measures were implemented in accordance with the NJDEP *Technical Requirements for Site Remediation* (TRSR) (N.J.A.C. 7:26E) (NJDEP, 2005) and complied with the requirements for a NJDEP-certified laboratory in *Regulations Governing the Certification of Laboratories and Environmental Measurements* (NJDEP, 1981). Results of the data validation indicated that in general, the analytical data were of adequate quality to meet the project objectives. However, there were some quality assurance (QA)/QC issues identified during data validation that resulted in rejection of data or qualification of data as estimated.

Data usability was evaluated using the data quality indicators of precision, accuracy, representativeness, comparability, completeness, and sensitivity. Data that were not rejected during validation are regarded as usable.

Certain Cr^{+6} results that were rejected due to failure of the matrix spikes to meet the NJDEP-specified control limits of 50-150% were qualified "RA" to indicate that the result may have value for information

purposes. This qualifier is typically used for Cr^{+6} where the spiked sample matrix appears to be reducing and would not be expected to support the presence of Cr^{+6}. The presence of other indicators of a reducing environment such as total organic carbon (TOC), sulfide, or ferrous iron is a factor in the decision to utilize the "RA" qualifier. In this dataset, the RA qualifier was also used for positive chromium and nickel results associated with field duplicate with relative percent difference (RPD) >120%.

4.4.2.1 Precision

Precision is the measure of agreement among repeated measurements of the same property under identical or substantially similar conditions and includes both field and analytical components. The information used to evaluate precision included results for field duplicates, matrix duplicates, and laboratory duplicates. For the RAWP dataset, RPD non-conformances were observed for field and/or laboratory duplicates associated with CCPW metals, Cr^{+6}, and SVOCs.

Field precision was assessed through the collection and analysis of field duplicates and expressed as the RPD of the sample and field duplicate pair results. For the Forrest RAWP dataset, field duplicate precision resulted in qualification of 10.1% of the CCPW metals data, 25.0% of the concrete data, 22.5% of the soil Cr^{+6} data, and 5.4% of the SVOC data; none of the benzene results were qualified based on field precision.

Laboratory precision was assessed through the RPD results for MS/MSDs, LCS/laboratory control sample duplicate (LCSD) pairs, and duplicate sample analyses. MS/MSDs and duplicate sample analyses do not reflect laboratory precision as purely as LCS/LCSDs since sample homogeneity, which can be a significant issue for soil samples, can impact the precision of sample and matrix spike duplicates. However, no differentiation of the applied reason code is made between LCS/LCSDs and MS/MSDs or sample duplicates. Laboratory precision resulted in qualification of 2.4% of the CCPW metals data, 75.0% of the concrete data, and 15.2% of the soil Cr^{+6} data; none of the benzene or SVOC results in the RAWP dataset were qualified based on laboratory precision.

4.4.2.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference or true value. The results of LCS data, surrogate recoveries, method blanks, and MS/MSDs were used as the primary indicators of accuracy; information such as sample container type, preservation, holding time, and moisture content were also considered as impacts to analytical accuracy. Some of this information was assessed by the laboratory at the time of receipt (container type and preservation); other parameters were evaluated during the validation process.

Twenty-five (25) of the Cr^{+6} results in soil (3.3%) and one (1) Cr^{+6} result in concrete (5.0%) in the RAWP dataset were qualified "RA" to indicate the results were rejected since both the initial and reanalysis spike recoveries fell outside of the control limits of 50-150%. For each sample qualified RA, the matrix of the spiked sample appeared to be reducing based on the Eh/pH plot and the presence of ferrous iron and TOC and, therefore, unable to support the presence of Cr^{+6}. In addition, 40 nickel and chromium CCPW results (2.0%) were qualified RA based on the field duplicate RPD. The RPD values for these analytes in the field duplicate were >120% resulting in rejection of positive results under NJ specific validation requirements. However, these results can provide information for project decisions with an understanding of the data limitations as described in the data validation report. There were no rejected benzene or SVOC results in the RAWP dataset. The Cr^{+6} and CCPW results that were

qualified RA may provide further information for project decisions but should be used with an understanding of the QC issues identified in the associated data validation report.

Qualification of data as estimated (J/UJ) for accuracy was related to issues such as field or laboratory blank contamination or MS results. A summary of the validation findings is presented by QC parameter type below.

The presence of negative blanks or target analytes in laboratory blanks was cited as a reason for qualification of 4.4% of the CCPW metals results and 5.2% of the soil Cr^{+6} results; no qualification on the basis of blanks was reported for Cr^{+6} in the concrete, benzene, or SVOC data. For those blanks in which contaminants were detected, action levels were established per the NJDEP or USEPA Region 2 validation guidance documents. Associated sample results were qualified accordingly.

MS and/or MSD recoveries resulted in qualification of 20.8% of the CCPW metals data, 10.0% of the Cr^{+6} in the concrete data, and 37.4% of the Cr^{+6} in the soil data. None of the benzene or SVOC data was qualified on the basis of matrix spike recoveries.

4.4.2.3 Representativeness

The representativeness of any field program is a function of the planning and procedures used to collect the samples and the locations and density of samples collected. Sampling and preservation methods were based on established methods and SOPs outlined in the Soil RIWP (AECOM, 2011) and FSP-QAPP (AECOM, 2010a), which are known to minimize error associated with the disturbance of environmental samples from their natural setting.

Factors to be considered in evaluating representativeness are the use of standard analytical procedures, sample preservation, and the use of the appropriate sample containers. The analytical methods, preservation procedures, and containers used in this program were as specified in the FSP-QAPP.

The moisture content of samples is also a factor in the representativeness of the data. In accordance with USEPA Region 2 validation guidance, samples containing more than 50% moisture are qualified as estimated. None of the RAWP results were qualified for high moisture content.

4.4.2.4 Comparability

Comparability of the data generated as part of the RAWP investigations was maximized by using standard methods for sampling, analysis, and data validation.

4.4.2.5 Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system; valid data are defined as those data judged to be usable (i.e., not rejected as a result of the validation process). For the RAWP dataset 3,168 individual data points were generated, 2.1% (26 Cr^{+6} and 40 CCPW results) were qualified RA to indicate that, although QC exceedances were identified, the results still may have value for understanding site conditions. Overall, 97.9% of the reported RAWP values generated for benzene, CCPW metals, Cr^{+6}, and SVOCs are considered fully usable for project decisions with an understanding of the quality issues identified during validation.

The Cr^{+6} values qualified as “RA” do not meet the required 50-150% soluble and insoluble matrix spike recovery limits due to sample matrices which do not appear capable of supporting Cr^{+6}. CCPW

results qualified as RA had RPD values greater than 120% for field duplicates. Results qualified RA can be used for information purposes with a full understanding of the limitations as described in the data validation report.

4.4.2.6 Sensitivity

Analytical dilutions can be necessary for certain samples due to the sample matrix or elevated concentrations of target or non-target analytes. The detection limits reported by the laboratory were adjusted to reflect any dilution factors. Limitations in analytical methodologies and/or low percent solids content for some soil samples can result in detection limits that exceed either the RDCSRS or DIGWSSL; however, no RAWP results were reported as non-detect at levels above the target regulatory limits.

4.4.2.7 Data Quality/Data Usability Conclusions

The findings of this Data Quality Assessment and Data Usability Evaluation indicate that the data presented for the RAWP are sufficiently representative of actual conditions and may be used to support decisions with the exceptions identified below:

- Cr^{+6} results qualified “RA” due to matrix spike recoveries outside the range of 50-150% but having evidence of a reducing matrix and CCPW results (Ni and Cr) qualified RA due to field duplicate RPD >120% may provide useful information for site decisions but should be used with an understanding of the data limitations which are described in the data validation memoranda.

Data qualifiers and reason codes were applied by the data validator to identify data limitations found in the validation process. Specific details regarding analytes and samples can be found in the individual data validation reports.

5.0 Description of the Current-Use Remediation Areas

The current-use remediation areas include both saturated and unsaturated soils that are within the Forrest Street building footprints and the excavation offsets. Because the accessibility of Site Impacts, structural concerns, utilities, and potential impacts to tenants vary within the different current-use remediation areas, engineering controls will vary, as well. Therefore, each of the current-use remediation areas (**Figure 5-1**) will be assessed and addressed independently.

This RAWP evaluates remedial alternatives for the portions of Forrest Street and Forrest Street Properties where excavation was not possible due to structural concerns for the buildings at 84/86/90 Forrest Street (Block 21501, Lots 11 and 12) and 98/100 Forrest Street (Block 21501, Lot 14) and existing nearby subsurface utilities, which are currently used for commercial purposes. For the purpose of this remedial alternative evaluation, Forrest Street and Forrest Street Properties were subdivided into multiple areas based on the current use. Within each current-use remediation area, AOCs were identified based on the contaminant type and property (**Figure 5-2**). The identified current-use remediation areas and associated AOCs are:

- 100 Forrest Street Offset
    - AOC FSP-1B: For CCPW-impacted soil within Lot 15
    - AOC FSP-2B: For MGP-impacted soil within Lot 15
    - AOC FSP-1C: For CCPW-impacted soil within Lot 14
    - AOC FSP-2C: For MGP-impacted soil within Lot 14
- 84 Forrest Street Building Footprint and Loading Dock
    - AOC FSP-1D: For CCPW-impacted soil within Lots 11 and 12
- Forrest Street Utility Offset
    - AOC FS-1B: For CCPW-impacted soil within Forrest Street
    - AOC FS-2B: For MGP-impacted soil within Forrest Street
    - AOC FSP-1E: For CCPW-impacted soil within Lot 14
    - AOC FSP-2E: For MGP-impacted soil within Lot 14
- 90 Forrest Street Alleyway
    - AOC FSP-1F: For CCPW-impacted soil within Lots 12 and 14
- 98/100 Forrest Street Building Footprint
    - AOC FSP-1G: For CCPW-impacted soil within Lot 14
- 100 Forrest Street Loading Dock Driveway (Associated with the 98/100 Forrest Street Building Footprint)
    - AOC FS-1C: For CCPW-impacted soil within Forrest Street
    - AOC FS-2C: For MGP-impacted soil within Forrest Street
    - AOC FSP-1H: For CCPW-impacted soil within Lot 14

    - AOC FSP-2H: For MGP-impacted soil within Lot 14
- 86/90 Forrest Street Building Footprint
    - AOC FSP-1I: For CCP-impacted soil within Lots 11 and 12
- 90 Forrest Street Boiler Room Basement
    - AOC FSP-1J: For CCPW-impacted soil within Lot 12
- Grid GG15B
    - AOC FSP-1K: For CCPW-impacted soil within Lot 14

Areas of Concern within Forrest Street Properties and Forrest Street where full remedial excavation was previously conducted are not covered by this RAWP, including:

- Forrest Street Excavation Area
    - AOC FS-1A: For CCPW-impacted soil within the Forrest Street Excavation Area
    - AOC FS-2A: For MPG-impacted soil within the Forrest Street Excavation Area
- Forrest Street Properties Lot 15 Excavation Area
    - AOC FSP-1A: For CCPW-impacted soil within the Forrest Street Properties Lot 15 Excavation Area
    - AOC FSP-2A: For MPG-impacted soil within the Forrest Street Properties Lot 15 Excavation Area

5.1 100 Forrest Street Offset (AOC FSP-1B, AOC FSP-2B, AOC FSP-1C, and AOC FSP-2C)

South of 100 Forrest Street, within the property boundary, there is a driveway comprised of a concrete apron and asphalt that provides access to a loading dock at the southern wall of the 100 Forrest Street building. The Skyways property is located directly west of this location and the 100 Forrest Street building. Prior to the Skyways excavation, the area was paved with asphalt pavement which was in poor condition. The driveway is at a lower elevation than the Skyways property and the soil on the Skyways property is supported by a deteriorated and aging, unreinforced, concrete-block retaining wall that is visibly leaning or tilting east. The building is presently occupied by a tenant whose business is bike sharing.

On May 5, 2017, AECOM and Mueser Rutledge Consulting Engineers (MRCE) inspected the retaining wall during a rain event and observed water leaking through cracks in the retaining wall. The leaking water did not appear to be impacted by chromium.

Due to the condition of the 100 Forrest Street building and the retaining wall, PPG, based on MRCE's recommendation, proposed no intrusive activity within a 25-ft horizontal offset of this building (AECOM, 2017a). This current-use remediation area, referred to as the "100 Forrest Street Offset" (**Figure 5-1**), encompasses the Site Impacts remaining in place following the Skyways property excavation due to the limitations associated with this 25-ft horizontal offset. Site Impacts, including CCPW and CCPW-impacted soil, within the 100 Forrest Street Offset will remain in place until the future residential-use remediation is implemented, as described in **Section 7.3**.

5.1.1 Summary of Impacts

Site Impacts exceeding the applicable remediation standards remaining in place following the Skyways excavation include the presence of visually observed CCPW (Grid W12B and Grid X13B), Cr^{+6} (Grids W13B, X13B, and X14B), the CCPW metal nickel (Grid X13B), benzo(a)anthracene (Grid W13B), and naphthalene (Grid W13B). Note that the Chromite Ore Processing Residue (COPR) seam observed during excavation in Grid W12B was removed during restoration.

The offset is bounded to the west by the 100 Forrest Street building and the retaining wall and bounded to the south by Forrest Street. The offset is delineated to the north for CCPW and Cr^{+6} by boring NFS-PDI-X15B and for nickel by FS25. Exceedances of applicable standards for naphthalene and benzo(a)anthracene, in post-excavation confirmation sample FSP-W12B-SW-3.5-4.0, remain in the soil and are capped.

The results of the September 22, 2016 sampling of the ponded water at the base of the driveway indicated that Cr^{+6} and CCPW metals were not detected at concentrations greater than their respective Groundwater Water Quality Standards.

5.2 84 Forrest Street Building Footprint and Loading Dock (AOC FSP-1D)

The 84 Forrest Street building is a commercial, one-story addition to the 90 Forrest Street building (building shed). The building is constructed from metal framing with a non-load-bearing corrugated metal exterior wall, and a corrugated metal roof. The building shed contains a concrete slab and concrete block foundation which extends several feet above the surface grade of the adjacent properties to the east and north; this concrete block foundation functions as a retaining wall for soil within the building footprint. Foundations below the perimeter block masonry wall have not been investigated due to structural concerns. Therefore, the following uncertainties exist: whether reinforced concrete or leveling stone forms the base of the concrete block courses; the depth of the extent of the foundation wall; and whether the bearing elevation of the foundation wall is consistent around the perimeter or if it follows the slope of the existing grade with a similar depth of embedment.

The 84 Forrest Street building houses an elevated loading dock. The loading dock consists of an approximately 4-inch thick, reinforced concrete slab on a concrete block interior wall that is elevated approximately 4-ft high. The loading dock is connected to the building's concrete block foundation. Load-bearing metal columns bear on the loading dock surface and the surrounding perimeter concrete block walls.

The tenant at 84 Forrest Street is a division of Hudson County Law Enforcement.

5.2.1 Assessment of Building Footprint

Sanborn maps and aerial photographs indicate that the 84 Forrest Street building shed was constructed as early as in 1989. At various times prior to the construction of the 84 Forrest Street building, the property was vacant, contained residential buildings, and included miscellaneous small buildings. Therefore, fill containing CCPW or CCPW-impacted soil could potentially have been placed within the building's footprint prior to or during its construction.

5.2.2 Summary of Impacts and Assessment of Existing Interim Remedial Measures

In 2011, one RI boring (ICO-25) was advanced in the 84 Forrest Street property (AECOM, 2016a). In 2014, two RI soil borings were advanced in the 84 Forrest Street building footprint (AECOM, 2016c).

Boring FSI10 was advanced on the concrete slab of the 84 Forrest Street loading dock and boring FSI9 was advanced on the covered concrete driveway south of the loading dock. In 2016, the PDI borings P4-FOR-FF10B and P4-FOR-FF10BR were installed directly south of the 84 Forrest Street property boundary (AECOM 2016a). No Site Impacts were detected at borings ICO-25, FSI9, FSI10, P4-FOR-FF10B, and P4-FOR-FF10BR.

In July 2014, at the request of NJDEP, AECOM conducted an inspection of the 90 and 98 Forrest Street buildings. Light green/yellow staining was identified on the concrete block face of the 84 Forrest Street loading dock (AECOM, 2014). AECOM collected a composite sample of the stained material (114-90F-IRM-20140714), which was analyzed for Cr^{+6}, pH, Eh, and Cr. Cr^{+6} and Cr results were 44.6 mg/kg and 127.0 mg/kg, respectively. Epoxy was applied to the stained concrete block face to prevent direct contact with chromium-containing material.

In March 2015, AECOM completed the quarterly inspection of the 90 Forrest Street building and the Forrest Street Properties IRMs that were installed to address potential chromium blooms (AECOM, 2015). Green staining was identified in the mortar between the concrete blocks on the face of the 84 Forrest Street loading dock. AECOM collected a composite sample of the stained material (90 FORREST-2015-Q2) which was analyzed for Cr^{+6}, pH, Eh, and total Cr. Cr^{+6} and total Cr results were 65 mg/kg and 192 mg/kg, respectively. Epoxy was applied to the stained concrete block face to prevent direct contact with chromium-containing material. The applications of epoxy to the green stains that were observed in 2014 and 2015 are collectively referred to as the “84 Forrest Street Loading Dock IRM”. The 84 Forrest Street Loading Dock IRM remains in good condition and meets the intended objective of preventing direct contact with previously observed chromium blooms. The analytical results for these concrete samples are presented in **Table 2-3**.

Four additional RI soil borings were advanced and sampled on the 90 Forrest Street Loading Dock in September 2016 (AECOM 2016a). Two of the four borings (LD-FS10AVN and LD-FS10AVS) were advanced on top of the loading dock and the remaining two borings (LD-FS10AHN and LD-FS10AHS) were advanced at an angle of approximately 30 degrees into the loading dock’s concrete block face. The analysis of soil sample LD-FS10AVS-6.0-6.5 indicated that the Cr^{+6} concentration exceeded the CrSCC. The Cr^{+6} concentration in soil sample LD-FS10AHN 8.0-8.5 was 20 mg/kg, equivalent to the CrSCC limit. No CCPW was observed in these soil borings.

The exceedance of the CrSCC for Cr^{+6} in boring LD-FS10AVS is delineated to the south by borings ICO-25, FSI9, and P4-FOR-FF10B(R), and to the west by boring FSI10 (**Figure 4-2**). The loading dock structure is bounded to the north and east by the concrete block retaining wall, beyond which the adjacent properties are at a lower surface elevation than the loading dock. Therefore, the CCPW-related impacts beneath the loading dock are unlikely to extend outside the loading dock’s footprint.

5.3 Forrest Street Utility Offset (AOC FS-1B, AOC FS-2B, AOC FSP-1E, and AOC FSP-2E)

Due to the condition of the Forrest Street buildings and to protect subsurface utilities, PPG, based on MRCE's recommendation, proposed no intrusive activity within a 25-ft horizontal offset south of the buildings (AECOM, 2017a). This current-use remediation area, referred to as the "Forrest Street Utility Offset" (**Figure 5-1**), encompasses the Site Impacts remaining in place in Forrest Street after the completion of the Forrest Street excavation. Site Impacts remaining within the Forrest Street Utility Offset are delineated to the east (AECOM, 2017b), and are bounded by Forrest Street Properties to the north, the Forrest Street excavation's footprint to the south, and the Skyways property to the west.

5.3.1 Summary of Impacts

Site Impacts that remain in place in the Forrest Street Utility Offset following the Forrest Street excavation are presented on **Figure 4-1** through **Figure 4-9** and on **Table 2-2** through **Table 2-9**.

Site Impacts remaining in place include the presence of visually observed CCPW (Grids X12B, Y11B, Y12B, Z11B, AA11B, and AA10B); Cr^{+6} (Grids Y11B, Y12B, Z11B, Z12B, AA11B, BB11B, CC10B, and CC11B); the CCPW metal vanadium (Grid Y11B); the SVOCs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene (Grids Y12B and Z12B), and naphthalene (Grid Y12B); and the VOC benzene (Grid Z12B). Note that the COPR seam observed during excavation in Grids X12B, Y11B, Y12B, Z11B, AA11B, and AA10B was removed during restoration.

The delineation of MGP-related impacts emanating from Site 114 beyond location P4-FOR-Y12B (**Figure 4-6**) is achieved through extrapolation in accordance with the *Technical Guidance for Site Investigation of Soil, Remedial Investigation of Soil, and Remedial Action Verification Sampling for Soil* (NJDEP, 2015) as discussed in **Table 2-6**. Based on the concentration gradient and the field observations, the approximate limits of MGP-related impacts are estimated to extend no further north than the 100 Forrest Street Loading Dock Driveway. In accordance with the *Technical Guidance for Site Investigation of Soil, Remedial Investigation of Soil, and Remedial Action Verification Sampling for Soil* (NJDEP, 2015), the extent of contamination greater than the applicable unrestricted use remediation standard still needs to be confirmed using laboratory analyses prior to the completion of a Remedial Action.

Due to the condition of the Forrest Street buildings, PPG, based on MRCE's recommendation, proposed no intrusive activity within a 25-ft horizontal offset of the buildings (AECOM, 2017a). This offset area is referred to as the "Forrest Street Utility Offset" (**Figure 5-1**). Site Impacts within this offset area will remain in place until the building is demolished at a later date.

5.4 90 Forrest Street Alleyway (AOC FSP-1F)

The 90 Forrest Street Alleyway is located between 90 Forrest Street and 98 Forrest Street buildings and is primarily within the 90 Forrest Street property boundary. The alleyway is bounded by Forrest Street to the south and vacant land to the north.

The alleyway is paved with asphalt and soil borings advanced during RI and PDI activities indicate that the asphalt thickness varies. The asphalt abuts the exterior walls of the 90 Forrest Street and 98 Forrest Street buildings. Subsurface concrete was also observed between 0.5 and 4.0 ft below ground surface (bgs) in borings advanced in Grids BB12B and CC13B. The northern portion of the alleyway

(located at the northwest corner of 86/90 Forrest Street) widens into a yard that measures approximately 50 ft by 50 ft.

Several subsurface utilities are located within the alleyway between the 90 Forrest Street and 98 Forrest Street buildings. A sewer lateral line runs north to south along the western side of the alleyway, connecting to the sewer main in Forrest Street. Two potable water laterals that run north to south in the alleyway connect to the water main in Forrest Street and service the 90 Forrest Street and 98 Forrest Street buildings. Several stormwater laterals for roof drainage connect to a drainage line in the alleyway that runs north to south towards Forrest Street. An overhead electrical line services the nearby buildings.

Due to the condition of the 90 Forrest Street and 98 Forrest Street buildings, PPG, based on MRCE's recommendation, proposed no intrusive activity in the alleyway (AECOM, 2016c). Site Impacts within the alleyway will remain in place until the building is demolished at a later date.

5.4.1 Summary of Impacts

Site Impacts include the presence of visually observed CCPW (Grids BB12B and BB13B), Cr^{+6} (Grids BB11B, BB12B, BB13B, CC12B, CC13B, CC14B, and EE16B), the CCPW metal nickel (Grids BB12B, EE15B, and DD16B), dibenzo(a,h)anthracene (Grid CC12B), benzo(a)anthracene (Grids CC12B, CC14B, and EE15B), benzo(b)fluoranthene (Grid CC12B), and benzene (Grid EE15B).

Visually observed CCPW and Cr^{+6} exceedances are generally located in the southern portion of the alleyway, except in Grid EE16B, where one shallow (0.0 to 0.5 ft bgs) Cr^{+6} exceedance is delineated to the north and west, and bounded by the 90 Forrest Street building to the south and east.

5.5 98/100 Forrest Street Building Footprint (AOC FSP-1G) and 100 Forrest Street Loading Dock Driveway (AOC FS-1C, AOC FS-2C, AOC FSP-1H, and AOC FSP-2H)

The 98/100 Forrest Street building is located on Block 21501, Lot 14. The 98 Forrest Street property includes a commercial three-story building, constructed with masonry block wall facades built around steel framing and the 100 Forrest Street property features a commercial one-story extension of the 98 Forrest Street building. The west, north, and south walls of the 100 Forrest Street extension are constructed from stuccoed, unreinforced concrete masonry block, and the western wall is clad in aluminum siding.

The building is built on concrete slabs and the depth of building's reinforced concrete foundation is unknown. The building does not include any floors below grade (basements). The elevations of the surfaces of the slabs are between approximately El. 10 ft NAVD88 and El. 11 ft NAVD88.

As previously described in **Section 5.1**, a driveway that provides access to a loading dock is located south of the 100 Forrest Street extension, within the property boundary. The western bay is constructed of a concrete apron and the eastern bay is paved with asphalt. For the purpose of this RAWP, the driveway is considered to be part of the 98/100 Forrest Street Building Footprint.

The 98/100 Forrest Street property owner is 100 Forrest Street, LLC. Citi Bike currently rents 100 Forrest Street and uses the building as a bicycle maintenance garage. The 98 Forrest Street building was previously rented to Wilson Auto Parts.

5.5.1 Assessment of the Building Footprint

The Sanborn maps indicate that the 98 Forrest Street building was constructed in 1917. The 100 Forrest Street extension was constructed by 1958; before 1958, the footprint of the extension was vacant and undeveloped. The chromate chemical production facility located on Site 114 began operations in 1911. Therefore, fill containing CCPW or CCPW-impacted soil could potentially have been placed within the building's footprint prior to or during its construction.

5.5.2 Summary of Impacts

Site Impacts below the building slab include the presence of Cr^{+6} (Grids Z13B, AA12B, AA13B, AA14B, and BB13B). CCPW was not visually observed below the building slab.

During RI activities, one concrete core sample was collected from the 100 Forrest Street extension's concrete slab at boring FS19 in Grid Y14B and one concrete core sample was collected from the 98 Forrest Street building's concrete slab at boring FS21 in Grid BB14B. The concrete core samples were analyzed for Cr^{+6}, Eh, pH, and total Cr. Hexavalent chromium was detected at a concentration of 323 mg/kg in the sample collected at the top of the core at boring FS21 (sample FS21-CT), and green staining was observed in the sampled interval. Hexavalent chromium was detected at the bottom of the core (Sample FS21-CB) at a concentration of 0.78 mg/kg.

No chromium blooms have been observed on the surface of the 98/100 Forrest Street building concrete slabs or on the surface of the loading dock driveway.

The results of the November 13, 2017 groundwater sampling at monitoring well 114-MW44A within the 98/100 Forrest Street Building Footprint indicated that Cr^{+6} and CCPW metals were not detected at concentrations greater than the respective detection limits (**Appendix F**).

5.6 86/90 Forrest Street Building Footprint (AOC FSP-1I)

The 86/90 Forrest Street building is located on Block 21501, Lots 11 and 12. The 90 Forrest Street building is a commercial three-story building that is constructed with masonry block wall facades built around steel framing.

The building is a split-level, slab-on-grade structure, except within the footprint of the boiler room basement, which is discussed in **Section 5.7**. The surface elevation of the slab ranges between approximately 7.5 ft NAVD88 and 10.5 ft NAVD88.

The 86/90 Forrest Street property owner is 90 Forrest Associated, LLC. The 86/90 Forrest Street building is currently rented to the Pearl Studios and the Hudson County Prosecutor. PPG also rents space within the 90 Forrest Street building.

In the Forrest TEE, PPG deferred remedial excavation of Site Impacts within the 86/90 Forrest Street Building Footprint to protect the current use of the Forrest Street buildings and utilities.

5.6.1 Assessment of Building Footprint

When the chromate chemical production facility on Site 114 began operations in 1911, the property was occupied by Moore Brother's Publishing Company. The 1951 Sanborn map indicates that the large building currently present at 86/90 Forrest Street was constructed in 1917. It is possible that

CCPW and CCPW-impacted soil may have been placed within the footprint of the 86/90 Forrest Street building when it was being constructed before and during 1917.

5.6.2 Summary of Impacts

Site Impacts below the 86/90 Forrest Street building's slab include the presence of Cr^{+6} (Grids CC11B, CC12B, CC13B, and DD11B) and benzo(a)anthracene (Grid CC12B). CCPW was not visually observed within the building footprint (excluding the 90 Forrest Street boiler room footprint). The 90 Forrest Street Boiler Room Basement is described in **Section 5.7.**

The results of the September 2017 groundwater sampling at monitoring well 114-MW36A, located immediately south of the 96/90 Forrest Street building, were non-detect for Cr^{+6} and 1.1 micrograms per liter (µg/L) for total Cr.

5.7 90 Forrest Street Boiler Room Basement (AOC FSP-1J)

The 90 Forrest Street Boiler Room Basement is located within the footprint of the 86/90 Forrest Street building on Block 21501, Lot 12. The basement is approximately 40-ft long by 30-ft wide. The basement is partially below grade with walls constructed from concrete block (below grade foundation walls) and brick (above grade). The surface elevation of the boiler room basement's concrete slab is approximately 3.5 ft NAVD88. A figure presenting surveyed spot elevations collected in the boiler room basement, prepared by Borbas Surveying & Mapping LLC., is included in **Appendix H**.

An interior perimeter drain runs along a portion of the north, east, and west walls, and a trench drain runs from east to west through the center of the floor slab. The trench drain is covered by plastic grating. Two sumps (east and west sumps) are present on the ends of the trench drain. A third sump (south sump) is located on the side of the south wall of the basement, accessible through the90 Forrest Street former office space. All three sumps are currently equipped with submersible pumps to maintain dry conditions in the basement. The east and west sump pumps were malfunctioning in the past and were therefore replaced by PPG with a commercial-grade pump system in November 2018. PPG plans to replace the south sump pump during implementation of the selected remedial action. A remote telemetry unit with level sensor alarm and power outage alarm notification ability was also installed in the east and west sumps.

A wooden shed has been constructed inside the basement for storage. A wooden staircase has been built over a defunct masonry staircase and provides access to the basement after entering through the main entrance door (which is kept locked). Masonry staircases are also present at the southeast and northwest corners of the basement.

5.7.1 Summary of Impacts and Existing Interim Remedial Measures

Site Impacts were not found in soil beneath the 90 Forrest Street Boiler Room Basement's concrete slab during RI and PDI activities.

Yellow water in the 90 Forrest Street Boiler Room Basement sumps was sampled in October 2011. Analytical results for additional groundwater samples that were collected from 2012 through 2015 are presented in the Technical Memorandum: *FOR-005 Additional Forrest Street Remedial Investigation – Soil & Groundwater* (AECOM, 2016a). Both historical analytical results and the September 2017 sump water sampling analytical results are presented in the December 19, 2017 email from PPG/AECOM to NJDEP presenting results of the supplemental groundwater investigation (AECOM, 2017i). Sump

water analytical results do not indicate a trend in Cr concentrations, which remain greater than the NJDEP Ground Water Quality Criterion (GWQC) of 70 µg/L.

In 2014, five concrete core samples were collected from the basement slab and analyzed for Cr^{+6}, Eh, pH, and total Cr. Hexavalent chromium was detected in the middle of the concrete core (FSI2) at a concentration of 21.6 mg/kg (AECOM, 2016a). No Cr^{+6} or total Cr was detected at concentrations greater than the CrSCC in the other four cores. Concrete core locations are presented on **Figure 4-3** and analytical results for the concrete core samples are presented on **Table 2-3**.

In 2013, green staining was observed on the walls of the 90 Forrest Street Boiler Room Basement. Concrete chip samples were collected from the lower portion of the concrete block walls and analyzed for Cr^{+6}, Eh, pH, and total Cr. Hexavalent chromium was detected in concrete chip samples collected from the north, south, and west walls at concentrations of 155 mg/kg, 789 mg/kg, and 26.6 mg/kg, respectively. Following the concrete chip sampling, an epoxy coating was applied to the basement slab and walls, and the basement was locked to prevent entry. The epoxy coating and restricted access together constitute an IRM. The purpose of this IRM is to prevent contact with chromium blooms and chromium-impacted groundwater.

In July 2018, water accumulation in the music studio basement (**Figure 1-2**) was reported, as described in an email correspondence from Prabal Amin (Weston) to Ronald Riccio (Site Administrator) and Wayne Howitz (NJDEP) (Weston, 2018a). On July 16, 2018, AECOM and Weston conducted an inspection of the basement to assess the area for potential CCPW-related impacts resulting from the water. In areas of the basement that were physically and/or visually accessible, no green staining or chromium blooming was observed. A Cr concentration of 166 µg/L was detected in an unfiltered water sample, which was collected from the sump pump discharge line as there was not sufficient water to collect a sample from the basement floor water at the time of sampling. However, it was determined that this sample was likely biased high due to possible cross-contamination from the sump pump and to the high turbidity of the unfiltered sample. Additionally, the sump sample was subsequently filtered by the lab outside of the holding time and a Cr concentration of 58.6 µg/L was detected.

In August 2018, standing water was observed in the music studio basement (up to 1.5 inches in depth in one area). The standing water is likely the result of a broken pipe, which drains to a hole in the basement floor. The origin of the pipe is unknown. On August 22, 2018 two water samples, one filtered and one unfiltered, were collected from the standing water, and samples were submitted for Cr^{+6} and Cr analysis. Total Cr was detected in the unfiltered and filtered water samples at concentrations of 10.9 µg/L and 6.8 µg/L, respectively. Hexavalent chromium was not detected above the method detection limit (MDL) in either of the water samples. PPG/AECOM reported the results of the August 22, 2018 sampling to the NJDEP and Weston via email on September 4, 2018 and to the property owner via email on September 5, 2018. Email documentation regarding the water accumulation in the music studio basement is provided in **Appendix F**.

5.7.2 Assessment of Existing Interim Remedial Measures

No additional chromium blooms have been observed on the walls of the 90 Forrest Street Boiler Room Basement following the installation of the IRM. However, chromium blooming was observed on top of the epoxy coating in the 90 Forrest Street Boiler Room Basement floor following installation of the epoxy coating IRM. The chromium blooming observed on the epoxy coating of the floor was likely the result of impacted groundwater that dried following a flooding event in the basement.

The epoxy coating on the walls and floors remains in good condition, as documented in the IRM inspection reports. However, unlike other IRMs where an epoxy coating prevents contact with chromium blooms, the basement concrete slab and a portion of the concrete foundation walls are below the water table elevation, and hydrostatic pressure could eventually cause the epoxy to blister or delaminate in the future.

Locking the basement effectively prevents access to, and direct contact with, both potential chromium blooms and chromium-impacted groundwater. Because the IRM requires the basement to remain locked, the existing IRM prevents the basement from being rented to potential tenants or being used for other purposes. During the May 17, 2017 meeting between PPG, NJDEP, the Jersey City Redevelopment Agency (JCRA), and the property owner, PPG agreed to evaluate more permanent engineering controls that would allow access to the boiler room.

5.8 Grid GG15B (AOC FSP-1K)

Grid GG15B is located adjacent to the northeast corner of the 86/90 Forrest Street building in a grassed area and just beyond the backyards of the Halladay Street residential properties.

5.8.1 Summary of Impacts

CCPW-related impacts have been identified in shallow soil in this grid. Specifically, the Cr^{+6} concentration of 21.3 mg/kg for the soil sample collected at NFS-PDI-GG15B from 1.7 to 2.2 ft bgs is greater than the CrSCC. This Cr^{+6} exceedance of the CrSCC has been delineated to the north and to the south. The remediated Halladay Street residential area is located to the east and the 86/90 Forrest Street building is located to the west.

6.0 Remedial Alternatives Evaluation

Remedial alternatives were identified and assessed for each of the current-use remediation areas based on the following factors: protectiveness of human health and the environment; compliance with the applicable remediation standards; permanence in relation to the anticipated timeframe until redevelopment; structural feasibility; effects on surrounding structural elements; duration of construction; the construction equipment required; inherent risks; impacts to existing businesses; and the relative costs. A description of each remedial alternative evaluated is provided below and summarized in tabular format in **Table 6-1**.

Work conducted in close proximity to buildings and other structures may pose a risk to the structural integrity of the building and structures. PPG has retained MRCE to consult on and prepare structural support design documents and to provide condition surveys, vibration and deformation monitoring services, and oversight during the remedial activities aimed at providing advance notice of any issues associated with protecting the structural integrity of existing structures, working personnel, and the public.

6.1 100 Forrest Street Offset (AOC FSP-1B, AOC FSP-2B, AOC FSP-1C, and AOC FSP-2C)

Remedial excavation of Site Impacts within the 100 Forrest Street Offset will be deferred to the future residential-use remediation, due to potential structural concerns associated with the current-use of the 100 Forrest Street building. One remedial alternative for the 100 Forrest Street Offset was proposed, evaluated, and developed as a component of the Forrest Street and Forrest Street Properties restoration, which was included in the *Restoration Technical Execution Plan, Garfield Avenue Group, Jersey City, New Jersey* (Restoration TEP) (AECOM, 2017d) and the PPG/AECOM memorandum entitled *Summary of Proposed Forrest Street Restoration Activities – Skyways and Roadway* (Restoration Memorandum), dated November 21, 2017 (AECOM, 2017g). Verbal concurrence on the Restoration Memorandum was received from the NJDEP and the property owner on November 9, 2017.

The proposed remedial alternative with the use of an engineering control is not anticipated to pose a structural concern to the adjacent building, is protective of human health and the environment, and will mitigate the surface water runoff leaking through the west wall of the 100 Forrest Street Building. A deed notice and corresponding RAP will be required for this restricted-use remedy. Monitoring of engineering controls implemented for restricted-use remedies will be conducted as discussed in **Section 8.9**.

The combined engineered control/mitigation measure consists of the following:

- A high-density polyethylene (HDPE) liner will be placed on top of the impacted soil and overlain with dense-graded aggregate (DGA). The area will then be paved with an asphalt cap;
- Adjacent to the 100 Forrest Street building, an HDPE liner will be placed on top of impacted soils, overlain with DGA, and covered with geosynthetic cementitious composite mat (GCCM) to address impacted soils and mitigate the surface water runoff leaking through the west wall of the 100 Forrest Street building; and

- The former asphalt pavement that was present in the Skyways property (including the portion of the property within the 100 Forrest Street Offset), will be restored.

The mitigation measure to address the storm water runoff leaking through the west wall of 100 Forrest Street was developed by MRCE and presented in their work plan (**Appendix I**) (MRCE, 2017). MRCE is the lead engineering firm for the mitigation of the surface water runoff leaking through the wall.

The duration of the remediation and construction activities for this work was estimated to be 2 to 3 weeks.

The Forrest Street and Forrest Street Properties restoration, which included the elements of the proposed remedial alternative for the Forrest Street Utility Offset, was completed between January 3, 2018 and June 27, 2018, and is presented in the Forrest Street RAR (AECOM, 2019b). The Forrest Street and Forrest Street Properties restoration as-built is provided in **Figure 6-1**.

6.2 84 Forrest Street Building Footprint and Loading Dock (AOC FSP-1D)

Four remedial alternatives have been evaluated; these alternatives are protective of human health and the environment by removing or isolating impacted soils and concrete while minimizing potential impacts to existing adjacent structures during remediation. Monitoring of engineering controls implemented for restricted-use remedies will be conducted as discussed in **Section 8.9**. The four remedial alternatives are:

- Remedial Alternative 1: Demolition and removal of the loading dock slab and front masonry wall, soil excavation, and construction of a new slab and front masonry wall, combined with Remedial Alternative 2;
- Remedial Alternative 2: Sealing the entirety of the loading dock interior horizontal and vertical surfaces with epoxy and installation of a protective wearing surface;
- Remedial Alternative 3: In-situ chemical reduction, combined with Remedial Alternative 2; and
- Remedial Alternative 4: Installing a new concrete block wall in front of the existing block wall, combined with Remedial Alternative 2.

A description of each remedial alternative is provided below. Refer to **Figure 7-2** for the plan view of the loading dock.

6.2.1 Remedial Alternative 1

For Remedial Alternative 1, it is PPG's intent to remediate the loading dock to achieve unrestricted use for soils by removing known CCPW-related impacts. However, there is the potential that additional CCPW-impacted material may be discovered during post-excavation soil and/or concrete chip sampling. In this event, the remedial excavation of these additional soil and/or concrete impacts may be prohibited due to the close proximity of load-bearing walls along the perimeter of the loading dock and the potential structural concerns if the additional soil and/or concrete impacts are removed. If the removal of all CCPW-related impacts by Remedial Alternative 1 cannot be achieved without jeopardizing the integrity of adjacent structures, then more extensive remedial excavation of the loading dock will be deferred until the future residential-use remedial action.

Remedial Alternative 1 includes demolition and removal of the loading dock slab and masonry wall, soil excavation, and construction of a new slab and wall combined with Remedial Alternative 2 to seal

remaining impacted concrete structures, if necessary. Remedial Alternative 1 involves remediation and construction activities in close proximity to load-bearing columns, dust control measures, and the replacement of masonry and concrete. This alternative will remove soil beneath the loading dock, including known soil hot-spots, and known concrete impacts and chromium blooms, and will include a physical barrier containment system (if necessary) to prevent direct contact with potentially impacted concrete and prevent future chromium blooms.

Remedial Alternative 1 consists of the following primary remediation and construction activities (listed in the sequence of occurrence and indicating the estimated respective durations):

- Install temporary steel structures to support the loads carried by the steel columns supporting the overhead beams and roof. This work is necessary prior to the removal of the slab, front face, and soil excavation (5-7 days).
- Implement dust control measures, including the use of polyethylene sheeting and/or water mist to prevent the migration of fugitive dust during remediation activities (2-3 days).
- Remove the concrete slab and masonry block wall at the front of the loading dock using compact construction equipment and handwork. Loadout and dispose of the concrete and masonry debris (1-2 weeks).
- Excavate soil underlying the loading dock slab to 6 or 7 feet below the surface slab and remove the soil at the two hot-spot soil boring locations. Loadout and dispose of the excavated soils (1-2 weeks).
- Collect post-excavation soil and/or concrete chip samples for verification purposes. These samples will be analyzed for Cr^{+6}, Eh, pH, and total Cr (1-2 weeks).
- Line the interior face of the masonry block walls with an HDPE liner (2-3 days).
- Construct a new masonry wall for the front of the loading dock (5-7 days).
- Backfill and compact the open excavation with imported certified clean structural fill. Place a liner on top of the finished surface of the structural fill (1-2 weeks).
- Form and pour a new concrete slab and allow time for the concrete to cure (2-3 weeks).
- If the results of the post-excavation samples indicate that Cr^{+6} concentrations exceed the CrSCC, Remedial Alternative 1 becomes a restricted-use remedy with the use of an engineering control using the concrete and masonry surfaces as a cap. Collect chip samples from pre-existing masonry and concrete surfaces remaining in-place to determine if the masonry and concrete can serve as an engineering control without additional remediation. These concrete chip samples will be analyzed for Cr^{+6}, Eh, pH, and total Cr (3-5 days).
- If necessary, seal the remaining impacted concrete and masonry interior loading dock surfaces with epoxy material identified in Remedial Alternative 2 (1-2 weeks) (See **Section 6.2.2**).

The duration of the remediation and construction activities for Remedial Alternative 1 is 2 to 3 months. The productivity of the field activities will be impacted by the use of small construction equipment and hand work required in the limited space of the loading dock area to accommodate the structural support measures, and the need to coordinate field activities with the loading dock operations. Remedial Alternative 1 may interfere with normal loading dock operations. Therefore, the contractor will work closely with the property owner to coordinate field activities with the loading dock operations. MRCE will lead the design effort for the structural support system for Remedial Alternative 1.

6.2.2 Remedial Alternative 2

Remedial Alternative 2 is a restricted-use remedy with the use of an engineering control for the loading dock. It includes sealing the entirety of the interior loading dock concrete and masonry horizontal and vertical surfaces with an epoxy. After applying the epoxy, a protective wearing material will be installed over the interior horizontal surface of the loading dock as a measure to protect the epoxy from wear and tear. Loading dock bumpers will be installed on the interior vertical surface of the loading dock to protect the epoxy from vehicle impacts during loading/offloading. Remedial Alternative 2 does not require structural support measures. Remedial Alternative 2 will serve as a physical barrier containment system to prevent direct contact with impacted concrete, prevent future chromium blooms, and provide a durable, slip-resistant wearing surface.

The protective wearing surface installed over the interior horizontal surface of the loading dock will consist of industrial rubber matting, diamond plating, or another form of an industrial-strength wearing surface. The loading dock bumpers installed on the interior vertical surface of the loading dock will consist of durable material capable of withstanding impacts from vehicles during loading/offloading activities of the loading dock. These features will be installed as an added measure to protect the epoxy coating.

Remedial Alternative 2 will consist of the following primary remediation activities (listed in the sequence of occurrence and indicating the estimated respective durations):

- Implement dust control measures, including the use of polyethylene sheeting and/or water mist to prevent the migration of fugitive dust during scarification activities (2-3 days).
- Scarify the entirety of the masonry and concrete interior horizontal and vertical surfaces of the loading dock using electrical-powered hand tools and/or walk-behind equipment with vacuum-powered dust collection attachments for dust control measures. The concrete dust generated during scarification will be drummed, sampled, and analyzed for disposal purposes (2-3 days).
- Install epoxy coating over the prepared surfaces.
- Install a protective wearing surface over the interior horizontal surface of the loading dock where the epoxy coating has been applied.
- Install loading dock bumpers to the vertical interior face of the loading dock where the epoxy coating has been applied.

The duration of the remediation activities for Remedial Alternative 2 is estimated to be 2 to 3 weeks. The only activity that may have an impact to loading dock operations is the scarification process.

Appendix J contains product information and specifications for an epoxy product that may be considered for use as an epoxy coating.

6.2.3 Remedial Alternative 3

Remedial Alternative 3 is a restricted-use remedy with the use of an engineering control for the loading dock. It includes sealing the entirety of the interior horizontal and vertical surfaces of the loading dock with an epoxy material (Remedial Alternative 2) and instituting in-situ chemical reduction of CCPW-impacted soils, as well as post-treatment confirmation sampling. Remedial Alternative 3 also does not require structural support measures. This Alternative will chemically reduce the Cr^{+6} in

hot-spot soils to Cr^{+3} using FerroBlack®-H (FB-H) solution and will include a physical barrier containment system to prevent direct contact with impacted concrete, prevent future chromium blooms, and provide a durable, slip-resistant wearing surface.

FB-H, a proprietary reagent of Redox Solutions, LLC, is a reductive, colloidal suspension of iron sulfides (main component). The FB-H will be injected to encourage the reduction of Cr^{+6} to Cr^{+3}, thereby reducing the Cr^{+6} concentration in soil to less than 20 mg/kg within the treatment area. One of the potential downsides associated with the use of FB-H is the potential generation of Hydrogen Sulfide and the associated odors.

Remedial Alternative 3 will include the following remediation activities (listed in the sequence of occurrence and indicating the estimated respective durations):

- Core through the loading dock concrete slab at each of the two hot-spot soil boring locations (1-2 days).
- Inject 7% (by weight) FB-H solution using direct push technology at each of the cored concrete locations (1-2 days).
- Grout the injection locations with bentonite (1-2 days).
- Seal each cored concrete location with a cement mix (1-2 days).
- Implement Remedial Alternative 2 (3-5 days).

The duration of the remediation activities for Remedial Alternative 3 is estimated to be 1 to 2 weeks and will have little impact on the loading dock operations.

6.2.4 Remedial Alternative 4

Remedial Alternative 4 is a restricted-use remedy with the use of an engineering control for the loading dock. It includes capping the loading dock surfaces where chromium blooms have been observed and sealing the entirety of the interior horizontal surface of the loading dock with epoxy (see Remedial Alternative 2). Remedial Alternative 4 will serve as a physical barrier containment system to prevent direct contact with impacted concrete and prevent future chromium blooms.

Remedial Alternative 4 consists of constructing a new concrete block wall against the existing concrete block wall on the south side of the loading dock with an HDPE liner installed and anchored in between the existing and new concrete block walls. The new concrete block wall will extend vertically from the building floor slab to the bottom elevation of the loading dock concrete slab. The loading dock concrete slab (4 inches thick) will be extended to the south to the new concrete block wall.

Remedial Alternative 4 does not require structural support measures. However, two steel channels running north to south off the loading dock, that appear to provide lateral support for some columns, may have to be removed, relocated, or integrated into the physical barrier containment system.

Remedial Alternative 4 consists of the following primary remediation and construction activities (listed in the sequence of occurrence and indicating the estimated respective durations):

- Install and anchor an HDPE liner along the entire face of the existing concrete block wall on the south side of the loading dock. Seal the HDPE penetrations (1-2 days).

- Construct a new concrete block wall (waterproofed) against the installed HDPE liner; install vertical dowels in the concrete blocks for stability; install tension ties to batten the new concrete wall against the HDPE liner and existing concrete wall; and seal the penetrations (1-2 weeks).
- Extend the existing loading dock concrete slab to the new concrete block wall with new reinforced concrete (1-2 weeks).
- Install epoxy coating over the entirety of the interior horizontal surface of the loading dock (1-2 weeks).
- Install a protective wearing surface over the interior horizontal surface of the loading dock where the epoxy coating has been applied.
- Install loading dock bumpers to the vertical interior face of the loading dock where the epoxy coating has been applied.

The protective wearing surface installed over the interior horizontal surface of the loading dock will consist of industrial rubber matting, diamond plating, or another form of an industrial-strength wearing surface. The loading dock bumpers installed on the interior vertical surface of the loading dock will consist of durable material capable of withstanding impacts from vehicles during loading/offloading activities of the loading dock. These features will be installed as an added measure to protect the epoxy coating.

The duration of the remediation and construction activities for Remedial Alternative 4 is 3 to 6 weeks and should have minimal impact on loading dock operations.

6.3 Forrest Street Utility Offset (AOC FS-1B, AOC FS-2B, AOC FSP-1E, and AOC FSP-2E)

Remedial excavation of the Site Impacts within the Forrest Street Utility Offset will be deferred to the future residential-use remediation to protect the structural integrity of the current use of the Forrest Street buildings and utilities. One remedial alternative for the Forrest Street Utility Offset was proposed, evaluated, and developed as a component of the Forrest Street and Forrest Street Properties restoration, which was included in the Restoration TEP (AECOM, 2017d) and the Restoration Memorandum (AECOM, 2017g). The Restoration Memorandum included a restoration design for Forrest Street that was developed in conjunction with Jersey City Engineering and complied with Jersey City roadway specifications. Verbal concurrence on the Forrest Restoration Memorandum was received from the NJDEP and the property owner on November 9, 2017.

The proposed remedial alternative with the use of an engineering control is not anticipated to pose a structural concern to the adjacent building or utilities and is protective of human health and the environment. A deed notice and corresponding RAP will be required for this restricted-use remedy. Monitoring of engineering controls implemented for restricted-use remedies will be conducted as discussed in **Section 8.9**.

The remedial alternative consists of the following activities:

- In Forrest Street, remove asphalt and excavate underlying soils to approximately 18 inches bgs, place an HDPE liner on top of impacted soil and up to the buildings, and restore the roadway in accordance with City of Jersey City standard construction details.

The HDPE liner placed in Forrest Street serves as the engineering control in the Forrest Street Utility Offset, which functions as a cap, preventing direct contact with Site Impacts within that area. The HDPE liner extends beneath the sidewalks, concrete aprons, and curbs within the Forrest Street excavation and the Forrest Street Utility Offset as shown in **Figure 6-1**.

The proposed remediation activities were conducted concurrently with the Forrest Street restoration and excavation. One continuous HDPE liner was placed approximately 18 inches bgs above soils left in place within the Forrest Street Utility Offset and the backfilled Forrest Street excavation. Additionally, where the HDPE liner is placed within the Forrest Street excavation and the Forrest Street Utility Offset, the liner serves as a component of the capillary break. Replacement of existing sidewalks, concrete aprons, and asphalt, and construction of new concrete curbs, where required, was conducted as part of Forrest Street restoration activities in accordance with the City of Jersey City standard construction details.

The Forrest Street and Forrest Street Properties restoration, which included the elements of the proposed remedial alternative for the Forrest Street Utility Offset, was completed between January 3, 2018 and June 27, 2018, and is presented in the Forrest Street Properties RAR (AECOM, 2019a). The Forrest Street and Forrest Street Properties restoration as-built is provided in **Figure 6-1**.

6.4 90 Forrest Street Alleyway (AOC FSP-1F)

Three remedial alternatives have been evaluated for the 90 Forrest Street Alleyway. Because Site Impacts in the 90 Forrest Street Alleyway are present at depths too deep to be excavated without jeopardizing the integrity of adjacent structures and subsurface utilities, the three proposed remedial alternatives are engineering controls designed to prevent direct contact with Site Impacts and prevent infiltration of water into the vadose zone soils within the alleyway's footprint. Monitoring of engineering controls implemented for restricted-use remedies will be conducted as discussed in **Section 8.9**. The three remedial alternatives are as follows:

- Remedial Alternative 1: Patch/repair the existing asphalt surface;
- Remedial Alternative 2: Mill the existing asphalt surface down 2 inches and install a new asphalt surface course; and
- Remedial Alternative 3: Excavate the existing asphalt/concrete to 10 inches bgs, install an HDPE liner, backfill with DGA, and install a 4-inch asphalt base course and 2-inch asphalt surface course.

A description of each remedial alternative is provided below.

6.4.1 Remedial Alternative 1

For Remedial Alternative 1, the asphalt will be inspected for cracks and breaks. Broken asphalt will be cut out and asphalt patches will be installed. Cracks will be cleaned and a bitumen sealant will be installed. Implementation of Remedial Alternative 1 is expected to require 1 to 2 weeks.

6.4.2 Remedial Alternative 2

For Remedial Alternative 2, the asphalt will be milled down 2 inches. Cracks in the sub-base will be sealed and broken asphalt will be patched. A tack coat will be applied to the prepared sub-base and a new 2-inch bituminous surface course will be installed. The existing fence and fence posts may have

to be removed and replaced. Implementation of Remedial Alternative 2 is expected to require 4 to 6 weeks.

6.4.3 Remedial Alternative 3

For Remedial Alternative 3, the alleyway will be excavated to 10 inches bgs and will include the removal of any subsurface concrete features. An HDPE liner and 4 inches of DGA will be placed on top of the subgrade. A 4-inch bituminous base course, tack coat and 2-inch bituminous surface course will then be installed. The existing fence and fence posts may have to be removed and replaced. Implementation of Remedial Alternative 3 is expected to require 8 to 12 weeks.

6.4.4 90 Forrest Street Alleyway: Grid EE16B

Because the Cr^{+6} exceedance in the northern portion of the alleyway is shallow (0.0 - 0.5 ft bgs) and limited to Grid EE16B, spot excavation to remove the soils that exhibit this exceedance is possible without posing a significant risk to the structural integrity of the adjacent buildings. Grid EE16B was proposed to be excavated to the proposed terminal excavation elevation (TEE) of 10.4 ft NAVD88 to remove the soils exhibiting this exceedance. Because a clean PDI sample result for Cr^{+6} is present at the proposed targeted excavation elevation, a post-excavation pit-bottom sample will not be collected.

If CCPW impacts are visually observed in the pit-bottom or excavation sidewalls, a soils cap consisting of an HDPE liner, DGA, and asphalt will be installed. Otherwise, the excavation will be backfilled with DGA. If the soils cap is installed in Grid EE16B, the deed notice will include Grid EE16B's excavation extents.

6.5 98/100 Forrest Street Building Footprint (AOC FSP-1G), 100 Forrest Street Loading Dock Driveway (AOC FS-1C, AOC FS-2C, AOC FSP-1H, and AOC FSP-2H), and 86/90 Forrest Street Building Footprint (AOC FSP-1I)

One remedial alternative, utilization of the buildings' concrete slabs as a soils cap, was evaluated for the 98/100 Forrest Street Building Footprint. The concrete slabs, constructed in 1917 (at 98 Forrest Street and 86/90 Forrest Street) and by 1958 (at 100 Forrest Street), continue to prevent direct contact with underlying Site Impacts and prevent infiltration of water into the vadose zone soils within the buildings' footprints. The concrete and asphalt driveway that provides access to a loading dock for the 100 Forrest Street building will also be utilized as a portion of the soils cap, since it continues to prevent direct contact with Site Impacts. The remedial alternative for the 98/100 Forrest Street Building Footprint, 86/90 Forrest Street Building Footprint, and for the 100 Forrest Street Loading Dock Driveway, includes sealing cracks/breaches in the existing concrete slabs. A deed notice and corresponding RAP will be required for this restricted-use remedy. Monitoring of engineering controls implemented for restricted-use remedies will be conducted as discussed in **Section 8.9**.

The following other remedial alternatives have been considered for the driveway, but due to the poor structural integrity of the adjacent concrete block retaining wall, these are not appropriate:

- Removal of existing concrete, placement of HDPE liner, and installation of new concrete cap; and
- Placement and compaction of asphalt over the existing concrete apron.

Implementation of these other remedial alternatives would require intrusive activities that would cause vibrations, exacerbate the poor structural integrity of the retaining wall, and pose a safety hazard to workers and pedestrians.

In a concrete core sample (FS21-CT) collected from the 98 Forrest Street building floor slab, Cr^{+6} was detected at a concentration of 323 mg/kg and green staining was observed; however, no chromium blooms have been observed on the surface of the slabs.

The concrete slabs will require periodic inspection to confirm the absence of chromium blooms on their surfaces. In the event that chromium blooms are observed during periodic inspections, an immediate temporary Remedial Action, followed by a permanent Remedial Action, will be required.

Four remedial alternatives were evaluated for the 100 Forrest Street concrete block retaining wall to prevent potential future chromium blooms or to prevent direct contact with potential future chromium blooms on the concrete block wall. A description of each remedial alternative evaluated for the 100 Forrest Street concrete block retaining wall is provided below.

6.5.1 100 Forrest Street Concrete Block Retaining Wall

The four remedial alternatives that were evaluated for the 100 Forrest Street Concrete Block Retaining Wall are protective of human health and the environment by removing or isolating the exterior concrete block wall while minimizing potential impacts to existing adjacent structures during remediation. Monitoring of engineering controls implemented for restricted-use remedies will be conducted as discussed in **Section 8.9**. The four remedial alternatives are:

- Remedial Alternative 1: Demolition and removal of the concrete block wall and replacement of wall with a non-cementitious retaining wall;
- Remedial Alternative 2: Sealing the entirety of the concrete block wall with epoxy material;
- Remedial Alternative 3: Installation of a protective cover over the concrete block wall and
- Remedial Alternative 4: Sealing cracks/breaches in the concrete block wall and monitoring for chromium blooms on the surface of the concrete block wall as part of the monitoring plan schedule for engineering controls discussed in **Section 8.9**.

A description of each remedial alternative is provided below.

6.5.1.1 Remedial Alternative 1

Remedial Alternative 1 includes demolition and removal of the concrete block wall and construction of a new retaining wall. As part of this remedy, the retaining wall will be removed and will be replaced with a new retaining wall constructed of non-cementitious materials to prevent potential future chromium blooms.

Construction activities associated with Remedial Alternative 1 will be conducted in close proximity to existing buildings and structures. Therefore, vibration monitoring will be conducted. Additionally, construction activities associated with Remedial Alternative 1 may interfere with normal loading dock operations. Therefore, the contractor will work closely with the property owner to coordinate field activities with loading dock operations.

Remedial Alternative 1 consists of the following primary construction activities (listed in the sequence of occurrence and indicating the estimated respective durations):

- Implement dust control measures, including the use of polyethylene sheeting and/or water mist to prevent the migration of fugitive dust during remediation activities (1-2 days).
- Mobilize vibration monitoring equipment and evaluate vibration monitoring data during field activities (1-2 weeks).
- Demolish the concrete block wall using construction equipment and handwork. Loadout and dispose of the concrete (1-2 weeks).
- Construct a new retaining wall using non-cementitious materials (e.g., treated timber) (3-4 weeks).

The duration of the remediation and construction activities for Remedial Alternative 1 is 4 to 7 weeks.

6.5.1.2 Remedial Alternative 2

Remedial Alternative 2 is a restricted-use remedy that includes the use of an engineering control for the concrete block retaining wall. As part of Remedial Alternative 2, the exposed faces of the retaining wall will be sealed with an epoxy material, which will serve as a physical barrier containment system to prevent direct contact with potential future chromium blooms on the retaining wall. Construction activities associated with Remedial Alternative 2 may interfere with normal loading dock operations. Therefore, the contractor will work closely with the property owner to coordinate field activities with the loading dock operations.

Remedial Alternative 2 will consist of the following primary remediation activities (listed in the sequence of occurrence and indicating the estimated respective durations):

- Implement dust control measures, including the use of polyethylene sheeting and/or water mist to prevent the migration of fugitive dust during scarification activities (1-2 days).
- Mobilize vibration monitoring equipment and evaluate vibration monitoring data during field activities (5-7 days).
- Stabilize the concrete block retaining wall prior to start of remediation work based on the poor structural condition of the wall (5-7 days).
- Scarify the entirety of the masonry block wall, using electrical-powered hand tools and/or walk-behind equipment with vacuum-powered dust collection attachments for dust control measures. The dust generated during scarification will be drummed, sampled, and analyzed for disposal purposes (1-2 days).
- Install epoxy coating over prepared surfaces.

The duration of the construction activities for Remedial Alternative 2 is estimated to be 2 to 3 weeks.

Appendix J contains product information and specifications for an epoxy product that may be considered for use as an epoxy coating.

6.5.1.3 Remedial Alternative 3

Remedial Alternative 3 is a restricted-use remedy that includes the use of an engineering control for the concrete block retaining wall. As part of Remedial Alternative 3, a protective cover will be installed over the concrete block retaining wall, which will serve as physical barrier containment system to prevent direct contact with potential future chromium blooms, while allowing for some relief of hydrostatic pressure. Construction activities associated with Remedial Alternative 3 may interfere with normal loading dock operations. Therefore, the contractor will work closely with the property owner to coordinate field activities with the loading dock operations.

Remedial Alternative 3 will include the following remediation activities (listed in the sequence of occurrence and indicating the estimated respective durations):

- Implement dust control measures, including the use of polyethylene sheeting and/or water mist to prevent the migration of fugitive dust during remediation activities (1-2 days).
- Mobilize vibration monitoring equipment and evaluate the vibration monitoring data during field activities (5-7 days).
- Stabilize the concrete block retaining wall prior to start of remediation work based on the poor structural condition of the wall (5-7 days).
- Seal cracks in the existing concrete block wall with an appropriate filler material (1-2 days).
- Install and anchor an HDPE dimpled membrane along the entire surface area of the concrete block wall (3-5 days).
- Install lightweight façade to protect the HDPE dimpled membrane (5-7 days).
- Install bollards to prevent the protective covering from physical damage (1-2 days).

The duration of the remediation and construction activities for Remedial Alternative 3 is 3 to 5 weeks.

6.5.1.4 Remedial Alternative 4

Remedial Alternative 4 is a restricted-use remedy that includes sealing of cracks/breaches in the existing concrete wall and monitoring for chromium blooms on the surface of the concrete wall. As part of Remedial Alternative 4, periodic inspections will be conducted as part of the monitoring plan schedule for engineering controls discussed in **Section 8.9** to confirm the absence of chromium blooms on the surface of the concrete block wall. In the event that chromium blooms are observed during periodic inspections, an immediate temporary Remedial Action, followed by a permanent Remedial Action, will be required.

6.6 90 Forrest Street Boiler Room Basement (AOC FSP-1J)

Three remedial alternatives have been evaluated for the 90 Forrest Street Boiler Room Basement. Because each remedial alternative is an engineering control that prevents direct contact with chromium blooms and chromium-impacted groundwater, a deed notice and corresponding RAP will be required for the selected restricted-use remedy. Monitoring of engineering controls implemented for restricted-use remedies will be conducted as discussed in **Section 8.9**.

6.6.1 Interior Surfaces

Each remedial alternative includes the replacement of the existing sumps with commercial-grade systems to mitigate the risk of basement flooding. Additionally, each alternative includes the removal of the wooden shed, wooden stairs, and wooden landing.

The three remedial alternatives are as follows:

- Remedial Alternative 1: Install new epoxy coating on the walls, floor and stairs;
- Remedial Alternative 2: Install epoxy coating on the masonry/concrete staircases. Install an HDPE dimpled membrane on the walls and floor; and
- Remedial Alternative 3: Install waterproof wallboard with an HDPE liner on the walls and an HDPE dimpled membrane on the floor. Install epoxy on the masonry/concrete staircases.

6.6.1.1 Remedial Alternative 1

Remedial Alternative 1 includes the removal of the existing epoxy coating from the concrete basement slab and foundation walls, and replacement with epoxy coating. This remedy would be applied up to the elevation of the existing epoxy coating. The installation process for Remedial Alternative 1 includes the following steps:

- Implement dust control measures, including the use of polyethylene sheeting and/or water mist to prevent the migration of fugitive dust during scarification activities.
- Scarify the masonry staircases, concrete floor slab, and concrete foundation walls using electrical-powered hand tools and/or walk-behind equipment with vacuum-powered dust collection attachments for dust control measures. The concrete dust generated during scarification will be drummed, sampled, and analyzed for disposal purposes.
- Install epoxy coating on prepared masonry staircases, slab, and walls.

Appendix J contains product information and specifications for an epoxy product that may be considered for use as an epoxy coating.

6.6.1.2 Remedial Alternative 2

Remedial Alternative 2 includes the installation of a 20-millimeter (mil) to 40-mil HDPE dimpled membrane on the walls and floor. An HDPE dimpled membrane will not prevent groundwater infiltration through the concrete surfaces or prevent chromium blooms; instead, it will channel water to the existing interior perimeter drain and trench drain and prevent direct contact with the floor and walls. **Appendix J** contains product information for typical dimpled membranes for installation on floors and walls. The installation process for Remedial Alternative 2 includes the following steps:

- Anchor the HDPE dimpled membrane to the walls to the elevation of the existing epoxy wall coating, unless the results of concrete chip samples indicate otherwise.
- Install the HDPE dimpled membrane on the floor.
- Install the subfloor directly on the HDPE dimpled membrane.
- Install epoxy coating on the masonry/concrete staircases.
- Install steel staircase and landing at the former location of the wooden staircase and landing.

6.6.1.3 Remedial Alternative 3

Remedial Alternative 3 includes the installation of a 20-mil to 40-mil HDPE dimpled membrane on the floor and construction of a moisture-resistant interior wall. The wall will be constructed to allow moisture or water to drain to the interior perimeter drain.

The installation process for Remedial Alternative 3 includes the following steps:

- Install the HDPE dimpled membrane on the floor.
- Construct an interior wall frame from treated dimensional lumber. Anchor the wall frame to the concrete wall using concrete wall anchors.
- Install a 20-mil to 40-mil HDPE liner to the back of the moisture resistant wallboard.
- Affix the wallboard to the interior wall frame.
- Install the subfloor directly on the HDPE dimpled membrane.
- Install epoxy coating on the masonry/concrete staircases.

6.6.2 Management of Sump Water

Three remedial alternatives have been evaluated for the management of the sump water associated with the three sumps in and adjacent to the boiler room basement, as discussed in **Section 5.7**. The three remedial alternatives are as follows:

- Remedial Alternative 1: Store the sump water and haul it to the Site 114 groundwater treatment plant;
- Remedial Alternative 2: Install a skid-mounted treatment system in or directly outside of the basement; and
- Remedial Alternative 3: Convey the sump water to the Site 114 groundwater treatment plant.

6.6.2.1 Remedial Alternative 1

Remedial Alternative 1 includes the installation of a bulk storage container to store the sump water before hauling the water to the Site 114 groundwater treatment plant via tanker truck. This remedial alternative consists of the following steps:

- Collect field data from the existing sumps to determine, at a minimum: flow rates, volumes, and contaminant concentrations.
- Evaluate the potential permits and approvals that may be required.
- Design and install a bulk storage container and piping with spill prevention measures.
- Develop a work plan and schedule to haul the sump water to the Site 114 groundwater treatment plant.
- Divert the sump water to bulk storage tanks while maintaining a connection to the combined sewer for contingency purposes.
- Haul the sump water from the bulk storage tank to the Site 114 groundwater treatment plant under manifest.

6.6.2.2 Remedial Alternative 2

Remedial Alternative 2 includes the installation of a skid-mounted treatment system with discharge of the treated sump water to the local sewer. This remedial alternative consists of the following steps:

- Collect field data from the existing sumps to determine, at a minimum: flow rates, volumes, and contaminant concentrations.
- Evaluate the potential permits and approvals that may be required.
- Design and install a skid-mounted treatment system.
- Develop an operation and maintenance manual for the treatment system.
- Sample treated effluent, as needed, and discharge the treated effluent to the local sewer system.

6.6.2.3 Remedial Alternative 3

Remedial Alternative 3 includes the conveyance of the sump water to the groundwater treatment plant, located at Site 114. This remedial alternative consists of the following steps:

- Collect field data from the existing sumps to determine, at a minimum: flow rates, volumes, and contaminant concentrations.
- Evaluate the potential permits, approvals, and easements that may be required.
- Design a subsurface conveyance system that discharges the sump water to the treatment plant at Site 114.
- Install a conveyance system and discharge the sump water to the Site 114 groundwater treatment plant.
- Convey the sump water to the Site 114 groundwater treatment plant.

6.7 Grid GG15B (AOC FSP-1K)

Because the Cr^{+6} exceedance is shallow (1.7 - 2.2 ft bgs) and limited to Grid GG15B, spot excavation to remove the exceedance is possible without posing a significant risk to the structural integrity of the adjacent building. A clean PDI sample result for Cr^{+6} is present at the proposed TEE of 9.9 ft NAVD88; therefore, a post-excavation pit-bottom sample will not be collected.

7.0 Summary of Selected Remedial Actions

7.1 Remedial Action Requirements

This RAWP has evaluated Remedial Actions, identified in **Section 6.0,** consisting of source removal and capping or containment of Site Impacts. The extents of the selected Remedial Actions are presented on **Figure 7-1**.

The selected remedial alternatives that are restricted-use will require deed notices and a notice in lieu of deed notice upon approval by the NJDEP and the applicable stakeholders, as well as a RAP. A description of the deed notices and notice in lieu of deed notice is included in **Section 8.7**.

The remedial objectives for these AOCs are the prevention of direct contact with, ingestion of, and inhalation of CCPW-related impacts and non-CCPW-related impacts emanating from Site 114 to Forrest Street and Forrest Street Properties with concentrations exceeding applicable criteria. The selected Remedial Actions for each of the current-use remediation areas (which include engineering controls and institutional controls, and in limited cases, source removal) are proposed as follows:

- 100 Forrest Street Offset (AOC FSP-1B, AOC FSP-2B, AOC FSP-1C, and AOC FSP-2C)
    - Engineering Control: HDPE Liner Overlain with DGA and Either an Asphalt Cap or GCCM
    - Institutional Controls: Deed Notices on Lots 14 and 15
- 84 Forrest Street Building Footprint and Loading Dock (AOC FSP-1D)
    - Engineering Control: 84 Forrest Street Building Footprint and Loading Dock Engineering Control (consisting of a new concrete block wall, an HDPE liner between the new and the existing concrete block wall, epoxy material, protective wearing surface, and dock bumpers)
    - Institutional Controls: Deed Notice on Lots 11 and 12
- Forrest Street Utility Offset (AOC FS-1B, AOC FS-2B, AOC FSP-1E, and AOC FSP-2E)
    - Engineering Control: HDPE Liner
    - Institutional Controls: Notice in Lieu of Deed Notice on Forrest Street and Deed Notice on Lot 14
- 90 Forrest Street Alleyway (AOC FSP-1F)
    - Source Removal: Excavation in Grid EE16B
    - Engineering Control: Asphalt Cap
    - Institutional Controls: Deed Notices on Lots 12 and 14
- 98/100 Forrest Street Building Footprint (AOC FSP-1G)
    - Engineering Control: Existing Concrete Cap
    - Institutional Controls: Deed Notice on Lot 14

- 100 Forrest Street Loading Dock Driveway (AOC FS-1C, AOC FS-2C, AOC FSP-1H, AOC FSP-2H)
    - Engineering Control: Existing Asphalt and Concrete Cap
    - Institutional Controls: Notice in Lieu of Deed Notice on Forrest Street and Deed Notice on Lot 14
- 86/90 Forrest Street Building Footprint (AOC FSP-1I)
    - Engineering Control: Existing Concrete Cap
    - Institutional Controls: Deed Notice on Lots 11 and 12
- 90 Forrest Street Boiler Room Basement (AOC FSP-1J)
    - Engineering Control: 90 Forrest Street Boiler Room Basement (consisting of HDPE dimpled membrane, drainage system, and epoxy coating)
    - Institutional Controls: Deed Notice on Lot 12
- Grid GG15B (AOC FSP-1K)
    - Source Removal: Excavation in Grid GG15B

7.2 Remedial Action Description and Implementation

A conceptual description of the selected Remedial Actions for each of the current-use remediation areas is provided below. Remedial Actions are underway in the 100 Forrest Street Offset, the Forrest Street Utility Offset, and the alleyway. In these current-use remediation areas, details of the Remedial Actions completed to-date are also provided below.

7.2.1 100 Forrest Street Offset (AOC FSP-1B, AOC FSP-2B, AOC FSP-1C, and AOC FSP-2C)

The selected remedy for this current-use remediation area is the engineering control presented in **Section 6.1**, the installation of an HDPE liner, regrading, the installation of a GCCM, and the restoration of asphalt pavement. The selected remedy will be protective of human health and the environment and will prevent contact with impacted soils and mitigate the surface water runoff leaking through the west wall of 100 Forrest Street. A draft deed notice for this restricted-use remedy is described in **Section 8.7**.

The selected Remedial Action for the 100 Forrest Street Offset was presented by AECOM (on behalf of PPG) to the Stakeholders in the November 21, 2017 Restoration Memorandum (AECOM, 2017g). The Restoration Memorandum presents a plan view of the Remedial Action's extents and construction details, and is attached in **Appendix K**. Verbal concurrence on the Restoration Memorandum was received from the NJDEP and the property owner on November 9, 2017. Implementation of the Remedial Action began on December 18, 2017 and was completed on December 22, 2017.

As presented in the Restoration Memorandum, the remediation and construction activities within the 100 Forrest Street Offset were implemented in the following sequence:

- Mobilization of vibration monitoring settlement instrumentation and evaluation of vibration settlement monitoring data during field activities.

- Preparation, grading, and compaction of the subgrade to meet the proposed subgrade elevations. The excess soil generated during the grading phase was disposed off-site at a permitted solid waste facility.
- Placement of an HDPE liner on the prepared subgrade (where required), over the existing concrete apron, and up to the building and block retaining wall.
- Placement, grading, and compaction of the DGA layer above the HDPE liner, except on the concrete apron.
- Placement of a geosynthetic drainage composite on top of the section of the HDPE liner installed on the concrete apron.
- Placement of the GCCM over a portion of the DGA layer, up to the block retaining wall, and on top of the geosynthetic drainage composite fabric.
- Anchoring the HDPE liner, geosynthetic drainage composite, and cementitious composite mat to the concrete apron.
- Placement and compaction of the asphalt sub-base and wearing surface over the DGA layer to meet the proposed final grades and asphalt paving.
- Installation of pre-cast concrete parking stops at the interface of the asphalt and the cementitious concrete mat.

Additional restoration measures implemented at the request of the property owner included placement of landscape stone on top of the GCCM for aesthetic reasons.

Pending favorable weather conditions, a waterproof material, such as an outdoor caulk,(e.g. Sikaflex), will be applied between the GCCM and building interface and between the GCCM and block retaining wall interface to prevent moisture from infiltrating the joint space.

The engineering controls will be inspected in accordance with the Current-Use Engineering Controls Inspection/Maintenance/Repair Plan and communication protocol, provided in **Appendix L**.

7.2.2 84 Forrest Street Building Footprint and Loading Dock (AOC FSP-1D)

The remedy selected for this subarea is Remedial Alternative 4, which is a restricted-use remedy with the use of an engineering control and a deed notice. The selected remedy will be protective of human health and the environment.

The remediation and construction activities will be implemented in the following sequence (including the estimated respective durations):

- Install and anchor an HDPE liner along the entire face of the existing concrete block wall on the south side of the loading dock. Seal the HDPE penetrations (1-2 days).
- Construct a new concrete block wall with epoxy coating against the installed HDPE liner; install vertical dowels in the concrete blocks for stability; install tension ties to batten the new concrete wall against the HDPE liner and existing concrete wall; and seal the penetrations (1-2 weeks).
- Extend the existing loading dock concrete slab to the new concrete block wall with new reinforced concrete (1-2 weeks).

- Install epoxy coating over the entirety of the interior horizontal surface of the loading dock (1-2 weeks).
- Install a protective wearing surface over the interior horizontal surface of the loading dock where the epoxy coating has been applied.
- Install loading dock bumpers to the vertical interior face of the loading dock where the epoxy coating has been applied.

The protective wearing surface installed over the interior horizontal surface of the loading dock will consist of industrial rubber matting, diamond plating, or another form of an industrial-strength wearing surface. The loading dock bumpers installed on the interior vertical surface of the loading dock will consist of durable material capable of withstanding impacts from vehicles during loading/offloading activities of the loading dock. These features will be installed as an added measure to protect the epoxy-like coating.

The duration of the remediation and construction activities for Remedial Alternative 4 is approximately 3 to 6 weeks and should have minimal impact on the loading dock operations.

Construction plans and specifications will be developed for the remediation contractor upon approval of the selected remedy. **Figure 7-2** presents a detail of the 84 Forrest Street loading dock.

The engineering controls will be inspected in accordance with the Current-Use Engineering Controls Inspection/Maintenance/Repair Plan and communication protocol, provided in **Appendix L**.

7.2.3 Forrest Street Utility Offset (AOC FS-1B, AOC FS-2B, AOC FSP-1E, and AOC FSP-2E)

The selected remedy for this current-use remediation area is the engineering control presented in **Section 6.3** which consists of the installation of an HDPE liner, which will function as a soils cap. The soils cap will be protective of human health and the environment and will prevent contact with impacted soils. Because no deed for Forrest Street exists, in accordance with the NJDEP document entitled *Technical Guidance on the Capping of Sites Undergoing Remediation* (NJDEP, 2014), a notice in lieu of deed notice is required for Forrest Street. A draft notice in lieu of deed notice for the soils underlying this restricted-use remedy is described in **Section 8.7**.

The selected Remedial Action for the Forrest Street Utility Offset was presented to the Stakeholders in the November 21, 2017 Restoration Memorandum (AECOM, 2017g). The Restoration Memorandum presents a plan view of the Remedial Action's extents and construction details, and is attached in **Appendix K**. The Restoration Memorandum included a restoration design for Forrest Street that was developed in conjunction with Jersey City Engineering and complied with Jersey City roadway specifications. Verbal concurrence on the Forrest Restoration Memorandum was received from the NJDEP and the property owner on November 9, 2017. Implementation of the Remedial Action began on January 20, 2018 and was completed on January 31, 2018, except for the restoration of asphalt pavement, concrete sidewalks, and curbing. The restoration of asphalt pavement, sidewalks, and curbing was completed in May 2018, to allow for favorable weather conditions.

As presented in the Restoration Memorandum, the following remediation and construction activities were implemented:

- Mobilization of vibration monitoring settlement instrumentation and evaluation of vibration settlement monitoring data during field activities.
- Removal of existing sidewalk and asphalt up to the buildings.
- Excavation, grading, and compaction of the subgrade to meet the proposed subgrade elevations. Demarcation of the soil remaining in place in the excavation's northern sidewall with 10-ounce geotextile fabric and snow fencing.
- Placement of an HDPE liner for both the restoration/capillary break for the Forrest Street excavation and the soils cap for the Forrest Street Utility Offset up to the edge of the buildings.
- Placement, grading, and compaction of 8 inches of DGA in accordance with the NJ Department of Transportation specifications.
- Installation of new sidewalks, each 10 ft wide with a curb. The northern sidewalk is a concrete sidewalk in accordance with standard City of Jersey City engineering details. The sidewalk on the southern side consists of 2 inches of asphalt and 4 inches of DGA, in accordance the design provided by Joe Cunha (City of Jersey City).
- Placement and compaction of 6 inches of hot mix asphalt base course and 2 inches of hot asphalt mix surface wearing course in Forrest Street and up to the new sidewalks.

The HDPE liner engineering control will be inspected in accordance with the Current-Use Engineering Controls Inspection/Maintenance/Repair Plan and communication protocol, provided in **Appendix L**.

7.2.4 90 Forrest Street Alleyway (AOC FSP-1F)

The selected remedy for the 90 Forrest Street Alleyway is Remedial Alternative 2, which consists of milling the existing asphalt surface down 2 inches and installing a new asphalt surface course. The selected remedy will be protective of human health and the environment by preventing direct contact with underlying Site Impacts and preventing infiltration of water into the vadose zone soils within the alleyway's footprint. A draft deed notice for the soils underlying this restricted-use remedy is described in **Section 8.7**.

The remediation and construction activities will be implemented in the following sequence:

- Mobilize vibration monitoring equipment and evaluate vibration monitoring data during field activities.
- Mobilize construction equipment, install sediment and erosion control measures, and establish work zones.
- Mill asphalt down 2 inches using low-vibration equipment and dispose of millings.
- Implement dust control measures (standard water spraying application associated with asphalt milling machines).
- Seal cracks in the sub-base and repair broken asphalt by cutting and patching.
- Place tack coat to prepared and cleaned sub-base.
- Place and compact 2 inches of hot asphalt mix surface wearing course using low-vibration equipment.

- Clean up and demobilize equipment and materials.

The duration of the remediation and construction activities for the 90 Forrest Street Alleyway is approximately 4 to 6 weeks. Construction plans and specifications will be developed for the remediation contractor upon approval of the selected remedial alternative.

The engineering controls will be inspected in accordance with the Current-Use Engineering Controls Inspection/Maintenance/Repair Plan and communication protocol, provided in **Appendix L**.

7.2.4.1 90 Forrest Street Alleyway: Grid EE16B

The selected remedy for the Cr^{+6} exceedance located in Grid EE16B (**Figure 5-1**), at the northwest corner of 86/90 Forrest Street in the 90 Forrest Street Alleyway is excavation. On behalf of PPG, AECOM presented the proposed excavation extents in an October 27, 2017 email to Weston/NJDEP entitled *Forrest Street Properties Upcoming Work* (AECOM, 2017f). The October 27, 2017 email and the attachment presenting the proposed excavation extents are included in **Appendix F**.

The excavation of Grid EE16B was completed from December 4, 2017 to December 5, 2017 and included the following steps:

- Mobilization of equipment and establishment of work zones.
- Removal of debris and surface coverings within the work area. Historic boring logs did not indicate that asphalt was present in the northern portion of the alleyway. However, after removal of gravel covering the surface of the proposed excavation extents, asphalt pavement was observed. The asphalt pavement was saw-cut and removed to allow for excavation.
- Excavation using low-vibration equipment to the proposed TEE of 10.4 ft NAVD88. Under Weston's oversight, the excavation was completed 6 inches below the former asphalt surface. The excavation's surveyed pit bottom was at approximately 9.5 ft NAVD88. No CCPW was visually observed in the excavation.
- Maintenance of a one-foot offset around existing utilities observed during the field activities. Soils within one foot of the utilities remained in place.
- Loadout and disposal of the excavated soils.
- Removal of a concrete block from a former fence post foundation in the excavation's pit bottom, in accordance with Weston's direction. The concrete was not sampled as it was disposed of.
- Application of a waterproofing membrane to the block foundation of the 90 Forrest Street building where it was exposed.
- Lining the excavation's pit bottom and side walls with perforated plastic sheeting, and backfilling the excavation to the pre-excavation surface elevation with DGA.
- Cleaning the work zone and demobilizing equipment.

The selected Remedial Action for the 90 Forrest Street Alleyway, milling and paving, will encompass the Grid EE16B excavation's extents. The asphalt pavement in Grid EE16B, that was removed to allow for excavation, will be replaced with new asphalt during the implementation of the 90 Forrest Street Alleyway's Remedial Action.

7.2.5 98/100 Forrest Street Building Footprint (AOC FSP-1G), 100 Forrest Street Loading Dock Driveway (AOC FS-1C, AOC FS-2C, AOC FSP-1H, and AOC FSP-2H), and 86/90 Forrest Street Building Footprint (AOC FSP-1I)

The selected remedy for this area is utilization of the concrete slabs, including the building's concrete slabs and the concrete apron within the 100 Forrest Street Loading Dock Driveway, as a soils cap with a deed notice and corresponding RAP. The existing concrete slabs for the 98/100 Forrest Street Building Footprint, 86/90 Forrest Street Building Footprint, and the 100 Forrest Street Loading Dock Driveway, will prevent direct contact with underlying Site Impacts and prevent infiltration of water into the vadose zone soils within the buildings' footprints. As part of the selected remedy for the 98/100 Forrest Street Building Footprint, the 86/90 Forrest Street Building Footprint, and the 100 Forrest Street Loading Dock Driveway, cracks/breaches in the existing concrete slabs will be sealed.

A full and thorough baseline visual inspection of the buildings' interiors and exteriors will be completed to identify areas that may be inaccessible during future inspections (to determine the potential presence of: carpeting or floor tiles; heavy equipment or furniture; or obstructions blocking the line of sight to the area to be inspected). If the property owner notifies PPG that a previously inaccessible area becomes accessible (replacement or removal of carpet, flooring, heavy equipment, or furniture; or removal of other obstructions), PPG will coordinate with the property owner to inspect the area. An inspection communication protocol is included in the Current-Use Engineering Controls Inspection/Maintenance/Repair Plan attached in **Appendix L** and summarized in **Section 8.9**.

Following the baseline inspection, inspections will be conducted to confirm that: the buildings' concrete slabs continue to effectively prevent direct contact with Site Impacts and prevent infiltration of water; and no chromium blooming has occurred. Inspections will be coordinated and will proceed according to the Current-Use Engineering Controls Inspection/Maintenance/Repair Plan included in **Appendix L**. If additional cracks/breaches in the 100 Forrest Street Loading Dock Driveway or in the concrete building slabs are identified during the inspections, they will be sealed with a waterproof material (e.g. Sikaflex).

In the event that chromium blooms are identified during the inspections, a temporary engineering control will be applied to immediately prevent direct contact. Potential temporary engineering controls include, but are not limited to, epoxy, plastic sheeting, plywood, duct tape, cones, caution tape, folding caution signs, stone/gravel, or other barriers. The property owner and NJDEP will be immediately notified according to the inspections protocol if a chromium bloom is observed. Following initial notification, PPG will develop a permanent Remedial Action for the observed chromium bloom or other Site Impacts that will be submitted for concurrence to the property owner and NJDEP. Potential permanent Remedial Actions include, but are not limited to, hot-mix asphalt, masonry/concrete block, HDPE liner, Dri-Core® or equivalent subfloor, epoxy coating, concrete, and GCCM.

7.2.5.1 100 Forrest Street Concrete Block Retaining Wall

The selected remedy for the 100 Forrest Street concrete block retaining wall is Remedial Alternative 4, which is discussed in **Section 6.5.1.4**. Remedial Alternative 4 includes sealing of cracks/breaches in the concrete block wall, which will include periodic inspections of the sealed cracks/breaches and monitoring for chromium blooms on the surface of the concrete block wall. In the event that chromium blooms are identified during the inspections, a temporary engineering control will be applied to immediately prevent direct contact. Potential temporary engineering controls include, but are not limited to, epoxy, plastic sheeting, plywood, duct tape, cones, caution tape, folding caution signs, stone/gravel, or other barriers. The property owner and NJDEP will be immediately notified according

to the inspections protocol if a chromium bloom is observed. Following initial notification, PPG will develop a permanent Remedial Action for the observed chromium bloom or other Site Impacts that will be submitted for concurrence to the property owner and NJDEP. A potential permanent Remedial Action may include, but is not limited to, installation of protective cover over the concrete block retaining wall, such as an HDPE dimpled membrane as described in **Section 6.5.1.3**.

7.2.6 90 Forrest Street Boiler Room Basement (AOC FSP-1J)

The selected remedy for the 90 Forrest Street Boiler Room Basement is the installation of a 20-mil to 40-mil HDPE dimpled membrane on the walls and floor and installation of commercial-grade sumps to replace all three sumps. A conceptual drawing of the installed HDPE dimpled membrane and proposed drainage system is presented on **Figure 7-3** and product specifications are provided in **Appendix J**. The commercial-grade sumps will feature a battery-powered backup pump to prevent flooding in the event of a power outage. Additionally, the wooden shed will be removed, and the defunct masonry staircase at the main entrance will be rebuilt. The masonry staircases will be sealed with epoxy coating.

Remediation will be implemented in the following sequence:

- Remove the existing staircase and wooden shed. Construct a new concrete masonry staircase at the main entrance.
- Seal the concrete masonry staircases with epoxy coating in accordance with the manufacturer's guidelines.
- Remove the existing sump pumps and polyvinyl chloride (PVC) piping. Install commercial-grade sump pumps and new PVC piping. Install covers over the sumps.
- Install a new grating/cover over the trench drain that runs east to west across the basement.
- Install an HDPE dimpled membrane (20-mil to 40-mil in thickness) on the walls and floor.
- Install subfloor, consisting of Dri-Core®, or equivalent, on top of the HDPE dimpled membrane.

In November 2018, the east and west sump pumps were malfunctioning; therefore, they were removed and replaced with new commercial-grade sump pumps with battery backup that were designed to handle flowrates generated from a 25-year storm event. The pump in the south sump will be replaced in the future with a commercial-grade sump pump. A remote telemetry unit with level sensor alarm and power outage alarm notification ability was also installed in the east and west sumps. The new piping will be installed after the basement renovations are completed. Once the pump in the south sump is replaced, it will also be integrated with the existing remote telemetry unit.

The engineering controls will be inspected in accordance with the Current-Use Engineering Controls Inspection/Maintenance/Repair Plan and communication protocol, provided in **Appendix L**.

7.2.6.1 Management of Sump Water

The selected remedy for the management of sump water is Remedial Alternative 1. Remedial Alternative 1 includes the installation of a bulk storage container to store the sump water before hauling the water to the Site 114 groundwater treatment plant via tanker truck.

Field data was collected from the sumps, during dry weather and rain events in October 2018, to determine flow rates, volumes, and contaminant concentration. Data generated during the October

2018 field investigation were used to support the design of the bulk storage tanks, which have been sized to accommodate infiltration to the sumps generated from a 25-year storm event.

This remedial alternative consists of the following steps:

- Evaluate the potential permits and approvals that may be required.
- Install double-walled bulk storage tanks and double-walled piping with spill prevention measures. Piping will convey the sump water to the storage tanks.
- Install a valve to allow the sump water to be conveyed to the combined sewer for contingency/spill prevention purposes during high flow events.
- Install heat tracing for the conveyance piping and the bulk storage tanks.
- Install additional instrumentation for the bulk storage tanks and piping and integrate it with the existing remote telemetry unit for alarm notifications and flow controls.
- Develop a work plan and schedule to haul the sump water to the Site 114 groundwater treatment plant.
- Haul the sump water from the bulk storage tank to the Site 114 groundwater treatment plant under manifest.

It should be noted that PPG is in the process of evaluating a long-term remedy for the groundwater beneath Forrest Street and Forrest Street Properties in parallel with managing the sump water. The chosen remedy for the long-term groundwater remediation could potentially impact Remedial Alternative 1. Discussion of the groundwater Remedial Actions, once determined, will be presented in a future groundwater RAWP and documented in a corresponding RAP for groundwater.

7.2.7 Grid GG15B (AOC FSP-1K)

The selected remedy for the Cr^{+6} exceedance located in Grid GG15B (**Figure 5-1**) is excavation. On behalf of PPG, AECOM presented the proposed excavation extents in an October 27, 2017 email to Weston/NJDEP entitled *Forrest Street Properties Upcoming Work* (AECOM, 2017f). The October 27, 2017 email and the attachment presenting the proposed excavation extents are included in **Appendix F**.

The excavation of Grid GG15B was completed from December 4, 2017 to December 5, 2017. Excavation activities were implemented in the following sequence:

- The proposed excavation limits were surveyed and staked.
- Equipment was mobilized and work zones were established.
- Debris and surface coverings were removed within the work area.
- Soil was excavated soil using low-vibration equipment to the proposed TEE of 9.9 ft NAVD88. Under Weston's oversight, the excavation was completed to 3 ft bgs. The pit bottom was surveyed. No CCPW was visually observed in the excavation.
- The excavated soils were loaded out and disposed.
- The excavation was backfilled with DGA to the pre-excavation surface elevation.
- The work zone was cleaned and equipment was demobilized.

7.3 Future Residential-Use Remediation

As described in **Section 1.0**, the goal of this RAWP is to evaluate and propose the remedial alternatives for the portions of Forrest Street and Forrest Street Properties where full remedial excavation is not appropriate at this time based on Forrest Street Properties' current commercial use. Prior to the future residential use of Forrest Street Properties, and following demolition of the existing Forrest Street Properties buildings, PPG will conduct a remedial excavation to address CCPW-impacted soil which is currently inaccessible due to the current use.

The *Forrest Future Residential-Use Conceptual Excavation Plan* (Conceptual Excavation Plan) is provided in **Appendix M**. This remedial excavation will remove visible CCPW, CCPW-impacted soils, and CCPW-impacted concrete. It is anticipated that MGP-impacted soil remaining in place following this excavation will be addressed via engineering controls (capping) and institutional controls (deed notices and notice in lieu of deed notice). Specific Notes in **Tables 2-2** through **2-9** describe how Site Impacts will be addressed as part of the future residential-use remediation.

Following demolition of the existing Forrest Street Properties buildings, PPG will return to the site (within six months of notification) to complete an evaluation of all grids not previously investigated due to tenant inaccessibility. PPG will visually inspect subsurface soils and subsurface concrete structures (piles/pile caps/footings, etc.) to identify visible CCPW, CCPW-impacted soils, and CCPW-impacted concrete located beyond the excavation extents proposed in the Conceptual Excavation Plan. If CCPW-impacted materials are identified beyond the proposed excavation extents, the excavation extents will be expanded to address these impacts in accordance with the Chromium Policy per the Method to Determine Compliance. Post-excavation confirmation samples will be collected in accordance with the GA Group RAWP to confirm that the remedial objectives have been achieved.

Note that the proposed excavation is delineated on a per-grid basis in accordance with the GA Group RAWP and the Chromium Policy per the Method to Determine Compliance. Delineation was initially documented in the *Supplemental Soil Remedial Investigation Report, Final Revision 1*, dated August 2018, and approved by NJDEP on October 22, 2018. In addition to the remedial investigation, PPG has also conducted pre-design investigation activities, on a grid-by-grid basis, which were originally presented in various 2017 TEE submittals. These investigation results are included in the Forrest RAWP and are considered in the Forrest Future Residential Use Conceptual Excavation Plan.

An updated Cr^{+6} delineation line that takes into account the PDI data set is show on **Figure 4-2**. For the one grid (Grid DD12B) within the delineation line for which data have not yet been generated to document compliance with the Department's Chromium Policy, PPG will perform sampling consistent with the Updated Method to Determine Compliance included in Appendix F of the September 2018 *Remedial Action Work Plan (Soil) Rev. 4; Garfield Avenue Group Sites; Jersey City Hudson County, New Jersey.* This is also consistent with what has been done at other sites peripheral to Site 114 following demolition of existing structures which may have prevented delineation/confirmation sampling prior to building demolition. Excluding Grid DD12B, no additional pre-design investigation borings are anticipated to be advanced following demolition, unless warranted by the post-demolition visual inspection.

The future residential-use remediation will be conducted under the existing site-wide GA Group RAWP (AECOM, 2018c) in accordance with the February 8, 2007 NJDEP memorandum entitled *Chromium Moratorium* (NJDEP, 2007) and under the LSRP program. Following completion of the future residential-use remediation, PPG will update the deed notices and notice in lieu of deed notice,

RAR, and RAP. PPG's LSRP will then issue a Response Action Outcome (RAO) for the residential use of the property.

8.0 Implementation Details

8.1 Capillary Break

Evaluation of groundwater impacts in the Forrest Street and Forrest Street Properties area is currently ongoing as reported in the *Draft Groundwater Remedial Investigation Report, PPG Garfield Avenue Group, Hudson County Chromium Sites, Jersey City, New Jersey* (AECOM, 2018d). However, based on the current understanding of site conditions within Forrest Street and Forrest Street Properties and on the criteria established as part of the *Capillary Break Design Final Report (Revision 2)* (AECOM, 2017h), a capillary break is required in the current-use remediation areas, due to the presence of soil with Cr^{+6} concentrations greater than 20 mg/kg and CCPW-related impacts in groundwater. A description of the capillary break elements for each of the current-use remediation areas, as shown on **Figure 8-1**, is as follows:

- 100 Forrest Street Offset – The existing HDPE liner will serve as the capillary break in this area.
- 84 Forrest Street Building Footprint and Loading Dock – The proposed epoxy barrier on the horizontal surface of the loading dock and the proposed HDPE liner between the face of the existing concrete block wall and the proposed new concrete block wall of the loading dock will serve as the capillary break in the footprint of the loading dock.
- Forrest Street Utility Offset – The existing HDPE liner will serve as the capillary break in this area.
- 90 Forrest Street Alleyway – The existing asphalt will serve as the capillary break in this area.
- 90 Forrest Street Boiler Room Basement – The proposed HDPE dimpled membrane and epoxy coating will serve as the capillary break in this area.

No chromium blooming or chromium staining has been observed within the 84, 86/90, or 98/100 Forrest Street building concrete slabs, with the exception of boring FS21 (within 98/100 Forrest Street Building Footprint) as discussed in **Section 5.5.2**. The concrete building slabs will continue to be monitored for chromium blooming and chromium staining as part of the monitoring plan schedule for engineering controls discussed in **Section 8.9**, and if such blooming or staining is observed during monitoring events, additional remedial measures (to be determined in the future) will be implemented.

The need for a capillary break will be re-evaluated in the future during the future residential-use remediation when site conditions, including groundwater conditions, are better understood.

8.2 Permitting and Approvals

PPG will obtain the necessary municipal permits (construction/demolition, etc.) prior to the start of the work. New Jersey One-Call will be contacted prior to any intrusive actives so that buried utilities are marked to the property line for each property within the target area. In addition, a private utility location/geophysical contractor will be contacted to locate potentially buried utilities within the boundaries of the remedial activities.

For the 90 Forrest Street Boiler Room Basement, it is not anticipated that new permits or approvals, or modifications to existing permits/approvals, will be required for Remedial Alternative 1 that has been selected for the sump water. However, a final determination depends upon the future evaluation of the

data collected from the sumps. Permits and/or approvals may be required for the other proposed engineering controls at the 90 Forrest Street Boiler Room Basement.

For the 84 Forrest Street Building Footprint and Loading Dock, permits and/or approvals may be required by Jersey City for the proposed loading dock modifications.

A list of applicable permits and authorizations is shown below in **Table 8-1**. Note that the list of permits for the future residential-use remediation will be modified as needed to meet the conditions at the time the work is implemented.

Table 8-1 List of Applicable Permits and Authorizations

Permit Name/ Authorizing Entity	Required for	Current-Use Remediation	Future Residential-Use Remediation
Traffic engineering permits/Jersey City Traffic Engineering Department	Street or sidewalk closures and/or openings.	Permits for Forrest Street will be obtained on an as-needed basis by the contractor performing the work and will be renewed, as needed.	Permits for Forrest Street will be obtained on an as-needed basis by the contractor performing the work and will be renewed, as needed.
Registration of Excavation/Jersey City Engineering Department	Excavations on public property (roadway).	The registration will be filed by the contractor performing the work.	The registration will be filed by the contractor performing the work.
Building Permit/Jersey City Building Department	The presence of construction and security trailers.	The permits are maintained for construction trailers currently located on Site 135 and for the security trailer currently located on Carteret Avenue.	A permit modification or new permit may be required for any relocated or new construction trailers.
Construction Permit/ Jersey City Office of Construction Code Official	Building alteration work	The construction permit for work associated with installation of engineering controls for the 90 Forrest Street Boiler Basement.	A building demolition permit will be required by the party responsible for the building demolition. Pre-demolition activities and associated permits (e.g. for asbestos abatement) may also be required prior to obtaining a building demolition permit.
Soil Erosion and Sediment Control Plan (SESCP)/Hudson-Essex-Passaic Soil Conservation District (HEPSCD)	Soil disturbances greater than 5,000 square ft.	An SESCP was submitted to HEPSCD on 1/25/2017 and approved on 2/10/2017. The start notice was submitted on 3/20/2017. The plan is valid through 8/10/2020.	An SESCP will be required for the remedial excavation. The existing plan can be renewed prior to plan expiration or a new plan can be developed.

Permit Name/ Authorizing Entity	Required for	Current-Use Remediation	Future Residential-Use Remediation
Fire Safety Permits/Jersey City Fire Department	The storage of acids and/or combustibles in quantities greater than 55 gallons and the storage and handling of gasoline in closed containers in quantities not greater than 660 gallons.	The Fire Safety Permits are maintained on Site to support the remediation of Forrest Street. Permits numbered 19-0550 and 18-0549 17-0367 were approved on 11/19/2018 and 11/20/2018, respectively, and will be renewed and updated as required.	The Fire Safety Permits may be required.
NJ Community Right-to-Know and federal Emergency Planning and Community Right-to-Know Act (EPCRA)	Having 500 pounds (lbs.) or greater of Environmentally Hazardous Substance on site; EPCRA only for having 10,000 lbs. or more of other chemicals requiring a Safety Data Sheet but not listed in Table 1: EPCRA Chemicals and Reporting Thresholds of the EPCRA Fact Sheet (USEPA, 2017).	Will be filed if reporting requirements are triggered.	Will be filed if reporting requirements are triggered.
Water Use Registration (WUR)/NJDEP	Having the capability to divert in excess of 100,000 gallons per day, but withdrawing less than 3.1 million gallons per month (MGM).	The WUR for Site 114 was updated on 5/16/2018 to include diversions from Forrest Street. The WUR continues to be updated as new diversion sources are added or removed.	May be required.
Water Allocation Permit (WAP)/NJDEP	Withdrawing greater than 3.1 MGM	A WAP will be obtained because future diversions are expected to be greater than 3.1 MGM for combined remediation work at the GA Group Sites (groundwater IRM and excavation). PPG is in the process of preparing a permit application.	The WAP may no longer be required.
Well Decommissioning Permits/NJDEP	The wells within the confines of the area of disturbance in accordance with N.J.A.C. 7:9D prior to the start of work.	Area wells are protected. Well Decommissioning Reports are required for the decommissioning of wells. Well decommissioning must be performed by a licensed well driller.	Well Decommissioning Reports are required for the decommissioning of wells that may be conducted as part of the future residential-use remediation. Well decommissioning must be performed by a licensed well driller.

Permit Name/ Authorizing Entity	Required for	Current-Use Remediation	Future Residential-Use Remediation
Discharge to Groundwater Permit-by-Rule (PBR) (only applicable if FB-H amended backfill is used)	For application of FB-H (amended backfill) for the GA Group of Sites.	Approved as of 10/17/2012, with modification approved on 3/24/2017. A new PBR renewal application was submitted in July 2017 prior to its expiration on 10/17/2017. The new PBR authorization request was approved on 10/11/2017.	A PBR renewal will likely be required if using FB-H after 10/11/2022.

Note that per conversation with the Jersey City Municipal Utilities Authority, the proposed Boiler Room Basement sump connection to the existing combined sewer for emergency conditions will not require separate permitting.

8.3 Soil Erosion, Sediment Control, and Air Monitoring

The contractor will implement the necessary soil erosion and sediment control measures, in accordance with the SESCP approved by the local Soil Conservation District on February 10, 2017.

For the current-use remediation areas, an amendment to the program-wide *Air Monitoring Workplan for Ground Intrusion Activities at the Garfield Avenue Site in Jersey City, New Jersey* (AECOM, 2010b) detailing the placement of Perimeter and Fenceline Air Monitoring Stations will be submitted to NJDEP prior to execution of the work.

8.4 Health and Safety Plan and Field Sampling Plan/Quality Assurance Project Plan

The program-wide health and safety plan (HASP) and FSP-QAPP will be used for the proposed work described in this RAWP. The HASP establishes general health and safety protocols to be followed by Site personnel during implementation of the RAWP. The HASP describes training, medical surveillance, personnel hygiene practices, hazard exposure monitoring, and monitoring equipment maintenance requirements. It is a dynamic document, which will be updated, as needed, to address issues that may be encountered during the Remedial Actions.

The FSP-QAPP establishes the overall QA objectives for the Remedial Action program and documents sampling and analytical procedures to be used for collecting and analyzing environmental samples. It describes procedures for equipment decontamination, sample handling, sample chain-of-custody protocols, and standard QA procedures for conducting the Remedial Actions. The FSP-QAPP will be updated as conditions warrant. The FSP-QAPP was prepared to address the requirements presented in the ACO.

Structural support systems that may be required to implement construction and remediation work will be prepared under the guidance and supervision of MRCE, the structural engineering firm for the project, to protect working personnel, the public, and property. MRCE will provide continuous oversight during the construction and remediation activities.

8.5 Schedule of Implementation

The schedule for the remediation and construction activities will include the following activities:

- Coordinate with and provide the construction schedule to the property owner and tenants (ongoing).
- Execute the selected remedial alternatives (started in July 2017).
- Prepare a RAP and deed notice/notice in lieu of deed notice, for the selected remedies with restricted use.
- Submit a RAR to NJDEP.
- Obtain a Consent Judgment Compliance Letter from NJDEP for the property's current use.

A more detailed schedule to comply with the TRSR, N.J.A.C. 7:26E-5.5(b)11, will be provided within 3 months of approval of this RAWP, and after preparation of construction plans and specifications. The schedule is contingent upon NJDEP approval, site access issues, weather conditions, and contractor availability. The schedule will be developed based on consultation with the NJDEP and the property owners to comply with the Remedial Action timeframe and with the Master Schedule (Riccio, 2019). An RAR will be submitted after completion of the installation of the current-use engineering controls to document the remediation. The *Master Schedule for the NJ PPG Chrome Remediation Sites* (Riccio, 2019), as monitored by the Site Administrator pursuant to the JCO, defines the remedial investigation and Remedial Action timeframes and supersedes the requirements in N.J.A.C. 7:26E-4.10 and N.J.A.C. 7:26E-5.8.

8.6 Coordination

Continuous communication and coordination between PPG, the property owner, and the tenant will be vital to reducing potential disruptions to the operations of the Forrest Street Properties' tenants. Due to the potentially disruptive nature of the selected remedial alternatives, there is potential for Forrest Street Properties operations to be impacted during specific periods of the work activities. PPG will make efforts to minimize interruptions to the Forrest Street Properties operations.

A communications protocol flowchart is included in the Current-Use Engineering Controls Inspection/Maintenance/Repair Plan, which is attached in **Appendix L**. The communications protocol identifies the points of contact for coordinating/providing notification when an area inaccessible to inspection becomes accessible, when intrusive activities are proposed within the footprint of the engineering controls, and when potentially impacted areas not covered with a temporary or permanent engineering control are observed.

8.7 Deed Notice and Notice in Lieu of Deed Notice

PPG is leading the RA of CCPW-related impacts. PPG has prepared draft deed notices for CCPW-related impacts on Forrest Street Properties (Block 21501, Lots 11/12, 14, and 15) and a draft notice in lieu of deed notice for CCPW-related impacts on Forrest Street, which are provided in **Appendix N**. The deed notices and notice in lieu of deed notice document the engineering controls for current-use remediation (as well as the remedial excavation previously conducted in 2017) and identify CCPW-related soil impacts remaining in place at concentrations greater than the applicable remediation standards in the block and lots identified below:

- Block 21501, Lots 11/12: 90 Forrest Associates, LLC, last recorded in deed book 8943, pages 378 and 373, on October 24, 2013.
- Block 21501, Lot 14: 100 Forrest Associates, LLC, last recorded in deed book 8943, page 358, on October 24, 2013.
- Block 21501, Lot 15 (Skyways): 100 Forrest Associates, LLC, last recorded in deed book 8986, page 164, on July 31, 2014.
- Forrest Street: City of Jersey City.

After the engineering controls have been installed and surveyed, the final as-builts will be prepared and utilized to finalize the deed notice exhibits. PPG will then submit an RAR containing final drafts of these deed notices and notice in lieu of deed notice. PPG will seek NJDEP approval of the RAR. PPG will also seek owner consent for the selected remedies and acceptance of the deed notices and notice in lieu of deed notice from the Forrest Street Properties owner (90 Forrest Associates, LLC and 100 Forrest Associates, LLC) and the Forrest Street owner (the City of Jersey City). The final signed deed notice will document the Forrest Street Properties' owner consent. The final notice in lieu of deed notice will require a formal resolution by the municipality to document the City of Jersey's consent. The final deed notices will be filed with the county clerk. Once the deed notices and notice in lieu of deed notices are filed, the RAP for the remaining soil impacts will be submitted to NJDEP for approval.

PSEG, as the former MGP operator, is leading the RA of impacts related to the operation of the former MGP. PSEG is responsible for preparing and filing the deed notices, notice in lieu of deed notice, and RAPs associated with MGP impacts. Therefore, the draft deed notices and draft notice in lieu of deed notice for MGP-related impacts are not included in this submittal.

8.8 Current-Use and Future Residential-Use Remedy Costs

As requested by NJDEP in an August 11, 2017 email, PPG has included the current-use and future residential-use remedy cost estimates for the installation and maintenance of the engineering controls and for the future excavation of Site Impacts. Cost estimates for the installation and maintenance of the engineering controls and the future excavation of Site Impacts are included in **Appendix O**.

8.9 Operation, Maintenance, Monitoring and Reporting Requirements

Monthly inspections/reporting will be conducted for the first 6 months following installation of the engineering controls, followed by quarterly inspections/reporting, which will continue until the demolition of the Forrest Street Properties buildings. The Current-Use Engineering Controls Inspection/Maintenance/Repair Plan is attached in **Appendix L**. Maintenance of the engineering controls will be conducted on an as-needed basis based on the condition of the engineering controls, and may include, but not be limited to, the following:

- Sealing cracks in asphalt and concrete surfaces.
- Filling and sealing potholes with hot-mix asphalt.
- Milling and paving damaged asphalt surfaces.
- Repairing the GCCM.
- Repairing the HDPE liner and HDPE dimpled membrane.

- Repairing the masonry/concrete block.
- Reapplying epoxy coating.

8.10 Performance Evaluation

As a measure of engineering control performance, visual inspections to assess the condition of the engineering controls, and to determine the potential presence of chromium blooms, will be conducted during scheduled engineering control inspections.

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