From:	Quigley, Jennifer
To:	Desai, Sheilia
Cc:	"bucholtzp@michigan.gov"; "Saric.James@epamail.epa.gov"; "ewilson@plainwell.org"; "Joe.jackowski@weyerhaeuser.com"; "Lebo, Martin"; "michael.erickson@arcadis-us.com"; "Dawn.Penniman@arcadis-us.com"; "gtgriffi@GAPAC.com"; "Jeffrey.Lifka@ttemi.com"; Carli, Greg; "Gay, Richard"; Kirby-Miles, Leslie; Project Email Hold
Subject:	Remedial Investigation Report (Revision 2 - February 2013) - Former Plainwell, Inc. Mill Property ~COR-056394~
Date:	Monday, February 04, 2013 7:48:41 PM
Attachments:	Revised Remedial Investigation Report_Revision 2_02-04-13_Cover Letter.pdf Remedial Investigation Report (Revision 2)_Plainwell Mill_02-04-13_Text.pdf Response to January 3, 2013 U.S. EPA Comments.pdf

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Sheila,

On behalf of Weyerhaeuser Company, CRA is pleased to submit the attached report text revisions for the Remedial Investigation Report (Revision 2 – February 2013) for the former Plainwell, Inc. Mill Property. Due to the size of the files for the figures and Appendix E, I have also included a link to the revised report in its entirety below for your use. Three copies of the revised report text, figures and Appendix E will be sent to you and the MDEQ, along with pdfs of the entire report on compact disk. Please note that during preparation of the revised RI report, an error in the staff gauge data interpretation for the February 2010 was noted, as previously identified in the July 9, 2012 Revised Work Plan for Additional Remedial Investigation Activities. The error has been addressed and the updated contours presented on Figure 2.21.

http://2big4email.craworld.com/en/downloadfiles.aspx?param=AUCzRjwaWVawBCpFkGRVdQeQuAleQuAl

Additionally, please find attached, a response letter for U.S. EPA's January 3, 2013 comments on the October 19, 2012 Remedial Investigation Report (Revision 2).

Regards,
Jeni

Jennifer L. Quigley, P.E.
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Perform every task the safe way, the right way, every time!

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February 4, 2013 Reference No. 056394

Ms. Sheila Desai
Remedial Project Manager
U.S. Environmental Protection Agency – Region V
77 West Jackson Boulevard (SR-6J)
Chicago, Illinois 60604-3590

Dear Ms. Desai:

Re: Revised Remedial Investigation
Former Plainwell, Inc. Mill Property Operable Unit No. 7
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Allegan and Kalamazoo County

As required by Task 4, Remedial Investigation Report in the Statement of Work of the Remedial Investigation and Feasibility Study (RI/FS) at the former Plainwell, Inc. Mill Property, please find attached three printed copies of the RI Report, Revision 2 text and figure modifications, and electronic copies of Appendix E (on compact disk) to be exchanged within your existing hard copies of the RI Report, Revision 2 submitted on October 19, 2012. Additionally, please find three electronic copies of the complete RI Report, Revision 2 on compact disk for your use.

Should you have any questions or require any additional information, please do not hesitate to contact the undersigned.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Gregory A. Carli, P. E.

JQ/27/Pwl.
Encl.

cc: Paul Bucholtz (MDEQ) – 3 copies
Jim Saric (U.S. EPA) – electronic only
Leslie Kirby-Miles (U.S. EPA) – electronic only
Erik Wilson (City of Plainwell)
Richard Gay (Weyerhaeuser)
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Jeffrey Lifka (Tetra Tech) – electronic only
Jennifer Quigley (CRA) – electronic only

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Revision 2
February 4, 2013

REMEDIAL INVESTIGATION REPORT

FORMER PLAINWELL, INC. MILL PROPERTY
PLAINWELL, MICHIGAN

Prepared For:
Weyerhaeuser Company

DISCLAIMER:
SOME FORMATTING CHANGES MAY HAVE OCCURRED WHEN THE ORIGINAL DOCUMENT WAS PRINTED TO PDF; HOWEVER, THE ORIGINAL CONTENT REMAINS UNCHANGED.

FEBRUARY 2013
REF. NO. 056394 (7)

Prepared by:
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EXECUTIVE SUMMARY

This Remedial Investigation (RI) Report for the former Plainwell, Inc. Mill Property (Site) located at 200 Allegan Street in Plainwell, Michigan, has been prepared by Conestoga-Rovers & Associates (CRA) on behalf of Weyerhaeuser NR Company (Weyerhaeuser) for submittal to the United States Environmental Protection Agency (U.S. EPA) Region 5. This RI Report is being submitted in accordance with the RI/Feasibility Study (FS) Work Plan dated July 2009, the Multi-Area Field Sampling Plan dated November 2009, the Phase II RI Work Plan dated November 2009, the Statement of Work (SOW) for the RI/FS, and the terms of the Consent Decree for the Design and Implementation of Certain Response Actions at Operable Unit #4 and the Plainwell, Inc Mill Property of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Consent Decree), which became effective February 22, 2005.

As approved by the U.S. EPA on August 6, 2008, the RI was implemented in a phased approach. As a result, the RI was completed under a multi-volume work plan for the Site. To facilitate the evaluation of the Site related information as part of the development and implementation of the RI through the Phase II RI Work Plan, the Site was divided into three areas based on their locations and noted historical environmental impacts. The three historical operational areas are as follows:

- Area 1 – Former wastewater sludge dewatering lagoons and aeration basin area
- Area 2 – Mill Buildings area
- Area 3 – North central portion area

The results of the investigations conducted on the aforementioned areas were evaluated relative to the anticipated future use scenarios based on the current redevelopment plan, which consists of 11 primary areas. The 11 redevelopment areas are as follows:

- Residential Area 1
- Residential Area 2
- Residential Area 3
- Residential Area 4
- Waterfront Plaza
- Mixed Residential/Commercial Area 1
- Mixed Residential/Commercial Area 2

- Commercial Area 1
- Commercial Area 2
- Commercial Area 3
- Commercial Area 4

The Site comprises approximately 35.6 acres of land and consists of the former Plainwell, Inc. Mill property and buildings. Current Site features include the former Mill Buildings, Wastewater Treatment Plant (WWTP) buildings and associated clarifiers, the former Specialty Minerals, Inc. Building, (only the concrete pad of the former building remains), former Sludge Dewatering Building, former Quality Products Building, concrete pads, the guard shack, rail spurs, aboveground storage tanks (ASTs) and containment structures, 50,000-gallon water tower, ancillary support buildings (pump houses, former guard shacks, etc.), wooded areas, and asphalt-paved areas. As part of the on-going property redevelopment activities, portions of the former Mill Buildings were razed between March and August 2012 or are undergoing renovation for future anticipated occupancy by the City of Plainwell in 2013, and the former Sludge Dewatering Building was renovated for use by the City of Plainwell Public Safety Department, with occupancy in late 2012.

The scope of the RI included the Phase I RI activities completed by RMT in 2008, Phase II RI activities completed by CRA in 2010, and Additional RI activities completed by CRA in 2012.

The Phase I RI field sampling and analysis activities were conducted by RMT between May and December 2008 and included an historical information review, a geophysical survey, installation of test pits along the banks of the Kalamazoo River to the north of the Mill Buildings, and an initial groundwater evaluation (installation of 12 monitoring wells and three staff gauges), and assessment of the on-Site coal tunnel.

Phase II and Supplemental Phase II RI field activities were conducted by CRA between January and June 2010. A total of 207 soil borings, eight surface soil sample locations, and 47 test pits were installed to evaluate soil conditions across the Site. Additionally, a total of seven permanent monitoring wells, seven temporary monitoring wells, and two vertical aquifer profiling locations were completed at the Site to evaluate groundwater conditions across the Site. Based on the results of the Phase II and Supplemental Phase II field activities, additional RI activities were conducted by CRA between March and August 2012. A total of 41 soil borings were installed to further evaluate soil conditions across the Site. In addition, three deep permanent monitoring wells,

four shallow permanent monitoring wells, and one staff gauge were installed at the Site to further evaluate groundwater flow conditions across the Site.

Soil and groundwater samples collected during the RI activities and the analytical results were evaluated against the Generic Residential and Non-Residential Cleanup Criteria and Screening Levels established in Part 7 of Administrative Rules, effective September 28, 2012, pursuant to Part 201, Environmental Remediation, 1994 PA 451 as amended (Part 201). Based on the comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria, volatile organic compounds (benzene, ethylbenzene, methylene chloride, tetrachloroethene, toluene, 1,1,1-trichloroethane, trichloroethene, 1,2,4-trimethylbenzene, and xylenes (total)), semi-volatile organic compounds (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, carbazole, 4-chloro-3-methylphenol, dibenzo (a,h) anthracene, dibenzofuran, fluoranthene, fluorine, indeno(1,2,3-cd) pyrene, 2-methylnaphthalene, 4-methylphenol, naphthalene, pentachlorophenol, phenanthrene, 2,2,6-trichlorophenol), polychlorinated biphenyls (PCBs), metals (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, selenium, silver, sodium, thallium, vanadium, and zinc), cyanide (total), nitrate, and phosphorus were identified as chemicals of concern in soil at the Site. Based on the comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria, semi-volatile organic compounds (benzo(g,h,i) perylene and bis(2-ethylhexyl)phthalate) and metals (aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) were identified as chemicals of concern in groundwater at the Site. In addition, a Human Health Risk Assessment (HHRA) and Screening Level Ecological Risk Assessment (SLERA) were performed on the dataset. Based on the RI activities, the nature and extent of the contamination is discussed below, by operational and redevelopment area.

Site-Wide Historical Fill Material (Portions of All Redevelopment Areas)

In general, the majority of the metals exceedances are limited to Part 201 Residential and/or Non-Residential Drinking Water Protection Criteria (DWPC) and Groundwater Surface Water Interface Protection Criteria (GSIPC) in soil, and Part 201 Residential and/or Non-Residential DWC and GSIC in groundwater. Based on the results of the Synthetic Precipitation Leaching Procedure (SPLP) analysis, manganese, mercury, silver, copper, arsenic, selenium, and chromium, were identified to have the potential to leach at concentrations that exceed either the Part 201 DWC and/or GSIC.

Additional exceedances in various locations across the Site to the Part 201 Residential and/or Non-Residential Direct Contact Criteria (DCC) were noted for lead and arsenic in soil, with the predominant metal being arsenic. Arsenic and manganese were identified at one location each above the Part 201 Residential Particulate Soil Inhalation Criteria (PSIC). Manganese was also identified above the Part 201 Non-Residential PSIC in three locations.

Former Wastewater Treatment Area (Residential Areas 1 through 4, Waterfront Plaza and Mixed Residential/Commercial Area 2)

Various volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and inorganics are present in soil above the Part 201 Residential and/or Non-Residential DWPC. Additionally, various VOCs, SVOCs, metals, and inorganics are present in soil above the Part 201 GSIPC. SPLP results for soil samples indicate that some metals have the potential to leach at concentrations in exceedance of the Part 201 GSIC. Numerous exceedances of the Part 201 Residential DCC for arsenic are present across this area, which appear to be related to historical placement of fill material, as discussed above. This includes both the areas known to have been utilized as historical lagoons, and the surrounding areas to the north (along the Kalamazoo River) and to the east (former aeration basin and secondary clarifier areas) in Residential Areas 1 through 3 and Waterfront Plaza, as well as the former primary clarifier in Residential Area 4 and Mixed Residential/Commercial Area 2. Based on a correlation of observed paper residuals and various fill materials in this area to the exceedances of VOCs and SVOCs identified in soil above the Part 201 Cleanup Criteria, it appears that the exceedances of the phenolic compounds are associated with noted paper residuals, with the remainder associated with various sandy fill materials.

Former Substation/Area North of Mill Building (Commercial Area 4)

A former substation, that was owned and operated by Consumers Energy, was historically present to the north of Buildings 11 and 11A. Subsequent to the off-Site ERA and evidence of impacts to the north of the former substation, an investigation was conducted as part of the RI to evaluate potential issues in this area. Oily soils were observed in this area during the installation of test pits (see Section 5.2.1.2), with detections of Total Petroleum Hydrocarbons-Diesel Range Organics (TPH-DRO) as high as 3,300 ppm (there is no Part 201 Cleanup Criteria for TPH). Various polycyclic aromatic hydrocarbons (PAHs), tetrachloroethene, methylene chloride, trichloroethene, and 1,1,1-trichloroethane have been detected in soil samples in this area, along with various metals, at concentrations above the Part 201 Residential and/or Non-Residential

DWPC, GSIPC, and Residential DCC. Historical information indicates that Building 11 was constructed in 1906 and was used for storage and maintenance activities, and Building 11A was constructed in 1940 and was used for maintenance activities, which may have included the use and storage of solvents and/or petroleum products utilized during routine maintenance activities.

Non-Specific Historical Operational Impacts (Residential Area 3, Waterfront Plaza, Mixed Residential/Commercial Areas 1 and 2, and Commercial Areas 2, 3, and 4)

The non-specific historical operational impacts include the MW-16 area, the Mill Buildings (except Buildings 11 and 11A, as discussed above), one former water tower, one current water tower (Mixed Residential/Commercial Area 2 and Commercial Areas 3 and 4), the former Sludge Dewatering and former Quality Products Buildings (Residential Area 3, Waterfront Plaza, and Commercial Area 2), and former Specialty Minerals Building (Mixed Residential/Commercial Area 1 and Commercial Area 2). Suspected areas relating to general historical operations within the aforementioned structures were also considered as potential source areas. Specifically related to the Mill Buildings in Mixed Residential/Commercial Area 2 and Commercial Areas 3 and 4, additional potential areas where multiple sample locations indicated exceedances of similar organic constituents included the Train Shed, Building 6A, the parking lot east of Buildings 9F and 9E, Building 7, Former Buildings 3A and 28, and Former Buildings 9C and 9A. Additionally, during redevelopment activities conducted at the former Sludge Dewatering Building, two small below grade structures in series were encountered.

During the 2010 RI field activities, PCBs were identified in a soil sample from MW-16 above the Part 201 Residential DCC. Based on the identified detection and redevelopment activities that were proposed in this area, further evaluation was completed in 2012 to delineate the extent of PCB impacts in soil in the vicinity of MW-16.

Various PAHs, PCBs, benzene, ethylbenzene, toluene, tetrachloroethene, methylene chloride, trichloroethene, and 1,1,1-trichloroethene have been detected in soil samples in these areas, along with various metals, at concentrations above the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and DCC.

Non-Specific Support Operational Area Impacts (Residential Area 4, Mixed Residential/Commercial Area 1, Waterfront Plaza, and Commercial Area 3)

The non-specific support operations include the areas defined by Residential Area 4, Waterfront Plaza, a portion of Mixed Residential/Commercial Area 1, and a portion of

Commercial Area 3, which are primarily located on the northern portion of this area, along the Kalamazoo River, and may be related to historical filling activities in this area.

Various PAHs, benzene, ethylbenzene, toluene, methylene chloride, and xylenes, have been detected in soil samples in these areas, along with various metals, at concentrations above the Part 201 Residential and/or Non-Residential DWPC and GSIPC. Additionally, PAHs and PCBs were detected in soil above the Residential DCC.

Former Coal Storage Pile Area (Residential Area 4 and Waterfront Plaza)

The impacts to soil in this area include exceedances of the Part 201 Generic Cleanup Criteria for the listed constituents, which include inorganics discussed above as being associated with fill materials. However, several of these inorganics could also be the result of storage and handling practices associated with coal in this area, in conjunction with impacts from other fill materials in this area; although, insufficient data is available to differentiate the source of the impacts.

Various PAHs, benzene, ethylbenzene, toluene, and xylenes, have been detected in soil samples in these areas, along with various metals, at concentrations above the Part 201 Residential and/or Non-Residential DWPC and GSIPC. Additionally, arsenic and lead were detected in soil above the Residential DCC, and lead and PCBs were detected above the Non-Residential DCC. Benzene was detected above the Part 201 Residential Soil Volatilization to Indoor Air Criteria (SVIAC) in one location.

Former No. 6 Fuel Oil AST Area (Mixed Residential/Commercial Area 2 and Residential Area 4)

This area includes the former 200,000-gallon No. 6 fuel oil aboveground storage tank (AST) and a portion of the below grade process piping distribution system. Historical fuel oil releases to the ground surface in this area have been documented. The historical operation of railroad tracks and below grade product delivery systems also occurred in this area. During redevelopment activities, product was observed in the below grade piping from the former No. 6 fuel oil AST area to the former power house area. Product observed in the lines was containerized at the point where the piping formerly entered the AST area structures, and was characterized and disposed off Site during the redevelopment activities. No below grade evaluation of the piping line was completed during the redevelopment activities.

Various PAHs, tetrachloroethene, methylene chloride, benzene, and ethylbenzene, have been detected in soil samples in these areas, along with various metals, at concentrations above the Part 201 Residential and/or Non-Residential DWPC and GSIPC. Additionally, arsenic, benzo(a)pyrene and dibenzo(a,h)anthracene were detected in soil above the Residential DCC.

Coal Tunnel Area (Mixed Residential/Commercial Area 2)

Various VOCs, SVOCs, and metals are present in soil above Part 201 DWPC and/or GSIPC in the area of the coal tunnel. In addition, manganese was detected in groundwater above the Part 201 DWC and mercury was detected in groundwater above the Part 201 GSIC. Review of SPLP data for cobalt, manganese, mercury, selenium, and/or silver did not indicate an exceedance of the Part 201 GSIC for the leachate from soil samples collected. It should be noted that SPLP analysis was not conducted on all constituents that exceeded the Part 201 GSIPC. Benzo(a)pyrene, benzo(a)anthracene, dibenzo(a,h)anthracene, and arsenic are present in soil above Part 201 DCC. The benzo(a)pyrene, benzo(a)anthracene, and dibenzo(a,h)anthracene exceedances are associated with the soil sample from CTP-4, along the piping run for the former No. 6 fuel oil AST, to the east of the coal tunnel, adjacent to the coal hopper/Building 5E. The arsenic exceedances are associated with soil samples from multiple locations.

Based on the results for the samples in the vicinity of the coal tunnel, it appears that soils have been impacted by historical operations conducted at the Site, which were not specifically related to the operation of the coal tunnel. Impacts have been identified associated with the former Fuel Oil No. 6 product delivery piping that traversed the coal

tunnel in the direction of the boiler room and in areas historically known to have been used for the exterior storage of coal and fly ash. Visual observations of the accessible portions of the coal tunnel noted the presence of approximately 12 to 18 inches of liquid, described as a "heavy fuel oil with a layer of water over the top," was observed covering the bottom of the concrete floor of the tunnel. The thickness of the water was identified as approximately 1 to 2 inches, with the balance being the "heavy fuel oil." Due to the presence of the liquid, a visual evaluation of the condition of floor of the coal tunnel could not be conducted. Impacts to the soil immediately underlying the coal tunnel could not be determined; however, groundwater in the downgradient direction of the coal tunnel did not exhibit impacts from petroleum products and no free product was observed in the monitoring well (MW-2). Based on the January and February 2010 groundwater contours, the positions of MW-2 and MW-19 are not located immediately downgradient of the coal tunnel. Subsequently, an additional monitoring well (MW-22) was installed in August 2012 to further evaluate groundwater in this area. Observations and analytical results for groundwater samples collected in August 2012 were consistent with those for MW-2 and MW-19.

Based on the above discussion regarding the nature and extent of the contamination by former operational area, the following conclusions were identified by redevelopment area relative to soil impacts.

Residential Area 1

VOCs, SVOCs, metals and cyanide (total) were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and/or DCC in Residential Area 1.

The HHRA target risk and hazard level exceedances for Residential Area 1 soil are summarized as follows:

- The calculated cancer risks and hazards for the trespasser, recreational user, resident, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic and pentachlorophenol were the major contributors), and below the target hazard of 1.

Twenty-one constituents or constituent groups (e.g., PAHs, PCBs) were identified as Constituent of Potential Ecological Concern (COPECs). One SVOC [bis(2-ethylhexyl)phthalate], High Molecular Weight (HMW) PAHs, total PCBs, and

nine metals (cadmium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) were identified as COPECs based on SQs greater than unity. One VOC (isopropylbenzene) and two SVOCs (carbazole and dibenzofuran) were identified as COPECs because they were detected, but do not have an Ecological Screening Value (ESV). One VOC (1,2-dibromo-3-chloropropane) and four SVOCs (2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the Limit of Detection (LODs) for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a Bioaccumulative Chemical of Concern (BCOC) and the ESV does not consider bioaccumulation. Habitat for ecological receptors is currently present in this redevelopment area. The portion of this area adjacent to the Kalamazoo River will likely continue to provide habitat under the current redevelopment plan.

Residential Area 2

VOCs, SVOCs, and metals were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and/or DCC in Residential Area 2.

The HHRA target risk and hazard level exceedances for Residential Area 2 soil are summarized as follows:

- The calculated cancer risks and hazards for the recreational user, resident, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard of 1.
- The calculated cancer risk and hazard for the resident inhalation of indoor air (from soil) was above the target risk levels of 1×10^{-4} and 1×10^{-6}, and above the target hazard of 1, with benzene the major contributor to cumulative risk and hazard.
- The calculated cancer risk and hazard for the commercial worker inhalation of indoor air (from soil) was below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (benzene was the major contributor), and below the target hazard of 1.

Sixteen constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. HMW PAHs, total PCBs, and seven metals (copper, iron, lead, manganese, selenium, vanadium, and zinc) were identified as COPECs based on SQs greater than unity. One VOC (1,2-dibromo-3-chloropropane and four SVOCs (2-chlorophenol,

4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Mercury and nickel were identified as COPECs because they are BCOCs and their ESVs do not consider bioaccumulation. Habitat for ecological receptors is currently present in this redevelopment area. The portion of this area adjacent to the Kalamazoo River will likely continue to provide habitat under the current redevelopment plan.

Residential Area 3

VOCs, SVOCs, metals, and cyanide (total) were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and/or DCC in Residential Area 3.

The HHRA target risk and hazard level exceedances for Residential Area 3 soil are summarized as follows:

- The calculated cancer risks and hazards for the trespasser, recreational user, resident, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard of 1.

Twenty-one constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. HMW PAHs, total PCBs, and 11 metals (antimony, arsenic, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) were identified as COPECs based on SQs greater than unity. Two SVOCs (carbazole and dibenzofuran) were identified as COEPCs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and four SVOCs (2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation. Habitat for ecological receptors is currently present in this redevelopment area. The portion of this area adjacent to the Kalamazoo River will likely continue to provide habitat under the current redevelopment plan.

Residential Area 4

VOCs, SVOCs, PCBs, metals, cyanide (total), and phosphorus were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, DCC, and/or SVIAC in Residential Area 4.

The HHRA target risk and hazard level exceedances for Residential Area 4 soil are summarized as follows:

- The calculated cancer risks for the trespasser, recreational user, resident, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4} and at or above the target risk level of 1×10^{-6} (benzo(a)pyrene, dibenz(a,h)anthracene, arsenic, and total PCBs were the major contributors). In addition, the calculated hazard for the recreational user and resident direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil was above the target hazard of 1, with total PCBs the major contributor to cumulative hazard.
- The calculated cancer risk and hazard for the resident inhalation of indoor air (from soil) was above the target risk levels of 1×10^{-4} (benzene was the major contributor) and 1×10^{-6} (benzene and ethylbenzene were the major contributors), and above the target hazard of 1 (benzene, xylene, mercury were the major contributors).
- The calculated cancer risk and hazard for the commercial worker inhalation of indoor air (from soil) was below the target risk levels of 1×10^{-4} (benzene was the major contributor), at or above the target risk level of 1×10^{-6} (benzene and ethylbenzene were the major contributors), and above the target hazard of 1 (mercury was the major contributor).

Thirty-one constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. One VOC (acetone), four BTEX constituents (benzene, toluene, o-xylene, and m&p-xylene), HMW PAHs, total PCBs, 12 metals (antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) and cyanide were identified as COPECs based on SQs greater than unity. One VOC (isopropylbenzene) and two SVOCs (carbazole and dibenzofuran) were identified as COPECs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and six SVOCs (2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was

identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation. Habitat for ecological receptors is currently present in this redevelopment area. The portion of this area adjacent to the Kalamazoo River will likely continue to provide habitat under the current redevelopment plan.

Waterfront Plaza

Metals were detected in the soil sample in exceedance of the Part 201 Residential and/or Non-Residential DWPC and/or GSIPC in Waterfront Plaza.

The HHRA target risk and hazard level exceedances for Waterfront Plaza soil are summarized as follows:

- The calculated cancer risks and hazards for the trespasser, recreational user, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard of 1.

Iron was identified as COPEC based on a SQ greater than unity. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation. The evaluation of risk to ecological receptors was based on a single sample. Because this area will be fully developed under the current redevelopment plan, no further evaluation of risk to ecological receptors will be undertaken.

Mixed Residential/Commercial Area 1

VOCs, metals and cyanide (total) were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, PSIC, and/or DCC in Mixed Residential/Commercial Area 1.

The HHRA target risk and hazard level exceedances for Mixed Residential/Commercial Area 1 soil are summarized as follows:

- The calculated cancer risks and hazards for the recreational user, resident, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard of 1.

- The calculated cancer risk and hazard for the resident inhalation of indoor air (from soil) was below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (tetrachloroethene was the major contributor), and below the target hazard of 1.

Nineteen constituents or constituent groups (e.g., PAHs) were identified as COEPCs. HMW PAHs and 10 metals (arsenic, cadmium, cobalt, iron, lead, manganese, mercury, selenium, vanadium, and zinc) were identified as COPECs based on SQs greater than unity. One SVOC (carbazole) was identified as a COEPC because it was detected, but does not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and five SVOCs (2,4-dimethylphenol, 2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation. Vegetative cover in this redevelopment area has limited value as habitat for ecological receptors. Furthermore, this area will be fully developed under the current redevelopment plan. Based on these considerations, no further evaluation of risk to ecological receptors will be undertaken for this redevelopment area.

Mixed Residential/Commercial Area 2

VOCs, SVOCs, metals, cyanide (total), nitrate, and phosphorus were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, PSIC, and/or DCC in Mixed Residential/Commercial Area 2.

The HHRA target risk and hazard level exceedances for Mixed Residential/Commercial Area 2 soil are summarized as follows:

- The calculated cancer risks and hazards for the trespasser, recreational user, resident, commercial worker, utility worker, and construction worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were above the target risk level of 1×10^{-4} (resident only; arsenic was the major contributor), at or above the target risk level of 1×10^{-6} (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and arsenic were the major contributors), and above the target hazard level of 1 (resident only; arsenic and thallium were the major contributors).
- The calculated cancer risk and hazard for the resident inhalation of indoor air (from soil) was below the target risk level of 1×10^{-4}, at or above the target risk level of

1×10^{-6} (benzene, ethylbenzene, and tetrachloroethene were the major contributors), and above the target hazard of 1 (mercury was the major contributor).

- The calculated cancer risk and hazard for the commercial worker inhalation of indoor air (from soil) was below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (benzene and ethylbenzene were the major contributors), and below the target hazard of 1.

Forty constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. One VOC (acetone), four benzene, toluene, ethylbenzene, and xylenes (BTEX) constituents (benzene, toluene, o-xylene, and m&p-xylene), LMW PAHs, HMW PAHs, total PCBs, 15 metals (antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, vanadium, and zinc) and cyanide were identified as COPECs based on SQs greater than unity. Eight VOCs (1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 2-phenylbutane, cymene, isopropylbenzene, n-butybenzene, n-propylbenzene, and tetrahydrofuran,) and two SVOCs (carbazole and dibenzofuran) were identified as COPECs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and five SVOCs (2,4-dimethylphenol, 2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Habitat for ecological receptors is currently present in this redevelopment area. Some portions of this area may continue to provide habitat under the current redevelopment plan.

Commercial Area 1

VOCs and metals were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, PSIC, and/or DCC in Commercial Area 1.

The HHRA target risk and hazard level exceedances for Commercial Area 1 soil are summarized as follows:

- The calculated cancer risks for the commercial worker and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard level of 1.

Nineteen constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. HMW PAHs, total PCBs, and eight metals (copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) were identified as COPECs based on SQs greater than unity. Two SVOCs (carbazole and dibenzofuran) was identified as COEPCs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and five SVOCs (2,4-dimethylphenol, 2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation. Habitat for ecological receptors is currently present in this redevelopment area. The portion of this area adjacent to the Kalamazoo River will likely continue to provide habitat under the current redevelopment plan.

Commercial Area 2

VOCs, metals and cyanide (total) were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and/or DCC in Commercial Area 2.

The HHRA target risk and hazard level exceedances for Commercial Area 2 soil are summarized as follows:

- The calculated cancer risks for the trespasser, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard level of 1.

Nineteen constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. HMW PAHs, total PCBs, and nine metals (arsenic, cadmium, iron, lead, manganese, mercury, selenium, vanadium, and zinc), and cyanide were identified as COPECs based on SQs greater than unity. One VOC (1,2-dibromo-3-chloropropane) and five SVOCs (2,4-dimethylphenol, 4,6-dinitro-2-methylphenol, 2-chlorophenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation. Habitat for ecological receptors is currently present in this redevelopment area. Some portions of this area may continue to provide habitat under the current redevelopment plan.

Commercial Area 3

VOCs, metals and cyanide (total) were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and/or DCC in Commercial Area 3.

The HHRA target risk and hazard level exceedances for Commercial Area 3 soil are summarized as follows:

- The calculated cancer risks and hazards for the commercial worker and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard level of 1.
- The calculated cancer risk and hazard for the commercial worker inhalation of indoor air (from soil) was below the target risk levels of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (benzene was the major contributor), and above the target hazard of 1 (mercury was the major contributor).

Nineteen constituents or constituent groups (e.g., PAHs) were identified as COEPCs. HMW PAHs, and nine metals (antimony, cadmium, iron, lead, manganese, mercury, selenium, vanadium, and zinc), and cyanide were identified as COPECs based on SQs greater than unity. One VOC (isopropylbenzene) and one SVOC (dibenzofuran) were identified as COPECs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and four SVOCs (2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation. Vegetative cover in this redevelopment area has limited value as habitat for ecological receptors. Furthermore, this area will be fully developed under the current redevelopment plan. Based on these considerations, no further evaluation of risk to ecological receptors will be undertaken for this redevelopment area.

Commercial Area 4

VOCs, SVOCs, PCBs, metals, cyanide (total), nitrate, and phosphorus were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, PSIC, and/or DCC in Commercial Area 4.

The HHRA target risk and hazard level exceedances for Commercial Area 4 soil are summarized as follows:

- The calculated cancer risks and hazards for the trespasser, recreational user, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic and total PCBs were the major contributors), and below the target hazard level of 1.
- The calculated cancer risk and hazard for the commercial worker inhalation of indoor air (from soil) was below the target risk levels of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (benzene and tetrachloroethene were the major contributors), and below the target hazard of 1.

Twenty-seven constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. One BTEX constituent (benzene), HMW PAHs, total PCBs, 13 metals (antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) and cyanide were identified as COPECs based on SQs greater than unity. One VOC (isopropylbenzene) and two SVOCs (carbazole and dibenzofuran) were identified as COPECs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and five SVOCs (2,4-dimethylphenol, 2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation. Habitat for ecological receptors is currently present in this redevelopment area. The portions of this area adjacent to the Kalamazoo River and Mill Race will likely continue to provide habitat under the current redevelopment plan.

Based on the above discussion regarding the nature and extent of the contamination by former operational area, the following conclusions were identified by redevelopment area relative to groundwater impacts.

Residential Area 1

Metals are present in Residential Area 1 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC. Additionally, bis(2-ethylhexyl)phthalate was detected in a VAS water sample at a concentration above the Part 201 Residential and/or Non-Residential DWC in Residential Area 1. It should be noted that benzo(g,h,i)perylene was detected in a water sample at a concentration above the water solubility criteria; however, this sample was collected in 1997 and subsequent samples in the area did not identify the presence of this constituent above criteria.

The HHRA target risk and hazard level exceedances for Residential Area 1 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} and 1×10^{-6} (arsenic and hexavalent chromium were the major contributors), and above the target hazard level of 1 (arsenic, iron, and manganese were the major contributors).

Residential Area 2

Metals are present in Residential Area 2 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

The HHRA target risk and hazard level exceedances for Residential Area 2 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} and 1×10^{-6} (arsenic and hexavalent chromium were the major contributors), and above the target hazard level of 1 (arsenic, iron, and manganese were the major contributors).

Residential Area 3

Metals are present in Residential Area 3 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

The HHRA target risk and hazard level exceedances for Residential Area 3 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} and 1×10^{-6} (arsenic and hexavalent chromium were the major contributors), and above the target hazard level of 1 (arsenic, iron, and manganese were the major contributors).

Residential Area 4

Metals are present in Residential Area 4 in exceedance of the Part 201 Residential and/or Non-Residential DWC and GSIC.

The HHRA target risk and hazard level exceedances for Residential Area 4 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} and 1×10^{-6} (arsenic was the major contributor), and above the target hazard level of 1 (arsenic and manganese were the major contributors).

Waterfront Plaza

Metals are present in Waterfront Plaza in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

Following the HHRA, there were no target risk and hazard level exceedances for Waterfront Plaza groundwater.

Mixed Residential/Commercial Area 1

Metals are present in Mixed Residential/Commercial Area 1 in exceedance of the Part 201 GSIC.

The HHRA target risk and hazard level exceedances for Mixed Residential/Commercial Area 1 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} and 1×10^{-6} (arsenic was the major contributor), and above the target hazard level of 1 (arsenic and manganese were the major contributors).

Mixed Residential/Commercial Area 2

Metals are present in Mixed Residential/Commercial Area 2 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

The HHRA target risk and hazard level exceedances for Mixed Residential/Commercial Area 2 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} (arsenic was the major contributor) and 1×10^{-6} (arsenic and hexavalent chromium were the major contributors), and above the target hazard level of 1 (antimony, arsenic, cadmium, iron, and manganese were the major contributors).

Commercial Area 1

Metals are present in Commercial Area 1 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

Following the HHRA, there were no target risk and hazard level exceedances for Commercial Area 1 groundwater.

Commercial Area 2

No constituents are present in exceedance of the Part 201 Residential and/or Non-Residential Cleanup Criteria in Commercial Area 2.

Following the HHRA, there were no target risk and hazard level exceedances for Commercial Area 2 groundwater.

Commercial Area 3

Metals are present in Commercial Area 3 in exceedance of the Part 201 GSIC.

Following the HHRA, there were no target risk and hazard level exceedances for Commercial Area 3 groundwater.

Commercial Area 4

Metals are present in Commercial Area 4 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

Following the HHRA, there were no target risk and hazard level exceedances for Commercial Area 4 groundwater.

Recommendations for Additional Assessment

Based on the information reviewed and presented in this RI Report, the only area of additional assessment related to soil and groundwater identified during the RI phase of work is the continued collection of static water levels and staff gauge readings on a quarterly basis to evaluate seasonal fluctuations (i.e., wet versus dry).

Based on the information reviewed and presented in this RI Report, further evaluation and refinement of the constituents identified as COPECs during the Steps 1 and 2 is recommended based on several Site-specific factors, including RME concentrations rather than maximum concentrations, alternative ecological benchmarks for specific receptor groups (soil invertebrates, terrestrial plants, birds, and mammals), and historical use and generation as Step 3a of the U.S. EPA 8-step process. For metals, background concentrations may also be considered. For BCOCs, food chain models will be used to evaluate the potential for risk to upper trophic level receptors. The Step 3a refinement report will be submitted as a separate, stand-alone document.

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LIST OF ACRONYMS AND ABBREVIATIONS

%	Percent
ABS	Chemical Absorption Rate
AISLs	Acute Inhalation Screening Levels
AF	Soil to Skin Adherence Factor
AF_S	Absolute Absorption Fraction of Lead in Soil
AF_W	Absolute Absorption fraction of lead in water
AMSL	Above Mean Sea Level
AST	Aboveground Storage Tank
AT	Averaging Time
B	Dimensionless Ratio of Permeability Coefficient of a Compound Through the Stratum Corneum Relative to its Permeability Coefficient Across the Viable Epidermis
BBL	Blasland, Bouck and Lee
BCOC	Bioaccumulative Chemical of Concern
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BKSF	Biokinetic Slope Factor
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
BW	Body Weight
CDM	Camp, Dresser and McKee, Inc.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
Consent Decree	Consent Decree for the Design and Implementation of Certain Response Actions at Operable Unit #4 and the Plainwell, Inc Mill Property of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
COPEC	Constituent of Potential Ecological Concern
COPC	Chemical of Potential Concern
cm^2	square centimeter
cm/hr	centimeter per hour
CR	Cumulative Risk
CRA	Conestoga-Rovers & Associates
C	Chemical Concentration
C_{sat}	Soil Saturation Concentration Screening Levels
CF	Conversion Factor
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
CT	Central Tendency
DA_{event}	Absorbed Dose per Event

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

DCC	Direct Contact Criteria
DOT	Department of Transportation
DRO	Diesel Range Organics
DWC	Drinking Water Criteria
DWPC	Drinking Water Protection Criteria
ECO-SSL	Ecological Soil Screening Level
ED	Exposure Duration
EF	Exposure Frequency
EF_S	Exposure Frequency for Contact with Assessed Soils
EF_W	Exposure Frequency for Contact with Assessed Water
EPC	Exposure Point Concentration
ERA	Environmental Risk Assessment
ERM	Environmental Resources Management
ESL	Ecological Screening Level
ESV	Ecological Screening Value
ET	Exposure Time
EV	Event Frequency
°F	degrees Fahrenheit
FA	Fraction Absorbed Water
FESLs	Flammability and Explosivity Screening Level
FOD	Frequency of Detection
FOIA	Freedom of Information Act
FS	Feasibility Study
FSP	Field Sampling Plan
FT	Fraction of Time Exposed
ft bgs	feet below ground surface
GCC	Groundwater Contact Criteria
GCPC	Groundwater Contact Protection Criteria
GRO	Gasoline Range Organics
GSD	Geometric Standard Deviation
GSIC	Groundwater Surface Water Interface Criteria
GSIPC	Groundwater Surface Water Interface Protection Criteria
GVIAC	Groundwater Volatilization to Indoor Air Inhalation Criteria
HASP	Health and Safety Plan
HHRA	Baseline Human Health Risk Assessment
HI	Hazard Index

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

HMW	High Molecular Weight
HQ	Hazard Quotient
HSA	Hollow Stem Auger
hr	hour
I	Chemical Intake
IDW	Investigation-Derived Waste
IEUBK	Integrated Exposure Uptake Biokinetic Model for Lead
IR	Incidental Ingestion rate
IR_S	Ingestion Rate of Soil
IR_W	Ingestion rate of water
IRIS	Integrated Risk Information System
J&E Model	Johnson and Ettinger Model
K_p	Dermal Permeability Coefficient of Compound in Water
kg	kilogram
kg/mg	kilogram per milligram
LADD	Lifetime Average Daily Dose
LDF	Level of Detection Frequency
LDPE	low-density polyethylene
L/cm^3	liters per cubic centimeter
LFP	Low-Flow Purging
LOAEL	Lowest Observed Adverse Effect Level
L/day	liters per day
L/m^3	liters per cubic meter
LMS	Linearized Multistage
LMW	Low Molecular Weight
LNAPL	Light Non-Aqueous Phase Liquid
LOD	Limit of Detection
m^3	cubic meter
m^3/kg	cubic meters per kilogram
MDEQ	Michigan Department of Environmental Quality
MF	Modifying Factor
MGD	million gallons per day
mg/cm^2	milligrams per square centimeter
mg/day	milligrams per day
mg/kg	milligrams per kilogram
min/d	minutes per day

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

MLE	Maximum Likelihood Estimates
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MTBE	Methyl Tert Butyl Ether
N	Number of Chemicals
NAPL	Non-Aqueous Phase Liquid
NC	Not Calculated
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NELAC	National Environmental Laboratory Accreditation Conference
NOAEL	No Observed Adverse Effect Level
NPDES	National Pollutant Discharge Elimination System
ORNL	Oak Ridge National Laboratory
PAH	Polynuclear Aromatic Hydrocarbon
$PbB_{adult,0}$	Typical Lead Concentration in an Adult
$PbB_{fetal,\ 0.95}$	95th Percentile Target Blood Lead (PbB) Concentration in the Fetus
PbS	Soil Lead Concentration
PbW	Water Lead Concentration
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PEF	Particulate Emission Factor
PID	Photoionization Detector
PPM	Parts per Million
PPRTV	U.S. EPA's Provisional Peer Reviewed Toxicity
PSIC	Particulate Soil Inhalation Criteria
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/ Quality Control
OSWER	Office of Solid Waste and Emergency Response
$R_{fetal/maternal}$	Mean Ratio of Fetal to Maternal Blood Lead Concentration
RAGS	Risk Assessment Guidance for Superfund
RfC	Reference Concentration
RfD	Reference Dose
RfDo	Oral Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
RMT	RMT, Inc.

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

SA	Skin Surface Area Available for Contact
SDBL	State Default Background Level
Site	Former Plainwell, Inc. Mill Property
SLERA	Screening Level Ecological Risk Assessment
SOP	Standard Operating Procedure
SOW	Statement of Work
SPLP	Synthetic Precipitation Leaching Procedure
SQ	Screening Quotient
SVIAC	Soil Volatilization to Indoor Air Inhalation Criteria
SVOC	Semi-Volatile Organic Compound
t*	Time to Reach Steady State
τ_{event}	Lag Time per Event
t_{event}	Event Duration
TAL	Target Analyte List
1,1,1-TCA	1,1,1-Trichloroethane
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TCL	Target Compound List
TCRA	Time Critical Removal Action
TPH	Total Petroleum Hydrocarbons
TRW	Technical Review Workgroup for Lead
TSCA	Toxic Substances Control Act
UCL	Upper Confidence Limit
µg/dL	micrograms per deciliter
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
UF	Uncertainty Factor
URF	Unit Risk Factor
U.S. EPA	United States Environmental Protection Agency
USCS	Unified Soil Classification System
USGS	United States Geological Survey
UST	Underground Storage Tank
VAS	Vertical Aquifer Sampling
VOC	Volatile Organic Compound

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

VF	Volatilization Factor
VP	Vapor Pressure
VSIC	Volatile Soil Inhalation Criteria
Weyerhaeuser	Weyerhaeuser NR Company
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

This Remedial Investigation (RI) Report for the former Plainwell, Inc. Mill Property (Site) located at 200 Allegan Street in Plainwell, Michigan, has been prepared by Conestoga-Rovers & Associates (CRA) on behalf of Weyerhaeuser NR Company (Weyerhaeuser) for submittal to the United States Environmental Protection Agency (U.S. EPA) Region 5. This RI Report is being submitted in accordance with the RI/Feasibility Study (FS) Work Plan dated July 2009, the Multi-Area Field Sampling Plan dated November 2009, the Phase II RI Work Plan dated November 2009, the Statement of Work (SOW) for the RI/FS, and the terms of the Consent Decree for the Design and Implementation of Certain Response Actions at Operable Unit #4 and the Plainwell, Inc. Mill Property of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Consent Decree), which became effective February 22, 2005. The Site location is presented on Figure 1.1.

As approved by the U.S. EPA on August 6, 2008, the RI was implemented in a phased approach. As a result, the RI was completed under a multi-volume work plan for the Site that includes the below separate parts and various related subsequent correspondence:

- Addendum to RI/FS Work Plan: PCB Investigation Activities Near Mill Building Banks dated March 2008 (RMT, 2008a)
- Phase 2 Addendum No. 1 Remedial Investigation/Feasibility Study Work Plan dated September 2008 (RMT, 2008b)
- Phase I Groundwater and Coal Tunnel Assessment Work Plan dated November 2008 (RMT, 2008c)
- RI/FS Work Plan dated July 2009 (CRA, 2009a)
- Multi-Area Field Sampling Plan dated November 2009 (CRA, 2009b)
- Phase II RI Work Plan dated November 2009 (CRA, 2009c)
- Soil and Groundwater Investigation Work Plan, Fannie Pell Park Western Bridge Footing dated January 5, 2011 (CRA, 2011)

The RI Report was submitted to the U.S. EPA on June 20, 2011. Subsequently, representatives from the U.S. EPA, Michigan Department of Environmental Quality (MDEQ), SulTRAC, Camp Dresser and McKee, Inc. (CDM), Weyerhaeuser, and CRA participated in conference calls on September 28, 2011

and October 28, 2011 related to draft Remedial Action Objects (RAOs) and Human Health Risk Assessment (HHRA) and Screening Level Ecological Assessment (SLERA) portions of the RI Report. Subsequently on behalf of Weyerhaeuser, CRA prepared a memorandum, entitled *Proposed Modifications to Human Health and Ecological Risk Assessments, Remedial Investigation Report, Former Plainwell, Inc. Mill Property, Plainwell, Michigan*, which was submitted to U.S. EPA on November 9, 2011. U.S. EPA provided comments on the HHRA and SLERA portions of the RI Report and the November 9, 2011 memorandum on November 23, 2011. Additional comments on the June 20, 2011 RI Report, dated February 17, 2012, were received by Weyerhaeuser on February 28, 2012.

In support of the on-going redevelopment activities at the Site, additional delineation of the area surrounding MW-16 and the abandonment of MW-1 were proposed to the U.S. EPA on March 26, 2012. Conditional approval of the implementation of these activities was received by U.S. EPA on March 28, 2012 and the activities were initiated on March 29, 2012. Additionally, in May 2012, excavation of the area of TP-203 was completed with verification soil sampling conducted, in support of the on-going redevelopment activities at the Site.

On April 20, 2012, Weyerhaeuser submitted a revised RI Report (Revision 1) in response to U.S. EPA comments on the RI Report, dated February 17, 2012 and U.S. EPA's November 23, 2011 comments associated with the HHRA and SLERA portions of the RI and on a subsequent memorandum, entitled *Proposed Modifications to Human Health and Ecological Risk Assessments, Remedial Investigation Report, Former Plainwell, Inc. Mill Property, Plainwell, Michigan*, which was submitted to U.S. EPA on November 9, 2011. Subsequently, an error was discovered associated with the HHRA portion of the April 20, 2012 RI report and a revised RI Report (Revision 1) was submitted on July 10, 2012.

Based on the recommendations presented in the April 20, 2012 and July 10, 2012 RI Reports (Revision 1), a Work Plan for Additional RI Activities was submitted to U.S. EPA on May 7, 2012 (CRA, 2012a). On June 7, 2012, Weyerhaeuser received comments on the Work Plan for Additional RI Activities and subsequently submitted a Revised Work Plan for Additional RI Activities (CRA, 2012b) and a response to U.S. EPA's June 7, 2012 comments on July 9, 2012. Implementation of the Revised Work Plan for Additional RI Activities was initiated on July 31, 2012 under conditional approval from U.S. EPA received on July 19, 2012. Comments on the April 20, 2012 and July 10, 2012 RI Reports (Revision 1) were received from U.S. EPA on August 30, 2012.

Responses to the aforementioned comments related to the April 20, 2012 and July 10, 2011 RI Reports (Revision 1) are addressed under separate cover and incorporated herein, as applicable.

1.1 PURPOSE OF REPORT

The overall objective of the RI/FS was to identify and investigate any environmental concerns regarding prior use of the Site. As outlined in the SOW, "*The purpose of the RI program is to provide the data necessary to evaluate current and potential risks to human health and ecological receptors*". As provided in the SOW, the objectives of the RI/FS for the Site are as follows:

- **To determine the nature and extent of the contamination to assess risk and support development and evaluation of remedial alternatives –** Collect the data necessary to adequately characterize the nature and extent of contamination at the Site, consistent with the requirements of the National Oil and Hazardous Substance Pollution Contingency Plan (March 8, 1990) (NCP) and the Consent Decree.
- **To evaluate potential risk –** Assess any current and potential risks to human health or the environment caused by the release or threatened release of hazardous substances, pollutants, or contaminants at or from the Site.
- **To develop and evaluate remedial alternatives –** Develop and evaluate alternatives, consistent with reasonably anticipated future land use(s) at the Site, for remedial action to prevent, mitigate, control, or eliminate risks posed by any release or threatened release of historical contaminants present at or from the Site.

To facilitate the evaluation of the Site related information as part of the development and implementation of the RI through the Phase II RI Work Plan, the Site was divided into three areas based on their locations and noted historical environmental impacts. The three historical operational areas are as follows:

- Area 1 – Former wastewater sludge dewatering lagoons and aeration basin area
- Area 2 – Mill Buildings area
- Area 3 – North central portion area

The results of the investigations conducted on the aforementioned areas are discussed in this report relative to the anticipated future use scenarios based on the current redevelopment plan, which consists of 11 primary areas. The 11 redevelopment areas are as follows:

- Residential Area 1
- Residential Area 2
- Residential Area 3
- Residential Area 4
- Waterfront Plaza
- Mixed Residential/Commercial Area 1
- Mixed Residential/Commercial Area 2
- Commercial Area 1
- Commercial Area 2
- Commercial Area 3
- Commercial Area 4

For the purposes of discussing the implementation of the Phase II RI Work Plan activities, this RI Report presents the summary of information related to the historical operational areas (i.e., Areas 1 through 3). For the purposes of discussing and evaluating the results from the implementation of the RI, including the Phase II RI Work Plan, this RI Report presents the summary of information related to the currently anticipated future use areas (i.e., Residential Area 1, Commercial Area 1, etc.).

A layout of the Site, showing the boundaries of the three historical operational areas and 11 redevelopment areas is provided on Figure 1.2. As defined in the Consent Decree, "*Mill Operation and Maintenance shall not include any operation and maintenance of any portion of the Mill Property, if any, located between the top of the banks of the Kalamazoo River and the middle of the Kalamazoo River stream bed. Any operation and maintenance of such river banks and adjacent stream bed sediments will be addressed as part of the remedial action to be developed by EPA for the Kalamazoo River Operable Unit*" (United States District Court Western District of Michigan Southern Division, 2005). Therefore, the Site includes areas up to the top of the Kalamazoo River bank. Areas associated with the Kalamazoo River (i.e., beyond

the top of the riverbank and mill race) are not included in the scope of the RI/FS and are being addressed as part of the river remedial activities.

1.2 REPORT ORGANIZATION

The remainder of this RI Report is organized as follows:

- Section 2.0 Mill Description and Background
- Section 3.0 Groundwater Fate and Transport
- Section 4.0 Previous Response Actions
- Section 5.0 Source, Nature and Extent of Contamination
- Section 6.0 Analytical Data
- Section 7.0 Results of Pilot Tests
- Section 8.0 Human Health Risk Assessment
- Section 9.0 Ecological Risk Assessment
- Section 10.0 Summary and Conclusions
- Section 11.0 References

2.0 MILL DESCRIPTION AND BACKGROUND

The following subsections provide an overview of current and historical information relating to Site operations as well as physical and demographic characteristics of the Site. Additional information regarding historical information relating to the Site description and background was provided in previous work plans for the Site.

2.1 MILL LOCATION AND PHYSICAL SETTING

The Site is located in the southeast ¼ of the northeast ¼ of Section 30, Town 1 North, Range 11 West, in the City of Plainwell, Allegan County, Michigan. The property address is 200 Allegan Street in Plainwell, Michigan and is currently zoned as Central Business District.

The Site comprises approximately 35.6 acres of land and consists of the former Plainwell, Inc. Mill property and buildings. Current Site features include the former Mill Buildings, Wastewater Treatment Plant (WWTP) buildings and associated clarifiers, the former Specialty Minerals, Inc. Building (only the concrete pad of the former building remains), former Sludge Dewatering Building, concrete pads, the guard shack, rail spurs, one 50,000-gallon water tower (one 50,000-gallon water tower was removed in 2012), ancillary support buildings (pump houses, former guard shacks, etc.), wooded areas, and asphalt-paved areas. The Site buildings and structures are presented on Figure 1.2. As part of the on-going property redevelopment activities, portions of the former Mill Buildings were razed between March and August 2012, or are undergoing renovation for future anticipated occupancy by the City of Plainwell in 2013, and the former Sludge Dewatering Building was renovated for use by the City of Plainwell Public Safety Department, with occupancy in late 2012.

The former Mill is located on the eastern portion of the Site, adjacent to the Mill Race. The former Mill is comprised of approximately 25 adjacent and conjoined buildings, primarily constructed between 1900 and 1995. The former Specialty Minerals, Inc. Building previously occupied the south central portion of the Site, the former Sludge Dewatering Building is located to the west/northwest of the former Specialty Minerals, Inc. Building, with the previous Quality Products Building formerly located adjacent to the west of the former Sludge Dewatering Building. The WWTP buildings, clarifiers, and former aeration basin are located

on the northwestern portion of the Site. The western portion of the Site along the riverbank contained the former wastewater settling lagoons. The remaining residuals from various settling lagoons were consolidated into the four westerly lagoons, which are presently covered with soil and vegetation. The other lagoons were dredged and backfilled with soil. Former lagoons were filled to approximately the adjacent grade. A vacant wooded lot is present on the southwest portion of the Site. The majority of the Site is covered with concrete and asphalt pavement; however, there are areas, primarily along the riverbank, where vegetation is present.

To the north, the Kalamazoo River borders the Site. As defined in the Consent Decree and discussed in Section 1.1, the Site is defined as extending to the top of the river bank. The Site is bordered by the Mill Race to the east. Further east are the Plainwell central business units/commercial properties. The Site is bordered to the south by Allegan Street/M-89 and further south by residential properties. The Site is bordered to the west by mixed residential and commercial properties and the City of Plainwell Water Renewal Plant.

2.2 PRESENT AND PAST FACILITY OPERATIONS AND DISPOSAL PRACTICES

2.2.1 HISTORICAL MILL OPERATIONS

Based on historical information reviewed, the Mill Buildings Area (Commercial Area 4 and portions of Mixed Residential/Commercial Area 2, Commercial Area 4, and Residential Area 4) was originally developed for use as a paper mill in the early 1880s. The portions of the Site west of the Mill were acquired by various historical Site owners between 1950 and the mid-1980s for the purpose of expanding Mill operations and supporting associated WWTP and manufacturing processes. Throughout the 1900s, the Site underwent numerous improvements including the construction and removal of various buildings within Mill Buildings Area, and construction of WWTP buildings and lagoons and clarifiers (Residential Areas 1 through 4, Waterfront Plaza and Mixed Residential/Commercial Area 2), the former Specialty Minerals, Inc. Building (Mixed Residential/Commercial Area 1), the former Sludge Dewatering Building and the former Quality Products Building (Commercial Area 2). Residential structures occupied portions of the western area of the Site prior to their development for uses associated with Mill operations. The southwestern portion

of the Site (Commercial Area 1) has always reportedly been vacant land or utilized for agricultural purposes.

The historical information reviewed indicates that various activities took place at the Site during its operation as a paper mill, including the manufacturing of paper products and recycling of paper materials (which included the process of deinking), on-Site parking, paper sludge dewatering, wastewater treatment, waste storage, raw materials storage, storage of coal, storage of fuel and hydraulic oils, and general manufacturing-related activities. Available historical information indicates that the Mill produced "coated and uncoated book and cover release base and technical specialty paper products." Precipitated calcium carbonate slurry used in the paper making process was developed for the Site and other surrounding paper mills in the former Specialty Minerals, Inc. Building. Process wastewater was treated in the on-Site WWTP and paper waste from Mill operations was treated in the former Sludge Dewatering Building. These operations were located in the central portion of the Site. The former Quality Products Building, a retail store, and an associated metal storage building also operated in the central portion of the Site.

2.2.2 HISTORICAL OWNERSHIP AND OPERATIONS

Within the Mill Buildings Area, papermaking operations began as early as 1884 and continued until Site closure in 2000. During this time period, ownership of the Site was passed between various entities, including Weyerhaeuser who owned and operated the Site for approximately 9 years (1961 to 1970). The last operating owner, Plainwell, Inc., filed for bankruptcy in 2000 and the City of Plainwell subsequently purchased the property on August 31, 2006 with the objective of redeveloping the Site. A summary of previous owners is provided below.

Dates (approximate)	**Property Ownership**
(at least) 1884	Lyon Paper Mill
1891 to 1956	Michigan Paper Company
1956 to 1961	Hamilton Paper Company
1961 to 1970	Weyerhaeuser Company
1970 to 1985	Phillip Morris (operated the Nicolet Paper Company)
1985 to 1987	Chesapeake Corporation
1987 to 1996	Simpson Plainwell Paper Company

Dates (approximate)	Property Ownership
1996 to 2000	Plainwell, Inc.
2006 to present	City of Plainwell (portion)
2011 to present	CRA 200 Allegan Street LLC (portion)

On July 18, 2011, ownership of the eastern portion of the Site, including Building 17 and Building 19, was transferred to CRA 200 Allegan Street LLC. Since that time, CRA 200 Allegan Street LLC has been conducting renovation activities on offices and access ways. In March 2012, CRA moved its Kalamazoo, Michigan office staff into Building 17 and now occupies the top floor of this building.

The City of Plainwell is currently conducting renovation activities on office areas in Building 18 for the anticipated occupation of those areas in 2013 for City Hall operations. Additionally, the City of Plainwell is currently utilizing portions of the Site for storage of various seasonal decorative supplies, presentation rooms, fire hose testing, and ambulance driver testing. Demolition of the former Quality Products Building was conducted in October 2011, and demolition of the former Specialty Minerals Building was conducted in December 2011. Demolition activities associated with portions of the Mill Buildings were conducted on behalf of the City of Plainwell with oversight from the MDEQ for Buildings 3A, 9A, 9B, 9C, 9D, 9E, 9F, 23 and 28, the former 200,000-gallon fuel oil aboveground storage tank (AST) and associated area, the former clay, starch, and ammonia AST areas, and one of the 50,000-gallon water towers from March to August 2012. The former Sludge Dewatering Building was renovated for use by the City of Plainwell Public Safety Department, with occupancy in late 2012. The specific timing associated with demolition of other structures associated with the future redevelopment of the Site has not yet been established. Additionally, several structures are not anticipated to be demolished and will be redeveloped/renovated/reused.

Prior to initiation of demolition activities in these areas, a non-intrusive decommissioning assessment was conducted by CRA on behalf of the City of Plainwell. Decommissioning assessment activities included a Site inspection and file review to evaluate potential areas of environmental concern, which included: potential polychlorinated biphenyl (PCB) materials; asbestos-containing materials; lead-based paint; mercury containing devices, pits; trenches and sumps; refrigerants; electrical systems; battery charging systems; utilities; lighting; air pollution control systems/exhaust stacks; batteries; miscellaneous

hydraulic equipment; miscellaneous chemicals; and cathode ray tubes. Based on the decommissioning assessment inspection, initial sampling was conducted, with additional delineation completed for Buildings 3A, 9A, 9B, 9C, 9D, 9E, 9F, 23, and 28, the ASTs and associated areas, and the water tower prior to demolition. Sampling conducted for the structures included the collection of concrete, oil, paint, expansion joint, surface wipe, window caulk, and various other solid samples. The decommissioning and demolition work is being conducted under grants obtained by the City of Plainwell for the work.

2.2.3 WASTEWATER TREATMENT

According to historical documentation, prior to installation of the clarifier, wastewater generated during papermaking processes was discharged directly into the Kalamazoo River, without any treatment. Wastewater treatment commenced at the Site in 1954, and improved as wastewater treatment methods developed. Between 1954 and 1967, wastewater treatment was carried out through a primary clarifier that was constructed northwest of the Mill Buildings and a number of wastewater sludge dewatering lagoons on the northwest portion of the Site, as presented on Figure 1.2. After treatment of wastewater in the primary clarifier, the clarifier effluent was discharged into the Kalamazoo River and the clarifier underflow was discharged into the lagoons for further dewatering. The dewatered sludge in each lagoon was excavated and transported off Site to the 12th Street Landfill in Otsego Township, Michigan (RMT, 2006).

In 1967, wastewater treatment at the Site developed to include a 1.85 million gallon plastic lined aeration basin and a secondary clarifier, collectively referred to herein as the secondary clarifier, located east of the lagoons, as presented on Figure 1.2 (RMT, 2006). The primary clarifier's effluent passed through an aeration basin prior to discharge to Kalamazoo River and biosludges from the aeration basins along with the primary clarifier underflow were discharged to the dewatering lagoons. The dewatered sludge continued to be excavated and transported off-Site for disposal at the 12th Street Landfill (RMT, 2006).

From 1981 until termination of operations at the Site in 2000, a new wastewater treatment facility, consisting of a new primary clarifier, a mechanical dewatering system, a new secondary clarifier, and an activated sludge treatment system was constructed. The primary clarifier and wastewater sludge dewatering lagoons

were replaced with the new primary clarifier and a mechanical dewatering system, respectively. The new secondary clarifier and the activated sludge treatment system were constructed over several of the eastern lagoons (i.e., Lagoons D, E, and G) and the old primary clarifier was removed. The removal of the paper residuals from the dewatering lagoons continued across the Site and between 1981 and 1983, most of the remainder of the residuals in the lagoons were removed and transported off-Site for disposal or consolidated in western lagoons and covered with soil (RMT, 2006). In 1983, the former aeration system was taken out of service and partially backfilled. The general location of the new wastewater treatment system is shown on Figure 1.2.

2.2.4 HAZARDOUS SUBSTANCES

Based on the existing Site information, several Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulated hazardous substances were used, generated, and/or stored during the paper manufacturing operations.

Coal and Fly Ash

Coal was historically utilized as a fuel for steam generation for papermaking operations. Based on the review of historical aerial photographs, the north central portion of the Site (i.e., Residential Area 4) was used for exterior coal storage. Fly ash generated as a by-product of the combustion of coal in the boilers was mixed with wastewater sludge in the lagoons, prior to off-Site sludge disposal. Coal products, and waste generated from incineration of coal products, may contain metals and polycyclic aromatic hydrocarbons (PAHs) at various concentrations, depending on the origin of the coal. The resulting fly ash contains organic compounds and metals as noted in historical sample results.

Other Petroleum-Based Products

Several on-Site aboveground and underground storage tanks (ASTs/USTs) that historically contained petroleum products such as No. 6 fuel oil, gasoline, diesel, and kerosene were used at the Site.

Additives for the Papermaking Process

Additives, such as support products from the former Specialty Minerals Inc., were utilized during the papermaking process, along with cleaning products and petroleum products. Several paper machine additives, felt, and wire cleaning products containing volatile organic compounds (VOCs) and semi-volatile organic compound (SVOCs) were used during papermaking process at the Site.

Wastewater Sludge

Wastewater sludge was created during the papermaking processes on-Site. The sludge was removed from the facility and processed through a series of clarifiers before entering the former wastewater lagoons for dewatering. Once the paper sludge was dewatered, the material was then removed from the Site. In the late 1950s and early 1960s, paper that was de-inked and recycled at the Mill may have included carbonless copy paper containing PCBs and inks containing heavy metals. De-inking was discontinued at the Mill in 1963. The U.S. EPA's Technical and Procedural Amendments to the Toxic Substances Control Act (TSCA) Regulations indicates that the potential for PCBs present within the wastewater sludge would not be regulated under TSCA.

Electrical Equipment and Hydraulic Lubricants

Some fluids used in electrical equipment (e.g., transformers and capacitors), as well as hydraulic fluids, commonly contained PCBs during the timeframe the Mill was operational. As documented in the previous reports for the Site, PCBs were historically used in transformers (seven removed), capacitors (41 removed), and in the hydraulic fluids of five elevators inside the mill buildings (fluids have been removed and disposed off Site).

2.2.5 WASTE STORAGE AND DISPOSAL

The potentially regulated waste generated at the Site included used oil, spent solvents (prior to 1994), and wastewater sludge (RMT, 2006). All known disposal activities have been discussed above and landfilling activities associated with these waste streams are not known to have occurred on Site. PCBs that may be present in the paper residuals on Site are discussed in Section 2.2.3.

2.3 SUMMARY OF PREVIOUS INVESTIGATIONS AND/OR REMOVAL ACTIONS

2.3.1 PRE-RI INVESTIGATIONS

A number of investigations have been conducted at the Site beginning as early as 1996. Figures 2.1 to 2.10 present the associated Pre-RI sampling locations in Residential Areas 1 through 4, Waterfront Plaza, Mixed Residential/Commercial Areas 1 and 2, and Commercial Areas 2 through 4, respectively. No Pre-RI samples were collected from Commercial Area 1. Analytical results for the soil and groundwater samples were evaluated against the following Generic Residential and Non-Residential Cleanup Criteria and Screening Levels established in Part 7 of Administrative Rules, effective September 28, 2012, pursuant to Part 201, Environmental Remediation, 1994 PA 451 as amended (Part 201):

Soil:

- State Default Background (as applicable)(SDBL)
- Drinking Water Protection Criteria (DWPC)
- Groundwater Surface Water Interface Protection Criteria (GSIPC)
- Groundwater Contact Protection Criteria (GCPC)
- Soil Volatilization to Indoor Air Inhalation Criteria (SVIAC)
- Volatile Soil Inhalation Criteria (VSIC)
- Particulate Soil Inhalation Criteria (PSIC)
- Direct Contact Criteria (DCC)
- Soil Saturation Concentration Screening Levels (C_{sat})

Groundwater:

- Drinking Water Criteria (DWC)
- Groundwater Surface Water Interface Criteria (GSIC)
- Groundwater Volatilization to Indoor Air Inhalation Criteria (GVIAC)
- Groundwater Contact Criteria (GCC)
- Acute Inhalation Screening Levels (AISLs)

- Flammability and Explosivity Screening Level (FESLs)
- Water Solubility Limits

Summaries of the exceedances of the Part 201 Generic Residential and Non-Residential Cleanup Criteria for Residential Areas 1 through 4, Waterfront Plaza, Mixed Residential/Commercial Areas 1 and 2, and Commercial Areas 1 through 4 are presented in Tables 2.1 through 2.11, Tables 2.12 through 2.21, and Tables 2.22 through 2.32, for soil, groundwater, and soil synthetic precipitation leaching procedure (SPLP), respectively. Tables 2.33, 2.34, and 2.35 present the applicable soil, groundwater, and soil SPLP criteria, respectively. Additionally, complete summaries of historical soil and groundwater data from the previous investigations prior to the RI sampling at the Site, along with data from the RI investigations, are presented in Appendix A, B and C, respectively.

Tables A.1 through A.12 in Appendix A provide summaries of soil analytical data, including Pre-RI and RI data, as follows:

- Table A.1.a – Analytical Summary of Soil Sample Results – Residential Area 1 VOCs
- Table A.1.b – Analytical Summary of Soil Sample Results – Residential Area 1 SVOCs
- Table A.1.c – Analytical Summary of Soil Sample Results – Residential Area 1 PCBs
- Table A.1.d – Analytical Summary of Soil Sample Results – Residential Area 1 Inorganics
- Table A.2.a – Analytical Summary of Soil Sample Results – Residential Area 2 VOCs
- Table A.2.b – Analytical Summary of Soil Sample Results – Residential Area 2 SVOCs
- Table A.2.c – Analytical Summary of Soil Sample Results – Residential Area 2 PCBs
- Table A.2.d – Analytical Summary of Soil Sample Results – Residential Area 2 Inorganics
- Table A.3.a – Analytical Summary of Soil Sample Results – Residential Area 3 VOCs

- Table A.3.b – Analytical Summary of Soil Sample Results – Residential Area 3 SVOCs
- Table A.3.c – Analytical Summary of Soil Sample Results – Residential Area 3 PCBs
- Table A.3.d – Analytical Summary of Soil Sample Results – Residential Area 3 Inorganics
- Table A.4.a – Analytical Summary of Soil Sample Results – Residential Area 4 VOCs
- Table A.4.b – Analytical Summary of Soil Sample Results – Residential Area 4 SVOCs
- Table A.4.c – Analytical Summary of Soil Sample Results – Residential Area 4 PCBs
- Table A.4.d – Analytical Summary of Soil Sample Results – Residential Area 4 Inorganics
- Table A.5.a – Analytical Summary of Soil Sample Results – Waterfront Plaza VOCs
- Table A.5.b – Analytical Summary of Soil Sample Results – Waterfront Plaza SVOCs
- Table A.5.c – Analytical Summary of Soil Sample Results – Waterfront Plaza PCBs
- Table A.5.d – Analytical Summary of Soil Sample Results – Waterfront Plaza Inorganics
- Table A.6.a – Analytical Summary of Soil Sample Results – Mixed Residential/Commercial Area 1 VOCs
- Table A.6.b – Analytical Summary of Soil Sample Results – Mixed Residential/Commercial Area 1 SVOCs
- Table A.6.c – Analytical Summary of Soil Sample Results – Mixed Residential/Commercial Area 1 PCBs
- Table A.6.d – Analytical Summary of Soil Sample Results – Mixed Residential/Commercial Area 1 Inorganics
- Table A.7.a – Analytical Summary of Soil Sample Results – Mixed Residential/Commercial Area 2 VOCs
- Table A.7.b – Analytical Summary of Soil Sample Results – Mixed Residential/Commercial Area 2 SVOCs

- Table A.7.c – Analytical Summary of Soil Sample Results – Mixed Residential/Commercial Area 2 PCBs
- Table A.7.d – Analytical Summary of Soil Sample Results – Mixed Residential/Commercial Area 2 Inorganics
- Table A.8.a – Analytical Summary of Soil Sample Results – Commercial Area 1 VOCs
- Table A.8.b – Analytical Summary of Soil Sample Results – Commercial Area 1 SVOCs
- Table A.8.c – Analytical Summary of Soil Sample Results – Commercial Area 1 PCBs
- Table A.8.d – Analytical Summary of Soil Sample Results – Commercial Area 1 Inorganics
- Table A.9.a – Analytical Summary of Soil Sample Results – Commercial Area 2 VOCs
- Table A.9.b – Analytical Summary of Soil Sample Results – Commercial Area 2 SVOCs
- Table A.9.c – Analytical Summary of Soil Sample Results – Commercial Area 2 PCBs
- Table A.9.d – Analytical Summary of Soil Sample Results – Commercial Area 2 Inorganics
- Table A.10.a – Analytical Summary of Soil Sample Results – Commercial Area 3 VOCs
- Table A.10.b – Analytical Summary of Soil Sample Results – Commercial Area 3 SVOCs
- Table A.10.c – Analytical Summary of Soil Sample Results – Commercial Area 3 PCBs
- Table A.10.d – Analytical Summary of Soil Sample Results – Commercial Area 3 Inorganics
- Table A.11.a – Analytical Summary of Soil Sample Results – Commercial Area 4 VOCs
- Table A.11.b – Analytical Summary of Soil Sample Results – Commercial Area 4 SVOCs
- Table A.11.c – Analytical Summary of Soil Sample Results – Commercial Area 4 PCBs

- Table A.11.d – Analytical Summary of Soil Sample Results – Commercial Area 4 Inorganics
- Table A.12 – Analytical Summary of Speciated Chromium Soil Sample Results – Site-Wide

Tables B.1 through B.10 in Appendix B provide summaries of the groundwater analytical data including Pre-RI and RI data, as follows:

- Table B.1.a – Analytical Summary of Groundwater Sample Results – Residential Area 1 VOCs
- Table B.1.b – Analytical Summary of Groundwater Sample Results – Residential Area 1 SVOCs
- Table B.1.c – Analytical Summary of Groundwater Sample Results – Residential Area 1 PCBs
- Table B.1.d – Analytical Summary of Groundwater Sample Results – Residential Area 1 Inorganics
- Table B.2.a – Analytical Summary of Groundwater Sample Results – Residential Area 3 VOCs
- Table B.2.b – Analytical Summary of Groundwater Sample Results – Residential Area 3 SVOCs
- Table B.2.c – Analytical Summary of Groundwater Sample Results – Residential Area 3 PCBs
- Table B.2.d – Analytical Summary of Groundwater Sample Results – Residential Area 3 Inorganics
- Table B.3.a – Analytical Summary of Groundwater Sample Results – Residential Area 4 VOCs
- Table B.3.b – Analytical Summary of Groundwater Sample Results – Residential Area 4 SVOCs
- Table B.3.c – Analytical Summary of Groundwater Sample Results – Residential Area 4 PCBs
- Table B.3.d – Analytical Summary of Groundwater Sample Results – Residential Area 4 Inorganics
- Table B.4.a – Analytical Summary of Groundwater Sample Results – Waterfront Plaza VOCs

- Table B.4.b – Analytical Summary of Groundwater Sample Results – Waterfront Plaza SVOCs
- Table B.4.c – Analytical Summary of Groundwater Sample Results – Waterfront Plaza PCBs
- Table B.4.d – Analytical Summary of Groundwater Sample Results – Waterfront Plaza Inorganics
- Table B.5.a – Analytical Summary of Groundwater Sample Results – Mixed Residential/Commercial Area 1 VOCs
- Table B.5.b – Analytical Summary of Groundwater Sample Results – Mixed Residential/Commercial Area 1 SVOCs
- Table B.5.c – Analytical Summary of Groundwater Sample Results – Mixed Residential/Commercial Area 1 PCBs
- Table B.5.d – Analytical Summary of Groundwater Sample Results – Mixed Residential/Commercial Area 1 Inorganics
- Table B.6.a – Analytical Summary of Groundwater Sample Results – Mixed Residential/Commercial Area 2 VOCs
- Table B.6.b – Analytical Summary of Groundwater Sample Results – Mixed Residential/Commercial Area 2 SVOCs
- Table B.6.c – Analytical Summary of Groundwater Sample Results – Mixed Residential/Commercial Area 2 PCBs
- Table B.6.d – Analytical Summary of Groundwater Sample Results – Mixed Residential/Commercial Area 2 Inorganics
- Table B.7.a – Analytical Summary of Groundwater Sample Results – Commercial Area 1 VOCs
- Table B.7.b – Analytical Summary of Groundwater Sample Results – Commercial Area 1 SVOCs
- Table B.7.c – Analytical Summary of Groundwater Sample Results – Commercial Area 1 PCBs
- Table B.7.d – Analytical Summary of Groundwater Sample Results – Commercial Area 1 Inorganics
- Table B.8.a – Analytical Summary of Groundwater Sample Results – Commercial Area 2 VOCs
- Table B.8.b – Analytical Summary of Groundwater Sample Results – Commercial Area 2 SVOCs

- Table B.8.c – Analytical Summary of Groundwater Sample Results – Commercial Area 2 PCBs
- Table B.8.d – Analytical Summary of Groundwater Sample Results – Commercial Area 2 Inorganics
- Table B.9.a – Analytical Summary of Groundwater Sample Results – Commercial Area 3 VOCs
- Table B.9.b – Analytical Summary of Groundwater Sample Results – Commercial Area 3 SVOCs
- Table B.9.c – Analytical Summary of Groundwater Sample Results – Commercial Area 3 PCBs
- Table B.9.d – Analytical Summary of Groundwater Sample Results – Commercial Area 3 Inorganics
- Table B.10.a – Analytical Summary of Groundwater Sample Results – Commercial Area 4 VOCs
- Table B.10.b – Analytical Summary of Groundwater Sample Results – Commercial Area 4 SVOCs
- Table B.10.c – Analytical Summary of Groundwater Sample Results – Commercial Area 4 PCBs
- Table B.10.d – Analytical Summary of Groundwater Sample Results – Commercial Area 4 Inorganics

Tables C.1 through C.11 in Appendix C provide summaries of the soil SPLP analytical data including RI data, as follows:

- Table C.1 – Analytical Summary of SPLP Soil Sample Results – Residential Area 1
- Table C.2 – Analytical Summary of SPLP Soil Sample Results – Residential Area 2
- Table C.3 – Analytical Summary of SPLP Soil Sample Results – Residential Area 3
- Table C.4 – Analytical Summary of SPLP Soil Sample Results – Residential Area 4
- Table C.5 – Analytical Summary of SPLP Soil Sample Results – Waterfront Plaza

- Table C.6 – Analytical Summary of SPLP Soil Sample Results – Mixed Residential/Commercial Area 1
- Table C.7 – Analytical Summary of SPLP Soil Sample Results – Mixed Residential/Commercial Area 2
- Table C.8 – Analytical Summary of SPLP Soil Sample Results – Commercial Area 1
- Table C.9 – Analytical Summary of SPLP Soil Sample Results – Commercial Area 2
- Table C.10 – Analytical Summary of SPLP Soil Sample Results – Commercial Area 3
- Table C.11 – Analytical Summary of SPLP Soil Sample Results – Commercial Area 4

The following subsections provide a discussion of the data. For the purposes of this discussion the data summarized below only consists of Pre-RI investigations (i.e., 2007 and earlier). Analytical data collected during the Phase I, II and Additional RI investigations with comparison to Part 201 Generic Residential and Non-Residential Cleanup is presented in Section 5.0.

As part of the development of the Phase II RI Work Plan, CRA conducted a review of the Pre-RI data to assess the usability of the data for inclusion in the RI. Based on that review and to the best of CRA's knowledge, the samples from Pre-RI investigations were analyzed by National Environmental Laboratory Accreditation Conference (NELAC)-accredited laboratories using standard U.S. EPA methods, consistent with those methods selected in the QAPP. To attain NELAC accreditation, laboratories must pass rigorous audits and semi-annual proficiency testing, which attest to the quality of the laboratories used to perform these sample analyses. The U.S. EPA methods used to analyze the samples include significant quality assurance and quality control requirements that must be met by the laboratories during testing.

In addition, the data from the RI was used to supplement the Pre-RI data and therefore used together in development of the RI. Evaluation of the data did not produce any significant discrepancies between the Pre-RI data and the RI data which would suggest the data quality of the Pre-RI data is questionable. Therefore, given the above and the lack of any indication that the data is not

usable for the purposes of the RI, despite the absence of a QAPP, there is no reason to question the quality of these data.

2.3.2 PRE-RI SOIL INVESTIGATION SITE CHARACTERIZATION

Exceedances of the Part 201 Residential and Non-Residential Cleanup Criteria in soil from Pre-RI investigations are summarized below and in Tables 2.1 through 2.11. Pre-RI sample locations are presented on Figures 2.1 through 2.10, by redevelopment area respectively.

Residential Area 1

Exceedances of constituents in soil samples are present at various locations as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
Lagoon J- 3A	4.5 - 5	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
Lagoon M-1B	4 - 4.5	Residential and Non-Residential DWPC GSIPC	Arsenic
SB-2	9 – 10	GSIPC	Selenium
SB-3	2 – 2.5	Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Chromium
		GSIPC	Mercury
	4 - 5	GSIPC	Mercury
SB-4	9.0 – 10.0	GSIPC	Selenium

No other parameters were detected in soil samples analyzed in Residential Area 1 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of metals and inorganics in soil samples for Residential Area 1 are presented on Plan 3.

Residential Area 2

Exceedances of constituents in one soil sample are present as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-1	12.5 - 13	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Chromium

No other parameters were detected in soil samples analyzed in Residential Area 2 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of metals and inorganics in soil samples for Residential Area 2 are presented on Plan 7.

Residential Area 3

No parameters were detected in Pre-RI soil samples analyzed in Residential Area 3 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Residential Area 4

Exceedances of constituents in soil samples are present at various locations as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
DG-3	0 – 1.5	Residential and Non-Residential DWPC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Mercury
		Residential DCC	Benzo(a)pyrene
		GSIPC	Phenanthrene
DG-4	0 – 1.5	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Chromium
		GSIPC	Copper
		Residential and Non-Residential DWPC Residential and Non-Residential DCC	Lead
		GSIPC	Mercury
		GSIPC	Zinc
		Residential DCC	Dibenzo(a,h)anthracene

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-7	0 – 0.5	GSIPC	Mercury
		GSIPC	Selenium
	7 – 7.5	GSIPC	Chromium
		GSIPC	Copper
		Residential and Non-Residential DWPC GSIPC	Mercury
		GSIPC	Zinc
SCSB-2A	0 – 2	Residential and Non-Residential DWPC GSIPC	Arsenic
SB-5	2.5 – 3.5	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Mercury
		GSIPC	Copper
		GSIPC	Selenium

No other parameters were detected in soil samples analyzed in Residential Area 4 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of SVOCs and PCBs, and metals and inorganics in soil samples for Residential Area 4 are presented on Plans 13 and 14, respectively.

Waterfront Plaza

No Pre-RI soil samples were collected from Waterfront Plaza.

Mixed Residential/Commercial Area 1

No parameters were detected in Pre-RI soil samples analyzed in Mixed Residential/Commercial Area 1 above the laboratory method detection limits, or if detected, were below the Part 201 Residential Cleanup Criteria.

Mixed Residential/Commercial Area 2

Exceedances of constituents in soil samples are present at various locations as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
Sample #2	0.7 – 1.7	GSIPC	Phenanthrene
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC	Benzene
		GSIPC	Xylenes (total)
		GSIPC	1,2,4-Trimethylbenzene
Sample #3	0.7 – 1.7	GSIPC	Phenanthrene
		GSIPC	Xylenes (total)
		GSIPC	Naphthalene
SB-6	0 – 1	GSIPC	Naphthalene
		GSIPC	Xylenes (total)
SBA-1A	0 – 2	GSIPC	Phenanthrene
SBA-2A	0 – 2	Residential DCC	Benzo(a)pyrene
		Residential DCC	Dibenzo(a,h)anthracene
		GSIPC	Phenanthrene
		GSIPC	2-Methylnaphthalene
SBA-3A	0 – 2	Residential and Non-Residential DWPC	Tetrachloroethene

No other parameters were detected in soil samples analyzed in Mixed Residential/Commercial Area 2 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Mixed Residential/Commercial Area 2 are presented on Plans 24A and 24B, Plans 25A and 25B, and Plans 26A and 26B, respectively.

Commercial Area 1

No Pre-RI soil samples were collected from Commercial Area 1.

Commercial Area 2

No parameters were detected in Pre-RI soil samples analyzed in Commercial Area 2 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Commercial Area 3

No parameters were detected in Pre-RI soil samples analyzed in Commercial Area 3 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Commercial Area 4

Exceedances of constituents in soil samples are present at various locations as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
BK-5	2.5 – 3	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Mercury

No other parameters were detected in soil samples analyzed in Commercial Area 4 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of metals and inorganics in soil samples for Commercial Area 4 are presented on Plan 42A, 42B, and 42C, respectively.

2.3.3 PRE-RI GROUNDWATER INVESTIGATION SITE CHARACTERIZATION

Exceedances of the Part 201 Residential and Non-Residential Cleanup Criteria in groundwater from Pre-RI investigations are summarized below and in Tables 2.12 through 2.22.

Residential Area 1

Exceedances of constituents in groundwater samples are present at the identified location as summarized below.

Sample Location	Part 201 Cleanup Criteria Exceedance	Constituent
TW-3	Residential and Non-Residential DWC GSIC	Arsenic
SGWB-1	GSIC	Chromium
SGWB-2	GSIC	Chromium

No other parameters were detected in groundwater samples collected in Residential Area 1 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of SVOCs and metals in groundwater samples for Residential Area 1 are presented on Plan 4.

Residential Area 2

No Pre-RI groundwater samples were collected from Residential Area 2.

Residential Area 3

No Pre-RI groundwater samples were collected from Residential Area 3.

Residential Area 4

Exceedances of one constituent in a groundwater sample are present as summarized below.

Sample Location	Part 201 Cleanup Criteria Exceedance	Constituent
TW-7	GSIC	Mercury

No other parameters were detected in groundwater samples analyzed in Residential Area 4 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of SVOCs and metals in groundwater samples for Residential Area 4 are presented on Plan 15.

Waterfront Plaza

Exceedances of one constituent in a groundwater sample are present as summarized below.

Sample Location	Part 201 Cleanup Criteria Exceedance	Constituent
SGWB-3	GSIC	Chromium

No other parameters were detected in groundwater samples analyzed in Waterfront Plaza above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of SVOCs and metals in groundwater samples for Waterfront Plaza are presented on Plan 19.

Mixed Residential/Commercial Area 1

Exceedances of one constituent in a groundwater sample are present as summarized below.

Sample Location	Part 201 Cleanup Criteria Exceedance	Constituent
SGWB-4	GSIC	Chromium

No other parameters were detected in groundwater samples analyzed in Mixed Residential/Commercial Area 1 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of SVOCs and metals in groundwater samples for Mixed Residential/Commercial Area 1 are presented on Plan 23.

Mixed Residential/Commercial Area 2

Exceedances of constituents in groundwater samples are present at the identified location as summarized below.

Sample Location	Part 201 Cleanup Criteria Exceedance	Constituent
SGWA-4	GSIC	Chromium
SGWA-5	GSIC	Chromium
SGWB-5	GSIC	Chromium
SGWB-7	Water Solubility Limit (1)	Benzo(g,h,i)perylene
	GSIC	Chromium
SGWB-6	Residential and Non-Residential DWC GSIC	Cadmium
SGWG-1	GSIC	Chromium
SGWK-1	GSIC	Chromium
TW-8	Residential and Non-Residential DWC	Lead
	GSIC	Mercury
	GSIC	Copper

Sample Location	Part 201 Cleanup Criteria Exceedance	Constituent
TW-9	Residential and Non-Residential DWC	Lead
	GSIC	Mercury

(1) Not a health-based criteria.

No other parameters were detected in groundwater samples analyzed in Mixed Residential/Commercial Area 2 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of SVOCs and metals in groundwater samples for Mixed Residential/Commercial Area 2 are presented on Plan 27.

Commercial Area 1

No Pre-RI groundwater samples were collected from Commercial Area 1.

Commercial Area 2

No Pre-RI groundwater samples were collected from Commercial Area 2.

Commercial Area 3

Exceedances of constituents in groundwater samples are present at various locations as summarized below.

Sample Location	Part 201 Cleanup Criteria Exceedance	Constituent
SGWB-9	GSIC	Chromium
SGWB-10	GSIC	Chromium

No other parameters were detected in groundwater samples analyzed in Area 3 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of SVOCs and metals in groundwater samples for Commercial Area 3 are presented on Plan 39.

Commercial Area 4

Exceedances of one constituent in a groundwater sample are present as summarized below.

Sample Location	Part 201 Cleanup Criteria Exceedance	Constituent
SGWB-8	GSIC	Chromium

No other parameters were detected in groundwater samples analyzed in Mixed Residential/Commercial Area 1 above the laboratory method detection limits, or if detected were below the Part 201 Residential Cleanup Criteria.

Exceedances of SVOCs and metals in groundwater samples for Commercial Area 4 are presented on Plan 43.

2.3.4 PRE-RI REMOVAL ACTIONS

Two removal actions were completed adjacent to the Site prior to the commencement of the RI. These include:

- The Plainwell Impoundment Time Critical Remedial Action (TCRA) completed in 2007 and 2008 by Arcadis/BBL on behalf of the Kalamazoo River Study Group
- Emergency response actions for the southern banks of the Kalamazoo River adjacent to the Site in 2007 by RMT, Inc. on behalf of Weyerhaeuser

Details of the TCRA and the emergency response activities are provided in Section 4.0. Because the remedial actions were conducted adjacent to the Site and are outside the limits of the defined Site boundaries, the summary regarding the removal actions is provided for informational purposes and the majority of the data is not included in the evaluation of the Site relative to this RI. No other removal actions are known to have been conducted on the Site prior to the initiation of the RI.

2.4 GEOLOGY/HYDROLOGY/HYDROGEOLOGY

2.4.1 REGIONAL AND SITE GEOLOGY

The regional geology consists of unconsolidated glacial materials deposited during the last advance/retreat of the Laurentide Ice Sheet during the Wisconsinan Glacial Stage. These deposits consist of various amounts of gravel, sand, silt, and clay and are approximately 200 feet thick in this region (Lillienthal, 1978). The Site is located within the Kalamazoo River valley, which was likely formed as large amounts of water drained from the ice sheet.

Underlying the glacial deposits, are the consolidated bedrock formations of the Michigan Basin (a bowl-shaped structure with its approximate center located well to the northeast of this region). The immediate bedrock formation underlying the glacial deposits at the Site is the Mississippian Coldwater Shale. The Coldwater consists predominantly of gray to bluish-gray shale and is approximately 800 feet thick in this region (Lillienthal, 1978).

The unconsolidated deposits beneath the Site consist of various amounts of fill material (debris, clay, sand) and native unconsolidated glacial material and recent alluvium (sands, gravels, silts, and clay). To better understand the surficial geology at the Site, eight cross-sections were prepared, based on observations during subsurface investigation results. Locations of the cross-sections are presented on Figure 2.11. Cross-sections A-A', B-B', C-C', D-D', E-E', F-F', G-G', and H-H' are presented on Figures 2.12 through 2.19, respectively. The entire Site consists predominantly of poorly graded fill material of fine to coarse grained sand, with fine to coarse grained gravel. Interbedded within the fill material are discontinuous lenses of concrete and brick debris, paper residuals, and sandy clay. Generally, within 10 to 15 feet below ground surface (bgs) across the Site, native materials consist of poorly graded, fine to medium sand with fine to coarse gravel and lenses of poorly graded fine to coarse grained gravel with sand. At one location (VA-2), the native sand and gravel was found to be underlain by a layer of silt and clay at approximately 32 feet bgs. Previous production supply wells once utilized in the manufacturing process also encountered this silt and clay unit at approximately 30 to 40 feet bgs. No records were found of any borings penetrating this unit at the Site.

2.4.2 REGIONAL AND SITE HYDROLOGY

The Site lies within the lower one-third of the Kalamazoo River drainage basin. This surface water drainage basin drains over 2,000 square miles in southwestern Michigan. The Kalamazoo River drainage basin begins to the southeast in Hillsdale County and discharges into Lake Allegan and ultimately into Lake Michigan near the City of Saugatuck to the northwest of the Site (approximately 162 miles in total river length: Kalamazoo River Watershed Council, 2007).

Locally, the Kalamazoo River controls most surface water drainage from the uplands and flows from the southeast to the northwest along the northern property boundary of the Site. From the earliest development of the property, on which the former Mill is currently located, a man-made drainage way (i.e., Mill Race) was constructed to bring water from the Kalamazoo River (south of the City of Plainwell – upstream) immediately adjacent to the mill property to the east. The City of Plainwell is known as the "Island City" due to the fact that the majority of the city is located between the Kalamazoo River and the Mill Race.

The Mill Race is dammed just prior to its confluence back to the Kalamazoo River. Hydraulically, the Mill Race is approximately 6 feet higher than the Kalamazoo River. A portion of the Mill Race is diverted to run beneath the former Mill prior to the dam. The diverted portion of the Mill Race runs under Building 20 and the difference in hydraulic head was captured by a turbine to generate electricity to power the Mill property during operations prior to rejoining the Kalamazoo River downstream of the confluence of the Mill Race and Kalamazoo River. The divergence of the Mill Race beneath the building prior to the Mill Race entering the Kalamazoo River, and the reintroduction of the flow associated with the divergence after the confluence of the Mill Race and Kalamazoo River may impact the interaction between the associated surface water bodies and groundwater in this portion of the Site, as inferred in Figures 2.20 through 2.24. Figures 2.20 through 2.24 provide groundwater flow contours for the upper-most aquifer across the Site for January 2010, February 2010, March 2012, August 2012, and October 2012, respectively.

With the removal of the Plainwell Impoundment downstream of the project Site, river stage levels would be primarily influenced by precipitation events or drought. There appears to be a direct relationship of the surface water in the Mill Race recharging the groundwater to the east of the Site. This recharge directly influences the direction of groundwater flow and hydraulic gradients across the

Site. In addition, a portion of the Kalamazoo River may also be a source of local recharge to the aquifer in the immediate area of the confluence of the Mill Race with the Kalamazoo River. Based on available information to date, groundwater appears to discharge to the Kalamazoo River in the downgradient (westerly) portion of the Site.

There are no other surface water drainage features located within the vicinity that would be expected to affect the hydrology at the Site.

During the implementation of the Phase I RI activities, three staff gauges (SG-1 through SG-3) were installed in the Mill Race (SG-1) and the Kalamazoo River (SG-2 and SG-3). The staff gauges could not be located during the implementation of the Phase II RI activities and were subsequently reinstalled. One additional staff gauge (SG-4) was installed during the Additional RI activities immediately downstream of the confluence of the Mill Race and the Kalamazoo River.

2.4.3 REGIONAL AND SITE HYDROGEOLOGY

Regionally, the groundwater flow directions approximate the surface water drainage basin, typically mimicking the topography. The Kalamazoo River is typically the discharge point for groundwater located within this groundwater drainage basin.

Static water levels were measured in groundwater monitoring wells across the Site on January 13, 2010, February 5, 2010, March 30, 2012, August 6, 2012, and October 1, 3, 5, 8, 10, and 12, 2012 and are presented in Table 2.36. Figures 2.20 through 2.24 provide groundwater flow contours for the upper-most aquifer across the Site for January 2010, February 2010, March 2012, August 2012, and October 2012, respectively. It should be noted that variability in the groundwater flow contours from January to February 2010 may be due in part to the availability of additional monitoring points in February 2010, subsequent to the installation of the Phase II RI monitoring wells. Groundwater elevations are presented in Table 2.36.

With the creation of the Mill Race and dam to the east of the Site (artificially holding the surface water there above the river stage), the uppermost, unconfined, water table aquifer appears to be recharged by the surface water

within the Mill Race. Groundwater flow within water table aquifer is to the west from the Mill Race (flowing sub-parallel to the flow of the Kalamazoo River) across the Site. Analysis of the groundwater-surface water interaction indicates that the Kalamazoo River acts as a hydraulic barrier (i.e., the river elevation is higher than the adjacent groundwater elevation) along the entire Site during periods when groundwater elevations are lower (August and October 2012), while at times of higher groundwater elevations (February 2010 and March 2012), the hydraulic gradient is reversed along the northwest portion of the Site and groundwater appears to be discharging to the river, while most of the Site still maintains the hydraulic barrier with the surface water being at a greater elevation than the adjacent groundwater.

Vertical hydraulic gradients within the aquifer itself are minimal with a slight upward component at monitoring wells MW-4S/D of 0.007 ft./ft. and at monitoring wells MW-12S/D of 0.001 ft./ft, and a slight downward gradient at monitoring wells MW-21S/D of 0002 ft./ft.

Based on static water levels measured over all measurement dates, the change in head from east to west across the Site is consistent at approximately 2.5 feet over a span of approximately 2,400 feet horizontally, thereby giving an average hydraulic gradient of 0.001 ft./ft.

2.5 CURRENT AND PAST GROUNDWATER USE IN THE MILL AREA

The City of Plainwell provides potable water to the surrounding area via three wells, which draw groundwater from the regional aquifer. Potable water service has been disconnected to all Mill Buildings except for Building No. 17, due to the current operational status of the Site.

According to information reviewed, non-potable water for Mill operations was historically supplied by seven on-Site groundwater wells. According to information in the Phase I RI Work Plan (RMT, 2008c), this included four process water wells, which pumped approximately 2.8 million gallons per day (MGD) to support paper making operations. Two additional wells supplied water for fire suppression purposes and one well, used for non-sanitary purposes, was present near the wastewater treatment system.

Four wells (identified as 3, 4, 5, and 6) are depicted west of the Mill in historical drawings dated 1969 and reviewed by CRA. Well No. 3 is depicted west of the former engine room and boiler room area and Wells 4, 5, and 6 are depicted in the west yard near the railroad spurs. Based on review of available well records, Well No. 5 was installed in 1964 (rescreened in 1989) and a well in the same location identified on historical drawings as Well No. 6 was installed in 1974. The use of this well was identified as "industrial" on the well record. One fire well (also referred to as Well No. 6 on the well record) was installed south of Mill Building 17 in 1967. A second fire well was installed north of Building 11 and East of Building 11A in 1988. A Type IIa Public well, identified as Well No. 8 on the well record, was installed in 1989.

Based on observations during on-Site activities, Well Nos. 3 and 4 are no longer present. No documentation regarding the abandonment of these wells was available for review by CRA. Well No. 6 (near Scott Street, identified in previous reports as "production well") is periodically utilized by the City of Plainwell for fire hose testing activities. The "fire well" to the northeast of the Mill Building and Well No. 8 are currently present at the Site, but not in use. The current presence of the "fire well" (to the south of Mill Building 17, identified in previous reports as "Well No. 6") could not be confirmed.

Historical drawings depicting the aforementioned water supply well locations and available water well logs are presented in Appendix E.

2.6 SURROUNDING LAND USE AND POPULATIONS

The Site is located in a mixed industrial, commercial, and residential area in the City of Plainwell, Allegan County, Michigan. According to the City of Plainwell 2002 Land Use Plan, existing land use in 2000 consisted of 40 percent Residential, 25 percent Vacant Land, 10 percent Industrial, 10 percent Institutional, 7 percent Commercial/Mixed Use, 6 percent Railroad Right-of-Way, and 2 percent Open Space/Recreational. The Site is bordered by the following properties:

North: by the Kalamazoo River and beyond by residential and commercial properties

East: by the Mill Race and beyond by commercial properties and Main Street North

South: by Allegan Street and beyond by residential and commercial properties

West: by residential properties and the City of Plainwell Water Renewal Plant, and beyond by US-131

According to the U.S. Bureau of Census, the City of Plainwell had an estimated population in 2009 of approximately 3,893. The population racial mix is approximately 94.6 percent Caucasian; 0.6 percent African American; 5.2 percent Hispanic or Latino origin; 4.5 percent persons of some other race, and 0.3 percent persons reporting two or more races. The male population in Plainwell is estimated to be 1,887 and the female population is estimated to be 2,006 (U.S. Bureau of Census Factsheet, 2005-2009).

2.7 SENSITIVE ECOSYSTEMS

According to the Michigan State University Extension Michigan Natural Features Inventory map of occurrences for Allegan County, there are no occurrences of "threatened, endangered, and special concern species and high quality natural communities" in the Public Land Survey System section (Section 30), which includes the area of the Site.

A Freedom of Information Act (FOIA) inquiry was submitted to the Michigan Department of Natural Resources on March 28, 2011 requesting "any information on or relating to any endangered species" for the "Former Plainwell, Inc. Mill, 200 Allegan Street, Plainwell, Michigan," including an approximate property boundary map. Based on a written response from the State of Michigan Department of Natural Resources dated March 29, 2011, the FOIA request was denied because "Based upon our best information, knowledge, and belief, the information you requested does not exist in our files. Nor is this material available by any other name reasonably known to the DNR." A copy of the March 28, 2011 letter is provided in Appendix D.

A Screening-Level Ecological Risk Assessment (SLERA) was performed as part of the RI and is summarized in Section 9.0, including descriptions of species and habitats of concern associated with or potentially associated with the Site.

2.8 METEOROLGY/CLIMATOLOGY

Michigan has a temperate climate with well-defined seasons. The climate in Plainwell, Michigan is temperate with warm summers, very cold winters, and no distinguishable wet or dry seasons. The annual mean temperature in Plainwell, Michigan is 49.9 degrees Fahrenheit (˚F). The warmest month of the year is July with an average maximum temperature of 84.2 ˚F and the coldest month of the year is January with an average minimum temperature of 17˚F. Temperature variations between night and day tend to be moderate during summer, with a difference that can reach 22˚F, and fairly limited during winter with an average difference of 15˚F. The annual average precipitation in Plainwell is 37.41 inches. Peak rainfall occurs in September with an average rainfall of 4.1 inches.

Wind rose diagrams of the Kalamazoo/Battle Creek International Airport, which is located approximately 9 miles east of the Site, were reviewed. Based on the wind rose diagrams, the average wind speed at the Site is generally between 5 and 12 knots from the southwest.

3.0 GROUNDWATER FATE AND TRANSPORT

In order to understand and evaluate concentrations of any constituents of concern within the groundwater aquifer, a good understanding of the chemical characteristics and contaminant fate and transport is necessary. The following sections briefly describe these groundwater fate and transport processes.

3.1 CONTAMINANT CHARACTERISTICS

The subsurface environment and the physiochemical/biological properties of the contaminants are the two general processes affecting the fate and transport in the subsurface. The subsurface environment (e.g., aerobic versus anaerobic, substrate material, etc.) will control whether some contaminants may degrade (and the rate of that potential degradation), it will affect the ionic state of some contaminants, or it may not impede the contaminant beyond the hydrodynamic processes (e.g., advection, dispersion, and preferential flow). Non-reactive contaminants will be transported through the subsurface with minimal retardation, while contaminants with certain biologic properties can be degraded or retarded, thereby affecting the rate of migration as well as the concentrations.

3.2 GROUNDWATER FATE AND TRANSPORT PROCESSES

Advection, which is where the dissolved contaminants move along with the flow of groundwater, and diffusion, changes in concentration due to concentration gradients, are the two main processes affecting contaminant migration through the aquifer.

Diffusion refers to the process where high contaminant concentrations move to areas of lower concentration and is described by Fick's Law. The process of diffusion can become the dominant transport mechanism in very low permeability formations. In higher permeability formations, advection becomes the dominant transport process.

Advection is typically described as advection-dispersion since the groundwater flow through the aquifer is between and around the grains of the subsurface materials, thereby mechanically dispersing the contaminants (mixing and spreading) and causing lower concentrations through dilution. Mechanical

dispersion can be longitudinal or lateral to the flow of groundwater. Longitudinal dispersion is where the contaminant is less impeded through the center of the pore spaces between the grains of the aquifer [more impeded along the edges of the pore spaces; and along preferential pathways (or, the contaminant will travel faster through larger pore spaces than smaller ones)]. Lateral dispersion refers to the lateral spreading and mixing with un-impacted water.

Typically, the processes of advection and diffusion are described under one set of equations as the coefficient of hydrodynamic dispersion (since these processes really cannot be separated in reality).

In addition to the above discussion on the physical transport processes, the contaminant itself can also affect the rate of transport. Chemical constituents can either be conservative or non-conservative. Conservative contaminants are those that do not react with aquifer materials or groundwater. Non-conservative (or reactive) constituents are contaminants that can go undergo chemical, biologic, or radioactive changes that tend to reduce concentrations (typically regarded as retardation). Chemical reactions include adsorption-desorption, cation exchange, precipitation-dissolution, and oxidation-reduction. Biological reactions can include aerobic and anaerobic decay.

3.3 GROUNDWATER CONTAMINATION MIGRATION TRENDS

Based on the information collected during the Pre-RI and RI, groundwater contamination trends cannot be completed at this time due to a lack of available legacy data. As discussed in Sections 2.0 and 5.0, groundwater exceedances are limited to exceedances of the Part 201 Generic Residential and Non-Residential Drinking Water Criteria and the Groundwater Surface Water Interface Criteria. Use of groundwater at the Site is currently restricted and there are no known off-Site or property boundary indications of off-Site migration of contamination.

Static water levels were measured in groundwater monitoring wells across the Site on January 13, 2010, February 5, 2010, March 30, 2012, August 6, 2012, and October 1, 3, 5, 8, 10, and 12, 2012 and are presented in Table 2.36. Figures 2.20 through 2.24 provide groundwater flow contours for the upper-most aquifer across the Site for January 2010, February 2010, March 2012, August 2012, and October 2012, respectively, and are presented in Figures 2.20 through 2.24. Based

on these measurements, it appears that the Kalamazoo River behaves as a hydraulic barrier along most of the banks along the northern limits of the Site. At times of higher groundwater elevations however, it appears that groundwater does discharge to the Kalamazoo River along the north-western boundaries of the Site.

3.4 GROUNDWATER MODELING

Based on current information, groundwater modeling is not anticipated to be required as part of the RI/FS activities. Modeling may be required in the future to enhance the understanding of contaminant migration and the Site and/or to support Remedial Design.

4.0 PREVIOUS RESPONSE ACTIONS

4.1 TIME CRITICAL REMOVAL ACTION

In 2007 and 2008, the Plainwell Impoundment TCRA was undertaken in accordance with the Administrative Settlement Agreement and Order on Consent for Removal Action, Docket No. V-W-07-C-863, with members of the Kalamazoo River Study Group. TCRA activities were designed and conducted in targeted areas along the Kalamazoo River, but did not include any response actions associated with the banks adjacent to the Site.

At the request of the City of Plainwell, emergency response actions for the southern banks of the Kalamazoo River adjacent to the Site were initiated by RMT on behalf of Weyerhaeuser in 2007. Response actions were planned concurrently with TCRA activities. An Emergency Response Action (ERA) approach was authorized by the U.S. EPA, in accordance with the emergency action provisions of the Consent Decree, in correspondence dated June 29, 2007. ERA activities for the adjacent Plainwell Mill Banks were designed and implemented consistent with applicable provisions of the Administrative Settlement Agreement and the Plainwell Impoundment TCRA Design Report prepared by Arcadis BBL in 2007 (Arcadis BBL, 2007). Details of the ERA are discussed in the Emergency Response Plan Documentation Report prepared by RMT and dated January 2009 (RMT, 2009c).

4.1.1 SCOPE AND OBJECTIVES

According to the Emergency Response Plan, the emergency action was driven by three objectives:

- "*Remove or contain visible paper residuals and address previously identified areas of reported polychlorinated biphenyls (PCBs) concentrations of greater than 50 mg/kg in soils/sediments along the former Plainwell Mill banks to a target concentration of either 4 mg/kg or 1 mg/kg*
- *Reconstruct the river bank, as needed, to minimize future release of PCBs*
- *Reconfigure banks to limit upland cutbacks into former Plainwell Mill property and place erosion controls to provide comparable stability to pre-excavation conditions*"

The ERA activities associated with the adjacent Plainwell Mill Banks were conducted in the following phased approach:

- Prepare and submit Plainwell Mill Banks Emergency Action – Conceptual Design Approach
- Prepare and submit Emergency Action Design Report
- Update Multi-Area Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP)
- Conduct Site preparation activities
- Excavate residuals and reconfigure banks
- Document emergency action

Excavation activities were conducted in four stages (Zone A through Zone D), each stage addressing a separate section of the adjacent Plainwell Mill Banks, which were selected based on similar bank and/or river conditions. Removal activities began with Zone A, a 600-foot length of river bank adjacent to the west end of the Site and then moved upstream to Zone B, a 700-foot length of river bank east of Zone A, followed by Zone D, a 650-foot length of river bank adjacent to the east end of the Site, and finally Zone C, a 650-foot length of river bank area situated between Zones B and D.

4.1.2 TIMELINE

The timeline associated with the implementation of the Plainwell Mill Banks ERA is summarized below.

- **June 29, 2007 –** U.S. EPA authorized Weyerhaeuser to proceed with Plainwell Mill Banks ERA in accordance with Consent Decree
- **August 14, 2007** - Plainwell Mill Banks Emergency Action Conceptual Design Approach submitted to U.S. EPA
- **September 5, 2007 –** Emergency Action Design Report submitted to U.S. EPA
- **September 10, 2007 –** Multi-Area QAPP and FSP submitted to U.S. EPA
- **October 15, 2007 –** U.S. EPA approved site preparation activities
- **October 18, 2007 –** RMT initiated site preparation activities

- **October 31, 2007** – U.S. EPA conditionally approved Emergency Action Design Report
- **November 12, 2007** – RMT initiated excavation, verification sampling, and bank reconfiguration activities in Zone A
- **December 11, 2007 –** RMT initiated excavation, verification sampling and bank reconfiguration activities in Zone B
- **December 12, 2007** – RMT completed excavation, sampling, and bank reconfiguration activities in Zone A
- **January 16 to 28, 2008** – Work suspended due to high water level in the Kalamazoo River following heavy rain and snowmelt
- **January 28, 2008** – RMT completed excavation, sampling, and bank reconfiguration activities in Zone B
- **January 28, 2008 –** RMT initiated excavation, verification sampling and bank reconfiguration activities in Zone D
- **March 5, 2008** – RMT initiated excavation, verification sampling and bank reconfiguration activities in Zone C
- **March 6, 2008** - RMT completed excavation, sampling, and bank reconfiguration activities in Zone D
- **March 28, 2008** - RMT completed excavation, sampling, and bank reconfiguration activities in Zone C
- **April 16, 2008** – Weyerhaeuser submitted a Disposal Plan to the U.S. EPA
- **September 15, 2008** – U.S. EPA approved Disposal Plan
- **October 29 to November 7, 2008** – Residual materials were loaded and removed from the containment area for off-Site disposal
- **January 2009** – Submittal of Emergency Response Plan Documentation Report by RMT, on behalf of Weyerhaeuser, to the U.S. EPA

4.1.3 SUMMARY OF CONTAMINATION REMOVED

Zone A

Approximately 2,500 cubic yards of sediment and floodplain soil were removed from Zone A and placed in the containment area. Initially, 13 verification soil and sediment samples were collected and analyzed for PCBs. PCB concentrations were below the target level of 1 milligram per kilogram (mg/kg)

in all but two of the samples (PM-SD-003 and PM-SD-013). Additional material was removed and two additional verification samples were collected (PM-SD-003R and PM-SD-013R) in these areas. PCB concentrations detected in the samples were below 1 mg/kg.

Zone B

Approximately 400 cubic yards of near shore sediment was removed from Zone B and placed in the containment area. The banks in Zone B were characterized as heavily wooded and steep with no observable floodplain areas. A total of 21 verification sediment samples were collected from the underlying sediment and analyzed for PCBs. PCB concentrations were below the target level of 1 mg/kg in all but two samples (PM-SD-029 and PM-SD-032). An additional 3.5 to 4 cubic yards of sediment were removed and these areas were re-sampled. PCB concentrations were below 1 mg/kg in PM-SD-029R and PM-SD-032R.

Zone C

Seven pre-excavation samples were collected from Zone C. Excavation activities were conducted in three sections beginning with the 300-foot eastern section of Zone C. Visible residuals were removed and placed in the containment area and seven verification samples were collected for PCB analysis. PCBs were below the target level of 1 mg/kg in all but two samples (PM-SD-048 and PM-SD-051). Additional material was excavated in the area of these samples until the natural river bed was encountered. Verification samples PM-SD-48R and PM-SD-51R were collected and according to laboratory results, PCB concentrations in the samples still exceeded 1 mg/kg. In accordance with the approved methods, no further removal was conducted and the banks were reconfigured and stabilized with rip-rap.

Removal activities continued in the central portion of Zone C and four verification samples were collected for PCB analysis. PCBs exceeded the action level of 1 mg/kg in three of the four samples (PM-SD-55, PM-SD-56, and PM-SD-57) and also exceeded 50 mg/kg in one sample (PM-SD-57). Therefore, a portion of the material was segregated into a roll off container for disposal. Based on the results of the verification sampling, additional sediment was removed until the original river bottom was encountered. Additional verification samples were collected and PCBs were again detected above

1 mg/kg in PM-SD-55R and PM-SD-57R; however, in accordance with the approved methods, no further removal was conducted and the banks were stabilized with geotextile fabric and rip-rap.

Based on previous visual reconnaissance of the 180-foot western portion of Zone C, it was not anticipated that paper residuals were present in this section of the Plainwell Mill Banks. Therefore, six test pits were conducted prior to commencing removal activities. No residual material was observed in the test pits and one sample was collected from each test pit for PCB analysis. Based on the locations presented on the figures included with RMT's Emergency Response Plan Documentation Report, these results are included in the Pre-RI sample results for Residential Area 3 and were all below 1 mg/kg. Additional hand auger samples were also collected in this area and were analyzed for PCBs. According to RMT's report, PCB concentrations ranged from 0.092 mg/kg to 5.6 mg/kg. Based on the presence of steep banks and high velocity flow conditions associated with this section of the river, Weyerhaeuser requested U.S. EPA approval to cover the area with geotextile fabric and erosion control stone, without completion of excavation activities. This approach was approved by the U.S. EPA on March 28, 2008.

Zone D

Zone D was characterized as having lower banks with little observable floodplain area. While excavating near shore sediments in the eastern half of Zone D, RMT encountered concrete debris and when the debris was penetrated an oily sheen appeared on the water surface. A clay layer was immediately placed over the concrete debris to limit further contact with surface water. Seven verification samples were collected during excavation activities in the eastern half of Zone D and analyzed for PCBs. PCB concentrations exceeded the action level in all of the samples and were as high as 513 mg/kg in one sample (PM-SD-041). To prevent further exacerbation and limit potential for further release to surface water, the entire 300-foot eastern section of Zone D was capped with 1 to 1.5 feet of clay and stabilized with rip-rap without further excavation.

Based on the PCB concentrations detected in sediments from the eastern half of Zone D, RMT began collecting pre-excavation samples from the remaining removal areas. A total of seven pre-excavation samples were collected from the western half of Zone D and analyzed for PCBs. PCB concentrations were below the target level in all but two of the samples. Elevated PCB concentrations were

detected in PEX-1 and PEX-2; therefore, no excavation activities were conducted in the vicinity of these two samples as to minimize potential for a release. Instead, the area was covered with a clay barrier and stabilized with rip-rap. Approval for this interim measure was granted by U.S. EPA on February 19, 2008. Excavation activities continued in the remainder of the western portion of Zone D and five verification samples were collected for PCB analysis. Some questions were raised by U.S. EPA and MDEQ as to whether an appropriate sampling method was used to collect the verification samples in Zone D; therefore, 5 additional verification samples were collected using an approved method. No PCBs were detected above the target level of 1 mg/kg in any of the ten verification samples collected in the western portion of Zone D.

A total of 300 cubic yards of sediment and floodplain soil were removed from Zone D. 25 cubic yards of this total were removed from the eastern portion of Zone D in the area of elevated PCB concentrations (above 50 mg/kg) and were therefore segregated into lined roll off containers for characterization and disposal.

Zone A through D removal information is provided in the Emergency Response Plan Documentation Report prepared by RMT and dated January 2009 (RMT, 2009c), which is presented in Appendix E.

4.1.4 TREATMENT METHODS AND CLOSURE LEVELS

According to the Emergency Response Plan prepared by RMT, excavation on shore was considered complete when visible residuals were removed and PCB concentrations in composite verification samples collected from underlying soils were less than 4 mg/kg. Excavation of floodplain and near shore sediments was considered complete when the original river bottom was encountered or when residuals were no longer visible in soil and sediment samples and PCB concentrations in verification samples collected from the underlying material were less than 1 mg/kg. Areas where PCB concentrations exceeding target levels remained in place were covered with geotextile fabric and 6 inches of clean soil or stone.

A residuals containment area was constructed in the area of the former aeration basin. The containment area was constructed using a sand covered low density polyethylene liner and was surrounded by an earthen containment berm. The

containment area was graded to allow water to drain to a collection area where it could be transferred to an on-Site holding tank for treatment. A wastewater treatment system was installed adjacent to the containment area, which consisted of a 20,000-gallon holding tank, multi-media filters and carbon absorption columns. A total of 185,000 gallons of treated water was discharged to the Kalamazoo River under a National Pollutant Discharge Elimination System (NPDES) permit.

Subsequent to completion of activities, the temporary access road was scraped and material disposed off Site with the excavated materials. Additionally, the sand and liner system from the containment pad were removed and disposed off Site after sampling and waste characterization.

Excavated areas were backfilled with clean fill material, graded, and stabilized with rip-rap in accordance with the approved design report.

5.0 SOURCE, NATURE AND EXTENT OF CONTAMINATION

5.1 LOCATION AND CHARACTER OF POTENTIAL SOURCES

The historical land uses of the property combined with the Pre-RI data summarized in Section 2.0 suggest that the potential sources of impacts are localized within three operational areas at the Site as described below.

Former Lagoon and Wastewater Treatment Area (Area 1)

Historical land uses of this area included the treatment and dewatering of wastewater sludge prior to off-Site disposal. The area includes fourteen former wastewater sludge dewatering lagoons (i.e., Lagoons A through L), primary clarifier, former secondary clarifier, former wastewater treatment building activated sludge tank, former aeration basin, secondary clarifier, and activated sludge treatment system. This operational area was identified as Area 1 in the Phase II RI Work Plan. Area 1 includes redevelopment areas Residential Areas 1 and 2 and Commercial Area 1, and a portion of Residential Area 3. Figure 1.2 shows the operational areas (i.e., Area 1, etc.) relative to the redevelopment areas (i.e., Residential Area 1, etc.).

Plainwell Mill Building Area (Area 2)

This area includes the former primary clarifier, Mill Buildings, and two former and current water towers. The primary clarifier was constructed northwest of the mill buildings and treated wastewater from the mill buildings. Prior to 1967, the effluent of the clarifier discharged to the Kalamazoo River and the underflow discharged to the dewatering lagoons. By introduction of secondary clarifier and aeration basin in 1967, the effluent of former primary clarifier was processed through the aeration basin and then into the secondary clarifier before being discharged to the Kalamazoo River. The underflow of both the former primary and secondary clarifier was discharged into the dewatering lagoons. Suspected areas relating to historical operations within the Mill Buildings are also considered as potential source areas. This operational area was identified as Area 2 in the Phase II RI Work Plan. Area 2 includes redevelopment area Commercial Area 4, and portions of Mixed Residential/Commercial Area 2, Commercial Area 3, and Residential Area 4. Figure 1.2 shows the operational areas (i.e., Area 1, etc.) relative to the redevelopment areas (i.e., Residential Area 1, etc.).

Central Portion of the Site (Area 3)

This area includes the former Quality Products and Sludge Dewatering buildings, the former Specialty Minerals, Inc. building, the former coal pile storage area, the former 200,000-gallon No. 6 fuel oil AST, former Coal Tunnel area, and the remainder of the areas located in central portion of the Site. These operational areas were identified as Areas 3, 3A, 3B, 3C, 3D, and 3E, respectively, in the Phase II RI Work Plan. Area 3 includes portions of redevelopment areas Waterfront Plaza, Residential Area 4, Mixed Residential/Commercial Area 1, and Commercial Area 3. Area 3A includes portions of redevelopment areas Residential Area 3 and Commercial Area 2. Area 3B includes portions of redevelopment areas Commercial Area 2 and Mixed Residential/Commercial Area 2. Area 3C includes portions of redevelopment areas Residential Area 4 and Waterfront Plaza. Area 3D includes portions of redevelopment areas Residential Area 4 and Mixed Residential/Commercial Area 2. Area 3E includes portions of redevelopment areas Mixed Residential/Commercial Area 2 and Commercial Area 3. Figure 1.2 shows the operational areas (i.e., Area 1, etc.) relative to the redevelopment areas (i.e., Residential Area 1, etc.).

Review of Pre-RI data for these operational areas indicated the presence of several data gaps associated with potential impacts from the historical areas described above, as discussed in the Phase II RI Work Plan.

5.2 SCOPE OF RI ACTIVITIES

The following scope of work was implemented to supplement and further evaluate each of the aforementioned areas. The below described scope of work includes the Phase I RI activities completed by RMT in 2008, the Phase II RI activities completed by CRA in 2010, and the Additional RI activities completed by CRA in 2012.

All RI field activities were conducted in accordance with the Standard Operating Procedures (SOPs) presented in the Multi-Area FSP (CRA, 2009b).

5.2.1 PHASE I REMEDIAL INVESTIGATION

The Phase I RI field sampling and analysis activities were conducted between May and December 2008 and included an historical information review, a geophysical survey, installation of test pits along the banks of the Kalamazoo River to the north of the Mill Buildings, and an initial groundwater evaluation and assessment of the on-Site coal tunnel.

The Phase I RI activities were conducted in accordance with the following work plans:

- Addendum to RI/FS Work Plan: PCB Investigation Activities Near Mill Building Banks
- Phase 2 Addendum No. 1 Remedial Investigation/Feasibility Study Work Plan
- Phase I Plainwell Mill RI/FS Work Plan: Initial Groundwater and Coal Tunnel Assessment

5.2.1.1 PCB INVESTIGATION ACTIVITIES NEAR MILL BUILDINGS BANKS (MIXED RESIDENTIAL/COMMERCIAL AREA 2 AND COMMERCIAL AREA 4)

The specific objectives of the PCB investigation activities near the Mill Buildings banks, as presented in the Addendum to RI/FS Work Plan (RMT, 2008a), were as follows:

- Identify the likely source of the oily sheen observed in the vicinity of the former transformer pad and if the potential for non-aqueous phase liquid (NAPL) exists
- Determine if the oily material in the vicinity of the former transformer pad and elevated PCB concentrations identified during the ERA are related
- Determine if NAPL, if identified to be present, is migrating into the Kalamazoo River
- Determine the nature of the contamination associated with the oily material
- Identify immediate and additional activities required to address the oily material related to the RI

It should be noted that the ERA is not part of the RI/FS for the Site and the detected constituents identified during the ERA are considered off-Site for the purposes of this RI Report; however, the activities described in this section were conducted on-Site under the Consent Decree. The scope of work implemented for these activities is summarized below. The results of these activities were submitted to the U.S. EPA as part of the Phase 2 Addendum No. 1 Remedial Investigation/Feasibility Study Work Plan (RMT, 2008b), which is provided in Appendix E.

5.2.1.1.1 HISTORICAL DOCUMENT REVIEW

The following sources of historical information were reviewed to determine potential sources of PCBs and petroleum products associated with historical operations at the Site in the area to the north of the Mill Building, near the former transformer pad.

- Sanborn fire insurance maps
- Available historical analytical data for PCBs and petroleum products for this area
- Additional information regarding the former Consumers Energy substation that was located near the confluence of the Mill Race and original Kalamazoo River channel
- Historical aerial photographs from the United States Department of Agriculture office in Allegan, Michigan
- Historical on-Site drawings and plans specifically related to sewer lines and outfalls, foundation design, and additional relevant subsurface features
- Historical information available in the Ransom Public Library in Plainwell, Michigan

Based on the review of the aforementioned documentation, the following information was obtained.

- Numerous channels and a secondary Mill Race were historically present beneath the Mill Buildings between circa 1884 and circa 1911 (not present on 1918 Sanborn maps). No information was available regarding the source and nature of the material utilized to fill these former features.
- The substation appeared to be present as early as 1955.

- A total of 11 outfalls were identified from review of historical documentation.
- No indication of an on-going release requiring immediate action was identified.
- Documentation reviewed indicates that PCBs were present in electrical equipment at the Site and may have been present in paper recycled/manufactured at the Site. No specific locations of PCB sources, or releases therefrom, were available in the information reviewed.
- No specific conduit or outfall was identified that would directly link the observed oily material near the former transformer pad to the elevated PCB concentrations observed along the banks during the ERA.

5.2.1.1.2 GEOPHYSICAL SURVEY

A geophysical survey was conducted by Prism GeoImaging, Inc. on April 24, 2008. The geophysical survey was conducted utilizing a Geonics EM-61 time-domain metal detector and an EMP-400 multi-frequency electromagnetic conductivity meter.

A total of six metal anomalies were identified utilizing the EM-61 during the geophysical survey as Metallic Objects A to F. Metallic Objects A and C through G were interpreted as follows: possible discharge pipes (Metallic Objects A, D, E and G); and manhole covers (Metallic Objects C and F). Metallic Object B was located in the immediate vicinity of the observed oily material and the former transformer pad. The results indicated that Metallic Object B may potentially extend from the Mill Buildings to the Kalamazoo River through a manhole (Metallic Object C). Inspection of the manhole identified the presence of three underground connections; however, none of the observed connections were consistent with the direction of the Kalamazoo River or Metallic Object C.

The electrical conductivity portion of the geophysical survey indicated the presence of varying amounts of numerous types of fill materials across the areas evaluated.

5.2.1.2 PHASE 2 - PCB INVESTIGATION ACTIVITIES NEAR MILL BUILDINGS BANKS (MIXED RESIDENTIAL AND COMMERCIAL AREA 2 AND COMMERCIAL AREA 4)

The specific objectives of the Phase 2 portion of the PCB investigation activities near the Mill Buildings banks, as presented in the Phase 2 Addendum No. 1 Remedial Investigation/Feasibility Study Work Plan (RMT, 2008b), were as follows:

- Identify the likely source of the oily sheen observed in the vicinity of the former transformer pad and if the potential for NAPL exists
- Determine if the oily material in the vicinity of the former transformer pad and elevated PCB concentrations identified during the ERA are related
- Determine if NAPL, if identified to be present, is migrating into the Kalamazoo River
- Determine the nature of the contamination associated with the oily material
- Identify immediate and additional activities required to address the oily material related to the RI

The scope of work implemented for these activities is summarized below.

5.2.1.2.1 TEST PIT INSTALLATION

A total of 20 test pits, TP-1 through TP-20, were installed in Mixed Residential/Commercial Area 2 and Commercial Area 4 between November 10 and 12, 2008 in accordance with SOP-8 of the FSP (RMT, 2009a). Ten of the test pits (TP-1 through TP-10) were installed in the vicinity of the oily material, Metallic Object B, and the former transformer pad. Five of the test pits (TP-11 through TP-15) were installed in the vicinity of elevated PCB concentrations detected off-Site during the ERA that were identified to consist of fill material during the geophysical survey. Five additional test pits (TP-16 through TP-20) were installed to further evaluate areas where indications of impacts were noted during the installation of the previous 15 test pits.

Test pits were installed to the water table, which ranged in depths between 7 and 8 feet bgs. One soil sample was collected from each test pit and analyzed for total petroleum hydrocarbons (TPH) as gasoline range organics (GRO) and diesel range organics (DRO), and PCBs. Six additional soil samples were collected from

select test pit locations for analysis for VOCs, PAHs, or specific metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver).

During the installation of the test pits, subsurface materials were observed to primarily consist of a sand/gravel with ash fill with varying amounts of concrete debris and miscellaneous fill, with some slag and clay. Excavated soil was screened utilizing a photoionization detector (PID) in accordance with SOP-9 of the FSP. Petroleum-like odors were noted during the installation of TP-18, which was located in the footprint of the former transformer pad. Additionally, an asphalt-like odor was noted in TP-19. No measurable PID readings were encountered. No visual evidence of NAPL was observed during the installation of the test pits.

5.2.1.3 INITIAL GROUNDWATER AND COAL TUNNEL ASSESSMENT (SITE-WIDE)

The specific objectives of the initial groundwater and coal tunnel assessment, as presented in the Phase I Plainwell Mill RI/FS Work Plan: Initial Groundwater and Coal Tunnel Assessment (RMT, 2008c), were as follows:

- Perform an initial evaluation of shallow groundwater at the Site based on current understanding of potential source areas
- Determine if free product is present on the groundwater table at the monitoring well locations
- Assess shallow, Site-specific hydrogeologic characteristics and interconnections with the Kalamazoo River that will be used to refine the preliminary Conceptual Site Model
- Determine if there is an on-going release of oily material in the coal conveyance tunnel to the adjacent soil or groundwater
- To refine the location and condition of the coal tunnel and possible access and egress points for future evaluations

The scope of work implemented for these activities is summarized below.

5.2.1.3.1 GROUNDWATER INVESTIGATION

Twelve monitoring wells (MW-1 through MW-12) and three staff gauges (SG-1 through SG-3) were installed at the Site, from December 8 to December 18, 2008 to assess the possible presence of light NAPL (LNAPL), to quantify the concentrations of constituents in shallow groundwater and to further evaluate groundwater flow regime (RMT, 2009c).

Monitoring wells were installed in various redevelopment areas of the Site, as follows:

- Residential Area 1 – MW-11 and MW-12
- Residential Area 3 – MW-10
- Residential Area 4 – MW-5 and MW-7
- Waterfront Plaza – MW-8
- Mixed Residential/Commercial Area 1 – MW-6
- Mixed Residential/Commercial Area 2 – MW-2 and MW-4
- Commercial Area 1 – MW-9
- Commercial Area 4 – MW-1 and MW-3

Monitoring well and staff gauge locations are presented on Figures 5.1 through 5.11A/B.

Following installation, all monitoring wells and staff gauges were surveyed, consistent with the FSP, to the National Geodetic Vertical Datum of 1929, established by the U.S. Coast and Geodetic Survey.

5.2.1.3.1.1 MONITORING WELL AND STAFF GAUGE INSTALLATION

Monitoring wells were installed utilizing a 4 ¼-inch hollow-stem auger (HSA) driven by a drill rig. During installation of monitoring wells, split-spoon samples were collected and soils classified in accordance with SOP-15 of the FSP. The depths of the monitoring wells ranged from 10.5 to 18.5 feet bgs. Soil cuttings were screened with a PID and examined for visual/olfactory evidence of contamination in accordance with SOP-9 of the FSP.

Monitoring wells were constructed in accordance with SOP-15 of the FSP using wire-wrapped 2-inch diameter Schedule 40 polyvinyl chloride (PVC) risers and 7-foot long, 0.01-inch slot Schedule 40 PVC screen through the augers. The monitoring well screens were constructed so as to straddle the water table.

An inert silica sandpack was placed to a height of 2 vertical feet above the top of the screens, with the exception of MW-3 and MW-4, where the sandpack was placed to a height of 1 vertical foot above the top of the screens due to the shallow water table encountered at these locations.

The remainder of the annulus was filled with hydrated bentonite chips to approximately 1-foot bgs. The remaining portion of the unfilled annulus was filled with concrete and a protective surface casing was installed at the well. The protective casing was centered over the riser and extended into the concrete collar 1-foot. The riser pipe was capped with an expandable locking cap. The monitoring wells were clearly labeled with a unique identification number.

5.2.1.3.1.2 MONITORING WELL DEVELOPMENT

Monitoring well development was conducted in accordance with SOP-15 of the FSP. The wells were surged with a surge block and purged utilizing a submersible pump. Development was initiated a minimum of 24 hours following installation of the monitoring wells. Three volumes of the water added during installation were purged and then 20 well volumes were subsequently removed, until groundwater was clear.

During development, black suspended solids were observed in MW-3, MW-11 and MW-12. A slight hydrocarbon odor was noted during development in MW-3 and MW-12, with a slight sheen observed on the purged water associated with MW-12. No LNAPL was observed during development activities.

5.2.1.3.1.3 GROUNDWATER SAMPLE COLLECTION

Groundwater samples were collected in accordance with SOP-11 of the FSP.

Groundwater samples were collected utilizing low-flow procedures with a peristaltic pump and disposable low density polyethylene (LDPE) tubing.

Groundwater samples were collected for laboratory analysis for Target Compound List (TCL) TCL VOCs, TCL SVOCs, PCBs, metals, and cyanide (total). Low-level mercury sampling was conducted in accordance with SOP-11 of the FSP for the quantification of concentrations required to meet the Michigan Part 201 criteria.

5.2.1.3.1.4 SLUG TESTING

A slug test was conducted at each of the monitoring wells utilizing a well slug with a 0.25-gallon displacement and a pressure transducer.

Due to the high hydraulic conductivity of the formation, no appreciable drawdown was measured utilizing this technique; therefore, a hydraulic conductivity could not be calculated. The rapid hydraulic response measured in each of the wells indicates that the hydraulic conductivity of the formation is uniformly high and greater than 10^{-2} centimeters/second.

5.2.1.3.1.5 STAFF GAUGE INSTALLATION

Three vertical staff gauges (SG-1 through SG-3) were installed in accordance with SOP-10 of the FSP.

Each gauge consists of a 3.3-foot section graduated every 1-foot, 0.10-foot, and 0.02-foot. The gauges were mounted to steel posts driven approximately 3 feet into the river bottom.

5.2.1.3.2 COAL TUNNEL ASSESSMENT

5.2.1.3.2.1 INITIAL RECORDS REVIEW AND VISUAL EVALUATION

Correspondence to Weyerhaeuser from U.S. EPA, dated November 1, 2008, expressed concern related to fuel oil within the coal tunnel from belowground piping that traverses the tunnel from the former 200,000-gallon No. 6 fuel oil AST to the boiler house, as well as the potential for residual fuel oil remaining in said piping. Based on the correspondence from U.S. EPA, a visual evaluation of a portion of the coal tunnel was performed by RMT in August 2008. The northeastern portion of the tunnel was visually evaluated by RMT at this time;

however, the remainder of the tunnel was not accessed due to confined space conditions. Additionally, RMT reviewed available historical drawings of the coal tunnel.

Review of historical drawings by RMT, the coal tunnel walls, floor and ceiling were constructed of concrete, 18 to 24 inches in thickness. The original construction date could not be confirmed by RMT; however, reviewed information indicated that the original tunnel was approximately 40 feet in length extending from the main boiler house wall to the southwest and an additional approximately 80 feet of length was constructed in the mid-1970s. The original tunnel included two steel lines, one containing a natural gas line and one containing fuel oil supply and return lines, steam lines, and condensate lines associated with the former 200,000-gallon fuel oil AST. During the addition, these lines were re-routed beneath the coal conveyor (Building 5A).

The visual assessment by RMT included observations made from a door on the northeastern end of the tunnel, which included approximately 20 feet of the tunnel. Minimal cracking of the walls was observed by RMT in the older section of the tunnel, with no visible cracks identified in the walls of the newer portion of the tunnel. At the time of the visual assessment, RMT observed approximately 1 foot of a mixture of liquid and solids in the bottom of the tunnel. RMT noted that the material appeared to be comprised of approximately 6 inches of water and approximately six inches of "a mixture of coal fines, water, and a petroleum-based product such as some grade of fuel oil." Staining along the wall of the tunnel beneath the fuel oil lines was noted by RMT, along with the fact that the lines were capped. The coal conveyor was also still in place at the time of the assessment, limiting access and observations.

Based on the review of available information and the limited visual assessment, RMT recommended the evaluation of groundwater in the vicinity of the coal tunnel for potential impacts from the residual material observed within the coal tunnel and further visual examination of the tunnel and conduits.

5.2.1.3.2.2 ADDITIONAL VISUAL EVALUATION AND SAMPLE COLLECTION

Based on the initial records review and visual evaluation, further visual assessment of the condition of the coal tunnel and installation of one

groundwater monitoring well downgradient of the coal tunnel (MW-2) was conducted. Based on the January and February 2010 groundwater contours, the position of MW-2 was determined not to be located immediately downgradient of the coal tunnel. Subsequently, an additional monitoring well (MW-22) was installed in August 2012 to further evaluate groundwater in this area (see Section 5.2.3).

As part of the additional visual evaluation, the top of the coal tunnel was exposed using a backhoe and the interior further accessed. The coal tunnel was measured as approximately 10 feet wide by 10 feet high by 100 feet long, and consisted of approximately 10 to 12-inch thick poured concrete walls, which is contradictory to previous information. The south end of the tunnel was reported to consist of the coal chute, which was noted to contain coal and soil, with no access points. RMT reported that the concrete that could be viewed was in good condition. At the time of the assessment, approximately 12 to 18 inches of liquid, described as a "heavy fuel oil with a layer of water over the top," was observed covering the bottom of the concrete floor of the tunnel (RMT, 2009c). The thickness of the water was identified as approximately one to two inches, with the balance being the "heavy fuel oil." Due to the presence of the liquid, a visual evaluation of the floor of the coal tunnel could not be conducted by RMT. A sample of the liquid in the tunnel was collected and analyzed for PCBs, viscosity, and specific gravity. No PCBs were detected in the sample.

Further evaluation of the lines traversing the coal tunnel was also conducted by RMT. The re-routing of the fuel lines was confirmed through additional drawing review by RMT, and staining was present along the wall entering the Mill Buildings. RMT conducted hand excavation activities on the fuel oil piping between the coal tunnel and the Mill Buildings. The fuel oil piping was observed to be present between 3.5 to 4 feet bgs, which is approximately 5 to 6 feet above the bottom of the tunnel. Stained soil was noted around the fuel oil piping and one soil sample (CTP-4) was collected adjacent to the east of the coal tunnel, to evaluate a release from the fuel oil piping present in the area (i.e., not for a potential release from the coal tunnel). CTP-4 was collected at approximately 4 feet for analysis for TPH-GRO, TPH-DRO, PAHs, PCBs, and metals.

MW-2 was installed approximately 25 feet north (downgradient) of the coal tunnel to evaluate groundwater conditions in the area. No free product was identified in this well. A groundwater sample was collected from the well on

December 16, 2008 for laboratory analysis of VOCs, SVOCs, PCBs, metals, and cyanide (total).

Based on the results of the Phase I work conducted relative to the coal tunnel, RMT concluded that "material within the coal tunnel appears to be contained within the tunnel" and "soil contamination located between the Mill Buildings and coal tunnel appears to be associated with the fuel oil lines connecting the fuel oil tank to the boiler system within the facility."

5.2.2 PHASE II REMEDIAL INVESTIGATION

Phase II and Supplemental Phase II RI field activities were conducted by CRA between January and June 2010.

The specific objectives of the Phase II RI as presented in the Phase II RI Work Plan dated November 2009 are as follows:

- Perform a supplemental groundwater investigation, developed based on the results of the Phase I RI groundwater investigation to further evaluate the nature and extent of impacts to the groundwater and their potential sources
- Further assess shallow Site-specific hydrogeologic characteristics and interconnections with the Kalamazoo River
- Perform soil investigations in the former wastewater sludge and dewatering lagoon and aeration basin area, the area of the Mill Buildings, and the north central portion of the Site, and undeveloped land areas to adequately characterize the nature and extent of impacts to soil in the unsaturated zone that may have occurred due to historical operations at the Site

5.2.2.1 BUILDING INSPECTION

The Mill Buildings, former Quality Products and Sludge Dewatering Buildings, and former Specialty Minerals, Inc. Building were identified as data gaps. Due to the limited knowledge of the historical land use and operations of these buildings, an inspection was conducted as part of the Phase II RI prior to commencement of drilling in these areas.

A detailed inspection consisting of a review of available historical information pertaining to the various areas of operation within the Mill Buildings, followed by a walkthrough of the buildings, was conducted on November 10, 2009 and January 22, 2010 by CRA to identify areas that may demonstrate a release to the environment due to historical activities. This included historical and current AST locations, loading and unloading areas, storage areas, process rooms, drainage piping and potential underground conveyances to the wastewater lagoon areas. Based on observations during the inspections, a proposed Sampling and Analysis Plan for the interior sampling, including photographs of the areas inspected, for these areas was submitted to the U.S. EPA on February 26, 2010.

5.2.2.2 SOIL INVESTIGATION

A total of 207 soil borings (including seven monitoring wells), eight surface soil sample locations, and 47 test pits were installed to evaluate soil conditions across the Site. Prior to initiating soil investigation activities, sample locations were discussed with SulTRAC, on Site representatives for the U.S. EPA, and SulTRAC concurred with the locations prior to completion. Sampling locations where Site field conditions or circumstances either prevented soil boring advancement or required a boring to be relocated significantly (i.e., greater than 10 feet) from its originally proposed location, are discussed in a memorandum entitled *Summary of Modifications to Proposed Soil Boring Locations, Supplemental Phase II RI Activities, Former Plainwell, Inc. Mill Property, Plainwell, Michigan,* which was submitted to U.S. EPA on September 9, 2010. A copy of this memorandum is included in Appendix E. Additionally, prior to initiation of activities, a utility clearance was conducted. Soil borings were advanced utilizing direct-push methods, consistent with the FSP. Test pits were installed utilizing a backhoe or excavator, consistent with the FSP.

Soil samples were collected on a continuous basis (2-foot intervals) as defined in the FSP for the soil borings. Test pits were approximately 5 to 10 feet in length and were completed as defined in the FSP. Consistent with the FSP, test pit installation was to 0 to 2 feet below the observed non-native/native soil interface on a location specific basis. Field screening of soil samples was conducted consisting of PID readings to determine the presence of undifferentiated volatile organic vapors, visual screening for lithologic changes, stained soils and residuals, and olfactory evidence of impacts. Soil samples were classified in

accordance with the Unified Soil Classification System (USCS). Stratigraphic soil boring and monitoring well construction logs are presented in Appendix F. Field observations (i.e., PID readings, odors, staining, etc.) are noted in the stratigraphic soil boring and monitoring well construction logs.

Surficial soil samples were collected to determine the quality of surficial soils across the Site. Samples were collected from 0 to 2-foot bgs. Non-soil materials were not observed to be present during the collection of the surficial soil samples.

To ensure that soil samples collected for VOCs were preserved prior to selection of samples for laboratory analysis the following process was completed:

- The 0 to 2-foot soil sample interval (surficial soil sample collected as noted above) was preserved.
- Sample intervals below the 0 to 2-foot interval were preserved if the material was non-native and the PID readings were greater than 5 parts per million (ppm). For example, all samples of the fill material were collected if there was field evidence of VOC impact (i.e., PID, visual, olfactory, etc.).
- The first sample below the interface of non-native/native material was preserved.
- The non-native material samples were not preserved unless there was field evidence of impact (i.e., PID, visual, olfactory, etc.).

To aid in the screening of soil quality across the Site, the following sampling programs were implemented during the completion of the Phase II RI and as noted in the area-specific discussions below.

<u>Sampling Program 1</u>

- One surficial soil sample was collected. One biased soil sample was collected from what was identified as fill material from a depth of 2 to 10 feet bgs based on field screening. If no impacts were noted, one soil sample was collected from 0 to 2 feet above the interface between the fill and native material within the vadose zone.
- One soil sample from 0 to 2 feet below the observed impact was collected. If no impact was observed, the soil sample was collected from 0 to 2 feet below the interface of the fill/ native material within the vadose zone.

- One soil sample was collected from the vadose zone, 0 to 2 feet above the saturated zone.

Sampling Program 2

- One surficial soil sample was collected.
- If no impact was noted, a discrete soil sample was collected from 0 to 2 feet above the interface of the vadose and saturated zone. If impact was noted, one soil sample was collected within 2 to 10 feet bgs and a third sample was collected from 0 to 2 feet above the interface of vadose and saturated zone.

Sampling Program 3

- One surficial soil sample was collected.
- One soil sample was collected from the fill material, which was observed at approximate depths of 2 to 10 feet bgs, based on field screening methods. Soil borings not exhibiting any evidence of impact were sampled at 0 to 2 feet above the interface of fill/native material within vadose zone.
- One soil sample was collected from 0 to 2 feet below the observed contamination. If no evidence of impact was observed, the soil sample was collected from 0 to 2 feet below the interface of fill/native material within vadose zone.
- One soil sample was collected from vadose zone at 0 to 2 feet above the saturated zone.

Soil boring, surficial soil sample, and test pit locations are presented on Figures 5.1 through 5.11A/B, for Residential Areas 1 through 4, Waterfront Plaza, Mixed Residential/Commercial Areas 1 and 2, and Commercial Areas 1 through 4, respectively. Based on the fact that the investigation was conducted for specific historical operational areas consistent with the Phase II RI Work Plan, the below summaries include multiple redevelopment areas, as they relate to the historical operational area investigated.

Soil cuttings generated during the Phase II RI field activities were placed in 55-gallon drums or a lined roll-off box, sampled for waste characterization parameters, labeled, and staged for off-Site disposal.

5.2.2.2.1 AREA 1 (PORTIONS OF RESIDENTIAL AREAS 1 THROUGH 3, AND COMMERCIAL AREA 1

A total of 45 soil borings (SB-101 through SB-145), 3 monitoring wells (MW-13 through MW-15), one vertical aquifer profile boring (VA-1), and eight surficial soil sample locations (SS-100 through SS-107) were completed in Area 1 for further characterization of the potential contamination associated with the former wastewater lagoons and determine any potential impacts to the undeveloped portions of this area from historical uses. Area 1 includes portions of redevelopment areas Residential Areas 1 and 2, a portion of Residential Area 3, Commercial Area 1, and a portion of Waterfront Plaza. Sample locations for Residential Areas 1 through 3, Waterfront Plaza, and Commercial Area 1 are presented on Figures 5.1 through 5.3, Figure 5.5 and Figure 5.8, respectively.

All soil borings/monitoring well locations were advanced to 20 feet bgs. VA-1 was advanced to 40 feet bgs and surficial soil sample locations were advanced 2 feet bgs. Soil boring, monitoring well, and test pit logs are presented in Appendix F.

The following soil investigation activities were conducted:

- Soil borings SB-101 through SB-105 were advanced to the north of the former lagoons area to determine the extent of impact of potential paper waste between the former lagoons area and the Kalamazoo River. Paper residuals were not observed in SB-101 or SB-103. Limited paper residuals were observed in SB-102 (from 0.2 to 1-foot bgs mixed with sand fill), SB-104 (from 3.5 to 5 feet bgs, mixed with sand fill), and SB-105 (from 0.8 to 2.5 feet, mixed with sand fill). Soil sampling was conducted as per Sampling Program 1. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Monitoring well MW-14 was installed to the south of the former lagoons area to evaluate conditions upgradient of the former lagoons. Soil sampling was conducted as per Sampling Program 1. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Soil borings SB-106 through SB-133 were advanced in the area of former Lagoons A through N to evaluate potential paper residuals. Generally, paper residuals were noted mixed with either clay or sand fill, or as an individual interval, from approximately 4 to 10 feet bgs, with some observed as shallow as 0.2 feet bgs and as deep as 14 feet bgs (not accounting for elevation differences). Specifics regarding paper residuals observed during the

advancement of these borings are presented in the stratigraphic soil boring logs in Appendix F. Additionally, one vertical aquifer boring (VA-1) and one monitoring well (MW-13) were advanced within Lagoon J to confirm the depth of paper waste in this lagoon area. Paper residuals were observed in the clay fill from 6.5 to 8.5 feet bgs, with paper residuals only observed from 8.5 to 10 feet bgs, in VA-1. Soil sampling was conducted as per Sampling Program 1. Additionally, a sample of the observed paper residuals was collected from the aforementioned interval from VA-1. A sample summary, including parameters analyzed, is presented in Table 5.1.

- Soil borings SB-134 through SB-136 were advanced to evaluate the areas adjacent to the lagoons and aeration basin. Soil sampling was conducted as per Sampling Program 1. Additionally, soil samples were collected from SB-134 through SB-136 for soil physical property (i.e., moisture content, natural dry density, grain size, and Atterberg analysis) analysis from the 0 to 5-foot bgs interval for risk assessment purposes. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Soil boring SB-137 was advanced to evaluate the aeration basin area. Soil sampling was conducted as per Sampling Program 1. Additionally, soil samples were collected from SB-137 for soil physical property (i.e., moisture content, natural dry density, grain size, and Atterberg analysis) analysis from the 0 to 5-foot bgs interval for risk assessment purposes. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Soil borings SB-138 through SB-141, along with monitoring well MW-15, were advanced to evaluate the areas adjacent to the former secondary clarifier. Soil sampling was conducted as per Sampling Program 1. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Soil borings SB-142 through SB-145 were advanced to evaluate the undeveloped wooded area near the southwestern portion of the Site. Additionally, surficial soil samples SS-100 to SS-107 were collected from this area. Soil sampling was conducted as per Sampling Program 2. A sample summary, including parameters analyzed, is presented in Table 5.1. Based on review of historical information, the wooded area has remained unchanged throughout Mill expansions. As such, based on discussions with the U.S. EPA, eight surficial soil samples and four soil borings (including surficial soil samples) were randomly selected within this area. The following is a description of the selection process, consistent with the FSP:
  - A 100 foot grid was applied to the area creating 24 potential 100 by 100 foot sample areas.

- From the 24 potential sample areas, 12 locations were chosen based on a random number table.
- A 9 square grid within each of the 24 potential sample areas was used to select the specific sample location.
- Sample locations (within the 9 square grids) were selected using a random number table starting from grid location at the southwest corner.
- Soil boring locations were further selected by using a random number table to determine which 100 by 100 foot grid the soil borings would be placed in.
- Surficial sampling was conducted at the locations not selected for soil borings.

5.2.2.2.2 AREA 2 (PORTIONS OF RESIDENTIAL AREA 4, MIXED RESIDENTIAL/COMMERCIAL AREA 2 AND COMMERCIAL AREAS 3 AND 4)

A total of 112 soil borings (SB-201 through SB-299 and SB-2001 through SB-2013), two monitoring wells (MW-16 and MW-17), one vertical aquifer profile boring (VA-2), six temporary wells (TW-246, TW-263, TW-279, TW-297, and TW-2001), and 10 test pits (TP-201 through TP-203, and TP-337 through TP-343) were completed in Area 2 for further characterization of the potential contamination associated with the former Mill operations. Area 2 includes portions of redevelopment areas Residential Area 4, Mixed Residential/Commercial Area 2 and Commercial Areas 3 and 4. Sample locations for Residential Area 4, Mixed Residential/Commercial Area 2 and Commercial Areas 3 and 4 are presented on Figures 5.4, 5.7, 5.10, and 5.11A/B, respectively.

The majority of the soil boring locations were advanced to between 6 and 20 feet bgs, depending on the depth to groundwater encountered. Some borings encountered shallow refusal at depths between 0.2 and 6 feet bgs. The monitoring wells were installed to 20 feet bgs. VA-2 was advanced to 35 feet bgs. Test pits were installed to 10 feet bgs. Soil boring, monitoring well, and test pit logs are presented in Appendix F.

The following soil investigation activities were conducted in Area 2:

- Soil borings SB-201 through SB-204 were advanced to evaluate the areas adjacent to the former transformer pad in the vicinity of TP-17 and

TP-18, installed during the Phase I RI. Soil sampling was conducted as per Sampling Program 1, including a surface soil sample. Additionally, soil samples were collected from SB-201 and SB-202 for soil physical property (i.e., moisture content, natural dry density, grain size, and Atterberg analysis) analysis from the 0 to 5-foot bgs interval for risk assessment purposes. A sample summary, including parameters analyzed, is presented in Table 5.1.

- Soil borings SB-205 through SB-299 and SB-2001 through SB-2013 were advanced to evaluate the areas within the Mill Buildings footprint, based on observations made during the initial Site visual inspection (see Section 5.2.2.1). Soil sampling was conducted as per Sampling Program 2. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Visual inspection of the surface soils surrounding the Mill Buildings and the outflow points identified during previous investigations along the Kalamazoo River to ensure capping was conducted properly, to determine if any staining is present in relation to historical Site activities, and that no further issues pertain to these outflows. Based on the observations during the inspection, no additional surficial soil sample locations were identified, other than those included as part of the sample collection conducted for other locations.
- Temporary monitoring wells TW-246, TW-263, TW-279, TW-297, and TW-2001 were installed at the soil borings with the same number (i.e., SB-246) to evaluate groundwater in areas where visual/olfactory indicates of impact were noted during installation of the aforementioned soil borings. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Monitoring well MW-16 was installed adjacent to the Mill Race to determine groundwater conditions adjacent to the Mill Buildings. Samples were collected as per Sampling Program 1. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Monitoring well MW-17 was installed in the southern corner of the parking lot area adjacent to the Mill Race to determine groundwater conditions in this area. Samples were collected as per Sampling Program 2. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Test pits TP-201 through TP-203 were installed within the undeveloped south parking lot and near former background location BK5 to confirm the presence of fill below the parking lot areas and determine impacts associated with historical activities. Test pits TP-337 through TP-343 were installed to determine impacts associated with historical activities. Sampling was

conducted as per Sampling Program 2, including the collection of surface samples at each location. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.2.3 AREA 3 (PORTIONS OF RESIDENTIAL AREA 4, WATERFRONT PLAZA, MIXED RESIDENTIAL/COMMERCIAL AREA 1, AND COMMERCIAL AREA 3)

A total of three soil borings (SB-301, SB-302 and SB-321), one monitoring well (MW-18), and five test pits (TP-301 through TP-303, TP-306, and TP-307) were completed in Area 3 for confirmation of previous analytical results and nature of the fill materials in this area. Area 3 includes portions of redevelopment areas Residential Area 4, Waterfront Plaza, Mixed Residential/Commercial Area 1, and Commercial Area 3. Sample locations for Residential Area 4, Waterfront Plaza, Mixed Residential/Commercial Area 1, and Commercial Area 3 are presented on Figures 5.4, 5.5, 5.6, and 5.10, respectively.

All soil borings locations were advanced to 20 feet bgs. The monitoring well was installed to 20 feet bgs. Test pits were installed to depths between 7 and 11 feet bgs. Soil boring, monitoring well, and test pit logs are presented in Appendix F.

The following soil investigation activities were conducted in Area 3:

- Soil borings SB-301, SB-302, and SB-321 through SB-204 were advanced to confirm previous soil sampling results in these areas. Soil sampling was conducted as per Sampling Program 1. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Test pits TP-301 through TP-303, TP-306, and TP-307 were installed to evaluate the nature of the fill materials in this area. Soil sampling was conducted as per Sampling Program 2. Additionally, a soil sample was collected from TP-302 for soil physical property (i.e., moisture content, natural dry density, grain size, and Atterberg analysis) analysis from the 0 to 5-foot bgs interval for risk assessment purposes. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Monitoring well MW-18 was installed along the southern portion of Area 3 (near former SGWB-10) to confirm previous groundwater sampling results. Samples were collected as per Sampling Program 1. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.2.4 AREA 3A (PORTIONS OF RESIDENTIAL AREA 3 AND COMMERCIAL AREA 2)

A total of 14 soil borings (SB-323 through SB-333, SB-340, SB-342, and SB-343), one temporary monitoring well (TW-328), and 13 test pits (TP-316 through TP-328) were completed in Area 3A to evaluate the potential for impacts from historical operations associated with the former Sludge Dewatering and Quality Products Buildings. Area 3A includes portions of redevelopment areas Residential Area 3 and Commercial Area 2. Sample locations for Residential Area 3 and Commercial Area 2 are presented on Figures 5.3 and 5.9, respectively.

All soil borings locations were advanced to 15 feet bgs, with the exception of SB-340 where refusal was encountered at 2 feet bgs. The temporary monitoring well was installed to 15 feet bgs. Test pits were installed to depths between 7 and 10 feet bgs, consistent with the Phase II RI Work Plan, which required the installation to 0 to 2 feet below the observed non-native/native soil interface on a location specific basis. Based on the observed depth to native soils in each location, the final depths of the test pits were adjusted accordingly. Soil boring, monitoring well, and test pit logs are presented in Appendix F.

The following soil investigation activities were conducted in Area 3A:

- Soil borings SB-323 through SB-333, SB-340, SB-342, and SB-343 were advanced to evaluate the areas within and immediately adjacent to the former Quality Products and Sludge Dewatering Buildings, based on observations made during the initial Site visual inspection (see Section 5.2.2.1). Soil sampling was conducted as per Sampling Program 2. It should be noted that soil borings SB-324 and SB-326 could not be completed due to refusal; therefore, no samples were collected from these locations. Based on the review of historical drawings, a concrete foundation is present in the area where SB-324 was attempted, and a former residential structure basement is present in the area where SB-326 was attempted. Based on the areas covered by the foundation/basement, additional movement of the sample location would not have allowed for the borings to be advanced in close proximity to their intended target areas. A sample summary, including parameters analyzed, is presented in Table 5.1.

- Temporary monitoring well TW-328 was installed at the soil boring with the same number (i.e., SB-328) to evaluate groundwater in an area where visual/olfactory indications of impact were noted during installation of the aforementioned soil boring. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Test pits TP-316 through TP-328 were installed to determine impacts associated with historical activities. Sampling was conducted as per Sampling Program 2, including the collection of surface samples at each location. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.2.5 AREA 3B (PORTIONS OF MIXED RESIDENTIAL/COMMERCIAL AREA 1 AND COMMERCIAL AREA 2)

A total of seven soil borings (SB-334 through SB-339 and SB-341) and four test pits (TP-333 through TP-336) were completed in Area 3B to evaluate the potential for impacts from historical operations associated with the former Specialty Minerals Building. Area 3B includes portions of redevelopment areas Mixed Residential/Commercial Area 1 and Commercial Area 2. Sample locations for Mixed Residential/Commercial Area 1 and Commercial Area 2 are presented on Figures 5.7 and 5.9, respectively.

All soil boring locations were advanced to 15 feet bgs, with the exception of SB-335, where refusal was encountered at 8.5 feet bgs. Test pits were installed to depths between 5 and 10 feet bgs, consistent with the Phase II RI Work Plan, which required the installation to 0 to 2 feet below the observed non-native/native soil interface on a location specific basis. Based on the observed depth to native soils in each location, the final depths of the test pits were adjusted accordingly. Soil boring and test pit logs are presented in Appendix F.

The following soil investigation activities were conducted in Area 3B:

- Soil borings SB-334 through SB-339 and SB-341 were advanced to evaluate the areas within and immediately adjacent to the former Specialty Minerals Building, based on observations made during the initial Site visual inspection (see Section 5.2.2.1). Soil sampling was conducted as per Sampling Program

2. A sample summary, including parameters analyzed, is presented in Table 5.1.

- Test pits TP-333 through TP-336 were installed to determine impacts associated with historical activities, including adjacent to the belowgrade process lines that conveyed the precipitated calcium carbonate from the former Specialty Minerals Building to the Mill Buildings. Sampling was conducted as per Sampling Program 2, including the collection of surface samples at each location. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.2.6 AREA 3C (PORTIONS OF WATERFRONT PLAZA AND RESIDENTIAL AREA 4)

A total of eight test pits (TP-308 through TP-315) were completed in Area 3C confirm the extent of the coal impacts. Area 3C includes portions of redevelopment area Waterfront Plaza and Residential Area 4. Sample locations for Residential Area 4 and Waterfront Plaza are presented on Figure 5.4 and 5.5, respectively.

Test pits were completed to depths between 6 and 11 feet bgs, consistent with Phase II RI Work Plan, which required the installation to 0 to 2 feet below the observed non-native/native soil interface on a location specific basis. Based on the observed depth to native soils in each location, the final depths of the test pits were adjusted accordingly. Test pit logs are presented in Appendix F.

The following soil investigation activities were conducted in Area 3C:

- Test pits TP-308 through TP-315 were installed to determine impacts associated with historical activities. Sampling was conducted as per Sampling Program 2, including the collection of surface samples at each location. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.2.7 AREA 3D (RESIDENTIAL AREA 4 AND MIXED RESIDENTIAL/COMMERCIAL AREA 2)

A total of five soil borings (SB-303 through SB-307) and one monitoring well (MW-19) were completed in Area 3D to substantiate historical confirmation

sampling results from a previous release of fuel oil. Area 3D includes portions of redevelopment areas Residential Area 4 and Mixed Residential/Commercial Area 2. Sample locations for Residential Area 4 and Mixed Residential/Commercial Area 2 are presented on Figures 5.4 and 5.7, respectively.

All soil boring locations were advanced to 20 feet bgs. The monitoring well was installed to 20 feet bgs. Soil boring and monitoring well logs are presented in Appendix F.

The following soil investigation activities were conducted in Area 3D:

- Soil borings SB-303 through SB-307 were advanced to confirm previous soil sampling results in these areas. Additionally, SB-307 was completed adjacent to the brine USTs. Soil sampling was conducted as per Sampling Program 3. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Monitoring well MW-19 was installed to the northeast of the fuel oil AST (near former SGWA-5) to confirm previous groundwater sampling results. Samples were collected as per Sampling Program 2. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.2.8 AREA 3E (MIXED RESIDENTIAL/COMMERCIAL AREA 2 AND COMMERCIAL AREA 3)

A total of five soil borings (SB-308 through SB-312) and two test pits (TP-304 and TP-305) were completed in Area 3E to confirm historical contamination identified and to evaluate the potential for impacts from historical operations. Area 3E includes redevelopment areas Mixed Residential/Commercial Area 2 and Commercial Area 3. Sample locations for Mixed Residential/Commercial Area 2 and Commercial Area 3 are presented on Figures 5.7 and 5.10, respectively.

All soil boring locations were advanced to depths between 15 and 20 feet bgs, with the exception of SB-312, where refusal was encountered at 5 feet bgs. Test pits were installed to 8 feet bgs. Soil boring and test pit logs are presented in Appendix F.

The following soil investigation activities were conducted in Area 3E:

- Soil borings SB-308 through SB-312 were advanced to confirm previous soil sampling results in these areas. Soil sampling was conducted as per Sampling Program 2. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Test pits TP-304 and TP-305 were installed to determine impacts associated with historical activities. Sampling was conducted as per Sampling Program 2, including the collection of surface samples at each location. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.3 GROUNDWATER INVESTIGATION

A total of seven new monitoring wells (MW-13 through MW-19) were installed to evaluate groundwater conditions across the Site in conjunction with 12 existing monitoring wells (MW-1 through MW-12) installed during the Phase I RI. Additionally, seven temporary monitoring wells (TW-246, TW-263, TW-279, TW-297, TW-328, and TW-2001) and two vertical aquifer profiling locations (VA-1 and VA-2) were completed at the Site. The three staff gauges (SG-1 through SG-3) installed during the Phase I RI were identified to be missing/damaged, and; therefore, were reinstalled during the Phase II RI field activities.

Monitoring wells were installed utilizing a 4 ¼-inch HSA driven by a Geoprobe® rig. During installation of monitoring wells, split-spoon samples were collected and soils classified in accordance with SOP-15 of the FSP. Soil cuttings were screened with a PID and examined for visual/olfactory evidence of contamination in accordance with SOP-9 of the FSP. Monitoring wells were constructed in accordance with SOP-15 of the FSP using wire-wrapped 2-inch diameter Schedule 40 PVC risers and 7-foot long, 0.01-inch slot Schedule 40 PVC screen through the augers. The monitoring well screens were constructed so as to straddle the water table. An inert silica sandpack was placed to a height of 2 vertical feet above the top of the screens. The remainder of the annulus was filled with hydrated bentonite chips to approximately 1-foot bgs. The remaining portion of the unfilled annulus was filled with concrete and a stickup protective surface casing was installed at the well. The protective casing was centered over the riser and extended into the concrete collar 1 foot. The riser pipe was capped

with an expandable locking cap. The monitoring wells were clearly labeled with a unique identification number.

Monitoring well development was conducted in accordance with SOP-15 of the FSP.

Monitoring well purging and groundwater sampling was performed in accordance with acceptable U.S. EPA low-flow purging (LFP) and sampling techniques as outlined in the FSP. Special attention was paid to minimizing the possibility of degassing the groundwater samples during sample collection. Groundwater samples were not field filtered for dissolved metals analysis, with the exception of groundwater samples collected from the temporary monitoring wells.

VAS allowed for the collection of representative samples at various sample depths to create a profile of soil, waste, and groundwater conditions. This method allowed for the identification of confining layers which may limit migration of groundwater impacts below a certain depth both vertically and horizontally (i.e., impact noted within certain confining layers) and layers of fill materials in these areas. The purpose of this sampling as part of the RI investigation was to obtain information about the native soil and groundwater at depths greater than the historical information reviewed (i.e., deeper levels of the aquifer). VAS was conducted at two locations at the Site to determine soil, waste, and groundwater conditions at depth. As discussed below, the locations are within Residential Area 1 (Lagoon J) and Mixed Residential/Commercial Area 2 (adjacent to MW-4). These two locations were chosen based on historical impacts, current soil boring logs, and proximity to the Kalamazoo River. VAS samples were collected every 5 feet, to depths of 40 and 35 feet bgs for VA-1 and VA-2, respectively, to profile groundwater and soil conditions below the water table and the river banks. VAS samples were also collected for both filtered and unfiltered metals analysis. Purging of the groundwater prior to sample collection was conducted, as described in SOP F-17. As described in the SOP F-17 for the VAS sampling (included in the FSP for the Site), water levels were taken to ensure that the groundwater samples are that of the formation.

Development, purge, and decontamination water generated during the Phase II RI field activities were placed in 55-gallon drums, sampled for waste characterization parameters, labeled, and discharged off-Site via the City of

Plainwell sanitary sewer system, under approval from the City of Plainwell Water Renewal Plant.

5.2.2.3.1 AREA 1 (PORTIONS OF RESIDENTIAL AREAS 1 THROUGH 3 AND COMMERCIAL AREA 1)

A total of three monitoring wells (MW-13 through MW-15) and one vertical aquifer profile boring (VA-1) were completed in Area 1 for further characterization of the potential contamination associated with the former wastewater lagoons and determine any potential impacts to the undeveloped portions of this area from historical uses. Area 1 includes portions of redevelopment areas Residential Areas 1 and 2, a portion of Residential Area 3, Commercial Area 1, and a portion of Waterfront Plaza. Sample locations for Residential Areas 1 through 3, Waterfront Plaza, and Commercial Area 1 are presented on Figures 5.1 through 5.3, Figure 5.5 and Figure 5.8, respectively.

All monitoring well locations were advanced to 20 feet bgs. VA-1 was advanced to 40 feet bgs. The monitoring well logs are presented in Appendix F.

The following groundwater investigation activities were conducted in Area 1:

- Monitoring well MW-13 was installed and screened within a portion of the paper waste (based on depth to groundwater) to determine groundwater chemistry at the depth of the paper residuals located in the former lagoon area.
- Vertical aquifer sampling (VAS) was completed adjacent to MW-13 within Lagoon J at VA-1. This area was selected to characterize the groundwater above, within and below the residual paper waste and aid in the characterization of groundwater flow through the lagoon area and provide information related to the depth of potential confining layers within the native soil beneath the paper waste. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Monitoring well MW-14 was installed to the south of the former lagoon areas to characterize groundwater flow direction through this area and provide an upgradient monitoring well location for the lagoon area in the area of SGWB-2.

- Monitoring well MW-15 was installed to the north of the former secondary clarifier to determine any potential groundwater impacts related to prior discharges.
- Groundwater samples were collected from monitoring wells MW-8 through MW-15 to determine and confirm current groundwater impacts. A sample summary, including parameters analyzed, is presented in Table 5.1.
- A river level measurement was collected from SG-3 for evaluation of river elevations relative to groundwater elevations.

5.2.2.3.2 AREA 2 (PORTIONS OF RESIDENTIAL AREA 4, MIXED RESIDENTIAL/COMMERCIAL AREA 2 AND COMMERCIAL AREAS 3 AND 4)

A total of two monitoring wells (MW-13 through MW-15), six temporary monitoring wells (TW-246, TW-263, TW-279, TW-297, and TW-2001), and one vertical aquifer profile boring (VA-2) were completed in Area 2 for further characterization of the potential contamination associated with the former mill operations. Area 2 includes portions of redevelopment areas Residential Area 4, Mixed Residential/Commercial Area 2 and Commercial Areas 3 and 4. Sample locations for Residential Area 4, Mixed Residential/Commercial Area 2 and Commercial Areas 3 and 4 are presented on Figures 5.4, 5.7, 5.10, and 5.11A/B, respectively.

All monitoring well locations were advanced to 20 feet bgs. VA-2 was advanced to 35 feet bgs. The monitoring well logs are presented in Appendix F.

The following groundwater investigation activities were conducted in Area 2:

- Monitoring well MW-16 was installed adjacent to the Mill Race to further define the groundwater flow patterns in this area and the hydraulic interaction of the Mill Race and groundwater.
- Monitoring well MW-17 was installed in the southern corner of the parking lot area adjacent to the Mill Building to determine influences of the Mill Race on the water levels at the southern property boundary in relation to water levels at SG-1.
- Temporary monitoring wells TW-246, TW-263, TW-279, TW-297, and TW-2001 were installed at the soil borings with the same number (i.e.,

SB-246) to evaluate groundwater in areas where visual/olfactory indications of impact were noted during installation of the aforementioned soil borings. A sample summary, including parameters analyzed, is presented in Table 5.1.

- VAS was completed at VA-2, adjacent to MW-4 to the north of Building 1. This location is within the proximity of the Kalamazoo River and downgradient of the mill buildings. Historical impacts have been noted at this location; therefore, sampling was conducted to determine the depth of impact within this area and identify potential confining layers along the Kalamazoo River, while capturing any residual impacts downgradient of the Mill Buildings. A sample summary, including parameters analyzed, is presented in Table 5.1.
- Groundwater samples were collected from monitoring wells MW-1, MW-3, MW-4, MW-5, MW-16, and MW-17 to determine and confirm current groundwater impacts. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.3.3 AREA 3 (PORTIONS OF RESIDENTIAL AREA 4, WATERFRONT PLAZA, MIXED RESIDENTIAL/COMMERCIAL AREA 1, AND COMMERCIAL AREA 3)

One monitoring well (MW-18) was completed in Area 3 for further characterization of the potential contamination associated with the former mill operations. Area 3 includes portions of redevelopment areas Residential Area 4, Waterfront Plaza, Mixed Residential/Commercial Area 1, and Commercial Area 3. Sample locations for Residential Area 4, Waterfront Plaza, Mixed Residential/Commercial Area 1, and Commercial Area 3 are presented on Figures 5.4, 5.5, 5.6, and 5.10, respectively.

The monitoring well was advanced to 20 feet bgs. The monitoring well log is presented in Appendix F.

The following groundwater investigation activities were conducted in Area 3:

- Monitoring well MW-18 was installed along the southern portion of Area 3 (near former SGWB-10) to confirm previous groundwater sampling results.

- A groundwater sample was collected from monitoring well MW-18 to determine and confirm current groundwater impacts. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.3.4 AREA 3A (PORTIONS OF RESIDENTIAL AREA 3 AND COMMERCIAL AREA 2)

One temporary monitoring well (TW-328) was completed in Area 3A for further characterization of the potential contamination associated with the former operations. Area 3A includes portions of redevelopment areas Residential Area 3 and Commercial Area 2. Sample locations for Residential Area 3 and Commercial Area 2 are presented on Figures 5.3 and 5.9, respectively.

The temporary monitoring well log is presented in Appendix F.

The following groundwater investigation activities were conducted in Area 3A:

- Temporary monitoring well TW-328 was installed at the soil boring with the same number (i.e., SB-328) to evaluate groundwater in an area where visual/olfactory indications of impact was noted during installation of the aforementioned soil boring. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.3.5 AREA 3B (PORTIONS OF MIXED RESIDENTIAL/COMMERCIAL AREA 1 AND COMMERCIAL AREA 2)

No groundwater investigation activities were conducted in Area 3B. Area 3B includes portions of redevelopment areas Mixed Residential/Commercial Area 1 and Commercial Area 2. Sample locations for Mixed Residential/Commercial Area 1 and Commercial Area 2 are presented on Figures 5.7 and 5.9, respectively.

5.2.2.3.6 AREA 3C (PORTIONS OF RESIDENTIAL AREA 4 AND WATERFRONT PLAZA)

No groundwater investigation activities were conducted in Area 3C. Area 3C includes portions of redevelopment areas Residential Area 4 and Waterfront

Plaza. Sample locations for Residential Area 4 and Waterfront Plaza are presented on Figures 5.4 and 5.5, respectively.

5.2.2.3.7 AREA 3D (PORTIONS OF RESIDENTIAL AREA 4 AND MIXED RESIDENTIAL/COMMERCIAL AREA 2)

One monitoring well (MW-19) was completed in Area 3D to the northeast of the No. 6 fuel oil AST (near former SGWA-5) to confirm previous groundwater sampling results. Area 3D includes portions of redevelopment areas Residential Area 4 and Mixed Residential/Commercial Area 2. Sample locations for Residential Area 4 and Mixed Residential/Commercial Area 2 are presented on Figures 5.4 and 5.7, respectively.

The monitoring well was advanced to 20 feet bgs. The monitoring well log is presented in Appendix F.

The following groundwater investigation activities were conducted in Area 3D:

- Monitoring well MW-19 was installed to the northeast of the fuel oil AST (near former SGWA-5) to confirm previous groundwater sampling results.
- A groundwater sample was collected from monitoring well MW-19 to determine and confirm current groundwater impacts. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.3.8 AREA 3E (PORTIONS OF MIXED RESIDENTIAL/COMMERCIAL AREA 2 AND COMMERCIAL AREA 3)

No additional monitoring wells were installed in Area 3E. Area 3E includes portions of redevelopment areas Mixed Residential/Commercial Area 2 and Commercial Area 3. Sample locations for Mixed Residential/Commercial Area 2 and Commercial Area 3 are presented on Figures 5.7 and 5.10, respectively.

The following groundwater investigation activities were conducted in Area 3E:

- A groundwater sample was collected from monitoring well MW-2 to determine and confirm current groundwater impacts. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.4 SURFACE WATER INVESTIGATION

Two surface water samples, SW-001 and SW-002, were collected during the Phase II RI, one from the Kalamazoo River and one from the Mill Race to determine the hardness of the surface water receiving body, and for analysis for low-level mercury and methyl mercury. Surface water samples were collected in accordance with the FSP. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.2.5 DECONTAMINATION

Decontamination of non-disposal equipment was performed consistent with the FSP.

Upon mobilization to the Site and prior to drilling commencement, the drill rig, backhoe, and associated equipment were thoroughly cleaned using a high pressure, low volume steam wash and inspected. Prior to initiation of drilling at subsequent locations, the drill rig, backhoe and other associated equipment were decontaminated to prevent cross-contamination.

All non-disposable sampling equipment was decontaminated prior to each use by using an Alconox wash, potable water rinse, followed by a deionized water rinse and allowed to air dry.

Decontamination water was containerized in a DOT approved 55-gallon drum for future characterization and disposal.

5.2.2.6 MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

IDW generated during the implementation of the Phase II RI was managed and characterized, consistent with the protocols set forth in the Multi-Area FSP. The IDW generated during this investigation was properly disposed off Site upon receipt and review of final waste characterization data, as applicable.

5.2.3 ADDITIONAL REMEDIAL INVESTIGATION ACTIVITIES

Additional RI field activities were conducted by CRA between March and August 2012. The Additional RI field activities were conducted to address data gaps presented in the revised April 20, 2012 RI Report.

The revised April 20, 2012 RI Report provided the following recommendations for additional activities to be completed at the Site:

- Collection of static water levels and staff gauge readings on a quarterly basis to evaluate seasonal fluctuations (i.e., wet versus dry)
- Completion of a round of groundwater samples from existing monitoring wells, with analysis to include amenable cyanide
- Further evaluation of existing monitoring well and staff gauge network and potential installation of additional wells and/or staff gauges
- Development of a strategy to confirm the speciation assumptions for chromium used in the risk assessment
- Abandonment of existing monitoring well MW-1 in support of redevelopment activities associated with utility installation/replacement
- Excavation and verification sampling associated with impacts identified in soil samples from TP-203 in Commercial Area 4 in support of redevelopment activities
- Delineation of PCB impacts in the vicinity of MW-16 in support of redevelopment activities

Based on the recommendations presented in the April 20, 2012 Report (Revision 1), a Work Plan for Additional RI Activities was submitted to U.S. EPA on May 7, 2012 (CRA, 2012a). On June 7, 2012, Weyerhaeuser received comments on the Work Plan for Additional RI Activities and subsequently submitted a Revised Work Plan for Additional RI Activities (CRA, 2012b) and a response to U.S. EPA's June 7, 2012 comments on July 9, 2012. Implementation of the Revised Work Plan for Additional RI Activities was initiated on July 31, 2012 under conditional approval from U.S. EPA received on July 19, 2012.

In addition to the aforementioned activities, on August 24, 2012 during property redevelopment activities conducted along the western side of the former Sludge Dewatering Building (i.e., new City of Plainwell Public Safety Building), two small below grade structures in series were encountered approximately 3 feet

bgs. Removal of the tanks was implemented on August 27, 2012, subsequent to notification to the U.S. EPA, as described in Section 5.2.5.

5.2.3.1 GROUNDWATER/SURFACE WATER ELEVATIONS AND MONITORING

Groundwater elevations were measured and recorded in March, August and October 2012 to further evaluate groundwater flow direction, horizontal hydraulic gradient, and seasonal fluctuation of the water table. Measurements were obtained from existing on-Site monitoring wells and staff gauges present at the time the measurements were collected. Monitoring well and staff gauge locations are presented on Figures 2.20 through 2.24. Static water levels were measured in groundwater monitoring wells across the Site on January 13, 2010, February 5, 2010, March 30, 2012, August 6, 2012, and October 1, 3, 5, 8, 10, and 12, 2012 and are presented in Table 2.36. Figures 2.20 through 2.24 provide groundwater flow contours for the upper-most aquifer across the Site for January 2010, February 2010, March 2012, August 2012, and October 2012, respectively. Section 2.4 discusses the hydrogeology and hydrology observed during these events.

A groundwater monitoring event was completed at the Site which consisted of collection of a groundwater sample from each of the on-Site monitoring wells. Table 5.1 presents a sample summary, including parameters analyzed. Monitoring well purging and groundwater sampling were performed in accordance with acceptable U.S. EPA and MDEQ LFP and sampling techniques as outlined in the FSP.

5.2.3.2 MONITORING WELL NETWORK EVALUATION

The existing monitoring well network was augmented to include deeper (nested adjacent to an existing shallow monitoring well) well screens to evaluate the potential venting to surface water and to supplement the existing known hydrogeologic conditions of the aquifer beneath the Site. In addition, the need for additional monitoring wells where groundwater passes beneath the Site property lines was also evaluated with regard to current and potential future land and resource uses, as appropriate. Based on CRA's review of the hydrogeology of the Site, the following additional monitoring wells and staff

gauge were installed to assist with the understanding of the groundwater flow patterns at the Site and the interaction of the Kalamazoo River with the Site groundwater:

- An additional staff gauge (SG-4) near the confluence of the Mill Race and the Kalamazoo River to further evaluate what appeared to be the recharge of groundwater in this area
- An additional shallow well in Commercial Area 1 (MW-20)
- Two deep wells, adjacent to existing MW-12 in Residential Area 1 (MW-12D) and existing MW-4 in Mixed Residential/Commercial Area 2 (MW-4D)
- An additional nested well set in Commercial Area 2 (MW-21S/MW-21D)

The locations of the new monitoring wells are shown on Figures 5.1 through 5.11, as applicable. It should be noted that the previously identified MW-4 and MW-12 are now identified as MW-4S and MW-12S, respectively. Monitoring well construction logs are presented in Appendix F.

In addition to the above monitoring wells installed to further evaluate groundwater flow conditions, additional shallow monitoring wells downgradient of the coal tunnel (MW-22) and the former 200,000-gallon fuel oil aboveground storage tank (AST)(MW-23) were installed and monitored for potential impacts to groundwater. Originally MW-2 and MW-19 were believed to be a suitable location to monitor groundwater quality downgradient of the coal tunnel and the former 200,000-gallon fuel oil AST, respectively; however, groundwater elevation data has confirmed that groundwater flow is in a westerly direction in this area of the Site, and therefore, the new locations of MW-22 and MW-23 are better locations to monitor potential impacts to groundwater associated with the coal tunnel and former 200,000-gallon fuel oil AST.

Monitoring wells MW-20, MW-21S, MW-22, and MW-23 were constructed with 7-foot screens set to straddle the water table. Each screen is positioned such that approximately three feet of the screen is above the water table and four feet of the screen is below the water table. The selection of the screened interval was based on the objective to monitor the water table and provide additional information regarding groundwater flow across the shallow groundwater at the Site.

Monitoring wells MW-4D, MW-12D and MW-21D were constructed with 5-foot screens set at the top of the underlying native silt and clay, or from approximately 27 to 32 feet bgs, whichever is shallower. The selection of the screened intervals was based on the observed geologic conditions in these areas during previous subsurface investigations and observed geology, and maintaining a separation between the screened intervals of the corresponding shallow/water table wells at each location.

The newly installed monitoring wells were included in the August 2012 groundwater sampling event. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.3.3 CHROMIUM SPECIATION EVALUATION

In response to U.S. EPA's comments on the RI Report and the HHRA, concentrations of trivalent chromium and hexavalent chromium were calculated for each data point using measured total chromium concentrations and the recommended ratio of 1:6 hexavalent chromium to trivalent chromium, as per U.S. EPA Regional Screening Levels User's Guide, November 2011. The RI Report further recommended that a strategy be developed to confirm the speciation assumptions for chromium used in the risk assessment.

Limited chromium sampling was completed to further evaluate the 1:6 hexavalent chromium to trivalent chromium ration assumption used in the HHRA. A total of 11 soil borings (SB-2031 through SB-2039 and SB-2056) were advanced in the immediate vicinity of the RI sample locations that exhibited the highest chromium concentrations for each redevelopment area during the Phase II RI activities, as follows:

- Commercial Area 1 – SB-144 (from 7 to 9 feet bgs)
- Commercial Area 2 – SB-328 (from 8 to 10 feet bgs)
- Commercial Area 3 – SB-248 (from 8 to 10 feet bgs)
- Commercial Area 4 – TP-5 (at 6 feet bgs)
- Waterfront Plaza – TP-301 (from 8 to 10 feet bgs)
- Mixed Residential/Commercial Area 1 – SB-334 (from 8 to 10 feet bgs)
- Mixed Residential/Commercial Area 2 – SB-231 (from 0 to 1-foot bgs)
- Residential Area 1 – SB-116 (from 9.5 to 10 feet bgs)
- Residential Area 2 – SB-126 (from 7.5 to 9.5 feet bgs)
- Residential Area 3 – SB-134 (from 1.5 to 3.5 feet bgs)
- Residential Area 4 – TP-313 (from 4 to 6 feet bgs)

One soil sample was collected from each soil boring during the Additional RI activities for speciated and total chromium analysis for the intervals identified above. It should be noted that the sample from SB-2039 in Commercial Area 3 was collected from 14 to 15.75 feet bgs, while the original sample from SB-248 was collected from 4 to 6 feet bgs. This is due to the fact that the original sample was collected from beneath the basement floor slab prior to demolition and backfilling in this area. Approximately 9 to 10 feet of backfill was utilized in this area to bring the area to grade from the basement floor. A sample summary is presented in Table 5.1. Soil boring locations are presented on Figures 5.1 through 5.11A/B, respectively.

5.2.3.4 ABANDONMENT OF MW-1

In support of the on-going redevelopment activities at the Site, the abandonment of MW-1 in Commercial Area 4 was proposed to the U.S. EPA on March 26, 2012. Conditional approval of the implementation of these activities was received by U.S. EPA on March 28, 2012 and the activities were initiated on March 29, 2012.

MW-1 was abandoned utilizing a 4 ¼-inch hollow-stem auger (HSA) drilling method to total depth of the well (17 feet bgs). All well construction materials including well cover, casing, screen, cement seal, and sand pack were removed and the borehole was filled with cement-bentonite grout placed to the ground surface in one continuous flow by means of a tremie pipe.

5.2.3.5 REMOVAL OF IMPACTED SOIL IN THE AREA OF TP-203

Test pit TP-203 was installed in the southeastern portion of the Site during RI investigation activities conducted in redevelopment area Commercial Area 4 in January 2010. Based on laboratory analytical results for soil samples collected from TP-203 and as discussed in Section 5.4, benzo(a)pyrene and arsenic were detected above the Part 201 Criteria for Residential and/or Non-Residential Direct Contact in the soil sample collected from 0.5 to 1.5 feet bgs. Additionally, metals and SVOC constituents were detected in the soil sample collected from 0.5 to 1.5 feet bgs at concentrations above the Residential and/or Non-Residential DWPC and/or GSIPC. No contaminants were detected above Part 201 Residential and/or Non-Residential Direct Contact Criteria in the soil samples collected from 2 to 4 feet and 8 to 10 feet bgs in TP-203; however, metals were detected at concentrations above the Part 201 Residential and/or Non-Residential DWPC and/or GSIPC.

TP-203 was installed in an asphalt-paved parking area and removal of impacted soil in this area was proposed to take place concurrent with future parking lot resurfacing activities. Approximately 20 cubic yards of soil was excavated from the area of TP-203 to an approximate depth of 3 feet bgs and was be transferred to a covered, lined roll-off box prior to waste characterization and off-Site disposal. The estimated extent of the excavation was 13 feet by 10 feet and 3 feet deep. Subsequent to completion of excavation activities, verification soil samples were collected from the excavation in accordance with the MDEQ's *Sampling Strategies and Statistics Training Materials for Part 201 Cleanup Criteria* (MDEQ – Remediation and Redevelopment Division, 2002). Seven soil samples, including two floor and four sidewall samples (with one duplicate and matrix spike/matrix spike duplicate), were collected for laboratory analysis for PNAs and Target Analyte List (TAL) metals (not including total or amenable cyanide) based on the detected constituents identified above the Part 201 Non-Residential Cleanup Criteria.

Based on the results of the soil samples collected on May 11, 2012, arsenic was present at concentrations above the Part 201 Non-Residential DCC. As such, additional investigation in this area was conducted to further delineation the extent of the arsenic impacts prior to further excavation and off-Site disposal. A total of 15 soil borings (SB-2040 to SB-2054) to a depth of 5 feet below ground surface, which is consistent with the impacts identified in this area previously, were completed to further evaluate this area. The soil borings were oriented on

approximately 10-foot spacing in the north, south, east, and west direction from the former TP-203 location. Figures 5.11A/B show the sample locations. One soil sample was collected from each soil boring. PNAs and TAL metals analysis is consistent with prior exceedances identified in the impacted materials in this area. A sample summary, including parameters analyzed, is presented in Table 5.1. Based on visual observations during the field activities, only the samples from the furthest locations from the former TP-203 location (i.e., SB-2040 through SB-2043) were analyzed.

5.2.3.6 EVALUATION OF PCB-IMPACTED SOIL IN THE AREA OF MW-16

In support of the on-going redevelopment activities at the Site, additional delineation of the area surrounding MW-16, which is located in Commercial Area 4, was proposed to the U.S. EPA on March 26, 2012. Conditional approval of the implementation of these activities was received by U.S. EPA on March 28, 2012 and the activities were initiated on March 29, 2012.

On June 22, 2012, the *Summary of Additional Remedial Investigation Activities, PCB-Impacted Soil in the Area of MW-16* memorandum was submitted to the U.S. EPA Region 5 summarizing the activities conducted. On August 7, 2012, Weyerhaeuser received comments on the June 22, 2012 memorandum. Based on the August 7, 2012 U.S. EPA comments, a response to comments and a *Revised Summary of Additional Remedial Investigation Activities, PCB-Impacted Soil in the Area of MW-16* were submitted to U.S. EPA on September 7, 2012. On October 16, 2012, Weyerhaeuser received comments on the September 7, 2012 memorandum. Based on the October 16, 2012 U.S. EPA comments, a response to comments and a *Revised Summary of Additional Remedial Investigation Activities, PCB-Impacted Soil in the Area of MW-16* were submitted to U.S. EPA on November 16, 2012. U.S. EPA approved the November 16, 2012 version of the *Revised Summary of Additional Remedial Investigation Activities, PCB-Impacted Soil in the Area of MW-16* on December 6, 2012. A copy of the November 16, 2012 *Revised Summary of Additional Remedial Investigation Activities, PCB-Impacted Soil in the Area of MW-16* memorandum is included in Appendix E.

Nine soil borings (SB-2016 through SB-2024), including one adjacent to MW-16, and at a maximum of 10 feet to the north, south, east, and west of MW-16, were advanced utilizing Geoprobe™ direct push technology with continuous

macrocore sampling. One of the soil borings (SB-2020) was advanced adjacent to MW-16 to evaluate additional soil intervals in this location beyond those collected during the RI. The remainder of the initial soil borings was advanced on an approximate 10-foot grid to the north, northeast, northwest, east, west, south, southeast, and southwest of MW-16/SB-2020. An additional six soil borings (SB-2025 through SB-2030) were advanced 10 feet to the north and south of the initial borings. Figures 5.11A/B present the soil boring locations. Soil borings were advanced to 10 feet bgs. Groundwater was encountered between 8 and 10 feet bgs in several of the borings; however, no groundwater samples were collected as part of this investigation. Stratigraphic soil boring logs are presented in Appendix F.

A total of 73 soil samples, including QA/QC samples, were collected during the investigation. Soil samples were collected to represent each 2-foot interval (0 to 2 feet, 2 to 4 feet, 4 to 6 feet, 6 to 8 feet, and 8 to 10 feet) from the ground surface to total depth of the borings, with the exception of SB-2020. Samples were collected from the 4- to 6-foot, 6- to 8-foot, and 8- to 10-foot intervals only from SB-2020. A sample summary, including parameters analyzed, is presented in Table 5.1.

5.2.3.7 DECONTAMINATION

Decontamination of non-disposal equipment was performed consistent with the FSP.

Upon mobilization to the Site and prior to drilling commencement, the drill rig, backhoe, and associated equipment were thoroughly cleaned using a high pressure, low volume steam wash and inspected. Prior to initiation of drilling at subsequent locations, the drill rig, backhoe and other associated equipment were decontaminated to prevent cross-contamination.

All non-disposable sampling equipment was decontaminated prior to each use by using an Alconox wash, potable water rinse, followed by a deionized water rinse and allowed to air dry.

Decontamination water was containerized in a DOT approved 55-gallon drum for future characterization and disposal.

5.2.3.8 MANAGEMENT OF IDW

IDW generated during the implementation of the Additional RI was managed and characterized, consistent with the protocols set forth in the Multi-Area FSP. The IDW generated during this investigation will be properly disposed off Site upon receipt and review of final waste characterization data, as applicable.

5.2.4 UTILITY LINE INSTALLATION ACTIVITIES

In addition to the ongoing RI/FS evaluations being conducted at the Site by Weyerhaeuser, the City of Plainwell and CRA 200 Allegan Street LLC, the current property owners, are initiating property redevelopment activities on portions of the Site. Activities related to the upgrades to M-89 adjacent to the Site, including the installation of a natural gas pipeline by Michigan Gas Utilities, and the installation of two storm sewer lines by the Michigan Department of Transportation (MDOT) that traverse portions of the Site also have the potential to affect the Site. Figure 5.12 shows the natural gas and storm sewer line installation locations.

Natural gas line and storm sewer installation activities were conducted in March and April 2012. During natural gas and storm sewer line installation activities, visual evidence of a variety of fill materials was observed, including demolition type-debris (bricks, lumber, concrete, wires, floor tile, potential transite paneling, metal pipe, etc.), fly ash, coal fragments, and potential paper residuals. Approximate areas of observed fill materials are shown on Figure 5.12. During the removal of the existing subsurface materials and the subsequent backfilling of areas excavated for the installation of the aforementioned utility lines, some of the former subsurface materials were noted to remain at ground surface. The movement of the materials previously present below the current Site grade to the surface, which could be impacted at concentrations above the Part 201 Criteria, has the potential for exacerbation of pre-excavation conditions at these portions of the Site and impact the conclusions of the RI Report. Based on this potential, the below evaluation of pre-RI and RI data in the general vicinity of the utility line installation was performed and summarized in a memorandum entitled *Michigan Gas Utilities and Michigan Department of Transportation Utility Lines*, which was submitted to U.S. EPA on June 27, 2012. A copy of the memorandum is presented in Appendix E.

As part of the review, an comparison was completed related to detections of PCBs in soil samples collected with the observed media sampled, specifically related to potential paper residuals or what were described to be paper residuals, and fill materials containing potential paper residuals. Based on the results and as described in Section 5.4, PCB concentrations in the observed materials comprised of or including potential paper residuals ranged from non-detect to 13.8 milligrams per kilogram (mg/kg). Only one of the samples (from 5.5 to 7.5 feet bgs at SB-301) from the observed potential paper residuals or materials containing potential paper residuals exceeded the Part 201 Residential Criteria, and this location is in Residential Area 4, where no utility installation activities occurred. It should be noted that "gray material" was observed in the 4 to 6-foot sample collected from TP-313, also in Residential Area 4, where no utility installation activities occurred, which was identified to have a concentration of PCBs at 37.9 mg/kg.

Based on review of the information summarized in the June 27, 2012 memorandum, potential exacerbation of soil contamination relative to arsenic was identified associated with the Prince Street storm sewer installation in the vicinity of SB-111, SB-113, and 3A in the area of former Lagoon J. However, given that arsenic is present at ranges similar to the concentrations where potential exacerbation may have occurred, this potential exacerbation will not significantly impact the conclusions of the RI. No other potential exacerbation of soil contamination relative to detected metals was identified associated with the natural gas line and storm sewer installation.

Based on information provided by MDOT, the sewer line bottom elevations ranged from approximately 714.1 to 712.4 feet bgs for the Church Street installation and approximately 715.0. to 712.4 for the Prince Street installation. Copies of available drawings obtained from MDOT are included in Appendix E. Based on the review of groundwater elevations measured in the vicinity of the utility lines, there is the potential for the groundwater table to intersect the bottoms of these lines; however, review of the groundwater contour maps from pre-installation (Figures 2.20 through 2.23) to post-installation (Figure 2.24) shows that the position of the piping and the related bedding material do not significantly impact the flow of groundwater in this area.

5.2.5 BELOW GRADE STRUCTURES AT SLUDGE DEWATERING BUILDING

In addition to the ongoing RI/FS evaluations being conducted at the Site by Weyerhaeuser, the City of Plainwell and CRA 200 Allegan Street LLC, the current property owners, are initiating property redevelopment activities on portions of the Site. Activities related to the modification of the former Sludge Dewatering Building for use as the City of Plainwell Public Safety Building were completed in 2012.

On August 24, 2012 during property redevelopment activities conducted on the western side of the former Sludge Dewatering Building (i.e., new City of Plainwell Public Safety Building), two small below grade structures in series were encountered approximately 3 feet bgs. The structures were of metal construction, with portions of the metal damaged and/or perforated. The structures were oriented in a north-south direction and were attached via polyvinyl chloride piping. The northern structure was observed to be dry, with perforations along the bottom. The southern structure was observed to contain a sludgy liquid, which exhibited a sewage-like odor. No petroleum/solvent odors or staining were noted in the vicinity of the structures. U.S. EPA was notified of the initial structure discovery on August 27, 2012. Subsequent to notification on August 27, 2012, the structures were removed from the ground, placed on polyethylene sheeting on the northwestern corner of the former Sludge Dewatering Building portion of the Site, and covered with polyethylene sheeting for future characterization for off-Site disposal. One soil sample was collected from beneath the structures for analysis for TCL VOCs, PCBs, TCL SVOCs, TAL metals, total cyanide, and Site-specific general chemistry parameters (nitrate, nitrite, and total phosphorus). Additionally, a waste characterization sample was collected from the excavated materials, consistent with Section 5.2.3.8. The excavated materials were subsequently removed and disposed off-Site. A summary of the analytical data for the samples collected in this area and for waste characterization purposes was provided in the September 2012 progress report submitted to the U.S. EPA on October 10, 2012. A copy of the September 2012 progress report is provided in Appendix E.

5.3 DATA COMPARISON TO MICHIGAN ACT 451, PART 201CRITERIA

The below provides a summary of the nature and extent of contamination associated with each of the proposed redevelopment areas evaluated during the RI (i.e., Residential Area 1, Residential Area 2, etc.), based on the evaluation of analytical data collected during RI activities at the Site.

As discussed in Section 2.3, a number of investigations have been conducted at the Site beginning as early as 1996. Summaries of historical soil and groundwater data from the previous investigations, prior to the RI sampling at the Site, along with date from the RI investigations, are presented in Appendix A, B and C, respectively. Figures 5.1 to 5.11 present the associated sampling locations in Residential Areas 1 through 4, Waterfront Plaza, Mixed Residential/Commercial Areas 1 and 2, and Commercial Areas 1 through 4, respectively. For the RI, soil and groundwater samples were analyzed for Target Compound List (TCL) VOCs, TCL SVOCs, Target Analyte List (TAL) metals, cyanide (total), PCBs, and general chemistry parameters including nitrogen and phosphorus compounds. Based on the results of TAL metals analysis, select soil samples were also analyzed for SPLP for results that exceed the Act 451, Part 201 GSIPC. Select soil samples were also analyzed for speciated (trivalent [Cr^{+3}] and hexavalent [Cr^{+6}]) chromium. Additionally, groundwater samples collected in August 2012 were analyzed for amenable cyanide. Analytical results for the soil and groundwater samples were evaluated against the Generic Residential and Non-Residential Cleanup Criteria and Screening Levels established in Part 7 of Administrative Rules, effective September 28, 2012, pursuant to Part 201, Environmental Remediation, 1994 PA 451 as amended, that were presented in Section 2.3.

Tables summarizing exceedances of the Part 201 Generic Residential and Non-Residential Cleanup Criteria for Residential Areas 1 through 4, Waterfront Plaza, Mixed Residential/Commercial Areas 1 and 2, and Commercial Areas 1 through 4 are presented in Tables 2.1 through 2.11, Tables 2.12 through 2.22, and Tables 2.23 through 2.33, for soil, groundwater, and soil SPLP, respectively. Tables A.1 through A.12 in Appendix A provide summaries of soil analytical data with comparison to Part 201 Generic Residential and Non-Residential Cleanup Criteria. Tables B.1 through B.10 in Appendix B provide summaries of the groundwater analytical data with comparison to Part 201 Generic Residential and Non-Residential Cleanup Criteria. Tables C.1 through C.11 in Appendix C

provide summaries of the SPLP soil sample analytical data with comparison to Part 201 Generic Residential and Non-Residential Cleanup Criteria. Sections 5.3.1, 5.3.2, and 5.3.3 provide a summary of exceedances of Part 201 Generic Residential and Non-Residential Cleanup Criteria by redevelopment area for samples collected during the Phase I, II, and Additional RI activities, which were utilized in conjunction with the Pre-RI analytical results presented in Sections 2.3.1.1 and 2.3.1.2 for an overall evaluation of the Site. This summary is based on strict comparison the Part 201 Generic Residential and Non-Residential Cleanup Criteria and does not take into consideration future land use or completeness of pathways.

As discussed in Section 2.3.1, as part of the development of the Phase II RI Work Plan, a review of the Pre-RI data was conducted to assess the usability of the data for inclusion in the RI. Based on that review and available information provided, there is no information available that would suggest the data quality of the Pre-RI data is questionable. Therefore, given the above and the lack of any indication that the data is not usable for the purposes of the RI, despite the absence of a QAPP, there is no reason to question the quality of these data and it has been utilized in conjunction with the RI data in this report. Pre-RI and RI data have been evaluated qualitatively and quantitatively, along with other existing information, to evaluate potential sources of impacts identified through the investigations. The qualitative review considered sample locations and depths, chemicals analyzed, analytical methods, and any related field observations. The quantitative review is based on a comparison of results to the Part 201 Generic Residential and Non-Residential Cleanup Criteria. The Part 201 Residential Cleanup Criteria were used as a screening criteria to identify chemicals in the data set that may be potentially significant in areas to be utilized in the future for residential purposes. The Part 201 Residential and Non-Residential Cleanup Criteria were used as screening criteria to focus on the chemicals and concentrations that have the highest potential to be significant at on-Site locations based on current and reasonably expected future land uses. The Site-specific risk-based approach discussed in Section 8.0 can be utilized to more accurately identify potential risks that may exist at the Site, as required based on anticipated future use at the Site.

Based on the qualitative and quantitative review, a list of presentation parameters was developed based on a screening against the Part 201 Residential and Non-Residential Cleanup Criteria. Any parameters that exceeded any of the Part 201 Residential or Non-Residential Cleanup Criteria were identified as a

presentation parameter for all sample locations across the Site by media, if analysis was completed for a given constituent. Databox summaries of the identified presentation parameters are presented by area, constituent group (i.e., VOCs, SVOCs, etc.), and location in the drawings section of this report. The databoxes identify exceedances of specific Part 201 criteria by highlighting and listing the individual criteria exceeded. It should be noted that not all constituents may be shown for all locations on the databox figures if exceedances were not present, but are included in the tables.

5.3.1 SOIL

Residential Area 1

Exceedances of constituents in soil samples are present at various locations in Residential Area 1 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SS-100	0 – 2	Residential and Non-Residential DWPC GSIPC	Manganese
MW-14	0 - 2	Residential and Non-Residential DWPC GSIPC	Manganese
	8 - 10	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC Residential DCC	Arsenic
SB-101	0 -1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
	6.8 – 8.8	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Cyanide (total)

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-102	0 – 1	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-103	0 -1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
	7 -9	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-104	0 -1	GSIPC	Cyanide (total)
		Residential DWPC	Magnesium
		GSIPC	Mercury
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	3 – 5	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Iron
		GSIPC	Mercury
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	5 - 7	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-106	0 – 1	Residential DWPC	Magnesium
	3.5 – 5.5	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Chromium
		GSIPC	Mercury
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
SB-107	0 – 1	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		GSIPC	Selenium
	4.5 – 6.5	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Selenium
	6.5 – 8.5	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Mercury
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-108	0 – 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	6.5 – 8.5	Residential and Non-Residential DWPC	Iron
		GSIPC	Mercury
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-109	0 – 2	Residential DWPC	Magnesium
	8 - 10	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	4-Methylphenol

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-110	0 – 1	Residential DWPC	Magnesium
	8 – 10	Residential and Non-Residential DWPC	Methylene chloride
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		GSIPC	Selenium
		Residential and Non-Residential DWPC GSIPC	Manganese
SB-111	0 – 1	Residential DWPC	Magnesium
	7 - 9	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Chromium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-112	0 – 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
	6 - 8	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Aluminum
		GSIPC	4-Methylphenol
		GSIPC	Naphthalene
SB-113	0 – 1	Residential DWPC	Magnesium
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-114	0 – 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Selenium
SB-115	0 – 1	Residential DWPC	Magnesium
	3 – 5	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Mercury
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC	Magnesium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-116	0 – 1	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
	9.5 - 10	GSIPC	Selenium
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Chromium
SB-117	0 – 1	Residential and Non-Residential DWPC	Magnesium
	8 – 10	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
SB-118	0 – 1	GSIPC	Selenium
		GSIPC	Mercury
		GSIPC	Xylenes (total)
	7.5 – 9.5	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-119	0 – 1	Residential DWPC	Magnesium
		GSIPC	Phenanthrene
	8 - 10	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Arsenic
SB-120	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	7.75 - 9.75	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
SB-121	0 - 1	GSIPC	Mercury
	1 - 3	Residential DWPC	Magnesium
	11 - 13	Residential DWPC	Magnesium
SB-122	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
SB-123	0 – 1	Residential DWPC	Magnesium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-132	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-143	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
	8 - 10	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC	Iron
VA-1	0 - 2	Residential DWPC	Magnesium
	8 - 10	GSIPC	Ethylbenzene
		Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Aluminum
		GSIPC	Chromium
		GSIPC	Selenium
		GSIPC	4-Methylphenol
		GSIPC	4-Chloro-3-methylphenol
		Residential and Non-Residential DWPC	Pentachlorophenol
		GSIPC	2,4,6-Trichlorophenol

Exceedances of VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Residential Area 1 are presented on Plans 1, 2, and 3, respectively.

Residential Area 2

Exceedances of constituents in soil samples are present at various locations in Residential Area 2 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-105	0 - 1	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
	1 – 3	Residential and Non-Residential DWPC	Benzene
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
	3 – 5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Manganese
	8 - 10	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC	Iron
SB-124	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	7 - 9	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
SB-125	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Arsenic
	9.25 - 10	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-126	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
	7.5 - 9.5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Chromium
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
SB-127	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Selenium
	6.5 - 8.5	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		GSIPC	Chromium
		GSIPC	Copper
		GSIPC	Zinc
		GSIPC	Mercury
		Residential and Non-Residential DWPC GSIPC	Arsenic
	10.5 - 12.5	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Copper
		GSIPC	Mercury
SB-128	0 - 1	Residential and Non-Residential DWPC	Magnesium
	11.5 - 13.5	Residential and Non-Residential DWPC GSIPC	Arsenic
SB-129	0 - 1	Residential DWPC	Magnesium
	6 - 8	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC GSIPC	Arsenic
		Residential DWPC	Magnesium
SB-130	0 - 1	GSIPC	Chromium
		GSIPC	Selenium
	12.5 - 14.5	Residential DWPC	Magnesium
SB-131	0 - 1	Residential DWPC	Magnesium
	6 - 8	Residential DWPC	Magnesium

Analytical results for VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Residential Area 2 are presented on Plans 5, 6, and 7, respectively.

Residential Area 3

Exceedances of constituents in soil samples are present at various locations in Residential Area 3 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
MW-15	0 - 2	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	4 – 6	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Phenanthrene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-134	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
	1.5 - 3.5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-135	0 - 1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC GSIPC	Arsenic
	8 - 10	GSIPC	Cyanide (total)
		Residential DWPC	Magnesium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-136	0 - 1	Residential DWPC	Magnesium
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Iron
	8 - 10	Residential and Non-Residential DWPC	Methylene chloride
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Copper
		GSIPC	Zinc
		GSIPC	Mercury
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-137	0 - 1	Residential DWPC	Magnesium
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-138	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	Residential DWPC	Magnesium
SB-139	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Chromium
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	6 - 8	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-140	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10		
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-141	0 - 1	Residential and Non-Residential DWPC GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	9 - 11	Residential and Non-Residential DWPC	Magnesium
TP-319	0 - 1	Residential DWPC	Magnesium
		GSIPC	Selenium
	6 - 8	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
TP-320	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
	6 - 8	Residential DWPC	Magnesium

Analytical results for VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Residential Area 3 are presented on Plans 8, 9, and 10, respectively.

Residential Area 4

Exceedances of constituents in soil samples are present at various locations in Residential Area 4 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-301	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Xylenes (total)
		GSIPC	Selenium
	5.5 - 7.5	Residential DCC	Total PCBs
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Copper
		GSIPC	Zinc
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		Residential DCC	Lead
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Mercury
		Residential and Non-Residential DWPC	Aluminum
		GSIPC	Selenium
SB-302	0 - 1	Residential and Non-Residential DWPC GSIPC	Ethylbenzene
		Residential and Non-Residential DWPC	Benzene
		Residential and Non-Residential DWPC GSIPC	Xylenes (total)
		Residential and Non-Residential DWPC GSIPC	Toluene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Cyanide (total)
		GSIPC	Mercury
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	6.8 - 8.8	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Chromium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		GSIPC	Copper
		GSIPC	Zinc
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC GSIPC	Mercury
	8.8 - 9.8	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Silver
		Residential and Non-Residential DWPC GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Copper
		GSIPC	Zinc
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		Residential DCC	Lead
		Residential and Non-Residential DWPC GSIPC	Mercury
SB-321	0 - 1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	7 - 9	Residential DWPC	Magnesium
TP-302	0.5 - 1.5	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential DCC	Benzo(a)pyrene
		GSIPC	Carbazole
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
	4 - 6	Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Lead

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		Residential and Non-Residential DCC	
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		GSIPC	Mercury
	10 - 11	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Chromium
TP-308	0 - 1	Residential and Non-Residential DWPC GSIPC	Ethylbenzene
		Residential and Non-Residential DWPC Residential SVIAC	Benzene
		Residential and Non-Residential DWPC GSIPC	Xylenes (total)
		Residential and Non-Residential DWPC GSIPC	Toluene
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Naphthalene
	4 - 6	GSIPC	Cyanide (total)
TP-309	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	6 - 8	Residential and Non-Residential DWPC	Magnesium
TP-310	1 - 2	GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
TP-311	0 - 1	Residential and Non-Residential DWPC	Iron
		GSIPC	Phenanthrene
		GSIPC	Xylenes (total)
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	4 - 6	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
TP-312	0 - 1	GSIPC	Ethylbenzene
		GSIPC	Toluene

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		Residential and Non-Residential DWPC GSIPC	Xylenes (total)
		Residential and Non-Residential DWPC	Benzene
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Mercury
		GSIPC	Phenanthrene
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Selenium
	5 - 7	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Magnesium
TP-313	2 - 4	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	4 - 6	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Silver
		Residential and Non-Residential DWPC GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Zinc
		Residential and Non-Residential DWPC GSIPC	Mercury
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential and Non-Residential DCC	Total PCBs
		Residential DCC	Lead
		GSIPC	Selenium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		Residential and Non-Residential DWPC	Phosphorus
	8 - 9	GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
TP-314	0 - 1	GSIPC	Ethylbenzene
		GSIPC	Toluene
		Residential and Non-Residential DWPC GSIPC	Xylenes (total)
		Residential and Non-Residential DWPC	Benzene
		GSIPC	Phenanthrene
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Selenium
	6 - 8	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Silver
		GSIPC	Barium
		Residential and Non-Residential DWPC GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Copper
		GSIPC	Zinc
		Residential and Non-Residential DWPC GSIPC	Mercury
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC Residential and Non-Residential DCC	Lead
		GSIPC	Selenium
	10 - 11	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
TP-315	0 - 1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	4 - 6	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC GSIPC	Arsenic

Analytical results for VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Residential Area 4 are presented on Plans 12, 13, and 14, respectively.

Waterfront Plaza

Exceedances of constituents in soil samples are present at one location in the Waterfront Plaza as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
TP-301	6 - 8	Residential and Non-Residential DWPC	Magnesium
	8 - 10	Residential DWPC	Magnesium
		GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Arsenic

Analytical results for VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Waterfront Plaza are presented on Plans 16, 17, and 18, respectively.

Mixed Residential/Commercial Area 1

Exceedances of constituents in soil samples are present at various locations in Mixed Residential/Commercial Area 1 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-334	0 - 1	GSIPC	Cyanide (total)
		Residential DWPC	Magnesium
	8 - 10	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Chromium
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-335	0 - 1	Residential and Non-Residential DWPC GSIPC	Cobalt

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-336	8 - 10	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-337	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	10.5 - 12.5	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
SB-338	0 - 1	Residential and Non-Residential DWPC	Magnesium
	8 - 10	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-339	2.75 - 3.75	GSIPC	Mercury
		Residential DWPC	Magnesium
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Tetrachloroethene
	8 - 10	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Magnesium
SB-341	0 - 1	Residential DWPC	Magnesium
	8 - 10	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
TP-303	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
	6 - 8	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
TP-306	0.5 - 1.5	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Manganese
	6 - 7	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
TP-333	0 - 1	Residential DWPC	Magnesium
		GSIPC	Selenium
	6 - 8	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
TP-334	0 - 1	Residential and Non-Residential DWPC Non-Residential PSIC GSIPC	Manganese
		GSIPC	Mercury
		GSIPC	Selenium
	7 - 9	Residential and Non-Residential DWPC	Magnesium
TP-335	0 - 1	Residential DWPC	Magnesium
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
TP-336	0 - 1	GSIPC	Cyanide (total)
		Residential DWPC	Magnesium
	8 - 10	Residential DWPC	Magnesium

Analytical results for VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Mixed Residential/Commercial Area 1 are presented on Plans 20, 21, and 22, respectively.

Mixed Residential/Commercial Area 2

Exceedances of constituents in soil samples are present at various locations in Mixed Residential/Commercial Area 2 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-2010	0 - 1	Residential and Non-Residential DWPC GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	7 - 9	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-2011	0 - 1	GSIPC	Mercury

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
	3.4 - 4.75	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Iron
		GSPIC	Mercury
		GSIPC	Carbazole
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
	12.5 - 14.5	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-2013	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Chromium
		GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC Residential and Non-Residential DCC	Lead
	3 - 5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Chromium
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential DWPC	Magnesium
SB-205	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC GSIPC	Manganese

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
	2.5 - 4.5	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC GSIPC	Manganese
SB-206	0.5 – 1.5	Residential DWPC	Magnesium
	2.5 - 4.5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
SB-207	0 - 1	Residential DWPC	Magnesium
	3 - 5	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-208	0 - 1	Residential and Non-Residential DWPC	Benzene
		GSIPC	Xylenes (total)
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Zinc
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	4 - 6	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Xylenes (total)
		GSIPC	Ethylbenzene
SB-209	0 - 1	Residential and Non-Residential DWPC	Nitrate (as N)

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		GSIPC	Toluene
		Residential and Non-Residential DWPC	Benzene
		GSIPC	Xylenes (total)
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Chromium
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
	6 - 8	Residential DWPC	Magnesium
		GSIPC	Selenium
SB-210	0.5 - 1.5	GSIPC	Naphthalene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Ethylbenzene
		Residential and Non-Residential DWPC	Benzene
		GSIPC	Xylenes (total)
	3 - 5	Residential and Non-Residential DWPC	Iron
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Xylenes (total)
		GSIPC	Ethylbenzene
		Residential and Non-Residential DWPC	Benzene
SB-211	4 - 6	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-212	0 - 1	GSIPC	Cyanide (total)
		GSIPC	Selenium
	4 - 6	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-213	0 - 1	GSIPC	Selenium
	4 - 6	Residential and Non-Residential DWPC	Magnesium
SB-214	0 - 1	GSIPC	Selenium
	3.5 - 5.5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
SB-215	0 - 1	Residential and Non-Residential DWPC GSIPC	Cobalt
	4 - 6	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
SB-216	0 - 4	GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
SB-217	0 - 1	Residential and Non-Residential DWPC	Iron
		GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	GSIPC	Chromium
		Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
SB-218	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
	2.5 - 4.5	Residential and Non-Residential DWPC	Iron
		GSIPC	Chromium
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Selenium
SB-219	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
SB-220	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Zinc
		Residential and Non-Residential DWPC GSIPC	Mercury
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Copper
		Residential and Non-Residential DWPC Residential and Non-Residential DCC	Lead
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
SB-221	2 - 4	Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC GSIPC	Manganese

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-222	1.5 - 3.5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		GSIPC	Zinc
		Residential and Non-Residential DWPC GSIPC	Mercury
		GSIPC	Silver
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		Residential and Non-Residential DWPC Residential DCC	Lead
		GSIPC	Copper
		Residential DCC	Indeno(1,2,3-cd)pyrene
		Residential DCC	Benzo(b)fluoranthene
		GSIPC	Fluoranthene
		Residential DCC	Benzo(a)anthracene
		Residential DWPC GSIPC	Phenanthrene
		GSIPC	Dibenzofuran
		Residential DCC	Dibenzo(a,h)anthracene
		GSIPC	Fluorene
		GSIPC	Carbazole
		GSIPC	Naphthalene
		Residential and Non-Residential DCC	Benzo(a)pyrene
SB-223	1 - 4	Residential and Non-Residential DWPC	Methylene chloride
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-224	1 - 2	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Mercury
	2 - 4	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Mercury
SB-225	1 - 4	GSIPC	Selenium
SB-226	1 - 4	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Chromium
		GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-227	0.4 – 1.4	Residential DWPC	Magnesium
	1.5 – 3.5	GSIPC	Mercury
		Residential DWPC	Magnesium
SB-229	0 - 1	GSIPC	Mercury
		Residential DWPC	Magnesium
	0.5 - 1.5	Residential DWPC	Magnesium
		GSIPC	Selenium
SB-230	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
	3 - 5	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-231	0 - 1	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Copper
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Chromium
		Residential DWPC GSIPC	Zinc
		Residential and Non-Residential DWPC GSIPC	Mercury
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
		Residential DWPC	Phosphorus
SB-232	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC GSIPC	Chromium
		GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
	6 - 8	Residential DWPC	Phosphorus
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Chromium
		GSIPC	Mercury
		Residential and Non-Residential DWPC GSIPC	Thallium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC GSIPC	Selenium
		Residential and Non-Residential DWPC Residential PSIC Residential and Non-Residential DCC GSIPC	Arsenic

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-233	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Chromium
		GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Xylenes (total)
	2.5 - 4.5	Residential and Non-Residential DWPC	Magnesium
SB-234	0 - 1	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
	4 - 6	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Magnesium
SB-235	0.5 - 1.5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-236	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Chromium
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-237	0 - 1	Residential and Non-Residential DWPC	Trichloroethene
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
		Residential DCC	Benzo(a)pyrene
		GSIPC	Carbazole
	2 - 4	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		GSIPC	Carbazole
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		Residential DCC	Benzo(a)pyrene
		GSIPC	Phenanthrene
		GSIPC	Fluoranthene

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-238	0 - 1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Zinc
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
	2 - 4	Residential and Non-Residential DWPC	Nitrate (as N)
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Mercury
		Residential and Non-Residential DWPC	Pentachlorophenol
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC GSIPC	Selenium
		Residential DCC	Lead
		GSIPC	Xylenes (total)
SB-240	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	4 - 6	Residential and Non-Residential DWPC	Magnesium
SB-241	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
	4 - 6	Residential DWPC	Magnesium
SB-242	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
	4 - 6	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
SB-243	0 - 1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential DCC	Lead
	4 - 6	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-244	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	4 - 6	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-246	0 - 1	GSIPC	Cyanide (total)
		GSIPC	Selenium
	3 - 4	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Xylenes (total)
		GSIPC	Phenanthrene
		Residential and Non-Residential DWPC	Trichloroethene
	4 - 6	Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Selenium
SB-254	0 - 4	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Cyanide (total)
		GSIPC	Mercury
SB-255	1 - 2	GSIPC	Mercury
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2 - 4	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-256B	0 - 1	GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	2.5 - 4.5	GSIPC	Cyanide (total)
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
SB-257	2 - 4	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Cobalt
SB-258	0.8 - 3	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		GSIPC	Zinc
		GSIPC	Silver
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Copper
		Residential and Non-Residential DWPC GSIPC	Mercury

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		Residential and Non-Residential DWPC Residential and Non-Residential DCC	Lead
SB-259	1 - 4	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
SB-262	1 - 2	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	2.5 - 4.5	Residential DWPC	Magnesium
SB-303	0 - 2	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3.5 - 5.5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC GSIPC	Manganese
	5.5 - 7.5	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
	8 - 10	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC	Magnesium
SB-304	0 - 2	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Tetrachloroethene
		GSIPC	Xylenes (total)
		Residential and Non-Residential DWPC	Benzene
	4 - 6	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Arsenic
	6 - 8	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
	8 - 10	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-305	0 - 2	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Methylene chloride
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Xylenes (total)
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Iron
SB-306	0 - 1	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Xylenes (total)
		GSIPC	Mercury
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	7.5 - 9.5	GSIPC	Chromium
	9.5 - 11	Residential and Non-Residential DWPC	Magnesium
SB-307	0 - 1	GSIPC	Ethylbenzene
		Residential and Non-Residential DWPC	Benzene
		Residential and Non-Residential DWPC GSIPC	Xylenes (total)
		GSIPC	Mercury
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	6 - 8	Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
	8 - 10	Residential and Non-Residential DWPC	Magnesium
CTP-4	4	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DCC	Benzo(a)pyrene

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		Residential DCC	Dibenzo(a,h)anthracene
		Residential DCC	Benzo(a)anthracene
		GSIPC	Phenanthrene
		GSIPC	2-Methylnaphthalene
SB-308	0 - 2	Residential DWPC	Magnesium
	3 - 5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	7.5 - 9.5	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
SB-309	0 - 1	Residential and Non-Residential DWPC	Tetrachloroethene
		GSIPC	Xylenes (total)
		GSIPC	Mercury
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC	Iron
		GSIPC	Selenium
	12.5 - 14.5	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-310	0 - 1	Residential and Non-Residential DWPC GSIPC	Ethylbenzene
		GSIPC	Toluene
		Residential and Non-Residential DWPC	Benzene
		Residential and Non-Residential DWPC GSIPC	Xylenes (total)
		GSIPC	Phenanthrene
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC Residential DCC	Arsenic

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		GSIPC	
		GSIPC	Selenium
	12 - 14	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-311	0 - 1	Residential DWPC	Magnesium
		GSIPC	Mercury
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Xylenes (total)
		GSIPC	Selenium
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
		GSIPC	Dibenzofuran
		GSIPC	Fluorene
		GSIPC	Carbazole
	13 - 15	Residential and Non-Residential DWPC	Magnesium
SB-312	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
TP-339	0 - 1	GSIPC	Ethylbenzene
		Residential and Non-Residential DWPC	Benzene
		Residential and Non-Residential DWPC GSIPC	Xylenes (total)
		GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
TP-340	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		GSIPC	Selenium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
	3 - 4	Residential and Non-Residential DWPC	Iron
		GSIPC	Phenanthrene
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Copper
TP-342	0 - 1	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Iron
		GSIPC	Zinc
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Copper
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
	3.5 - 4	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
TP-343	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 4	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
TP-344	0 - 1	Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC GSIPC	Manganese
	1 - 3	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	4 - 6	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Vanadium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Tetrachloroethene
MW-19	0 - 2	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Xylenes (total)
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Manganese

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		GSIPC	
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Mercury
	8 - 10	Residential DWPC	Magnesium

Analytical results for VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Mixed Residential/Commercial Area 2 are presented on Plans 24A and 24B, 25A and 25B, and 26A and 26B, respectively.

Commercial Area 1

Exceedances of constituents in soil samples are present at various locations in Commercial Area 1 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SS-101	0 - 2	Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Selenium
SS-102	0 – 2	Residential and Non-Residential DWPC GSIPC	Manganese
SS-103	0 - 2	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SS-104	0 - 2	Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Selenium
SS-105	0 - 2	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Non-Residential PSIC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SS-106	0 – 2	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SS-107	0 – 2	Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Selenium
SB-133	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	7 - 9	Residential DWPC	Magnesium
		GSIPC	Zinc
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Xylenes (total)
SB-142	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
	8.5 - 10.5	Residential DWPC	Magnesium
SB-144	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
	7 - 9	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Chromium
SB-145	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
	7.5 - 9.5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic

Analytical results for VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Commercial Area 1 are presented on Plans 28, 29, and 30, respectively.

Commercial Area 2

Exceedances of constituents in soil samples are present at various locations in Commercial Area 2 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-323	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-325	0 - 1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC GSIPC	Manganese
	8 - 10	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
SB-326	8 - 10	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
SB-327	0 - 1	Residential and Non-Residential DWPC	Methylene chloride
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
SB-327B	8 - 10	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-328	0 - 1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Chromium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-329	0 - 1	Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Magnesium
SB-330	0 - 1	Residential DWPC	Magnesium
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-331	8 - 10	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
SB-340	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-342	0 - 1	GSIPC	Cyanide (total)
	8 - 10	GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-343	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
TP-316	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	6 - 8	Residential DWPC	Magnesium
		GSIPC	Selenium
TP-317	0 - 1	Residential DWPC	Magnesium
	4 - 6	Residential and Non-Residential DWPC	Magnesium
TP-318	6 - 8	GSIPC	Selenium
TP-321	0 - 1	Residential and Non-Residential DWPC	Methylene chloride
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
TP-322	6 - 8	GSIPC	Cyanide (total)
		GSIPC	Selenium
TP-323	0 - 1	GSIPC	Selenium
TP-324	0 - 1	GSIPC	Selenium
	9 - 10	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential DWPC	Magnesium
TP-325	0 - 1	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
	8 - 10	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
TP-326	6 - 8	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
TP-327	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	7 - 9	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
TP-328	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
	6 - 8	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic

Analytical results for VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Commercial Area 2 are presented on Plans 32, 33, and 34, respectively.

Commercial Area 3

Exceedances of constituents in soil samples are present at various locations in Commercial Area 3 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
MW-18	0 - 2	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-248	0 - 1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	4 - 6	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	0.5 - 1.5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
TP-304	0.5 - 1.5	Residential and Non-Residential DWPC	Methylene chloride
		Residential and Non-Residential DWPC GSIPC	Mercury
	5 - 7	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Cobalt
TP-305	0.5 - 1.5	Residential and Non-Residential DWPC	Methylene chloride
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2 - 4	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC GSIPC	Arsenic
	6 - 8	Residential DWPC	Magnesium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
TP-307	0.5 - 1.5	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
	2 - 3	Residential and Non-Residential DWPC	Methylene chloride
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
TP-337	0 - 1	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
	2 - 4	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	GSIPC	Cyanide (total)
		Residential DWPC	Magnesium
		GSIPC	Selenium
TP-338	0 - 1	GSIPC	Selenium
		GSIPC	Xylenes (total)
		Residential and Non-Residential DWPC	Benzene
	8 - 10	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium

Analytical results for VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Commercial Area 3 are presented on Plans 36, 37, and 38, respectively.

Commercial Area 4

Exceedances of constituents in soil samples are present at various locations in Commercial Area 4 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
MW-16	0 - 2	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Chromium
		GSIPC	Mercury
		Residential DCC	Total PCBs
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential DWPC	Magnesium
	8 - 10	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Mercury
MW-17	0 - 2	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC	Iron
	8 - 10	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-201	0 - 1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Iron
		GSIPC	Copper
		GSIPC	Zinc
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2 - 4	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		GSIPC	Copper
		GSIPC	Zinc
		GSIPC	Mercury
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC Residential DCC	Lead
SB-202	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		GSIPC	Chromium
		GSIPC	Copper
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2 - 4	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		GSIPC	Copper
		GSIPC	Zinc
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-203	0 - 1	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		GSIPC	Mercury
	2 - 4	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		GSIPC	Chromium
		GSIPC	Zinc
		GSIPC	Mercury
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC Residential DCC	Lead
		Residential DWPC GSIPC	Silver
		GSIPC	Phenanthrene
		GSIPC	Selenium
		Residential and Non-Residential DWPC GSIPC	Copper
SB-204	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2 - 4	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		GSIPC	Copper
		GSIPC	Zinc
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-245	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	5 - 7	Residential and Non-Residential DWPC	Magnesium
SB-249	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	12 - 14	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
SB-250	0 - 1	Residential and Non-Residential DWPC	Iron
		GSIPC	Selenium
	3 - 5	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-253	2.5 - 4.5	Residential and Non-Residential DWPC	Magnesium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-263	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC GSIPC	Tetrachloroethene
		Residential and Non-Residential DWPC GSIPC	1,1,1-Trichloroethane
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-264	0 - 1	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Benzene
		Residential and Non-Residential DWPC	Trichloroethene
		Residential and Non-Residential DWPC	Iron
		GSIPC	Mercury
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Copper
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
		GSIPC	Xylenes (total)
	2.5 - 4.5	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-265	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Naphthalene
		Residential and Non-Residential DWPC	Antimony
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Phenanthrene
		Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Benzene
		GSIPC	Mercury
		GSIPC	Xylenes (total)
	2 - 4	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Methylene chloride
SB-266	1.4 - 2.4	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	2.5 - 4.5	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Magnesium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-267	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Chromium
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	2.5 - 4.5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-268	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	5 - 7	Residential and Non-Residential DWPC	Magnesium
SB-269	0 - 1	Residential DWPC	Magnesium
	2.5 - 4.5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
SB-270	0 - 1	GSIPC	Selenium
		Residential and Non-Residential DWPC GSIPC	Manganese
SB-270B	0 - 1	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Tetrachloroethene
SB-271	1.5 - 4	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-272	1 - 3	Residential and Non-Residential DWPC	Aluminum
		GSIPC	Chromium
		Residential and Non-Residential DWPC GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-273	1 - 3	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Chromium
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
SB-274	0 - 1	Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential and Non-Residential PSIC GSIPC	Manganese
	2.5 - 4.5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-275	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2.5 - 4.5	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-276	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	4 - 6	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-277	0 - 1	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Iron
		GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
SB-278	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-279	0 - 1	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Cyanide (total)
SB-280	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-281	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Chromium
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential DWPC	Sodium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		Residential DWPC	Phosphorus
SB-282	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-283	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-284	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2.5 - 4.5	Residential and Non-Residential DWPC	Methylene chloride
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-285	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
	4 - 6	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-286	0 - 1	Residential and Non-Residential DWPC GSIPC	Tetrachloroethene
		GSIPC	Selenium
		GSIPC	Phenanthrene
		GSIPC	Naphthalene
		GSIPC	Xylenes (total)
	4 - 6	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
SB-287	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential DWPC	Magnesium
		GSIPC	Selenium
SB-288	0 - 1	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	5 - 7	Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
SB-289	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	5 - 7	Residential and Non-Residential DWPC	Magnesium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-290	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
	5 - 7	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Chromium
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Copper
SB-291	0 - 1	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-292	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential DWPC	Magnesium
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-293	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2.5 - 4.5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Cobalt
SB-294	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Iron
SB-295	0 - 1	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		GSIPC	Chromium
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
SB-296	0 - 1	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
	2.5 - 4.5	Residential DWPC	Magnesium
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-297	0 - 1	Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
	1 - 2	GSIPC	Cyanide (total)
		Residential and Non-Residential DWPC	Iron
		GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Xylenes (total)
		GSIPC	Selenium
	14 - 16	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
SB-298	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3.5 - 4.5	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
SB-299	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	4 - 5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-2001	0 - 1	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	2.75 - 4.75	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-2002	0 - 1	Residential DWPC	Phosphorus
		Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2.5 - 4.5	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium
SB-2003	0 - 1	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	1.5 - 3.5	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
SB-2004	0 - 1	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2 - 4	Residential DWPC	Magnesium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-2005	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	2.5 - 4.5	Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Mercury
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
SB-2006	2 - 5	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-2007	0 - 1	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
	2.5 - 4.5	GSIPC	Selenium
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
SB-2008	0 - 1	Residential DWPC	Phosphorus
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	3 - 5	Residential and Non-Residential DWPC	Magnesium
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-2009	1 - 2	Residential and Non-Residential DWPC	Tetrachloroethene
		Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Chromium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
	5 - 7	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium
SB-2012	0 - 1	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
	3 - 5	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Selenium

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-2014	0.5 – 1.5	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC GSIPC	Arsenic
		GSIPC	Cyanide (total)
	12.5 – 13.5	Residential and Non-Residential DWPC	Magnesium
SB-2015	0.5 – 1.5	Residential and Non-Residential DWPC	Magnesium
	12.5 – 13.5	Residential DWPC	Magnesium
SB-2016	4 – 6	Residential and Non-Residential DCC	PCBs (total)
	6 – 8	Residential and Non-Residential DCC	PCBs (total)
SB-2017	2 – 4	Residential DCC	PCBs (total)
	4 – 6	Residential and Non-Residential DCC	PCBs (total)
	6 – 8	Residential and Non-Residential DCC	PCBs (total)
SB-2021	4 – 6	Residential and Non-Residential DCC	PCBs (total)
SB-2022	2 – 4	Residential DCC	PCBs (total)
	4 – 6	Residential and Non-Residential DCC	PCBs (total)
	6 – 8	Residential and Non-Residential DCC	PCBs (total)
	8 – 10	Residential DCC	PCBs (total)
SB-2023	2 – 4	Residential DCC	PCBs (total)
SB-2027	6 – 8	Residential DCC	PCBs (total)
SB-2028	4 – 6	Residential and Non-Residential DCC	PCBs (total)
	6 – 8	Residential and Non-Residential DCC	PCBs (total)
	8 – 10	Residential and Non-Residential DCC	PCBs (total)
SB-2029	4 – 6	Residential DCC	PCBs (total)
SB-2030	2 – 4	Residential DCC	PCBs (total)
	6 – 8	Residential DCC	PCBs (total)
	8 - 10	Residential DCC	PCBs (total)
SB-2040	1.5 – 2.5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Naphthalene
SB-2041	1 – 2	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Mercury
SB-2042	2 – 5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Naphthalene
SB-2043	2.5 – 2.7	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC	Arsenic

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		Residential DCC GSIPC	
		GSIPC	Selenium
		GSIPC	Mercury
TP-5	6	GSIPC	Mercury
		Residential and Non-Residential DWPC GSIPC	Chromium
		GSIPC	Selenium
		Residential DCC	Benzo(a)pyrene
TP-17	7	GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
TP-18	8	GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cadmium
		Residential and Non-Residential DWPC GSIPC	Chromium
		GSIPC	Selenium
		GSIPC	Fluoranthene
		Residential DCC	Benzo(a)pyrene
		GSIPC	Phenanthrene
TP-19	8	GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
TP-20	6	GSIPC	Mercury
		Residential and Non-Residential DWPC GSIPC	Arsenic
	8.5	Residential and Non-Residential DWPC GSIPC	Mercury
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
TP-201	1 - 2	Residential and Non-Residential DWPC	Iron
		Residential DWPC	Magnesium
		Residential and Non-Residential DWPC	Pentachlorophenol
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		Residential and Non-Residential DWPC	Tetrachloroethene

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
	8 - 10	Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Fluoranthene
TP-202	0.5 - 1.5	Residential and Non-Residential DWPC GSIPC	Manganese
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
	8 - 10	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
TP-203	8 - 10	Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
TP-341	0.5 - 1.5	Residential and Non-Residential DWPC	Aluminum
		Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Chromium
		GSIPC	Zinc
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		Residential DCC	Lead
		GSIPC	Copper
		GSIPC	Fluoranthene
		GSIPC	Phenanthrene
		Residential and Non-Residential DWPC GSIPC	Tetrachloroethene
	3.5 - 5	Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC GSIPC	Arsenic
NW Sidewall	1.5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Mercury
		GSIPC	Naphthalene
SE Floor	3	Residential and Non-Residential DWPC GSIPC	Manganese
		GSIPC	Selenium
NW Floor	3	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC GSIPC	Manganese

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
		Residential and Non-Residential DWPC GSIPC	Arsenic
NE Sidewall	2	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		Residential and Non-Residential DWPC GSIPC	Cobalt
		GSIPC	Selenium
		GSIPC	Naphthalene
SE Sidewall	1.5	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC	Magnesium
		Residential and Non-Residential DWPC Residential and Non-Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Naphthalene
SW Sidewall	2	Residential and Non-Residential DWPC	Iron
		Residential and Non-Residential DWPC Residential DCC GSIPC	Arsenic
		GSIPC	Selenium
		GSIPC	Naphthalene

Analytical results for VOCs, SVOCs and PCBs, and metals and inorganics in soil samples for Commercial Area 4 are presented on Plans 40A/B, 41A/B/C/D, and 42A/B/C, respectively.

5.3.2 GROUNDWATER

Residential Area 1

Exceedances of constituents in groundwater samples from monitoring wells are present at various locations in Residential Area 1 as summarized below.

Sample Location	Sample Date	Part 201 Cleanup Criteria Exceedance	Constituent
MW-11	2008	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
	2010	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
	2012	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
MW-12S	2008	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC GSIC	Arsenic
	2010	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
	2012	Residential and Non-Residential DWC	Mercury
		Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC GSIC	Arsenic
MW-12D	2012	GSIC	Mercury
MW-13	2010	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
	2012	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
MW-14	2010	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
	2012	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese

Exceedances of constituents in groundwater samples from the vertical profiling well are present in Residential Area 1 as summarized below.

Sample Location	Sample Depth	Part 201 Cleanup Criteria Exceedance	Constituent
VA-1	10 - 14	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
	14 - 18	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
	18 - 22	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
	22 - 26	Residential and Non-Residential DWC	Iron

Sample Location	Sample Depth	Part 201 Cleanup Criteria Exceedance	Constituent
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		GSIC	Chromium
	26 – 30	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC	Lead
		Residential and Non-Residential DWC GSIC	Arsenic
		Residential and Non-Residential DWC GSIC	Chromium
		Residential DWC GSIC	Vanadium
		GSIC	Zinc
		GSIC	Copper
	30 - 34	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
	34 - 38	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC	Lead
		Residential and Non-Residential DWC GSIC	Arsenic
		Residential and Non-Residential DWC GSIC	Chromium
		Residential DWC GSIC	Vanadium
		GSIC	Zinc
		GSIC	Copper
	38 - 42	Residential and Non-Residential DWC	Iron

Sample Location	Sample Depth	Part 201 Cleanup Criteria Exceedance	Constituent
		Residential and Non-Residential DWC	Bis(2-ethylhexyl)phthalate
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC GSIC	Lead
		Residential and Non-Residential DWC GSIC	Arsenic
		Residential and Non-Residential DWC GSIC	Chromium
		Residential DWC GSIC	Vanadium
		GSIC	Zinc
		GSIC	Copper

Analytical results for SVOCs and metals in groundwater samples for Residential Area 1 are presented on Plan 4.

Residential Area 2

No groundwater samples were collected from Residential Area 2 during the RI activities.

Residential Area 3

Exceedances of constituents in groundwater samples from monitoring wells are present at various locations in Residential Area 3 as summarized below.

Sample Location	Sample Date	Part 201 Cleanup Criteria Exceedance	Constituent
MW-10	2008	Residential and Non-Residential DWC	Manganese
	2010	Residential and Non-Residential DWC	Manganese
	2012	Residential and Non-Residential DWC	Manganese
MW-15	2010	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
	2012	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese

Analytical results for SVOCs and metals in groundwater samples for Residential Area 3 are presented on Plan 11.

Residential Area 4

Exceedances of constituents in groundwater samples from monitoring wells are present at various locations in Residential Area 4 as summarized below.

Sample Location	Sample Date	Part 201 Cleanup Criteria Exceedance	Constituent
MW-5	2008	Residential and Non-Residential DWC	Manganese
		GSIC	Mercury
	2010	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		GSIC	Mercury
	2012	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		GSIC	Mercury
MW-7	2008	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC GSIC	Arsenic
		GSIC	Mercury
	2010	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC GSIC	Arsenic
		GSIC	Mercury
	2012	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC GSIC	Arsenic
		GSIC	Mercury
MW-23	2012	Residential and Non-Residential DWC	Manganese
		GSIC	Mercury

Analytical results for SVOCs and metals in groundwater samples for Residential Area 4 are presented on Plan 15.

Waterfront Plaza

Exceedances of constituents in groundwater samples from monitoring wells are present at one location in the Waterfront Plaza as summarized below.

Sample Location	Sample Date	Part 201 Cleanup Criteria Exceedance	Constituent
MW-8	2008	Residential and Non-Residential DWC	Manganese
	2010	Residential and Non-Residential DWC	Manganese
	2012	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese

Analytical results for SVOCs and metals in groundwater samples for Waterfront Plaza are presented on Plan 19.

Mixed Residential/Commercial Area 1

Exceedances of constituents in groundwater samples from monitoring wells are present at one location in Mixed Residential/Commercial Area 1 as summarized below.

Sample Location	Sample Date	Part 201 Cleanup Criteria Exceedance	Constituent
MW-6	2012	GSIC	Mercury

Analytical results for SVOCs and metals in groundwater samples for Mixed Residential/Commercial Area 1 are presented on Plan 23.

Mixed Residential/Commercial Area 2

Exceedances of constituents in groundwater samples from monitoring wells are present at various locations in Mixed Residential/Commercial Area 2 as summarized below.

Sample Location	Sample Date	Part 201 Cleanup Criteria Exceedance	Constituent
MW-2	2008	Residential and Non-Residential DWC	Manganese
		GSIC	Mercury
	2010	Residential and Non-Residential DWC	Manganese
	2012	Residential and Non-Residential DWC	Manganese
MW-4S	2008	Residential and Non-Residential DWC	Manganese
		GSIC	Mercury
	2010	Residential and Non-Residential DWC	Manganese
		GSIC	Mercury
	2012	Residential and Non-Residential DWC	Manganese
		GSIC	Mercury

Sample Location	Sample Date	Part 201 Cleanup Criteria Exceedance	Constituent
MW-4D	2012	Residential and Non-Residential DWC	Manganese
MW-19	2010	Residential and Non-Residential DWC	Manganese
	2012	Residential and Non-Residential DWC	Manganese

Exceedances of constituents in groundwater samples from the vertical profiling well are present in Mixed Residential/Commercial Area 2 as summarized below.

Sample Location	Sample Depth	Part 201 Cleanup Criteria Exceedance	Constituent
VA-2	6 - 10	Residential and Non-Residential DWC	Lead
		Residential and Non-Residential DWC	Antimony
		Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC GSIC	Cadmium
		Residential and Non-Residential DWC GSIC	Selenium
	10 - 14	Residential DWC	Vanadium
		Residential and Non-Residential DWC	Lead
		Residential and Non-Residential DWC	Antimony
		Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC GSIC	Cadmium
		Residential and Non-Residential DWC GSIC	Selenium
		GSIC	Mercury
	14 - 18	Residential and Non-Residential DWC	Antimony
		Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC GSIC	Cadmium
		Residential and Non-Residential DWC GSIC	Selenium
		GSIC	Mercury

Sample Location	Sample Depth	Part 201 Cleanup Criteria Exceedance	Constituent
	18 - 22	Residential and Non-Residential DWC	Antimony
		Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC GSIC	Cadmium
		Residential and Non-Residential DWC GSIC	Selenium
	22 - 26	Residential and Non-Residential DWC	Lead
		Residential and Non-Residential DWC	Antimony
		Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC GSIC	Arsenic
		Residential and Non-Residential DWC GSIC	Cadmium
		Residential and Non-Residential DWC GSIC	Selenium
	26 - 30	Residential and Non-Residential DWC	Lead
		Residential and Non-Residential DWC	Antimony
		Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC GSIC	Cadmium
		Residential and Non-Residential DWC GSIC	Selenium
	30 - 32	Residential and Non-Residential DWC	Antimony
		Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC GSIC	Lead
		Residential and Non-Residential DWC GSIC	Arsenic
		Residential and Non-Residential DWC GSIC	Cadmium
		Residential and Non-Residential DWC GSIC	Vanadium
		Residential and Non-Residential DWC GSIC	Chromium
		GSIC	Selenium
		GSIC	Zinc
		GSIC	Mercury
		GSIC	Copper

Analytical results for SVOCs and metals in groundwater samples for Mixed Residential/Commercial Area 2 are presented on Plan 27.

Commercial Area 1

Exceedances of constituents in groundwater samples from monitoring wells are present at various locations in Commercial Area 1 as summarized below.

Sample Location	Sample Date	Part 201 Cleanup Criteria Exceedance	Constituent
MW-9	2008	Residential and Non-Residential DWC	Manganese
	2010	Residential and Non-Residential DWC	Manganese
	2012	Residential and Non-Residential DWC	Manganese
MW-20	2012	Residential and Non-Residential DWC	Manganese
		GSIC	Mercury

Analytical results for SVOCs and metals in groundwater samples for Commercial Area 1 are presented on Plan 31.

Commercial Area 2

Exceedances of constituents in groundwater samples from monitoring wells are present at one location in Commercial Area 2 as summarized below.

Sample Location	Sample Date	Part 201 Cleanup Criteria Exceedance	Constituent
MW-21S	2012	GSIC	Mercury

Analytical results for SVOCs and metals in groundwater samples for Commercial Area 2 are presented on Plan 35.

Commercial Area 3

No exceedances of constituents in groundwater samples from monitoring wells were identified during the RI activities in Commercial Area 3. Analytical results for SVOCs and metals in groundwater samples for Commercial Area 3 are presented on Plan 39.

Commercial Area 4

Exceedances of constituents in groundwater samples from monitoring wells are present at various locations in Commercial Area 4 as summarized below.

Sample Location	Sample Date	Part 201 Cleanup Criteria Exceedance	Constituent
MW-16	2010	Residential and Non-Residential DWC	Manganese
		GSIC	Mercury
	2012	Residential and Non-Residential DWC	Manganese
MW-17	2012	Residential and Non-Residential DWC	Manganese
MW-3	2008	Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC	Lead
		Residential and Non-Residential DWC	Manganese
		GSIC	Mercury
	2010	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		GSIC	Mercury
	2012	Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
		GSIC	Mercury
		Residential and Non-Residential DWC	Lead
TW-263	2010	Residential and Non-Residential DWC	Manganese
		Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC GSIC	Arsenic
TW-279	2010	Residential and Non-Residential DWC	Aluminum
		Residential and Non-Residential DWC	Iron
		Residential and Non-Residential DWC	Manganese
TW-297	2010	Residential and Non-Residential DWC	Manganese
SB-2015	2011	Residential and Non-Residential DWC	Manganese

Analytical results for SVOCs and metals in groundwater samples for Commercial Area 3 are presented on Plan 43.

5.3.3 SOIL SPLP

Residential Area 1

Based on exceedances of the GSIPC in soil samples collected during the RI, additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Exceedances are present at various locations in Residential Area 1 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-103	7 – 9	Residential and Non-Residential DWC	Manganese
SB-104	5 – 7	Residential and Non-Residential DWC	Manganese
	8 - 10	Residential and Non-Residential DWC	Manganese
SB-111	0 – 1	Residential and Non-Residential DWC	Manganese
SB-114	0 – 1	Residential and Non-Residential DWC	Manganese
SB-116	9.5 – 10	Residential and Non-Residential DWC	Manganese
SB-118	7.5 – 9.5	Residential and Non-Residential DWC	Manganese
SB-123	0 – 1	Residential and Non-Residential DWC	Manganese
SB-143	0 – 1	Residential and Non-Residential DWC	Manganese
SS-100	0 – 2	Residential and Non-Residential DWC	Manganese

Residential Area 2

Based on exceedances of the GSIPC in soil samples collected during the RI, additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Exceedances are present at one location in Residential Area 2 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-105	1 – 3	Residential and Non-Residential DWC	Manganese

Residential Area 3

Based on exceedances of the GSIPC in soil samples collected during the RI, additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Exceedances are present at various locations in Residential Area 3 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-135	0 – 1	Residential and Non-Residential DWC	Manganese
SB-136	8 – 10	GSIC	Copper
		GSIC	Mercury
SB-139	0 – 1	Residential and Non-Residential DWC	Manganese
SB-141	0 – 1	GSIC	Mercury
TP-320	0 – 1	Residential and Non-Residential DWC	Manganese

Residential Area 4

Based on exceedances of the GSIPC in soil samples collected during the RI, additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Exceedances are present at various locations in Residential Area 4 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-301	5.5 – 7.5	GSIC	Copper
		GSIC	Mercury
SB-302	6.8 – 8.8	GSIC	Chromium
		GSIC	Copper
		GSIC	Mercury
	8.8 – 9.8	GSIC	Copper
		GSIC	Mercury
TP-309	0 – 1	Residential and Non-Residential DWC	Manganese
	3 - 4	Residential and Non-Residential DWC	Manganese
TP-313	4 – 6	GSIC	Silver
		GSIC	Mercury
TP-314	6 – 8	GSIC	Chromium

Waterfront Plaza

No soil samples were collected from Waterfront Plaza during the RI; therefore, no exceedances of the GSIPC were identified and no additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Mixed Residential/Commercial Area 1

Based on exceedances of the GSIPC in soil samples collected during the RI, additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Exceedances are present at various locations in Mixed Residential/Commercial Area 1 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-339	2.75 – 3.75	GSIC	Mercury
TP-303	0 – 1	Residential and Non-Residential DWC	Manganese
TP-306	0.5 – 1.5	Residential and Non-Residential DWC	Manganese
TP-334	0 – 1	Residential and Non-Residential DWC	Manganese
TP-335	3 – 5	Residential and Non-Residential DWC	Manganese

Mixed Residential/Commercial Area 2

Based on exceedances of the GSIPC in soil samples collected during the RI, additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Exceedances are present at various locations in Mixed Residential/Commercial Area 2 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-211	0 – 1	Residential and Non-Residential DWC	Manganese
SB-216	0 – 4	GSIC	Mercury
SB-224	1 – 2	GSIC	Copper
SB-220	0 – 1	GSIC	Mercury
SB-221	1 – 2	Residential and Non-Residential DWC	Lead
		Residential and Non-Residential DWC	Manganese
	2 – 4	Residential and Non-Residential DWC	Manganese
SB-222	1.5 – 3.5	GSIC	Copper
		GSIC	Mercury
SB-232	0 -1	GSIC	Mercury
	6 – 8	Residential and Non-Residential DWC GSIC	Arsenic
		GSIC	Mercury
		GSIC	Selenium
SB-236	0 – 1	GSIC	Chromium
		Residential and Non-Residential DWC	Manganese
		GSIC	Mercury

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-235	0.5 – 1.5	Residential and Non-Residential DWC	Manganese
SB-237	0 – 1	GSIC	Selenium
	2 – 4	GSIC	Selenium
SB-238	0 – 1	GSIC	Selenium
	2 - 4	GSIC	Selenium
SB-246	4 – 6	Residential and Non-Residential DWC	Manganese
SB-258	0.8 - 3	GSIC	Copper
		GSIC	Mercury
SB-2010	0 - 1	GSIC	Mercury
SB-2013	0 – 1	Residential and Non-Residential DWC GSIC	Chromium
		GSIC	Mercury
	3 – 5	GSIC	Mercury
SB-305	8 – 10	Residential and Non-Residential DWC	Manganese
SB-306	7.5 – 9.5	Residential and Non-Residential DWC	Manganese
SB-307	6 – 8	Residential and Non-Residential DWC	Manganese
TP-342	0 – 1	Residential and Non-Residential DWC GSIC	Arsenic
TP-343	3 – 4	Residential and Non-Residential DWC	Manganese
TP-344	0 – 1	Residential and Non-Residential DWC	Manganese

Commercial Area 1

Based on exceedances of the GSIPC in soil samples collected during the RI, additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Exceedances are present at various locations in Commercial Area 1 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-142	0 – 1	Residential and Non-Residential DWC	Manganese
SB-144	0 – 1	Residential and Non-Residential DWC	Manganese
SB-145	0 – 1	Residential and Non-Residential DWC	Manganese
	7.5 – 9.5	Residential and Non-Residential DWC	Manganese
SS-101	0 – 2	Residential and Non-Residential DWC	Manganese
SS-102	0 – 2	Residential and Non-Residential DWC	Manganese
SS-103	0 – 2	Residential and Non-Residential DWC	Manganese
SS-104	0 – 2	Residential and Non-Residential DWC	Manganese
SS-105	0 – 2	Residential and Non-Residential DWC	Manganese
SS-106	0 – 2	Residential and Non-Residential DWC	Manganese
SS-107	0 – 2	Residential and Non-Residential DWC	Manganese

Commercial Area 2

Based on exceedances of the GSIPC in soil samples collected during the RI, additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Exceedances are present at various locations in Commercial Area 2 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-323	0 – 1	Residential and Non-Residential DWC	Manganese
SB-343	0 – 1	Residential and Non-Residential DWC	Manganese
TP-316	0 – 1	Residential and Non-Residential DWC	Manganese
	6 – 8	Residential and Non-Residential DWC	Manganese
TP-321	0 – 1	Residential and Non-Residential DWC	Manganese
	6 – 8	Residential and Non-Residential DWC	Manganese
TP-323	0 – 1	Residential and Non-Residential DWC	Manganese
TP-324	0 – 1	Residential and Non-Residential DWC	Manganese
TP-326	0 – 1	Residential and Non-Residential DWC	Manganese
TP-327	0 – 1	Residential and Non-Residential DWC	Manganese
TP-328	0 – 1	Residential and Non-Residential DWC	Manganese

Commercial Area 3

Based on exceedances of the GSIPC in soil samples collected during the RI, additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Exceedances are present at various locations in Commercial Area 3 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
MW-18	0 – 2	Residential and Non-Residential DWC	Manganese
TP-304	0.5 – 1.5	GSIC	Mercury
	2 – 4	Residential and Non-Residential DWC	Manganese
TP-305	2 - 4	Residential and Non-Residential DWC	Manganese
TP-307	2 – 3	GSIC	Mercury
TP-338	0 – 1	Residential and Non-Residential DWC	Manganese
	8 – 10	Residential and Non-Residential DWC	Manganese

Commercial Area 4

Based on exceedances of the GSIPC in soil samples collected during the RI, additional analysis was conducted utilizing SPLP for comparison to the Part 201 Generic Residential and Non-Residential Cleanup Criteria for groundwater.

Exceedances are present at various locations in Commercial Area 4 as summarized below.

Sample Location	Sample Depth (feet bgs)	Part 201 Cleanup Criteria Exceedance	Constituent
SB-203	2 – 4	GSIC	Copper
SB-265	0 – 1	Residential and Non-Residential DWC	Lead
SB-272	1 – 3	GSIC	Mercury
SB-283	0 – 1	Residential and Non-Residential DWC	Manganese
SB-284	0 – 1	Residential and Non-Residential DWC	Manganese
	2.5 – 4.5	Residential and Non-Residential DWC	Manganese
TP-201	8 – 10	Residential and Non-Residential DWC	Manganese
TP-202	0.5 – 1.5	Residential and Non-Residential DWC	Manganese
TP-203	0.5 – 1.5	Residential and Non-Residential DWC GSIC	Arsenic
	2 - 4	Residential and Non-Residential DWC	Manganese
TP-341	0.5 – 1.5	GSIC	Copper
		GSIC	Chromium
TP-5	6	Residential and Non-Residential DWC GSIC	Lead

5.4 EVALUATION OF SOURCE, NATURE AND EXTENT OF CONTAMINATION

Based on the results summarized in Sections 2.0 and 5.0, the following former operational areas of environmental impact have been identified due to exceedances of the Part 201 Residential and/or Non-Residential Cleanup Criteria.

- Historical Fill Material (Site-Wide)
- Former Wastewater Treatment Area (Residential Areas 1 to 4 and Mixed Residential/Commercial Area 2)
- Former Substation/Building 11A Area (Commercial Area 4)
- Non-Specific Historical Operational Impacts (Residential Area 3, Waterfront Plaza, Mixed Residential/Commercial Areas 1 and 2, and Commercial Areas 2, 3 and 4)

- Non-Specific Support Operational Impacts (Residential Area 4, Waterfront Plaza, Mixed Residential/Commercial Area 1, and Commercial Area 3)
- Former Coal Storage Pile Area (Residential Area 4)
- Former No. 6 Fuel Oil AST Area (Mixed Residential/Commercial Area 2)
- Coal Tunnel Area (Mixed Residential/Commercial Area 2)

These issues are further discussed in the following subsections.

5.4.1 HISTORICAL FILL MATERIAL (SITE-WIDE)

Based on the review of available information and observations during the subsurface RI activities, fill materials of various compositions (i.e., various soil types, brick, concrete, coal, fly ash, etc.) have been utilized in numerous areas of the Site. A number of metals have been identified in exceedance of the Part 201 Residential and Non-Residential Cleanup Criteria in both soil and groundwater, which can be potentially attributed to the fill material.

5.4.1.1 SOIL IMPACTS

The impacts to soil across the Site that are likely attributable to historical fill activities include the following exceedances of the Part 201 Generic Cleanup Criteria for the listed constituents:

- Residential and/or Non-Residential DWPC: arsenic, manganese, aluminum, iron, magnesium, antimony, cobalt, mercury, lead, silver, copper, selenium, zinc, thallium, sodium, cadmium, vanadium, and chromium
- GSIPC: arsenic, barium, chromium, selenium, mercury, cobalt, zinc, copper, silver, thallium, cadmium, and manganese; and inorganics (cyanide [total])
- Residential and Non-Residential DCC: arsenic and lead
- Residential PSIC: arsenic and manganese
- Non-Residential PSIC: manganese

Based on the results of the specific soil results for the aforementioned metals that exceeded the GSIPC, analysis for SPLP was conducted for those metals. It should be noted that in some instances where arsenic exceeded the GSIPC, SPLP

analysis was not conducted. This is due to a change in the Part 201 Generic Cleanup Criteria that occurred in December 2010, where the GSIPC for arsenic was lowered. Therefore, current exceedances of the GSIPC were not identified at the time the SPLP analysis was conducted. Based on the results of the SPLP analysis, manganese, mercury, silver, copper, arsenic, selenium, and chromium, were identified to have the potential to leach at concentrations that exceed either the Part 201 DWC and/or GSIC.

VOCs, SVOCs, and/or PCBs were detected in the soil samples collected during the Pre-RI or RI activities at concentrations above the Part 201 Generic Residential or Non-Residential Cleanup Criteria; however, these exceedances are addressed in subsequent sections as they may not be related to historical fill activities, but instead are likely from other potential sources related to historical operations conducted at the Site.

5.4.1.2 GROUNDWATER IMPACTS

Analytical results for groundwater samples collected include the following exceedances of the Part 201 Generic Cleanup Criteria for the listed constituents:

- Residential and Non-Residential DWC: metals (arsenic, manganese, antimony, cadmium, aluminum, iron, lead, selenium, vanadium, and chromium)
- GSIC: metals (arsenic, chromium, lead, vanadium, zinc, cadmium, selenium, mercury and copper)

No VOCs, SVOCs, or PCBs were detected in the groundwater samples collected during the Pre-RI or RI activities at concentrations above the Part 201 Generic Residential or Non-Residential Cleanup Criteria, with the exception of benzo(g,h,i)perylene, which was detected above the Water Solubility Limit in a sample collected from SGWB-7 in 1997 and bis(2-ethylhexyl)phthalate above the Part 201 Generic Residential and Non-Residential DWC. The Water Solubility Limits are not health-based criteria, but are used as a screening tool for the potential presence of free-phase substances. Water solubility represents the maximum amount of a substance that will dissolve in a given amount of water to produce a saturated solution. Above this concentration, free-phase or solid may be present. For SGWB-7, the concentration of benzo(g,h,i)perylene is believed to be an artifact or potentially due to solids associated with sampling.

This is supported by the fact that no evidence of free-phase liquids were observed, no other organic compounds were detected in the sample (VOCs or SVOCs) and there is no known specific current or historical use of benzo(g,h,i)perylene in the area. Bis(2-ethylhexyl)phthalate is a common laboratory contaminant.

No exceedances of the Part 201 Residential and Non-Residential GVIAC or GCC, or AISLs or FESLs were detected in groundwater samples collected at the Site.

5.4.2 FORMER WASTEWATER TREATMENT AREA (RESIDENTIAL AREAS 1 TO 4, WATERFRONT PLAZA AND MIXED RESIDENTIAL/COMMERCIAL AREA 2)

Historical land uses of Residential Areas 1 through 3 and Waterfront Plaza included the treatment and dewatering of wastewater sludge prior to off-Site disposal. These areas include fourteen former wastewater sludge dewatering lagoons (i.e., Lagoons A through L), primary clarifier, former secondary clarifier, former wastewater treatment building activated sludge tank, former aeration basin, secondary clarifier, and activated sludge treatment system. Additionally, the former primary clarifier was located in Residential Area 4 and Mixed Residential/Commercial Area 2. Based on the results summarized in Section 5.4.1.1, various VOCs, SVOCs, metals, and inorganics are present in soil above the Part 201 Residential and/or Non-Residential DWPC. Additionally, various VOCs, SVOCs, metals, and inorganics are present in soil above the Part 201 GSIPC. SPLP results for soil samples indicate that some metals have the potential to leach at concentrations in exceedance of the Part 201 GSIC. Numerous exceedances of the Part 201 Residential DCC for arsenic are present across this area, which appear to be related to historical placement of fill material, as discussed in Section 5.4.1. This includes both the areas known to have been utilized as historical lagoons, and the surrounding areas to the north (along the Kalamazoo River) and to the east (former aeration basin and secondary clarifier areas) in Residential Areas 1 through 3 and Waterfront Plaza, as well as the former primary clarifier in Residential Area 4 and Mixed Residential/Commercial Area 2.

The impacts to soil in this area include the following exceedances of the Part 201 Generic Cleanup Criteria for the listed constituents:

- Residential and/or Non-Residential DWPC: VOCs (benzene, methylene chloride, and tetrachloroethene) and SVOCs (pentachlorophenol)
- GSIPC: VOCs (ethylbenzene and xylenes); SVOCs (phenanthrene, 4-methylphenol, naphthalene, 4-chloro-3-methylphenol, and 2,4,6-trichlorophenol)

The detections of pentachlorophenol may be related to historical water treatment usage during the papermaking operations. Additional phenolic compounds detected may be related to historical preservatives in glues and inks utilized at the Site, and may have been present in wastewaters and subsequent residuals, generated during operations, or may be the result of degradation/decomposition of pentachlorophenol. Observations during the advancement of soil borings in this area correlate the exceedances of these compounds to samples collected from paper residuals.

The remainder of the SVOCs and VOCs may be related to historical contaminants within wastewater generated during Site operations and discharged to the former lagoons or wastewater treatment areas, or could be attributed to fill materials across the Site (see Section 5.4.1). Observations during the advancement of soil borings in these areas do not correlate to paper residuals, but to samples collected from sand fill material, in some cases intermingled with coal or noted to be stained.

It should be noted that metals exceedances of the Part 201 Residential and/or Non-Residential Cleanup Criteria were also identified in these areas; however, those impacts appear to be related to the fill materials historically placed at the Site or may be naturally-occurring at depth and in observed native materials (see Section 5.4.1).

5.4.3 FORMER SUBSTATION/AREA NORTH OF MILL BUILDING (COMMERCIAL AREA 4)

A former substation, that was owned and operated by Consumers Energy, was historically present to the north of Buildings 11 and 11A. Subsequent to the off-Site ERA and evidence of impacts to the north of the former substation, an investigation was conducted as part of the RI to evaluate potential issues in this area. Oily soils were observed in this area during the installation of test pits (see Section 5.2.1.2), with detections of TPH-DRO as high as 3,300 ppm (there is no

Part 201 Cleanup Criteria for TPH). Various PAHs, tetrachloroethene, methylene chloride, trichloroethene, and 1,1,1-trichloroethene have been detected in soil samples in this area, along with various metals. Historical information indicates that Building 11 was constructed in 1906 and was used for storage and maintenance activities, and Building 11A was constructed in 1940 and was used for maintenance activities, which may have included the use and storage of solvents and/or petroleum products utilized during routine maintenance activities. Additionally, drum storage was historically conducted outside of Building 11A.

The impacts to soil in this area include the following exceedances of the Part 201 Generic Cleanup Criteria for the listed constituents, in addition to inorganics exceedances that are discussed in Section 5.4.1:

- Residential and/or Non-Residential DWPC: VOCs (benzene, tetrachloroethene, methylene chloride, trichloroethene, and 1,1,1-trichloroethane) and SVOCs (phenanthrene and pentachlorophenol)
- GSIPC: VOCs (xylenes (total), tetrachloroethene and 1,1,1-trichloroethane); SVOCs (phenanthrene, naphthalene, and fluoranthene)
- Residential DCC: benzo(a)pyrene

It should be noted that metals exceedances of the Part 201 Residential and/or Non-Residential Cleanup Criteria were also identified in these areas; however, those impacts appear to be related to the fill materials historically placed at the Site or may be naturally-occurring at depth and in observed native materials (see Section 5.4.1).

5.4.4 NON-SPECIFIC HISTORICAL OPERATIONAL IMPACTS (RESIDENTIAL AREA 3, WATERFRONT PLAZA, MIXED RESIDENTIAL/COMMERCIAL AREAS 1 AND 2, AND COMMERCIAL AREAS 2, 3 AND 4)

This area includes the MW-16 area, the Mill Buildings (except Buildings 11 and 11A, as discussed in Section 5.4.3 above), one former water tower, one current water tower (Mixed Residential/Commercial Area 2 and Commercial Areas 3 and 4), the former Sludge Dewatering and former Quality Products Buildings (Residential Area 3, Waterfront Plaza, and Commercial Area 2), and former Specialty Minerals Building (Mixed Residential/Commercial Area 1 and

Commercial Area 2). Suspected areas relating to general historical operations within the aforementioned structures were also considered as potential source areas. Specifically related to the Mill Buildings in Mixed Residential/Commercial Area 2 and Commercial Areas 3 and 4, additional potential areas where multiple sample locations indicated exceedances of similar organic constituents included the Train Shed, Building 6A, the parking lot east of Buildings 9F and 9E, Building 7, Former Buildings 3A and 28, and Former Buildings 9C and 9A. The Train Shed was constructed in 1988 and was utilized for the loading and unloading of raw materials. This structure has an aggregate floor. Building 6A was constructed in 1979 and was utilized as a courtyard prior to that time. This structure has a bare soil floor. Building 7 was constructed in 1915 and housed process equipment and tanks utilized to produce coatings. Former Buildings 3A and 28 were constructed in 1979 and 1960, and were used as chest storage buildings. These structures were razed in 2012. Former Building 9A was a former coater and calendar production area and former Building 9C was a former coating chemical storage dock, both constructed in 1964 and razed in 2012. Former Buildings 9E and 9F were constructed in 1978 and were operated as a finished goods warehouse and lathe room with enclosed rail dock, respectively. These structures were razed in 2012. Additionally, during redevelopment activities conducted at the former Sludge Dewatering Building, two small below grade structures in series were encountered.

During the 2010 RI field activities, PCBs were identified in a soil sample from MW-16 above the Part 201 Residential DCC. Based on the identified detection and redevelopment activities that were proposed in this area, further evaluation was completed in 2012 to delineate the extent of PCB impacts in soil in the vicinity of MW-16.

The impacts to soil in this area include the following exceedances of the Part 201 Generic Cleanup Criteria for the listed constituents, in addition to inorganics exceedances that are discussed in Section 5.4.1:

- Residential and/or Non-Residential DWPC: VOCs (xylenes (total), tetrachloroethene, benzene, methylene chloride, trichloroethene, and 1,1,1-trichloroethane) and SVOCs (phenanthrene and pentachlorophenol)
- GSIPC: VOCs (ethylbenzene, toluene, tetrachloroethene, xylenes, and 1,1,1-trichloroethane) and SVOCs (phenanthrene, naphthalene, fluoranthene, dibenzofuran, fluorene, and carbazole)

- Residential DCC: SVOCs (dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene benzo(a)pyrene, benzo(a)anthracene, and benzo(b)fluoranthene) and PCBs
- Non-Residential DCC: SVOCs (benzo(a)pyrene) and PCBs

5.4.5 NON-SPECIFIC SUPPORT OPERATIONS (RESIDENTIAL AREA 4, WATERFRONT PLAZA, MIXED RESIDENTIAL/COMMERCIAL AREA 1, AND COMMERCIAL AREA 3)

The non-specific support operations include the areas that include portions of Residential Area 4, Waterfront Plaza, Mixed Residential/Commercial Area 1, and Commercial Area 3. The impacts to soil in this area include the following exceedances of the Part 201 Generic Cleanup Criteria for the listed constituents, in addition to inorganics exceedances that are discussed in Section 5.4.1:

- Residential and/or Non-Residential DWPC: VOCs (benzene, methylene chloride, xylenes (total), toluene, ethylbenzene) and SVOCs (pentachlorophenol)
- GSIPC: VOCs (ethylbenzene, xylenes, and toluene) and SVOCs (naphthalene, carbazole, fluoranthene, and phenanthrene)
- Residential DCC: benzo(a)pyrene, dibenzo(a,h)anthracene, and PCBs

The impacts associated with the Part 201 DCC exceedances in SB-301 and SB-302 are consistent with historical results in this area.

5.4.6 FORMER COAL STORAGE PILE AREA (RESIDENTIAL AREA 4 AND WATERFRONT PLAZA)

The impacts to soil in this area included the following exceedances of the Part 201 Generic Cleanup Criteria for the listed constituents, which include inorganics discussed in Section 5.4.1 as being associated with fill materials. Several of these inorganics could also be the result of storage and handling practices associated with coal in this area, in conjunction with impacts from other fill materials in this area; however, insufficient data is available to differentiate the source of the impacts:

- Residential and/or Non-Residential DWPC: VOCs (ethylbenzene, benzene, xylenes, and toluene) and SVOCs (pentachlorophenol), metals (arsenic, manganese, magnesium, iron, cobalt, selenium, aluminum, chromium, mercury, lead, and antimony), and inorganics (phosphorus)
- GSIPC: VOCs (ethylbenzene, xylenes, and toluene), SVOCs (naphthalene and phenanthrene), metals (arsenic, selenium, manganese, cobalt, mercury, silver, chromium, zinc, barium, and copper) and inorganics (cyanide [total])
- Residential DCC: metals (arsenic and lead) and PCBs
- Non-Residential DCC: lead and PCBs
- Residential SVIAC: benzene

5.4.7 FORMER NO. 6 FUEL OIL AST AREA (MIXED RESIDENTIAL/COMMERCIAL AREA 2 AND RESIDENTIAL AREA 4)

The impacts to soil in this area include the following exceedances of the Part 201 Generic Cleanup Criteria for the listed constituents:

- Residential and/or Non-Residential DWPC: VOCs (xylenes (total), tetrachloroethene, benzene, and methylene chloride), SVOCs (pentachlorophenol), and metals (iron, cobalt, arsenic, aluminum, manganese, and magnesium)
- GSIPC: VOCs (ethylbenzene and xylenes (total)), SVOCs (naphthalene, phenanthrene, 2-methylnaphthalene, and 1,2,4-trimethylbenzene), and metals (cobalt, mercury, arsenic, selenium, manganese, and chromium)
- Residential DCC: arsenic, benzo(a)pyrene, and dibenzo(a,h)anthracene

Fuel oil releases to the ground surface in this area have been documented historically, as well as the historical presence of railroad tracks and below grade product delivery systems. Additionally, impacts have been documented to soils in the vicinity of the former No. 6 fuel oil below grade piping located to the east of the former coal tunnel area (see Section 5.4.8). During redevelopment activities, product was observed in the below grade piping from the former No. 6 fuel oil AST area to the former power house area. Product observed in the lines was containerized at the point where the piping formerly entered the AST area structures, and was characterized and disposed off Site during the redevelopment activities.

5.4.8 FORMER COAL TUNNEL AREA (MIXED RESIDENTAL/COMMERCIAL AREA 2)

Based on visual inspections conducted in the coal tunnel area, approximately 12 to 18 inches of liquid, described as a "heavy fuel oil with a layer of water over the top," was observed covering the bottom of the concrete floor of the tunnel. The thickness of the water was identified as approximately one to two inches, with the balance being the "heavy fuel oil." Due to the presence of the liquid, a visual evaluation of the floor of the coal tunnel could not be conducted for potential deterioration or cracks, which could provide a potential release point from the tunnel. A sample of the liquid in the tunnel was collected and analyzed for PCBs, viscosity, and specific gravity. No PCBs were detected in the sample.

PCE, benzene, ethylbenzene, toluene, xylenes (total), methylene chloride, carbazole, dibenzofuran, fluoranthene, fluorene, naphthalene, phenanthrene, 2-methylnaphthalene, aluminum, arsenic, selenium, iron, manganese, mercury, cobalt, and magnesium are present in soil above Part 201 DWPC and/or GSIPC in the area of the coal tunnel. The impacts associated with inorganic parameters in the vicinity of the coal tunnel are potentially due to the historical use of fill material and are discussed further in Section 5.4.1.

Benzo(a)pyrene, benzo(a)anthracene, dibenzo(a,h)anthracene, and arsenic are present in soil above Part 201 Residential and/or Non-Residential DCC. The benzo(a)pyrene, benzo(a)anthracene, and dibenzo(a,h)anthracene exceedances are associated with the soil sample from CTP-4.

Based on the results for the samples in the vicinity of the coal tunnel, it appears that soils have been impacted by historical operations conducted at the Site, which were not specifically related to the operation of the coal tunnel. Impacts have been identified in the vicinity of sample CTP-4, which was collected along the piping run associated with the former fuel oil No. 6 product delivery system that led from the former fuel oil No. 6 AST, traversed the coal tunnel, and continued in the direction of the boiler room. The approximate location of the below grade fuel delivery piping is shown on Figure 5.7 and on historical drawings in Appendix E. Additionally, impacts have been identified in areas historically known to have been used for the exterior storage of coal and fly ash. Impacts to the soil immediately underlying the coal tunnel could not be

determined; however, groundwater in the general downgradient direction of the coal tunnel (MW-2 and MW-19) did not exhibit impacts from petroleum products and no free product was observed in the associated monitoring well (MW-2). Based on the January and February 2010 groundwater contours, the positions of MW-2 and MW-19 are not located immediately downgradient of the coal tunnel. Subsequently, an additional monitoring well (MW-22) was installed in August 2012 to further evaluate groundwater in this area. Figures 2.20 and 2.24 provide groundwater flow contours for the upper-most aquifer across the Site for January 2010, February 2010, March 2012, August 2012, and October 2012, respectively. Static water levels were measured in groundwater monitoring wells across the Site on January 13, 2010, February 5, 2010, March 30, 2012, August 6, 2012, and October 1, 3, 5, 8, 10, and 12, 2012 and are presented in Table 2.36.

6.0 ANALYTICAL DATA

6.1 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance/quality control samples (QA/QC) were collected on the frequency as required in the QAPP and FSP, including field duplicate samples (at a frequency of 1 per 10 samples), matrix spike/matrix spike duplicates (MS/MSDs) (at a frequency of 1 per 20 samples), trip blanks (per cooler containing water samples) and field equipment blanks (frequency of 1 per 10 samples).

6.2 DATA VALIDATION

All samples were analyzed using U.S. EPA approved methods set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, 3rd Edition and Promulgated Update, November 1986.

The laboratory analytical data was reviewed by a CRA chemist to determine the quality and validity of the analytical data resulting from the collection and analysis of the samples. The laboratory analytical data is presented in Appendix G for the samples. The data validation memoranda are presented in Appendix H. A summary memorandum regarding the data validation memoranda is presented at the beginning of Appendix H. A cross-index table, correlating samples according to sample location and sample number, relating their locations in Appendices A, B and C (sample summary tables), Appendix G (laboratory analytical data), and Appendix G (data validation memoranda) is included at the beginning of Appendix G.

The data validation was performed in accordance with the requirements of the U.S. EPA, as identified in the QAPP (CRA, 2009d) and as approved by U.S. EPA. Data precision and accuracy meets all accepted standards and the data contained within this report is appropriate for use and without significant anomalies, with the qualifications noted, for the purposes of this investigation.

7.0 RESULTS OF PILOT TESTS

No pilot tests were completed as part of the implementation of the RI.

8.0 BASELINE HUMAN HEALTH RISK ASSESSMENT

The Baseline HHRA presents an evaluation of potential human exposure under both the current and planned future Site uses. Consistent with U.S. EPA guidance, the basis of this evaluation is worst case and assumes that no remediation ever occurs at the Site. This section presents the Baseline HHRA. The SLERA is presented in Section 9.0.

8.1 BASELINE HUMAN HEALTH RISK ASSESSMENT (HHRA)

The HHRA provides the cumulative risk (CR) and hazard index (HI) for each human receptor of concern exposed to Site media.

8.1.1 INTRODUCTION

The HHRA was conducted in accordance with the following U.S. EPA guidance:

- U.S. EPA Risk Assessment Guidance for Superfund (RAGS): Volume 1 - Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989 (U.S. EPA, 1989)
- U.S. EPA RAGS: Volume 1 – Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors, Interim Final, Office of Solid Waste and Emergency Response (OWSER) Directive 9285.6-03, March 25, 1991 (U.S. EPA, 1991a)
- U.S. EPA RAGS: Volume 1 – Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), Interim, EPA/540/R-92/003, December 1991 (U.S. EPA, 1991b)
- U.S. EPA Assessing Dermal Exposure from Soil, Region III Technical Guidance Manual Risk Assessment, EPA/903-K-95-003, December 1995 (U.S. EPA, 1995)
- U.S. EPA Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS, Section 4: Exposure Assessment, May 2000 (U.S. EPA, 2000)
- U.S. EPA RAGS: Volume 1 – Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments), Final, Publication 9285.7-47, December 2001 (U.S. EPA, 2001b)

- U.S. EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002 (U.S. EPA, 2002)
- U.S. EPA RAGS: Volume 1 – Human Health Evaluation Manual (Part E, Supplemental Guidance For Dermal Risk Assessment), Final, EPA/540/R/99/005, OSWER Directive 9285.7-02EP, PB99-963312, July 2004 (U.S. EPA, 2004a)
- U.S. EPA User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings, Office of Emergency and Remedial Response, February 22, 2004 (U.S. EPA, 2004b)
- U.S. EPA Child-Specific Exposure Factors Handbook, September 2008 (U.S. EPA, 2008)
- U.S. EPA RAGS: Volume 1 – Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment, Final, EPA-540-R-070-002, OSWER 9285.7-82, January 2009 (U.S. EPA, 2009a)

8.1.1.1 SPECIFIC GOALS OF THE HHRA

The specific goals of the HHRA were to:

- Identify and provide analysis of baseline risks (defined as risks that might exist if no remediation were conducted at the Site) and identify what areas of the Site may require remedial action
- Provide a basis for determining which media and exposure pathways are contributing to the identified risks/hazards at the Site
- Provide a basis for determining which chemicals, exposure pathways, and receptors would need to be addressed so that public health are adequately protected in the future
- Provide a basis for comparing potential health impacts of various remedial alternatives, which will be evaluated in a subsequent document under the RI/FS process.

8.1.1.2 ORGANIZATION OF THE HHRA

The HHRA is presented in the following sections:

Section 8.1.1	Introduction - Presents background information relevant to the HHRA, the purpose of the HHRA, and the organization of the HHRA
Section 8.1.2	Site Characterization/Hazard Identification - Summarizes the nature and extent of the contamination and hazard identification attributable to the historical operations at the Site, the Conceptual Site Model (CSM), and the selection of chemicals of potential concern (COPCs)
Section 8.1.3	Exposure Assessment - Summarizes the exposure settings, identifies the potential exposure pathways, and quantifies exposure based on the exposure assumptions
Section 8.1.4	Toxicity Assessment - Summarizes the toxicity data used to calculate the non-carcinogenic hazards and carcinogenic risks
Section 8.1.5	Risk Characterization - Presents the assessment of the potential risks to human health posed by Site media
Section 8.1.6	Uncertainty Analysis – Presents a summary and discussion regarding the uncertainties associated with the HHRA evaluation

8.1.2 SITE CHARACTERIZATION/HAZARD IDENTIFICATION

The Site characterization/hazard identification is discussed below in the following sections:

Section 8.1.2.1 HHRA CSM
Section 8.1.2.2 Receptor Characteristics
Section 8.1.2.3 Selection of COPCs

8.1.2.1 HHRA CONCEPTUAL SITE MODEL

In order to evaluate the significance of the impacted media at the Site, the potential pathways by which individuals may come in contact with the media

must be determined. The combination of factors (chemical source, media of concern, release mechanisms, and potential receptors) that could produce a complete exposure pathway and lead to human uptake of chemicals at the Site is assessed in what is defined as the CSM.

The human health CSM was developed based on the current land use and the reasonably anticipated future land re-use of the Site, as presented on Figure 1.2), and is consistent with the human health CSM presented in the approved Phase II RI Work Plan (CRA, 2009c). In the event that the Site Redevelopment Plan is modified, the HHRA will need to be reviewed, and potentially reissued, to ensure that the assumptions and scenarios evaluated are consistent with the proposed future use of the Site.

To facilitate the evaluation of Site-related information as part of the RI, the Site was subdivided into 11 redevelopment areas, as discussed in Section 1.0. The 11 redevelopment areas consist of residential, a waterfront plaza, mixed residential/commercial, and commercial land use types. The areas are referred to as follows: Residential Area 1, Residential Area 2, Residential Area 3, Residential Area 4, Waterfront Plaza, Mixed Residential/Commercial Area 1, Mixed Residential/Commercial Area 2, Commercial Area 1, Commercial Area 2, Commercial Area 3, and Commercial Area 4.

The HHRA CSM is summarized on Figure 8.1.

8.1.2.2 RECEPTOR CHARACTERISTICS

Trespasser

The trespasser receptor would be an occasional trespasser aged 7 to 16 years, who would gain access to any of the areas of the Site via trespassing. As the exposure frequency for an adolescent trespasser would be equal to or greater than an adult trespasser, only the adolescent trespasser, which is more sensitive than an adult trespasser, was evaluated in the HHRA. The trespasser was evaluated under current and future scenarios, and under the assumption that they could potentially have access and exposure to soil through direct contact within each of the 11 areas of the Site.

Resident

The resident would be a child from 1 to 6 years of age and a child/adult from 7 to 31 years of age. The resident would be an occupant of a future residential condominium building. As indicated on the Site layout presented on Figure 1.2, residential land use is proposed for six areas: Residential Area 1, Residential Area 2, Residential Area 3, Residential Area 4, Mixed Residential/Commercial Area 1, and Mixed Residential/Commercial Area 2. A resident exposure to indoor air within a future residential building that may be impacted by volatile chemicals present in soil and groundwater, and direct contact with soil was evaluated in the HHRA. Although groundwater is not currently used for potable purposes and is not expected to be used in the future, as a conservative approach, a hypothetical future potable groundwater exposure for a future resident is considered in the HHRA.

Commercial Worker

The commercial worker could be an adult working indoors within a commercial building constructed at the Site and outdoors conducting regular landscaping duties and general maintenance work around future commercial buildings. As indicated on Figure 1.2, commercial land use is proposed for seven areas of the Site: the Waterfront Plaza, Mixed Residential/Commercial Area 1, Mixed Residential/Commercial Area 2, Commercial Area 1, Commercial Area 2, Commercial Area 3, and Commercial Area 4. Therefore, a commercial worker exposure to indoor air that may be impacted by volatile chemicals present in soil and groundwater, and direct contact with soil was evaluated in the HHRA in the above mentioned seven areas of the Site. The commercial worker was evaluated under future scenarios in each of the above mentioned seven areas of the Sites. In addition, Commercial Area 4 is currently being utilized for commercial purposes. As such, Commercial Area 4 was examined under a current scenario in addition to a future scenario.

Construction Worker

Outdoor construction activities may occur during future Site development at all 11 Site areas. In addition, the former Sludge Dewatering Building located within Commercial Area 2 is currently under renovation and thus Commercial Area 2 was evaluated under a current scenario in addition to a future scenario. Construction activities were assumed to involve ground intrusive activities, such

as short-duration excavations or trenching for installation of foundations for above grade permanent structures. The construction worker would be an adult that spends a reasonable amount of time at the Site within a limited period (1-year) during the construction activities. Therefore, a construction worker direct contact exposure to soil and groundwater from each of the 11 Site areas under the future scenario and from Commercial Area 2 under the current scenario was evaluated in the HHRA.

Utility Worker

Outdoor utility activities may occur during future Site development at each 11 Site areas. In addition, given that utilities are active in all areas of the Site, and may require servicing, the utility worker was also evaluated under a current scenario for each 11 Site areas. Utility activities were assumed to involve installation/maintenance of subsurface utilities. The utility worker would be an adult that spends a short period of time at the Site each year, for many years. Therefore, a utility worker direct contact exposure to soil and groundwater from each of the 11 Site areas under current and future scenarios was evaluated in the HHRA.

Recreational User (Child and Adult)

The recreational user would be a child from 1 to 6 years and a child/adult from 7 to 31 years. The recreational user was assumed to be present at all Residential and Mixed Residential/Commercial Areas (Residential Area 1, Residential Area 2, Residential Area 3, Residential Area 4, Mixed Residential/Commercial Area 1, and Mixed Residential/Commercial Area 2), due to the expected presence of parks or playgrounds open to the public in these areas. Furthermore, areas located by the waterfront (Waterfront Plaza and Commercial Area 4) were assumed to have recreational users present due to the potential of a public pathway being developed in these areas. Commercial Area 4 will contain City Hall and, as such, will likely contain public green space. The recreational user was assumed to not be present within Commercial Areas 1, 2 and 3 because these areas are not located adjacent to the waterfront and are not expected to contain any recreational outdoor space. Therefore, the recreational user direct contact exposure to soil from the areas listed above was evaluated in the HHRA under a future scenario.

8.1.2.3 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

This section presents the process for establishing the COPCs for the exposure areas that have been affected by past operations at the Site. COPCs are chemicals that are related to the Site and that pose the greatest potential public health risk. In general, detected chemicals are identified as COPCs based on their concentrations and known toxicity characteristics. The selection of COPCs considers analytical data reported for each of the 11 redevelopment areas of the Site.

For each chemical reported in each medium associated with the exposure areas, comparisons were made to Part 201 Cleanup Criteria and Part 213 Risk-Based Screening Levels presented in the MDEQ Operational Memoranda for the Remediation and Redevelopment Division (MDEQ, 2012). The MDEQ Operational Memoranda No. 1 (MDEQ, 2012) includes Cleanup Criteria and Risk-Based Screening Levels for multiple exposure pathways. The screening values that were used for COPC selection were based on the minimum Cleanup Criteria and/or Risk-Based Screening Level protective of the following exposure pathways for soil and groundwater that were deemed relevant for the Site:

Media	*Exposure Pathways*
Soil (1,2)	Direct Contact Groundwater Protection (drinking water) Groundwater Protection (direct contact) Ambient Air Indoor Air Soil Saturation
Groundwater	Drinking Water Direct Contact Indoor Air Solubility

Notes:
(1) Under a current exposure scenario, only direct contact, ambient air, and soil saturation exposure pathways were included in the determination of the final screening value for surface soil.
(2) If the minimum of the MDEQ Cleanup Criteria and Risk-Based Screening Levels were below the Statewide Default Background Levels, the screening value was set to the Statewide Default Background Level.

The Cleanup Criteria and/or Risk-Based Screening Levels are chemical concentrations that correspond to fixed levels of risk [i.e., either an one-in-one hundred thousand (10^5) cancer risk or a non-carcinogenic HI of 1]. The chemical data for each medium were evaluated to identify chemicals at concentrations above the screening values. All chemicals determined to be present at

concentrations above the screening values and which had a level of detection frequency (LDF) greater than 5 percent (%) or those chemicals which did not have a screening value, were identified as COPCs. All essential nutrients (e.g., calcium, magnesium, and potassium) and parameters reported at concentrations below the screening values were not identified as COPCs, and therefore, not given further evaluation.

The analytical results for samples collected from soil and groundwater are summarized and discussed in Sections 2.0 and 5.0.

The surface soil data set consists of all soils less than or equal to 1 feet bgs. Subsurface soil consists of all soils from greater than 1 feet bgs to 10 feet bgs, given that human exposure to soils below a depth of 10 feet bgs is not expected. Exposure to soil was assumed to occur either through surface soil or through combined surface and subsurface soil. To differentiate between these two exposure pathways to soil, the exposure to surface soil only has been evaluated as an "undisturbed" scenario and the exposure to combined surface and subsurface soil has been evaluated as a "disturbed" scenario. The combined surface and subsurface soil data are referred to as "soil" throughout the remainder of the HHRA. The surface soil data set was used in evaluating soil exposure in current scenarios for trespasser and commercial worker receptors. The soil data set was used in evaluating soil exposure in current and future scenarios for construction and utility workers. For future scenarios for trespasser, resident, commercial worker, and recreational user, both the surface soil ("undisturbed") and combined surface and subsurface soil ("disturbed") were used to evaluate soil exposure.

It should be noted that total and dissolved groundwater metal data were screened separately to ensure that all metal COPCs were carried forward in the HHRA. However, all potential exposures were evaluated using only total metal groundwater concentrations.

Selection of COPCs is more specifically discussed below for Residential Area 1 (8.1.2.3.1), Residential Area 2 (8.1.2.3.2), Residential Area 3 (8.1.2.3.3), Residential Area 4 (8.1.2.3.4), Waterfront Plaza (8.1.2.3.5), Mixed Residential/Commercial Area 1 (8.1.2.3.6), Mixed Residential/Commercial Area 2 (8.1.2.3.7), Commercial Area 1 (8.1.2.3.8), Commercial Area 2 (8.1.2.3.9), Commercial Area 3 (8.1.2.3.10), and Commercial Area 4 (8.1.2.3.11).

The HHRA included soil and groundwater data for only total chromium. For soil, screening values are available for trivalent chromium and hexavalent chromium, but not total chromium. Therefore, concentrations of trivalent chromium and hexavalent chromium were calculated for each data point using measured total chromium concentrations and the recommended ratio of 1:6 hexavalent chromium to trivalent chromium, as per U.S. EPA Regional Screening Levels User's Guide, November 2011 (U.S. EPA, 2011a). CRA conducted soil sampling within each development area to confirm that the ratio of 1:6 hexavalent chromium to trivalent chromium was appropriate for the Site. Based on the analytical results (see Table A.12), hexavalent chromium was not detected in these soil samples. The results also indicate that total chromium was made up entirely of trivalent chromium. Given this information, the use of the ratio of 1:6 hexavalent chromium to trivalent chromium in the HHRA for soil is considered to be a conservative approach. For groundwater, the screening value is available for total chromium, which incorporates toxicity associated with trivalent and hexavalent chromium. However, in the areas where total chromium was identified as a groundwater COPC, EPCs are presented for both trivalent and hexavalent chromium according to U.S. EPA 2011a, which allowed for the calculation of risks/hazards for both chromium species in groundwater.

8.1.2.3.1 RESIDENTIAL AREA 1 (BY MEDIA)

This section presents the determination of COPCs for potential Residential Area 1 receptors, based on analytical data for Residential Area 1 media. The medium (e.g., surface soil) and the exposure area (Residential Area 1) are identified in the subtitles.

Surface Soil – Residential Area 1

As presented in Table I.1.1 of Appendix I.1, arsenic was detected at a maximum concentration greater than the screening value, and therefore was identified as a COPC.

Soil – Residential Area 1

As presented in Table I.1.2 of Appendix I.1, methylene chloride, pentachlorophenol, aluminum, antimony, arsenic, cobalt, iron, and manganese

were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

Groundwater – Residential Area 1

As presented in Table I.1.3 of Appendix I.1, bis(2-ethylhexyl)phthalate, aluminum, arsenic, chromium, iron, lead, manganese, and vanadium were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.2.3.2 RESIDENTIAL AREA 2 (BY MEDIA)

This section presents the determination of COPCs for potential Residential Area 2 receptors, based on analytical data for Residential Area 2 media. The medium (e.g., surface soil) and the exposure area (Residential Area 2) are identified in the subtitles.

Surface Soil – Residential Area 2

As presented in Table I.2.1 of Appendix I.2, arsenic was detected at a maximum concentration greater than the screening value, and therefore was identified as a COPC.

Soil – Residential Area 2

As presented in Table I.2.2 of Appendix I.2, benzene, pentachlorophenol, aluminum, arsenic, iron, and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

Groundwater – Residential Area 2

As presented in Table I.2.3 of Appendix I.2, bis(2-ethylhexyl)phthalate, aluminum, arsenic, chromium, iron, lead, manganese, and vanadium were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.2.3.3 RESIDENTIAL AREA 3 (BY MEDIA)

This section presents the determination of COPCs for potential Residential Area 3 receptors, based on analytical data for Residential Area 3 media. The medium (e.g., surface soil) and the exposure area (Residential Area 3) are identified in the subtitles.

Surface Soil – Residential Area 3

As presented in Table I.3.1 of Appendix I.3, arsenic was detected at a maximum concentration greater than the screening value, and therefore was identified as a COPC.

Soil – Residential Area 3

As presented in Table I.3.2 of Appendix I.3, methylene chloride, aluminum, antimony, arsenic, cobalt, iron, manganese, and mercury were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

Groundwater – Residential Area 3

As presented in Table I.3.3 of Appendix I.3, bis(2-ethylhexyl)phthalate, aluminum, arsenic, chromium, iron, lead, manganese, and vanadium were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.2.3.4 RESIDENTIAL AREA 4 (BY MEDIA)

This section presents the determination of COPCs for potential Residential Area 4 receptors, based on analytical data for Residential Area 4 media. The medium (e.g., surface soil) and the exposure area (Residential Area 4) are identified in the subtitles.

Surface Soil – Residential Area 4

As presented in Table I.4.1 of Appendix I.4, benzo(a)pyrene, dibenz(a,h)anthracene, arsenic, and lead, were detected at maximum

concentrations greater than the screening values, and therefore were identified as COPCs.

Soil – Residential Area 4

As presented in Table I.4.2 of Appendix I.4, benzene, ethylbenzene, toluene, xylenes (total), benzo(a)pyrene, dibenz(a,h)anthracene, pentachlorophenol, aluminum, antimony, arsenic, cobalt, iron, lead, manganese, mercury, selenium, and total PCBs were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

Groundwater – Residential Area 4

As presented in Table I.4.3 of Appendix I.4, arsenic, iron, and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.2.3.5 WATERFRONT PLAZA (BY MEDIA)

This section presents the determination of COPCs for potential Waterfront Plaza receptors, based on analytical data for Waterfront Plaza media. The medium (e.g., surface soil) and the exposure area (Waterfront Plaza) are identified in the subtitles.

Surface Soil – Waterfront Plaza

As presented in Table I.5.1 of Appendix I.5, arsenic was detected at a maximum concentration greater than the screening value, and therefore was identified as a COPC.

Soil – Waterfront Plaza

As presented in Table I.5.2 of Appendix I.5, methylene chloride, aluminum, arsenic, iron, and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

Groundwater – Waterfront Plaza

As presented in Table I.5.3 of Appendix I.5, arsenic, iron, and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.2.3.6 MIXED RESIDENTIAL/COMMERCIAL AREA 1 (BY MEDIA)

This section presents the determination of COPCs for potential Mixed Residential/Commercial Area 1 receptors, based on analytical data for Mixed Residential/Commercial Area 1 media. The medium (e.g., surface soil) and the exposure area (Mixed Residential/Commercial Area 1) are identified in the subtitles.

Surface Soil – Mixed Residential/Commercial Area 1

As presented in Table I.6.1 of Appendix I.6, arsenic was detected at a maximum concentration greater than the screening value, and therefore was identified as a COPC.

Soil – Mixed Residential/Commercial Area 1

As presented in Table I.6.2 of Appendix I.6, tetrachloroethene, aluminum, arsenic, cobalt, iron, and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

Groundwater – Mixed Residential/Commercial Area 1

As presented in Table I.6.3 of Appendix I.6, arsenic, iron, and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.2.3.7 MIXED RESIDENTIAL/COMMERCIAL AREA 2 (BY MEDIA)

This section presents the determination of COPCs for potential Mixed Residential/Commercial Area 2 receptors, based on analytical data for Mixed Residential/Commercial Area 2 media. The medium (e.g., surface soil) and the

exposure area (Mixed Residential/Commercial Area 2) are identified in the subtitles.

Surface Soil – Mixed Residential/Commercial Area 2

As presented in Table I.7.1 of Appendix I.7, benzo(a)pyrene, dibenz(a,h)anthracene, arsenic, and lead were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

Soil – Mixed Residential/Commercial Area 2

As presented in Table I.7.2 of Appendix I.7, benzene, ethylbenzene, methylene chloride, tetrachloroethene, xylenes (total), benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, aluminum, antimony, arsenic, cobalt, iron, lead, manganese, mercury, selenium, thallium, vanadium, and zinc were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

TPH-extractable (DRO) and TPH-purgeable (GRO) were detected in subsurface soils (greater than 1 feet bgs) within Mixed Commercial/Residential Area 2. There are no MDEQ Cleanup Criteria or Risk-Based Screening Levels for these petroleum mixtures, nor is there toxicity information available for these petroleum mixtures to allow for characterizing human health risks/hazards. As such, TPH-extractable and TPH-purgeable were not identified as COPCs due to lack of toxicity information. As indicated in MDEQ's, *Remediation and Redevelopment Division Operational Memorandum No. 2 Frequently Asked Questions, February 2005* (MDEQ, 2005), DRO and GRO analysis cannot be used to determine compliance with criteria or in making risk-based decisions. However, it should be noted that indicator parameters that are typically associated as components or additives of petroleum mixtures, including benzene, toluene, ethylbenzene, and xylenes (total)(BTEX), PAHs, trimethylbenzenes, isopropylbenzene, 1,2-dichloroethane, 1,2-dibromoethane, methyl tert butyl ether, and lead, which do have screening values, were evaluated within the HHRA.

Groundwater – Mixed Residential/Commercial Area 2

As presented in Table I.7.3 of Appendix I.7, aluminum, antimony, arsenic, cadmium, chromium, iron, lead, manganese, selenium, and vanadium were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.2.3.8 COMMERICAL AREA 1 (BY MEDIA)

This section presents the determination of COPCs for potential Commercial Area 1 receptors, based on analytical data for Commercial Area 1 media. The medium (e.g., surface soil) and the exposure area (Commercial Area 1) are identified in the subtitles.

Surface Soil – Commercial Area 1

As presented in Table I.8.1 of Appendix I.8, manganese was detected at a maximum concentration greater than the screening value, and therefore was identified as a COPC.

Soil – Commercial Area 1

As presented in Table I.8.2 of Appendix I.8, arsenic, iron, and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

Groundwater – Commercial Area 1

As presented in Table I.8.3 of Appendix I.8, bis(2-ethylhexyl)phthalate, aluminum, arsenic, chromium, iron, lead, and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.2.3.9 COMMERCIAL AREA 2 (BY MEDIA)

This section presents the determination of COPCs for potential Commercial Area 2 receptors, based on analytical data for Commercial Area 2 media. The

medium (e.g., surface soil) and the exposure area (Commercial Area 2) are identified in the subtitles.

Surface Soil – Commercial Area 2

As presented in Table I.9.1 of Appendix I.9, there were no chemicals detected at maximum concentrations greater than the screening values, and therefore no chemicals were identified as COPCs.

Soil – Commercial Area 2

As presented in Table I.9.2 of Appendix I.9, methylene chloride, arsenic, cobalt, iron, and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

Groundwater – Commercial Area 2

As presented in Table I.9.3 of Appendix I.9, arsenic and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.2.3.10 COMMERCIAL AREA 3 (BY MEDIA)

This section presents the determination of COPCs for potential Commercial Area 3 receptors, based on analytical data for Commercial Area 3 media. The medium (e.g., surface soil) and the exposure area (Commercial Area 3) are identified in the subtitles.

Surface Soil – Commercial Area 3

As presented in Table I.10.1 of Appendix I.10, there were no chemicals detected at maximum concentrations greater than the screening values, and therefore no chemicals were identified as COPCs.

Soil – Commercial Area 3

As presented in Table I.10.2 of Appendix I.10, benzene, methylene chloride, arsenic, cobalt, iron, manganese, and mercury were detected at maximum

concentrations greater than the screening values, and therefore were identified as COPCs.

Groundwater – Commercial Area 3

As presented in Table I.10.3 of Appendix I.10, arsenic and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.2.3.11 COMMERCIAL AREA 4 (BY MEDIA)

This section presents the determination of COPCs for potential Commercial Area 4 receptors, based on analytical data for Commercial Area 4 media. The medium (e.g., surface soil) and the exposure area (Commercial Area 4) are identified in the subtitles.

Surface Soil – Commercial Area 4

As presented in Table I.11.1 of Appendix I.11, arsenic and manganese were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

Soil – Commercial Area 4

As presented in Table I.11.2 of Appendix I.11, benzene, methylene chloride, tetrachloroethene, antimony, arsenic, cadmium, cobalt, copper, iron, lead, manganese, mercury, and total PCBs were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

TPH-extractable (DRO) and TPH-purgeable (GRO) were detected in subsurface soils (greater than 1 feet bgs) within Commercial Area 4. There are no MDEQ Cleanup Criteria or Risk-Based Screening Levels for these petroleum mixtures, nor is there toxicity information available for these petroleum mixtures to allow for characterizing human health risks/hazards. As such, TPH-extractable and TPH-purgeable were not identified as COPCs due to lack of toxicity information. As indicated in MDEQ's, *Remediation and Redevelopment Division Operational Memorandum No. 2 Frequently Asked Questions, February 2005* (MDEQ, 2005), DRO and GRO analysis cannot be used to determine compliance with criteria or in

making risk-based decisions. However, it should be noted that indicator parameters that are typically associated as components or additives of petroleum mixtures, including BTEX, PAHs, trimethylbenzenes, isopropylbenzene, 1,2-dichloroethane, 1,2-dibromoethane, methyl tert butyl ether, and lead, which do have screening values, were evaluated within the HHRA.

Groundwater – Commercial Area 4

As presented in Table I.11.3 of Appendix I.11, aluminum, antimony, arsenic, cadmium, chromium, iron, lead, manganese, selenium, and vanadium were detected at maximum concentrations greater than the screening values, and therefore were identified as COPCs.

8.1.3 EXPOSURE ASSESSMENT

Exposure is defined as the contact of a receptor (i.e., person, animal, or other flora or fauna) with a chemical or physical agent. The exposure assessment is the estimation of the magnitude, frequency, duration, and routes of exposure. An exposure assessment provides a systematic analysis of the potential exposure mechanisms by which a receptor may be exposed to chemical or physical agents at or originating from a study area. The objectives of an exposure assessment are as follows:

1. Characterization of exposure setting (see Section 8.1.3.1).
2. Identification of potential exposure pathways (see Section 8.1.3.2).
3. Quantification of exposure (see Section 8.1.3.3).

Special considerations related to evaluation of Residential and Non-Residential adult exposures to lead in the various media are discussed in Section 8.1.3.4.

8.1.3.1 CHARACTERIZATION OF EXPOSURE SETTING

As part of the HHRA process, potential exposure pathways are determined through an evaluation of the physical setting of the Site and the potentially exposed populations. A description of the physical setting of the Site is presented in Section 2.0. The consideration of Site-specific factors related to land usage is important in the development of realistic current and future exposure

scenarios and quantification of risks and hazards. The current and future potential land uses that are reasonably expected for the Site determine what populations may potentially be exposed.

8.1.3.1.1 CURRENT LAND USE

The Site comprises approximately 35.6 acres of land and consists of the former Plainwell, Inc. Mill property and buildings. Current Site features include the former Mill Buildings, Wastewater Treatment Plant (WWTP) buildings and associated clarifiers, the former Specialty Minerals, Inc. Building (only the concrete pad of the former building remains), former Sludge Dewatering Building, concrete pads, the guard shack, rail spurs, one 50,000-gallon water tower (one 50,000-gallon water tower was removed in 2012), ancillary support buildings (pump houses, former guard shacks, etc.), wooded areas, and asphalt-paved areas. The Site buildings and structures are presented on Figure 1.2. As part of the on-going property redevelopment activities, portions of the former Mill Buildings were razed between March and August 2012, or are undergoing renovation for future anticipated occupancy by the City of Plainwell in 2013, and the former Sludge Dewatering Building was renovated for use by the City of Plainwell Public Safety Department, with occupancy in late 2012.

On July 18, 2011, ownership of the eastern portion of the Site, including Building 17 and Building 19, was transferred to CRA 200 Allegan Street LLC. Since that time, CRA 200 Allegan Street LLC has been conducting renovation activities on offices and access ways. In March 2012, CRA moved its Kalamazoo, Michigan office staff into Building 17 and now occupies the top floor of this building.

The City of Plainwell is currently conducting renovation activities on office areas in Building 18 for the anticipated occupation of those areas in 2013 for City Hall operations. Additionally, the City of Plainwell is currently utilizing portions of the Site for storage of various seasonal decorative supplies, presentation rooms, fire hose testing, and ambulance driver testing. Demolition of the former Quality Products Building was conducted in October 2011, and demolition of the former Specialty Minerals Building was conducted in December 2011. Demolition activities associated with portions of the Mill Buildings were conducted on behalf of the City of Plainwell with oversight from the MDEQ for Buildings 3A, 9A, 9B, 9C, 9D, 9E, 9F, 23 and 28, the former 200,000-gallon fuel oil AST and

associated area, the former clay, starch, and ammonia AST areas, and one of the 50,000-gallon water towers from March to August 2012. The specific timing associated with demolition of other structures associated with the future redevelopment of the Site has not yet been established. Additionally, several structures are not anticipated to be demolished and will be redeveloped/renovated/reused.

In addition to the aforementioned redevelopment actions, activities related to the upgrades to M-89 adjacent to the Site, including the installation of a natural gas pipeline by Michigan Gas Utilities and the installation of two storm sewer lines by the MDOT that traverse portions of the Site were conducted. Natural gas line and storm sewer installation activities were conducted in March and April 2012, as summarized in Section 5.2.4. During the removal of the existing subsurface materials and the subsequent backfilling of areas excavated for the installation of the utility lines, some of the former subsurface materials were observed to remain at ground surface. The movement of the materials previously present below the current Site grade, which could be impacted at concentrations above the Part 201 Criteria, to the surface potentially exacerbated pre-excavation conditions at these portions of the Site. As a result, an evaluation was performed to determine if the potential exacerbation impacted the conclusions of the RI Report. This evaluation was summarized in a memorandum entitled *Michigan Gas Utilities and Michigan Department of Transportation Utility Lines*, which was submitted to U.S. EPA on June 27, 2012. Arsenic was identified to be the only potential concern for the movement of subsurface soils to the surface in Residential Area 1. As indicated in Section 8.1.2.3.1, arsenic has been identified as a surface soil COPC, and therefore, risks/hazards from exposure to arsenic in surface soil has been evaluated in the HHRA. Furthermore, the concentrations of arsenic that were detected in the subsurface soils that were brought to the surface are not significantly different compared to the EPC applied for arsenic in Residential Area 1 surface soil. Therefore, there is no significant impact to the HHRA with respect to the subsurface soils that were brough to the surface during the utilities installation.

In general, the Site is bordered by the Kalamazoo River to the north, residential and commercial properties (City of Plainwell business district) to the east, residential properties to the south, and residential properties and the City of Plainwell Water Renewal Plant to the west.

The majority of the Site is currently closed and fenced to pedestrian and vehicular traffic. The current potentially exposed population includes persons who may infrequently trespass on the Site, commercial workers in Commercial Area 4, construction workers in Commercial Area 2, and utility workers at all 11 areas of the Site, given that utilities are active throughout the Site.

8.1.3.1.2 FUTURE LAND USE

The City of Plainwell intends on re-developing the Site. The proposed re-development framework of the Site is for residential, commercial, and/or recreational land uses. Residential land use will potentially consist of residential condominium units facing the Kalamazoo River. Commercial land use will consist of commercial/retail units and office space. Recreational land use might include walking trails, playgrounds, green space for sporting activities, etc.

The future potentially exposed population for the Site includes trespassers, residents, commercial workers, and recreational users. As the future land use for these receptors is not finalized, the conservative exposure assumptions selected for these receptors are protective of all possible future land uses. The future re-development of the Site will necessitate some below-grade excavation or construction activity and/or utility installation and servicing. Future potential construction workers (who are assumed to be exposed for a reasonable amount of time within a limited period at the Site) were considered separate from utility workers (who are assumed to be exposed for a short period of time at the Site each year, for many years).

8.1.3.2 IDENTIFICATION OF POTENTIAL EXPOSURE PATHWAYS

An exposure pathway describes a mechanism by which humans may come into contact with Site-related COPCs. An exposure pathway is complete (i.e., it could result in a receptor contacting a COPC) if all of the following four elements are present:

1. A source or a release from a source [e.g., COPCs released to soil during historical Mill operations (see Section 8.1.3.2.1)].
2. A probable environmental migration route of a COPC [e.g., leaching or partitioning from one medium to another (see Section 8.1.3.2.2)].

3. An exposure point where a receptor may come in contact with a COPC [e.g., soil (see Section 8.1.3.2.3)].
4. A route by which a COPC may enter a potential receptor's body [e.g., ingestion, dermal contact, or inhalation (see Section 8.1.3.2.4)].

If any of these four elements are not present, then the exposure pathway is considered incomplete and would not contribute to the total exposure from the Site. Exposure scenarios and complete exposure pathways are discussed in Section 8.1.3.2.5.

All potentially complete exposure pathways within the human health CSM are presented on Figure 8.1. These pathways include:

- Direct contact to soil through incidental ingestion and dermal contact
- Indirect contact to soil through inhalation of particulates
- Indirect contact to soil through inhalation of vapors
- Direct contact to groundwater through potable use
- Direct contact to groundwater through incidental ingestion and dermal contact
- Indirect contact to groundwater through inhalation of vapors

8.1.3.2.1 RELEASE MECHANISMS

The potential mechanisms of contaminant release at the Site are:

- Potential leaching of contaminants from contaminated soil to groundwater and potential groundwater discharge to surface water
- Potential release of contaminants from contaminated surficial soil through contact with surface water through precipitation and subsequent erosion and runoff
- Potential release of contaminants from the soil to ambient air or indoor air by volatilization and wind
- Potential release of contaminants from the groundwater by volatilization through the unsaturated zone to ambient air or indoor air

A brief discussion of these release mechanisms is presented below.

It is possible for impacted soil (i.e., surficial and subsurface soils) to potentially act as a source for groundwater contamination. Downward transport of soluble materials to groundwater from soil in infiltrating water could occur by leaching.

The Site topography is generally flat and gently sloping towards the north to the Kalamazoo River and to the east towards the Mill Race. Thus, it is anticipated that limited or no potential exists for contaminant release and transport through surface water runoff to adjacent areas due to the current topography of the Site.

The majority of the Site is covered with asphalt and concrete pavement. The asphalt and concrete pavement is generally in poor condition and contains cracks and breaches characteristic of deterioration. There are areas primarily along the riverbank and former lagoon areas where vegetation is present. A wooded lot is present at the far southwestern extent of the Site. Given the nature of the cover material as currently understood and the Site topography, there is the potential for infiltration into the contaminated soil. Infiltration in areas of impacted media may cause contaminants to migrate downward to the underlying groundwater.

VOCs in the groundwater have the potential to be released to the unsaturated zone by diffusion. The VOCs may have the potential to migrate through the unsaturated zone to ambient and/or indoor air.

VOCs in the impacted soil can be released to the unsaturated zone by diffusion. The VOCs may have the potential to migrate through the unsaturated zone to ambient and/or indoor air.

Non-volatile soil contaminants can be released into ambient air as fugitive dust emissions through wind action.

8.1.3.2.2 FATE AND TRANSPORT IN RECEIVING MEDIA

Many factors control the partitioning of a chemical in the environment. An understanding of the general fate and transport characteristics of the COPCs is important when predicting future theoretical exposure, linking sources with currently contaminated media, and identifying potentially complete pathways to Site media. Therefore, the fate and transport analysis conducted at this stage of the exposure assessment is meant to identify media that are likely to receive

Site-related COPCs. The potential contaminant transport mechanisms at the Site are:

- Movement with wind
- Movement with surface water
- Movement during future Site re-use construction disturbance
- Movement of constituents leached from soil
- Movement with groundwater
- Movement of VOCs (from soil and groundwater) within subsurface gas

A brief discussion of the fate and transport characteristics of the COPCs is presented below.

The exposure of soil at the surface may result in the transport of dust and VOCs by wind. As previously stated, cover material is present but limited in some areas of the Site. The existing cover likely does not totally prevent upward migration of chemicals within vapors. The existing cover has also been found to contain detectable concentrations of contaminants. The presence of contaminants within the existing cover may contribute to contaminant migration of VOCs or fugitive dust. VOCs in the air will be subject to dispersion by the wind and photolysis due to exposure to sunlight, thereby limiting their concentrations.

The exposure of soil at the surface may also result in the transport of dissolved or suspended contaminants along surface water drainage pathways. As discussed earlier, the potential for this to occur is limited because of the topography of the Site. Organic chemicals dissolved in surface water may be subject to adsorption, hydrolysis, or photolysis. VOCs may also volatilize during transport in surface water.

Construction activities may also result in disturbance of contaminants in the various media. Contaminants attached to soil particulates may become suspended in the air column and transported by wind.

Movement of leached constituents is another potential contaminant transport mechanism. Leached constituents can be produced through infiltration of

precipitation into impacted surface soils. Once leached constituents have been produced, the following migration pathways are possible:

1. Leached constituents can be transferred to subsurface soil from percolation away from the surface soils. This transfer may occur through the process of mechanical filtration, precipitation, and/or sorption.
2. Leached constituents can percolate through the soil underlying and impact the underlying aquifer(s).
3. VOCs in leached material can migrate through the vadose zone via diffusion to ambient and/or indoor air.

Movement with groundwater is a potential transport mechanism. Once the chemicals have entered the groundwater, the following migration pathways are possible:

1. Lateral groundwater migration toward the Kalamazoo River.
2. Impacted groundwater can migrate vertically to deeper aquifers.
3. VOCs in groundwater can migrate through the vadose zone via diffusion to ambient and/or indoor air.

During groundwater transport, the contaminants released to the groundwater will be subject to dispersion, adsorption, volatilization, and biotic and abiotic degradation.

8.1.3.2.3 POTENTIAL EXPOSURE POINTS

After contaminated or potentially contaminated media have been identified, the exposure points are determined by identifying whether or not the potentially exposed population can contact these media.

The exposure domain is the area within which the potentially exposed population may contact the contaminated media. For example, incidental ingestion of surface soil by a current trespasser is complete only in areas that are not covered. Therefore, the exposure domain for surface soil ingestion by a current trespasser would include only the areas not under a cover. However, the surface soil exposure domain conservatively included all surface soil data to evaluate the exposure to Site surface soils for the trespasser.

The indoor air pathway was evaluated for future conditions under a worst case scenario corresponding to a typical small commercial building or residential building (with basement) that could be constructed as part of the future redevelopment of Site over existing impacted environmental media. For future buildings where vapor intrusion is a potentially complete pathway, this exposure pathway can be eliminated by implementing vapor intrusion barriers in the foundations irrespective of whether or not the proposed location has been evaluated for potential vapor intrusion.

8.1.3.2.4 POTENTIAL EXPOSURE ROUTES

In general, humans can be exposed to different environmental media, including soil, groundwater, and air contacting the other contaminated media. Based on the physical conditions of the Site, potential exposure routes associated with exposure to soil and groundwater may include ingestion, dermal contact, and inhalation (airborne particulates and/or vapors).

8.1.3.2.5 EXPOSURE SCENARIOS AND COMPLETED EXPOSURE PATHWAYS

Based on an understanding of the four components of an exposure pathway and the current/future conditions of the Site, human exposure pathways were identified. As discussed in Section 8.1.2.1, the potential human populations considered relevant to the HHRA for current and future Site conditions include an adolescent trespasser, residents (child and adult), recreational users (child and adult), construction workers, utility workers, and commercial workers.

The HHRA CSM shown on Figure 8.1 presents a summary of the exposure media, exposure pathways, exposure routes, and exposed receptors that are considered in the HHRA. The following media and potential human exposures (i.e., complete pathways) were identified for quantitative evaluation in the HHRA:

(1) Surface Soil ("undisturbed" soil exposure) – Current Condition:

- Dermal contact with surface soil by trespasser and commercial worker

- Incidental ingestion of surface soil by trespasser and commercial worker
- Inhalation of airborne particulate/vapors from surface soil by trespasser and commercial worker

(2) Surface Soil ("undisturbed" soil exposure) – Future Condition:

- Dermal contact with soil by trespassers, recreational users, residents, and commercial workers
- Incidental ingestion of soil by trespassers, recreational users, residents, and commercial workers
- Inhalation of airborne particulate/vapors originating from soil by trespassers, recreational users, residents, and commercial workers
- Inhalation of vapors in indoor air originating from soil by residents and commercial workers

(3) Soil ("disturbed" soil exposure) – Current Condition:

- Dermal contact with surface soil by construction worker and utility worker
- Incidental ingestion of surface soil by construction worker and utility worker
- Inhalation of airborne particulate/vapors from surface soil by construction worker and utility worker

(4) Soil ("disturbed" soil exposure) - Future Condition:

- Dermal contact with soil by trespassers, recreational users, residents, commercial workers, construction workers, and utility workers
- Incidental ingestion of soil by trespassers, recreational users, residents, commercial workers, construction workers, and utility workers
- Inhalation of airborne particulate/vapors originating from soil by trespassers, recreational users, residents, commercial workers, construction workers, and utility workers
- Inhalation of vapors in indoor air originating from soil by residents and commercial workers

(5) Groundwater – Current/Future Condition:

- Dermal contact with groundwater by residents, construction workers, and utility workers

- Ingestion of groundwater by residents, construction workers, and utility workers
- Inhalation of airborne vapors originating from groundwater by residents, construction workers, and utility workers
- Inhalation of vapors in indoor air originating from groundwater by residents and commercial workers

Although the inhalation of groundwater vapors migrating to ambient air for trespassers, recreational users, and commercial workers is a potentially complete exposure pathway, the trespasser, recreational user, and the commercial worker are expected to conduct activities at or near the surface, and therefore direct contact with groundwater is not expected to occur. Furthermore, based on the depth of groundwater at the Site (greater than 7 feet bgs), it is expected that negligible exposure levels would result in ambient air as the vapor migrate through the vadose zone. As such, inhalation of groundwater vapors migrating to ambient air was not considered further in the HHRA for trespassers, recreational users, and commercial workers. The ingestion of homegrown produce by residents was not considered a complete exposure pathway because condominiums, not single family detached homes, are proposed for the Residential Areas.

8.1.3.3 QUANTIFICATION OF EXPOSURE

To quantify exposure, potential exposure scenarios were developed using guidance presented in the following U.S. EPA documents:

- U.S. EPA RAGS: Volume 1 - Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989 (U.S. EPA, 1989)
- U.S. EPA RAGS: Volume 1 – Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors, Interim Final, OSWER Directive 9285.6-03, March 25, 1991 (U.S. EPA, 1991a)
- U.S. EPA RAGS: Volume 1 – Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), Interim, EPA/540/R-92/003, December 1991 (U.S. EPA, 1991b)
- U.S. EPA Assessing Dermal Exposure from Soil, Region III Technical Guidance Manual Risk Assessment, EPA/903-K-95-003, December 1995 (U.S. EPA, 1995)

- U.S. EPA Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS, Section 4: Exposure Assessment, May 2000 (U.S. EPA, 2000)
- U.S. EPA RAGS: Volume 1 – Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments), Final, Publication 9285.7-47, December 2001 (U.S. EPA, 2001b)
- U.S. EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002 (U.S. EPA, 2002)
- U.S. EPA RAGS: Volume 1 – Human Health Evaluation Manual (Part E, Supplemental Guidance For Dermal Risk Assessment), Final, EPA/540/R/99/005, OSWER Directive 9285.7-02EP, PB99-963312, July 2004 (U.S. EPA, 2004a)
- U.S. EPA User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings, Office of Emergency and Remedial Response, February 22, 2004 (U.S. EPA, 2004b)
- U.S. EPA Child-Specific Exposure Factors Handbook, September 2008 (U.S. EPA, 2008)
- U.S. EPA RAGS: Volume 1 – Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment, Final, EPA-540-R-070-002, OSWER 9285.7-82, January 2009 (U.S. EPA, 2009a)

In instances where U.S. EPA documents did not present necessary factors, or where more appropriate scientific data were not available, professional judgment was applied to develop conservative assumptions which are representative of the Reasonable Maximum Exposure (RME) and are protective of human health. The exposure scenarios and assumptions for each exposure area are presented in their respective appendix with the related data. The following list presents the exposure area and its associated appendix:

i)	Residential Area 1	-	Appendix I.1
ii)	Residential Area 2	-	Appendix I.2
iii)	Residential Area 3	-	Appendix I.3
iv)	Residential Area 4	-	Appendix I.4
v)	Waterfront Plaza	-	Appendix I.5
vi)	Mixed Residential/Commercial Area 1	-	Appendix I.6
vii)	Mixed Residential/Commercial Area 2	-	Appendix I.7
viii)	Commercial Area 1	-	Appendix I.8
ix)	Commercial Area 2	-	Appendix I.9
x)	Commercial Area 3	-	Appendix I.10

xi) Commercial Area 4 - Appendix I.11

The Central Tendency (CT) and RME exposure point concentration (EPC) values based on the 95 percent upper confidence limit (% UCL) of the mean of media (soil, groundwater, etc.) were determined for the various areas based on the observed data distribution and the percentage of censored data points (non-detected results). It should be noted that the same EPC was applied for both the CT and RME scenarios to estimate the exposure.

Surface Soil

The EPCs for the COPCs identified in surface soil are summarized in the following tables:

i)	Residential Area 1	-	Table I.1.4 of Appendix I.1
ii)	Residential Area 2	-	Table I.2.4 of Appendix I.2
iii)	Residential Area 3	-	Table I.3.4 of Appendix I.3
iv)	Residential Area 4	-	Table I.4.4 of Appendix I.4
v)	Waterfront Plaza	-	Table I.5.4 of Appendix I.5
vi)	Mixed Residential/Commercial Area 1	-	Table I.6.4 of Appendix I.6
vii)	Mixed Residential/Commercial Area 2	-	Table I.7.4 of Appendix I.7
viii)	Commercial Area 1	-	Table I.8.4 of Appendix I.8
ix)	Commercial Area 4	-	Table I.11.4 of Appendix I.11

Soil

The EPCs for the COPCs identified in soil are summarized in the following tables:

i)	Residential Area 1	-	Table I.1.5 of Appendix I.1
ii)	Residential Area 2	-	Table I.2.5 of Appendix I.2
iii)	Residential Area 3	-	Table I.3.5 of Appendix I.3
iv)	Residential Area 4	-	Table I.4.5 of Appendix I.4
v)	Waterfront Plaza	-	Table I.5.5 of Appendix I.5
vi)	Mixed Residential/Commercial Area 1	-	Table I.6.5 of Appendix I.6
vii)	Mixed Residential/Commercial Area 2	-	Table I.7.5 of Appendix I.7
viii)	Commercial Area 1	-	Table I.8.5 of Appendix I.8
ix)	Commercial Area 2	-	Table I.9.4 of Appendix I.9
x)	Commercial Area 3	-	Table I.10.4 of Appendix I.10
xi)	Commercial Area 4	-	Table I.11.5 of Appendix I.11

Groundwater

The EPCs for the COPCs identified in groundwater are summarized in the following tables:

i)	Residential Area 1	-	Table I.1.6 of Appendix I.1
ii)	Residential Area 2	-	Table I.2.6 of Appendix I.2
iii)	Residential Area 3	-	Table I.3.6 of Appendix I.3
iv)	Residential Area 4	-	Table I.4.6 of Appendix I.4
v)	Waterfront Plaza	-	Table I.5.6 of Appendix I.5
vi)	Mixed Residential/Commercial Area 1	-	Table I.6.6 of Appendix I.6
vii)	Mixed Residential/Commercial Area 2	-	Table I.7.6 of Appendix I.7
viii)	Commercial Area 1	-	Table I.8.6 of Appendix I.8
ix)	Commercial Area 2	-	Table I.9.5 of Appendix I.9
x)	Commercial Area 3	-	Table I.10.5 of Appendix I.10
xi)	Commercial Area 4	-	Table I.11.6 of Appendix I.11

Total chromium was identified as a groundwater COPC for several of the areas. Available toxicity information for chromium is presented for trivalent chromium and hexavalent chromium and not total chromium. Given that only total chromium was measured in groundwater samples collected within the various areas, concentrations of trivalent chromium and hexavalent chromium were calculated for each data point using measured total chromium concentrations and the recommended ratio of 1:6 hexavalent chromium to trivalent chromium, as per U.S. EPA Regional Screening Levels User's Guide, November 2011 (U.S. EPA, 2011a). Therefore, EPCs are presented for trivalent and hexavalent chromium, which allowed for the calculation of risks/hazards for both chromium species.

Quantification of exposure is discussed further below in terms of estimation of intake (Section 8.1.3.3.1) and exposure scenario assumptions (Section 8.1.3.3.2).

8.1.3.3.1 SPECIFIC INTAKE EQUATIONS

The following sections provide intake equations for ingestion, dermal, and inhalation exposure to soil and groundwater which were applied in the HHRA. In the HHRA, exposure estimates reflect chemical concentration, contact rate, exposure time, and body weight in a term called "intake" or "dose."

Soil Ingestion Intake Equation

The intake equation for calculating chemical intake from the incidental ingestion of soil (U.S. EPA, 1989) is:

$$I = \frac{\text{C x IR x EF x ED x CF}}{\text{BW x AT}}$$

Where:

I	=	Chemical intake (mg/kg body weight/day)
C	=	Chemical concentration (mg/kg)
IR	=	Incidental ingestion rate (mg soil/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factors (e.g., kg/10^6 mg)
BW	=	Body weight (kg)
AT	=	Averaging time (averaging period, days)

Soil Dermal Contact Intake Equation

The intake equation for calculating chemical intake from dermal exposure to soil (U.S. EPA, 1989) is:

$$I = \frac{\text{C x SA x AF x ABS x EF x ED x CF}}{\text{BW x AT}}$$

Where:

I	=	Chemical intake (mg/kg body weight/day)
C	=	Chemical concentration (e.g., mg/kg for soil)
SA	=	Skin surface area available for contact (cm^2/day)
AF	=	Soil to skin adherence factor (mg/cm^2)
ABS	=	Chemical absorption rate (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factors (e.g., kg/10^6 mg)
BW	=	Body weight (kg)
AT	=	Averaging time (averaging period, days)

Soil Particulate/Vapor Inhalation Intake Equation

The equation for calculating chemical intake from the inhalation of particulate or vapor originating from soil (U.S. EPA, 2002) is:

$$I = \frac{\text{C x FTx EF x ED}}{\text{(VF or PEF) x AT}}$$

Where:

I = Chemical intake (mg/m^3)
C = Chemical concentration (e.g., mg/kg for soil)
FT = Fraction of time exposed (hours per 24 hours) (unitless)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
VF = Volatilization factor (m^3/kg)
PEF= Particulate emission factor (m^3/kg)
AT = Averaging time (averaging period, days)

Groundwater Ingestion Intake Equation

The intake equation for calculating chemical intake from the incidental ingestion exposure to groundwater during excavation activities for construction workers and utility workers (U.S. EPA, 1989) is:

$$I = \frac{\text{C x IR x ET x EF x ED}}{\text{BW x AT}}$$

Where:

I = Chemical intake (mg/kg body weight/day)
C = Chemical concentration (mg/L)
IR = Incidental ingestion rate (L water/hour)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
ET = Exposure time (hours/day)
BW= Body weight (kg)
AT = Averaging time (averaging period, days)

The intake equation for calculating chemical intake from ingestion exposure to groundwater during potable groundwater use for residents (U.S. EPA, 1989) is:

$$I = \frac{\text{C x IR x EF x ED}}{\text{BW x AT}}$$

Where:

I = Chemical intake (mg/kg body weight/day)
C = Chemical concentration (mg/L)
IR = Ingestion rate (L water/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW= Body weight (kg)
AT = Averaging time (averaging period, days)

Groundwater Dermal Contact Intake Equation

The intake equation for calculating chemical intake from dermal exposure to groundwater during excavation activities for construction workers and utility workers during potable groundwater use for residents (U.S. EPA, 2004a) is:

$$I = \frac{DA_{event} \text{ x } EF \text{ x } ED \text{ x } EV \text{ x } SA}{BW \text{ x } AT}$$

Where:

I = Chemical intake (mg/kg body weight/day)
SA = Skin surface area available for contact (cm^2)
DA_{event}= Absorbed dose per event (mg/cm^2-event)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
EV = Event frequency (events/day)
BW = Body weight (kg)
AT = Averaging time (averaging period, days)

The absorbed dose per event (DA_{event}) equation for calculating dermal exposure to groundwater (U.S. EPA, 2004a) is:

For Organic COPCs:

$$\text{If } t_{event} \le t^*, \text{ then } DA_{event} = 2 \text{ x } FA \text{ x } K_p \text{x } C \text{ x} \sqrt{\frac{6 \text{ x } \tau_{event} \text{ x } t_{event}}{\pi}},$$

$$\text{If } t_{event} > t^*, \text{ then } DA_{event} = FA \text{ x } K_p \text{ x } C \text{ x} \left[\frac{t_{event}}{1+B} + 2 \text{ x } \tau_{event} x \left(\frac{1+3xB+3xB^2}{(1+B)^2} \right) \right]$$

For Inorganic COCs:

$$DA_{event} = K_p \times C \times t_{event}$$

Where:

C = Chemical concentration (e.g., mg/cm^3 water)
FA = Fraction absorbed water (dimensionless)
K_p = Dermal permeability coefficient of compound in water (cm/hr)
t_{event}= Event duration (hr/event)
τ_{event}= Lag time per event (hr/event)
t* = Time to reach steady state (hr) = 2.4 x τ_{event}
B= Dimensionless ratio of permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless)

Groundwater Vapor Inhalation Intake Equation

The equation for calculating chemical intake from the inhalation of vapors originating from groundwater during subsurface excavations by construction workers and utility workers and during potable groundwater use for residents (U.S. EPA, 1989) is:

$$I = \frac{C \times FT \times EF \times ED \times VF}{AT}$$

Where:

I = chemical intake (mg/m^3)
CW= chemical concentration (milligrams per liter or mg/L)
FT = fraction of time exposed (unitless)
EF = exposure frequency (days/year)
ED = exposure duration (years)
VF = volatilization factor (L/m^3)
AT = averaging time [period over which exposure is averaged] (days)

Indoor Air Inhalation Intake Equation

The intake equation for calculating chemical intake from the inhalation of indoor air (U.S. EPA, 1989) is:

$$I = \frac{C \times FT \times EF \times ED}{AT}$$

Where:

I = Chemical intake (mg/m^3)
C = Chemical concentration in air (mg/m^3)
FT = Fraction of time exposed (hours per 24 hours exposed) (unitless)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time (averaging period, days)

Carcinogens

A lifetime average daily dose of the chemical is estimated for carcinogens. This prorates the total cumulative intake over a lifetime. An averaging time (AT) of 70 years is used for carcinogens.

Non-Carcinogens

The chemical intake of non-carcinogens is estimated over the appropriate exposure period or averaging time. The averaging time selected depends on the toxic endpoint being assessed.

8.1.3.3.2 EXPOSURE SCENARIO ASSUMPTIONS

Different exposure scenarios were developed for each receptor population that was evaluated in the HHRA. Descriptions of each exposure scenario and associated exposure assumptions are presented in the following subsections.

Receptor characteristics had values assigned for CT and RME scenarios. In some cases these values differed between scenarios (e.g., exposure frequency, exposure duration, etc.) and in other cases these values were the same for both CT and RME scenarios (e.g., body weight, skin surface area, soil ingestion rate, etc.). The assignment of receptor characteristics by scenarios followed standard practices used by regulating agencies and risk assessment professionals. The specific values used are presented in the following sections.

Exposure scenario assumptions for the trespasser, recreational user, resident, commercial worker, construction worker, and utility worker are presented in the unnumbered tables below.

Trespasser

The exposure assumptions that were used in the estimation of the magnitude of the adolescent trespasser's exposure to surface soil (current/future "undisturbed" scenario) and soil (future "disturbed") are summarized in the following table.

Exposure Factor	*Units*	*Scenario*	*Trespasser (Adolescent)*
Soil Ingestion Rate [1]	mg/day	CT and RME	100
Soil Skin Adherence Factor [2]	mg/cm^2	CT	0.04
		RME	0.2
Dermal Absorption Factor [3]	%/100	CT and RME	chemical-specific
Skin Surface Area [4]	cm^2/day	CT and RME	4,471
Fraction of Time Exposed – Inhalation[5]	unitless	CT	1.7hr/24hr
		RME	3.4hr/24hr
Exposure Frequency [6]	days/year	CT	25.3
		RME	50.6
Exposure Duration[7]	years	CT and RME	10
Body Weight [8]	kg	CT and RME	45
Carcinogenic Averaging Time [9]	days	CT and RME	25,550
Non-Carcinogenic Averaging Time [9]	days	CT and RME	3,650
Conversion Factor	kg/mg	CT and RME	1.00E-06
Particulate Emission Factor [1]	m^3/kg	CT and RME	1.36E+09
Volatilization Factor [10]	m^3/kg	CT and RME	chemical-specific

Notes:

1 Obtained from U.S. EPA (2002).

2 Obtained from U.S. EPA (2004a).

3 Obtained from U.S. EPA (2004a) and U.S. EPA (1995). Published values obtained from U.S. EPA 1995 include: arsenic (3%), cadmium (0.1%), metals (1%), benzene (0.05%), VOCs vapor pressure (VP) > benzene VP (3%), VOCs VP < benzene VP (0.05%), PAHs (13%), SVOCs (10%), PCBs (14%), pesticides (10%).

4 Obtained from U.S. EPA (2004a).

5 The fraction of time exposed is the 50th percentile from Table 16-1, Recommended Values for Activity Factors - Time Outdoors (total) (U.S. EPA, 2008). The time spent outdoors for an 11- to 16-year old adolescent of 100 min/day equates to 1.7 hrs. (CT) [100/60]. The RME is double the CT value and is equal to 3.4 hrs. The time spent outdoors for the 6- to 11-year old child presented in U.S. EPA (2008) was not considered for the trespasser fraction of time exposed as it is assumed that an older child is more characteristic of an adolescent that may trespass.

6 The exposure frequency is the 50th percentile from Table 16-1, Recommended Values for Activity Factors - Time Outdoors (total) (U.S. EPA, 2008). The time spent outdoors for 11- to 16-year old adolescent of 100 min/day from out of a possible 365 days equates to 25.3 days (CT) [(100 min/d /1440 total min/d) × 365]. The RME is double the CT value for 50.6 days. The time spent outdoors for the 6- to 11-year old child presented in U.S. EPA (2008) was not considered for the trespasser exposure frequency as it is assumed that an older child is more characteristic of an adolescent that may trespass.

[7] It is assumed that the trespasser is 7 through 16 years old. Therefore, the exposure duration is set to 10 years, based on U.S. EPA (2000).
[8] Obtained from U.S. EPA (2000).
[9] Obtained from U.S. EPA (1989).
[10] Volatilization factor (VF) calculated using equations presented in U.S. EPA (2002); see further discussion in text below.

All exposure assumptions and equations utilized in the calculation of the magnitude of exposure to COPCs in surface soil and soil for an adolescent trespasser are also summarized in tables in Appendices I.1 (Residential Area 1), I.2 (Residential Area 2), I.3 (Residential Area 3), I.4 (Residential Area 4), I.5 (Waterfront Plaza), I.6 (Mixed Residential/Commercial Area 1), I.7 (Mixed Residential/Commercial Area 2), I.8 (Commercial Area 1), I.9 (Commercial Area 2), I.10 (Commercial Area 3), and I.11 (Commercial Area 4), respectively. These tables are listed at the end of this Section (Section 8.1.3.3.2).

To determine the potential inhalation exposure to volatile COPCs in soil volatilizing to ambient air, a VF was used to estimate ambient air concentrations based on the soil concentration. The VF is chemical-specific and was calculated using the approach presented in U.S. EPA (2002). Site-specific soil and chemical-specific properties were used in calculating the VF. The equations and inputs for the calculated VF values are presented in Table I.1.8 of Appendix I.1 (Residential Area 1), Table I.2.8 of Appendix I.2 (Residential Area 2), Table I.3.8 of Appendix I.3 (Residential Area 3), Table I.4.8 of Appendix I.4 (Residential Area 4), Table I.5.8 of Appendix I.5 (Waterfront Plaza), Table I.6.8 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.8 of Appendix I.7 (Mixed Residential/Commercial Area 2), Table I.9.7 of Appendix I.9 (Commercial Area 2), Table I.10.7 of Appendix I.10 (Commercial Area 3), and Table I.11.8 of Appendix I.11 (Commercial Area 4), respectively. It should be noted that volatile COPCs were not identified in Commercial Area 1. Therefore, potential trespasser inhalation exposure to volatile COPCs in soil volatilizing to ambient air and VF was not modeled or required in the HHRA for Commercial Area 1.

Recreational User

The exposure assumptions that were used in the estimation of the magnitude of the recreational user exposure to surface soil (future "undisturbed" scenario) and soil (future "disturbed") are summarized in the following table.

Exposure Factor	*Units*	*Scenario*	*Recreational User*	
			Child	*Adult*
Skin Surface Area [1]	cm^2/day	CT and RME	2,800	5,700
Soil Skin Adherence Factor [1]	mg/cm^2	CT	0.04	0.01
		RME	0.2	0.07
Fraction of Time Exposed [2]	unitless	CT	1hr/24hr	1hr/24hr
		RME	2hr/24hr	2hr/24hr
Exposure Frequency [3]	days/year	CT	35.2	35.2
		RME	70.4	70.4
Exposure Duration [1]	years	CT	6	3
		RME	6	24
Body Weight [4]	kg	CT and RME	15	70
Soil Ingestion Rate [4]	mg/day	CT and RME	200	100
Carcinogenic Averaging Time [5]	days	CT and RME	25,550	25,550
Non-Carcinogenic Averaging Time [5]	days	CT	2,190	1,095
		RME	2,190	8,760
Conversion Factor	kg/mg	CT and RME	1.00E-06	1.00E-06
Particulate Emission Factor [4]	m^3/kg	CT and RME	1.36E+09	1.36E+09
Dermal Absorption Factor - soil [6]	%/100	CT and RME	chemical-specific	chemical-specific
Volatilization Factor - soil [7]	m^3/kg	CT and RME	chemical-specific	chemical-specific

Notes:

1 Obtained from U.S. EPA (2004a).

2 The fraction of time exposed for soil is based on the time spent outdoors playing on dirt from Table 16-1, Recommended Values for Activity Factors - Time Outdoors Playing on Dirt (at residence) (U.S. EPA, 2008). It is assumed that the adult will spend the same amount of time outdoors with their child.

3 The basis for the exposure frequency is the 50th percentile from Table 16-1, Recommended Values for Activity Factors - Time Outdoors (total) (U.S. EPA, 2008). The time spent outdoors for 6-12 months old of 139 min/day from out of a possible 365 days equates to 35.2 days (CT) [(139 min/d /1440 total min/d)*365]. The RME is double the CT value for 70.4 days.

4 Obtained from U.S. EPA (2002).

5 Obtained from U.S. EPA (1989).

6 Obtained from U.S. EPA (2004a) and U.S. EPA (1995). Published values obtained from U.S. EPA 1995 include: arsenic (3%), cadmium (0.1%), metals (1%), benzene (0.05%), VOCs vapor pressure (VP) > benzene VP (3%), VOCs VP < benzene VP (0.05%), PAHs (13%), SVOCs (10%), PCBs (14%), pesticides (10%).

7 Volatilization factor calculated using equations presented in U.S. EPA (2002); see further discussion in text below.

All exposure assumptions and equations utilized in the calculation of the magnitude of exposure to COPCs in soil for the recreational user are also summarized in tables in Appendices I.1 (Residential Area 1), I.2 (Residential Area 2), I.3 (Residential Area 3), I.4 (Residential Area 4), I.5 (Waterfront Plaza), I.6 (Mixed Residential/Commercial Area 1), I.7 (Mixed Residential/Commercial Area 2), and I.11 (Commercial Area 4), respectively. These tables are listed at the end of this Section (Section 8.1.3.3.2).

To determine the potential inhalation exposure to volatile COPCs in soil volatilizing to ambient air, a VF was used to estimate ambient air concentrations based on the soil concentration. The VF is chemical-specific and was calculated using the approach presented in U.S. EPA (2002). Site-specific soil and chemical-specific properties were used in calculating the VF. The equations and inputs for the calculated VF values are presented in Table I.1.10 of Appendix I.1 (Residential Area 1), Table I.2.10 of Appendix I.2 (Residential Area 2), Table I.3.10 of Appendix I.3 (Residential Area 3), Table I.4.10 of Appendix I.4 (Residential Area 4), Table I.5.10 of Appendix I.5 (Waterfront Plaza), Table I.6.10 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.10 of Appendix I.7 (Mixed Commercial/Residential Area 2), and Table I.11.10 of Appendix I.11 (Commercial Area 4), respectively.

Resident

The exposure assumptions that were used in the estimation of the magnitude of the resident (child and adult) exposure to surface soil (future undisturbed scenario), soil (future disturbed scenario), groundwater, and indoor air (from soil and groundwater) are summarized in the following table.

Exposure Factor	*Units*	*Scenario*	*Resident*	
			Child	*Adult*
Water Ingestion Rate [1]	L/day	CT and RME	1	2
Skin Surface Area - groundwater [2]	cm^2	CT and RME	6,600	18,000
Skin Surface Area - soil [2]	cm^2/day	CT and RME	2,800	5,700
Soil Skin Adherence Factor [2]	mg/cm^2	CT	0.04	0.01
		RME	0.2	0.07
Fraction of Time Exposed – indoor air [3]	unitless	CT	18.5hr/24hr	18.5hr/24hr
		RME	24hr/24hr	24hr/24hr
Fraction of Time Exposed – soil to ambient air [3]	unitless	CT	1hr/24hr	1hr/24hr
		RME	2hr/24hr	2hr/24hr
Fraction of Time Exposed – groundwater [3]	unitless	CT	18.5hr/24hr	18.5hr/24hr
		RME	24hr/24hr	24hr/24hr
Dermal Exposure Time - groundwater [2]	hours/day	CT	0.33	0.25
		RME	1	0.58
Exposure Frequency [2]	days/year	CT and RME	350	350
Exposure Duration [2]	years	CT	6	3
		RME	6	24
Body Weight [4]	kg	CT and RME	15	70
Soil Ingestion Rate [4]	mg/day	CT and RME	200	100
Skin Permeability Constant [5]	cm/hr	CT and RME	chemical-specific	chemical-specific
Dermal – Fraction absorbed [5]	unitless	CT and RME	chemical-specific	chemical-specific
Dermal Lag time [5]	hr/event	CT and RME	chemical-specific	chemical-specific
Dermal B constant [5]	unitless	CT and RME	chemical-specific	chemical-specific

Exposure Factor	*Units*	*Scenario*	*Resident*	
			Child	*Adult*
Carcinogenic Averaging Time [6]	days	CT and RME	25,550	25,550
Non-Carcinogenic Averaging Time [6]	days	CT	2,190	1,095
		RME	2,190	8,760
Conversion Factor – soil	kg/mg	CT and RME	1.00E-06	1.00E-06
Conversion Factor - groundwater	L/cm^3	CT and RME	0.001	0.001
Particulate Emission Factor [4]	m^3/kg	CT and RME	1.36E+09	1.36E+09
Volatilization Factor - groundwater [7]	L/m^3	CT and RME	0.5	0.5
Dermal Absorption Factor - soil [8]	%/100	CT and RME	chemical-specific	chemical-specific
Volatilization Factor - soil [9]	m^3/kg	CT and RME	chemical-specific	chemical-specific

Notes:

1 Obtained from U.S. EPA (1991a).

2 Obtained from U.S. EPA (2004a).

3 The Fraction of time exposed for indoor air is based on the 50th and 95th percentile from Table 16-1, Recommended Values for Activity Factors - Time Indoors (at residence) (U.S. EPA, 2008). The time spent indoors for <1 year old of 1108 min/day equates to 18.5 hrs. (CT) [1108/60] and 24 hrs. (RME) [1440/60]. It is assumed that the adult will spend the same amount of time indoors with their child. The fraction of time exposed for potable groundwater use was obtained from U.S. EPA, 2004a. The fraction of time exposed for soil is based on the time spent outdoors playing on dirt from Table 16-1, Recommended Values for Activity Factors - Time Outdoors Playing on Dirt (at residence) (U.S. EPA, 2008). It is assumed that the adult will spend the same amount of time outdoors with their child.

4 Obtained from U.S. EPA (2002).

5 The permeability constant, fraction absorbed, lag time per event, and B constant used in the calculation of the dermal exposure to groundwater (DA_{event}) are chemical-specific and calculated using equations from U.S. EPA (2004a).

6 Obtained from U.S. EPA (1989).

7 Obtained from U.S. EPA (1991b).

8 Obtained from U.S. EPA (2004a) and U.S. EPA (1995). Published values obtained from U.S. EPA 1995 include: arsenic (3%), cadmium (0.1%), metals (1%), benzene (0.05%), VOCs vapor pressure (VP) > benzene VP (3%), VOCs VP < benzene VP (0.05%), PAHs (13%), SVOCs (10%), PCBs (14%), pesticides (10%).

9 Volatilization factor calculated using equations presented in U.S. EPA (2002); see further discussion in text below.

All exposure assumptions and equations utilized in the calculation of the magnitude of exposure to COPCs in soil and groundwater for the resident are also summarized in tables in Appendices I.1 (Residential Area 1), I.2 (Residential Area 2), I.3 (Residential Area 3), I.4 (Residential Area 4), I.6 (Mixed Residential/Commercial Area 1), and I.7 (Mixed Residential/Commercial Area 2), respectively. These tables are listed at the end of this Section (Section 8.1.3.3.2).

To determine the potential inhalation exposure to volatile COPCs in soil volatilizing to ambient air, a VF was used to estimate ambient air concentrations based on the soil concentration. The VF is chemical-specific and was calculated

using the approach presented in U.S. EPA (2002). Site-specific soil and chemical-specific properties were used in calculating the VF. The equations and inputs for the calculated VF values from soil are presented in Table I.1.10 of Appendix I.1 (Residential Area 1), Table I.2.10 of Appendix I.2 (Residential Area 2), Table I.3.10 of Appendix I.3 (Residential Area 3), Table I.4.10 of Appendix I.4 (Residential Area 4), Table I.6.10 of Appendix I.6 (Mixed Residential/Commercial Area 1), and Table I.7.10 of Appendix I.17 (Mixed Residential/Commercial Area 2), respectively. It should be noted that volatile COPCs were not identified for groundwater in any of the development areas. Therefore, potential resident inhalation exposure to volatile groundwater COPCs during potable groundwater use was not modeled or required in the HHRA.

To determine the potential inhalation exposure to volatile COPCs migrating to indoor air, the concentration of chemicals in indoor air was modeled, based on the concentrations of volatile chemicals in soil and using the J&E Model (Johnson and Ettinger, 1991), as implemented by U.S. EPA (U.S. EPA, 2004b), as described in Appendix I.12. The indoor air concentrations (from soil) calculated for the resident inhalation exposures are presented in Table I.1.21 of Appendix I.1 (Residential Area 1), Table I.2.21 of Appendix I.2 (Residential Area 2), Table I.3.21 of Appendix I.3 (Residential Area 3), Table I.4.21 of Appendix I.4 (Residential Area 4), Table I.6.21 of Appendix I.6 (Mixed Residential/Commercial Area 1), and Table I.7.21 of Appendix I.7 (Mixed Residential/Commercial Area 2), respectively.

The calculation of the DA_{event}, which was used to represent the absorbed dose per event during the resident dermal exposure to groundwater, is presented in Table I.1.25 of Appendix I.1 (Residential Area 1), Table I.2.25 of Appendix I.2 (Residential Area 2), Table I.3.25 of Appendix I.3 (Residential Area 3), Table I.4.25 of Appendix I.4 (Residential Area 4), Table I.6.25 of Appendix I.6 (Mixed Residential/Commercial Area 1), and Table I.7.25 of Appendix I.7 (Mixed Residential/Commercial Area 2), respectively.

Commercial Worker

The exposure assumptions that were used in the estimation of the magnitude of the commercial worker's exposure to surface soil (current/future "undisturbed" scenario), soil (future "disturbed" scenario), and indoor air are summarized in the following table.

Exposure Factor	*Units*	*Scenario*	*Commercial Worker*
Soil Ingestion Rate [1]	mg/day	CT and RME	100
Soil Skin Adherence Factor [2]	mg/cm^2	CT	0.02
		RME	0.2
Dermal Absorption Factor [3]	%/100	CT and RME	chemical-specific
Skin Surface Area [4]	cm^2/day	CT and RME	3,300
Fraction of Time Exposed [5]	unitless	CT and RME	8hr/24hr
Exposure Frequency [2]	days/year	CT	219
		RME	250
Exposure Duration [2]	years	CT	9
		RME	25
Body Weight [1]	kg	CT and RME	70
Carcinogenic Averaging Time [6]	days	CT and RME	25,550
Non-Carcinogenic Averaging Time [6]	days	CT	3,285
		RME	9,125
Conversion Factor	kg/mg	CT and RME	1.00E-06
Particulate Emission Factor [1]	m^3/kg	CT and RME	1.36E+09
Volatilization Factor [7]	m^3/kg	CT and RME	chemical-specific

Notes:
1 Obtained from U.S. EPA (2002).
2 Obtained from U.S. EPA (2004a).
3 Obtained from U.S. EPA (2004a) and U.S. EPA (1995). Published values obtained for U.S. EPA 1995 include: arsenic (3%), cadmium (0.1%), metals (1%), benzene (0.05%), VOCs VP > benzene VP (3%), VOCs VP < benzene VP (0.05%), PAHs (13%), SVOCs (10%), PCBs (14%), pesticides (10%).
4 The skin surface area available for contact includes the head, hands, and forearms (U.S. EPA 2004a).
5 Professional Judgment; fraction of time exposed is based on an assumed 8 hour work day during a 24 hour period.
6 Obtained from U.S. EPA (1989).
7 Volatilization factor calculated using equations presented in U.S. EPA (2002); see further discussion in text below.

All exposure assumptions and equations utilized in the calculation of the magnitude of exposure to COPCs in soil and indoor air for the commercial worker are also summarized in tables in Appendices I.1 (Residential Area 1), I.2 (Residential Area 2), I.3 (Residential Area 3), I.4 (Residential Area 4), I.5 (Waterfront Plaza), I.6 (Mixed Residential/Commercial Area 1), I.7 (Mixed Residential/Commercial Area 2), I.8 (Commercial Area 1), I.9 (Commercial Area 2), I.10 (Commercial Area 3), and I.11 (Commercial Area 4), respectively. These tables are listed at the end of this Section (Section 8.1.3.3.2).

To determine the potential inhalation exposure to volatile COPCs in soil volatilizing to ambient air, a VF was used to estimate ambient air concentrations based on the soil concentration. The VF is chemical-specific and was calculated using the approach presented in U.S. EPA (2002). Site-specific soil and chemical-specific properties were used in calculating the VF. The equations and inputs for the calculated VF values are presented in Table I.1.13 of Appendix I.1

(Residential Area 1), Table I.2.13 of Appendix I.2 (Residential Area 2), Table I.3.13 of Appendix I.3 (Residential Area 3), Table I.4.13 of Appendix I.4 (Residential Area 4), Table I.5.12 of Appendix I.5 (Waterfront Plaza), Table I.6.13 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.13 of Appendix I.17 (Mixed Residential/Commercial Area 2), Table I.9.9 of Appendix I.9 (Commercial Area 2), Table I.10.9 of Appendix I.10 (Commercial Area 3), and Table I.11.12 of Appendix I.11 (Commercial Area 4), respectively. It should be noted that volatile COPCs were not identified in Commercial Area 1. Therefore, potential commercial inhalation exposure to volatile COPCs in soil volatilizing to ambient air and VF was not modeled or required in the HHRA for Commercial Area 1.

To determine the potential inhalation exposure to volatile COPCs migrating to indoor air, the concentration of chemicals in indoor air was modeled, based on the concentrations of volatile chemicals in soil and groundwater and using the J&E Model (Johnson and Ettinger, 1991), as implemented by U.S. EPA (U.S. EPA, 2004b), as described in Appendix I.12. It should be noted that volatile COPCs were not identified for groundwater in any of the Redevelopment Areas. Therefore, potential commercial worker inhalation exposure to volatile groundwater COPCs in indoor air was not modeled or required in the HHRA. The indoor air concentrations (from soil) calculated for the commercial worker inhalation exposure are presented in Table I.1.23 of Appendix I.1 (Residential Area 1), Table I.2.23 of Appendix I.2 (Residential Area 2), Table I.3.23 of Appendix I.3 (Residential Area 3), Table I.4.23 of Appendix I.4 (Residential Area 4), Table I.5.20 of Appendix I.5 (Waterfront Plaza), Table I.6.23 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.23 of Appendix I.7 (Mixed Residential/Commercial Area 2), Table I.9.17 of Appendix I.9 (Commercial Area 2), Table I.10.17 of Appendix I.10 (Commercial Area 3), and Table I.11.20 of Appendix I.11 (Commercial Area 4), respectively. It should be noted that volatile COPCs were not identified in Commercial Area 1. Therefore, potential commercial worker inhalation exposure to volatile soil COPCs in indoor air was not modeled or required in the HHRA for Commercial Area 1.

Construction Worker

The exposure assumptions that were used to determine the exposure of the construction worker to soil (current and future disturbed scenarios) and groundwater while performing ground intrusive activities are summarized in the following table.

Exposure Factor	*Units*	*Scenario*	*Construction Worker*
Soil Ingestion Rate [1]	mg/day	CT and RME	330
Water Ingestion Rate [2]	L/hour	CT and RME	0.02
Soil Skin Adherence Factor [3]	mg/cm^2	CT	0.1
		RME	0.3
Dermal Absorption Factor [4]	%/100	CT and RME	chemical-specific
Skin Surface Area [5]	cm^2/day	CT and RME	3,300
Fraction of Time Exposed [6]	unitless	CT and RME	8hr/24hr
Exposure Frequency [7]	days/year	CT	60
		RME	120
Event Frequency [3]	events/day	CT and RME	1
Exposure Duration [8]	years	CT and RME	1
Body Weight [1]	kg	CT and RME	70
Skin Permeability Constant [3]	cm/hr	CT and RME	chemical-specific
Dermal – Fraction absorbed [3]	unitless	CT and RME	chemical-specific
Dermal Lag time [3]	hr/event	CT and RME	chemical-specific
Dermal B constant [3]	unitless	CT and RME	chemical-specific
Exposure Time - groundwater [9]	hours/day	CT and RME	4
Carcinogenic Averaging Time [10]	days	CT and RME	25,550
Non-Carcinogenic Averaging Time [10]	days	CT and RME	365
Conversion Factor - groundwater	L/cm^3	CT and RME	0.001
Conversion Factor – soil	kg/mg	CT and RME	1.00E-06
Particulate Emission Factor [11]	m^3/kg	CT and RME	Site-specific
Volatilization Factor [12]	m^3/kg	CT and RME	chemical-specific

Notes:
1 Obtained from U.S. EPA (2002).
2 Obtained from VDEQ (2002).
3 Obtained from U.S. EPA (2004a).
4 Obtained from U.S. EPA (2004a) and U.S. EPA (1995). Published values obtained for U.S. EPA 1995 include: arsenic (3%), cadmium (0.1%), metals (1%), benzene (0.05%), VOCs VP > benzene VP (3%), VOCs VP < benzene VP (0.05%), PAHs (13%), SVOCs (10%), PCBs (14%), pesticides (10%).
5 The skin surface area available for contact includes the head, hands, and forearms (U.S. EPA 2004a).
6 Professional Judgment; fraction of time exposed is based on an assumed 8 hour work day during a 24 hour period.
7 The RME exposure frequency is based on an exposure frequency of 5 days/week during a period of 6 month/year (120 days), which is based on professional judgment. CT exposure is half of the RME or 3 months/year (60 days).
8 Exposure duration is based on an assumed construction campaign occurring for a one year period, which is based on professional judgment.
9 Professional Judgment; assumes half of a worker's 8-hour day, or 4 hours per day, is spent in contact with groundwater.
10 Obtained from U.S. EPA (1989).
11 Particulate Emission Factor (PEF) is site-specific and was calculated using the approach presented by U.S. EPA (2002); see further discussion in text below. Volatilization factor calculated using equations presented in U.S. EPA (2002); see further discussion in text below.

All exposure assumptions and equations utilized in the calculation of the magnitude of exposure to COPCs in soil and groundwater for the construction worker are also summarized in tables in Appendices I.1 (Residential Area 1), I.2 (Residential Area 2), and I.3 (Residential Area 3), I.4 (Residential Area 4), I.5

(Waterfront Plaza), I.6 (Mixed Residential/Commercial Area 1), I.7 (Mixed Residential/Commercial Area 2), I.8 (Commercial Area 1), I.9 (Commercial Area 2), I.10 (Commercial Area 3), and I.11 (Commercial Area 4), respectively. These tables are listed at the end of this Section (Section 8.1.3.3.2).

To determine the potential inhalation exposure to non-volatile COPCs in soil particulates migrating into ambient air as part of fugitive dust emissions, a particulate emission factor (PEF) was used to estimate ambient air concentrations based on soil concentrations. The PEF is Site-specific and was calculated using the approach presented in U.S. EPA (2002). The equations and inputs for the calculated PEF values for soil are presented in Table I.1.18 of Appendix I.1 (Residential Area 1), Table I.2.18 of Appendix I.2 (Residential Area 2), and I.3.18 of Appendix I.3 (Residential Area 3), Table I.4.18 of Appendix I.4 (Residential Area 4), Table I.5.17 of Appendix I.5 (Waterfront Plaza), Table I.6.18 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.18 of Appendix I.7 (Mixed Residential/Commercial Area 2), Table I.8.12 of Appendix I.8 (Commercial Area 1), Table I.9.14 of Appendix I.9 (Commercial Area 2), Table I.10.14 of Appendix I.10 (Commercial Area 3), and Table I.11.17 of Appendix I.11 (Commercial Area 4), respectively.

To determine the potential inhalation exposure to volatile COPCs in soil volatilizing to ambient air, a VF was used to estimate ambient air concentrations based on the soil concentration. The VF is chemical-specific and was calculated using the approach presented in U.S. EPA (2002). Site-specific soil and chemical-specific properties were used in calculating the VF. The equations and inputs for the calculated VF values for soil are presented in Table I.1.19 of Appendix I.1 (Residential Area 1), Table I.2.19 of Appendix I.2 (Residential Area 2), and I.3.19 of Appendix I.3 (Residential Area 3), Table I.4.19 of Appendix I.4 (Residential Area 4), Table I.5.18 of Appendix I.5 (Waterfront Plaza), Table I.6.19 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.19 of Appendix I.7 (Mixed Residential/Commercial Area 2), Table I.9.15 of Appendix I.9 (Commercial Area 2), Table I.10.15 of Appendix I.10 (Commercial Area 3), and Table I.11.18 of Appendix I.11 (Commercial Area 4), respectively. It should be noted that volatile COPCs were not identified in Commercial Area 1. Therefore, potential construction worker inhalation exposure to volatile COPCs in soil volatilizing to ambient air and VF was not modeled or required in the HHRA for Commercial Area 1. As there were no volatile chemicals identified as COPCs for groundwater in any of the Redevelopment Areas, a VF used to determine

potential inhalation exposure to volatile COPCs in groundwater volatilizing to ambient air was not required.

The calculation of the DA_{event}, which was used to represent the absorbed dose per event during construction worker dermal exposure to groundwater, was calculated using equations and inputs obtained from U.S. EPA (2004a), and is presented in Table I.1.27 of Appendix I.1 (Residential Area 1), Table I.2.27 of Appendix I.2 (Residential Area 2), Table I.3.27 of Appendix I.3 (Residential Area 3), Table I.4.27 of Appendix I.4 (Residential Area 4), Table I.5.22 of Appendix I.5 (Waterfront Plaza), Table I.6.27 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.27 of Appendix I.7 (Mixed Residential/Commercial Area 2), Table I.8.14 of Appendix I.8 (Commercial Area 1), Table I.9.19 of Appendix I.9 (Commercial Area 2), Table I.10.19 of Appendix I.10 (Commercial Area 3), and Table I.11.22 of Appendix I.11 (Commercial Area 4), respectively.

Utility Worker

The exposure assumptions that were used to determine the exposure of the utility worker to soil (current and future disturbed scenarios) and groundwater while performing ground intrusive activities are summarized in the following table.

Exposure Factor	*Units*	*Scenario*	*Utility Worker*
Soil Ingestion Rate [1]	mg/day	CT and RME	330
Water Ingestion Rate [2]	L/hour	CT and RME	0.02
Soil Skin Adherence Factor [3]	mg/cm^2	CT	0.1
		RME	0.3
Dermal Absorption Factor [4]	%/100	CT and RME	chemical-specific
Skin Surface Area [5]	cm^2/day	CT and RME	3,300
Fraction of Time Exposed [6]	unitless	CT and RME	8hr/24hr
Exposure Frequency [7]	days/year	CT	10
		RME	20
Event Frequency [3]	events/day	CT	1
	events/day	RME	1
Exposure Duration [3]	years	CT	9
	years	RME	25
Body Weight [1]	kg	CT and RME	70
Skin Permeability Constant [3]	cm/hr	CT and RME	chemical-specific
Dermal – Fraction absorbed [3]	unitless	CT and RME	chemical-specific
Dermal Lag time [3]	hr/event	CT and RME	chemical-specific
Dermal B constant [3]	unitless	CT and RME	chemical-specific

Exposure Factor	*Units*	*Scenario*	*Utility Worker*
Exposure Time - groundwater [8]	hours/day	CT and RME	4
Carcinogenic Averaging Time [9]	days	CT and RME	25,550
Non-Carcinogenic Averaging Time [9]	days	CT	3,285
		RME	9,125
Conversion Factor - groundwater	L/cm^3	CT and RME	0.001
Conversion Factor – soil	kg/mg	CT and RME	1.00E-06
Particulate Emission Factor [10]	m^3/kg	CT and RME	Site-specific
Volatilization Factor [11]	m^3/kg	CT and RME	chemical-specific

Notes:
1 Obtained from U.S. EPA (2002).
2 Obtained from MDEQ (2002).
3 Obtained from U.S. EPA (2004a).
4 Obtained from U.S. EPA (2004a) and U.S. EPA (1995). Published values obtained for U.S. EPA 1995 include: arsenic (3%), cadmium (0.1%), metals (1%), benzene (0.05%), VOCs VP > benzene VP (3%), VOCs VP < benzene VP (0.05%), PAHs (13%), SVOCs (10%), PCBs (14%), pesticides (10%).
5 The skin surface area available for contact includes the head, hands, and forearms (U.S. EPA 2004a).
6 Professional Judgment; fraction of time exposed is based on an assumed 8 hour work day during a 24 hour period.
7 Professional Judgment; assumes 2 days/year (RME) and CT is half the RME or 1 day/year.
8 Professional Judgment; assumes half of a worker's 8-hour day, or 4 hours per day, is spent in contact with groundwater.
9 Obtained from U.S. EPA (1989).
10 Particulate Emission Factor (PEF) is site-specific and was calculated using the approach presented by U.S. EPA (2002); see further discussion in text below.
11 Volatilization factor calculated using equations presented in U.S. EPA (2002); see further discussion in text below.

All exposure assumptions and equations utilized in the calculation of the magnitude of exposure to COPCs in soil and groundwater for the utility worker are also summarized in tables in Appendices I.1 (Residential Area 1), I.2 (Residential Area 2), and I.3 (Residential Area 3), I.4 (Residential Area 4), I.5 (Waterfront Plaza), I.6 (Mixed Residential/Commercial Area 1), I.7 (Mixed Residential/Commercial Area 2), I.8 (Commercial Area 1), I.9 (Commercial Area 2), I.10 (Commercial Area 3), and I.11 (Commercial Area 4), respectively. These tables are listed at the end of this Section (Section 8.1.3.3.2).

To determine the potential inhalation exposure to non-volatile COPCs in soil particulates migrating into ambient air as part of fugitive dust emissions, a PEF was used to estimate ambient air concentrations based on soil concentrations. The PEF is Site-specific and was calculated using the approach presented in U.S. EPA (2002). The equations and inputs for the calculated PEF values for soil are presented in Table I.1.15 of Appendix I.1 (Residential Area 1), Table I.2.15 of Appendix I.2 (Residential Area 2), and I.3.15 of Appendix I.3 (Residential Area 3), Table I.4.15 of Appendix I.4 (Residential Area 4), Table I.5.14 of Appendix I.5 (Waterfront Plaza), Table I.6.15 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.15 of Appendix I.7 (Mixed

Residential/Commercial Area 2), Table I.8.10 of Appendix I.8 (Commercial Area 1), Table I.9.11 of Appendix I.9 (Commercial Area 1), Table I.10.11 of Appendix I.10 (Commercial Area 3), and Table I.11.14 of Appendix I.11 (Commercial Area 4), respectively.

To determine the potential inhalation exposure to volatile COPCs in soil volatilizing to ambient air, a VF was used to estimate ambient air concentrations based on the soil concentration. The VF is chemical-specific and was calculated using the approach presented in U.S. EPA (2002). Site-specific soil and chemical-specific properties were used in calculating the VF. The equations and inputs for the calculated VF values for soil are presented in Table I.1.16 of Appendix I.1 (Residential Area 1), Table I.2.16 of Appendix I.2 (Residential Area 2), and I.3.16 of Appendix I.3 (Residential Area 3), Table I.4.16 of Appendix I.4 (Residential Area 4), Table I.5.15 of Appendix I.5 (Waterfront Plaza), Table I.6.16 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.16 of Appendix I.7 (Mixed Residential/Commercial Area 2), Table I.9.12 of Appendix I.9 (Commercial Area 2), Table I.10.12 of Appendix I.10 (Commercial Area 3), and Table I.11.15 of Appendix I.11 (Commercial Area 4), respectively. It should be noted that volatile COPCs were not identified in Commercial Area 1. Therefore, potential utility worker inhalation exposure to volatile COPCs in soil volatilizing to ambient air and VF was not modeled or required in the HHRA for Commercial Area 1. As there were no volatile chemicals identified as COPCs for groundwater in any of the Redevelopment Areas, a VF used to determine potential inhalation exposure to volatile COPCs in groundwater volatilizing to ambient air was not required.

The calculation of the DA_{event}, which was used to represent the absorbed dose per event during utility worker dermal exposure to groundwater, was calculated using equations and inputs obtained from U.S. EPA (2004a), and is presented in Table I.1.27 of Appendix I.1 (Residential Area 1), Table I.2.27 of Appendix I.2 (Residential Area 2), Table I.3.27 of Appendix I.3 (Residential Area 3), Table I.4.27 of Appendix I.4 (Residential Area 4), Table I.5.22 of Appendix I.5 (Waterfront Plaza), Table I.6.27 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.27 of Appendix I.7 (Mixed Residential/Commercial Area 2), Table I.8.14 of Appendix I.8 (Commercial Area 1), Table I.9.19 of Appendix I.9 (Commercial Area 2), Table I.10.19 of Appendix I.10 (Commercial Area 3), and Table I.11.22 of Appendix I.11 (Commercial Area 4), respectively.

All exposure assumptions and equations utilized in the calculation of the magnitude of exposure to COPCs for a current and future adolescent trespasser, future recreational user, future resident, current and future commercial worker, current and future construction worker, and current and future utility worker are summarized in the following tables in Appendices I.1 (Residential Area 1), I.2 (Residential Area 2), I.3 (Residential Area 3), I.4 (Residential Area 4), I.5 (Waterfront Plaza), I.6 (Mixed Residential/Commercial Area 1), I.7 (Mixed Residential/Commercial Area 2), I.8 (Commercial Area 1), I.9 (Commercial Area 2), I.10 (Commercial Area 3), and I.11 (Commercial Area 4):

Receptor	*Area*	*Tables for each exposure pathway*		
		Soil	*Indoor Air*	*Groundwater*
Trespasser	Residential Area 1	Table I.1.7	N.A.[1]	N.A.
	Residential Area 2	Table I.2.7	N.A.	N.A.
	Residential Area 3	Table I.3.7	N.A.	N.A.
	Residential Area 4	Table I.4.7	N.A.	N.A.
	Waterfront Plaza	Table I.5.7	N.A.	N.A.
	Mixed Residential/Commercial Area 1	Table I.6.7	N.A.	N.A.
	Mixed Residential/Commercial Area 2	Table I.7.7	N.A.	N.A.
	Commercial Area 1	Table I.8.7	N.A.	N.A.
	Commercial Area 2	Table I.9.6	N.A.	N.A.
	Commercial Area 3	Table I.10.6	N.A.	N.A.
	Commercial Area 4	Table I.11.7	N.A.	N.A.
Recreational User	Residential Area 1	Table I.1.9	N.A.	N.A.
	Residential Area 2	Table I.2.9	N.A.	N.A.
	Residential Area 3	Table I.3.9	N.A.	N.A.
	Residential Area 4	Table I.4.9	N.A.	N.A.
	Waterfront Plaza	Table I.5.9	N.A.	N.A.
	Mixed Residential/Commercial Area 1	Table I.6.9	N.A.	N.A.
	Mixed Residential/Commercial Area 2	Table I.7.9	N.A.	N.A.
	Commercial Area 4	Table I.11.9	N.A.	N.A.

Receptor	*Area*	*Tables for each exposure pathway*		
		Soil	*Indoor Air*	*Groundwater*
Resident	Residential Area 1	Table I.1.11	Table I.1.20	Table I.1.24
	Residential Area 2	Table I.2.11	Table I.2.20	Table I.2.24
	Residential Area 3	Table I.3.11	Table I.3.20	Table I.3.24
	Residential Area 4	Table I.4.11	Table I.4.20	Table I.4.24
	Mixed Residential/Commercial Area 1	Table I.6.11	Table I.6.20	Table I.6.24
	Mixed Residential/Commercial Area 2	Table I.7.11	Table I.7.20	Table I.7.24
Commercial Worker	Residential Area 1	Table I.1.12	Table I.1.22	N.A.
	Residential Area 2	Table I.2.12	Table I.2.22	N.A.
	Residential Area 3	Table I.3.12	Table I.3.22	N.A.
	Residential Area 4	Table I.4.12	Table I.4.22	N.A.
	Waterfront Plaza	Table I.5.11	Table I.5.19	N.A.
	Mixed Residential/Commercial Area 1	Table I.6.12	Table I.6.22	N.A.
	Mixed Residential/Commercial Area 2	Table I.7.12	Table I.7.22	N.A.
	Commercial Area 1	Table I.8.8	NVCOPC[2]	N.A.
	Commercial Area 2	Table I.9.8	Table I.9.16	N.A.
	Commercial Area 3	Table I.10.8	Table I.10.16	N.A.
	Commercial Area 4	Table I.11.11	Table I.11.19	N.A.
Construction Worker	Residential Area 1	Table I.1.17	N.A.	Table I.1.28
	Residential Area 2	Table I.2.17	N.A.	Table I.2.28
	Residential Area 3	Table I.3.17	N.A.	Table I.3.28
	Residential Area 4	Table I.4.17	N.A.	Table I.4.28
	Waterfront Plaza	Table I.5.16	N.A.	Table I.5.23
	Mixed Residential/Commercial Area 1	Table I.6.17	N.A.	Table I.6.28
	Mixed Residential/Commercial Area 2	Table I.7.17	N.A.	Table I.7.28
	Commercial Area 1	Table I.8.11	N.A.	Table I.8.15
	Commercial Area 2	Table I.9.13	N.A.	Table I.9.20
	Commercial Area 3	Table I.10.13	N.A.	Table I.10.20
	Commercial Area 4	Table I.11.16	N.A.	Table I.11.23

Receptor	*Area*	*Tables for each exposure pathway*		
		Soil	*Indoor Air*	*Groundwater*
Utility Worker	Residential Area 1	Table I.1.14	N.A.	Table I.1.26
	Residential Area 2	Table I.2.14	N.A.	Table I.2.26
	Residential Area 3	Table I.3.14	N.A.	Table I.3.26
	Residential Area 4	Table I.4.14	N.A.	Table I.4.26
	Waterfront Plaza	Table I.5.13	N.A.	Table I.5.21
	Mixed Residential/Commercial Area 1	Table I.6.14	N.A.	Table I.6.26
	Mixed Residential/Commercial Area 2	Table I.7.14	N.A.	Table I.7.26
	Commercial Area 1	Table I.8.9	N.A.	Table I.8.13
	Commercial Area 2	Table I.9.10	N.A.	Table I.9.18
	Commercial Area 3	Table I.10.10	N.A.	Table I.10.18
	Commercial Area 4	Table I.11.13	N.A.	Table I.11.21

Notes:
[1] N.A. not applicable as exposure pathway is incomplete.
[2] NVCOPC indicates that no volatile COPC were detected in Commercial Area 1 and therefore exposure through indoor air is an incomplete exposure pathway within this Area.

8.1.3.4 EVALUATION OF LEAD IN SOIL AND WATER

8.1.3.4.1 EVALUATION OF NON-RESIDENTIAL ADULT EXPOSURES TO LEAD IN SOIL AND WATER

The best available method for determining hazards associated with non-residential adult exposures to lead-impacted soil and water is based on the adult lead exposure equation as presented by U.S. EPA (2003a).

The hazard associated with adult lead exposure stems from the relationship between the lead concentration in media and the blood lead concentration in the developing fetus of a pregnant woman exposed to site media. Current Office of Soil Waste and Emergency Response (OSWER) guidance calls for the establishment of cleanup goals to limit childhood risk of exceeding 10 micrograms per deciliter (µg/dL) to 5% of the population.

The media/receptors where lead was identified as a COPC are summarized in the following table:

Area	*Media*	*Receptor*
Residential Area 1	Groundwater	Future resident Future construction worker Current/future utility worker
Residential Area 2	Groundwater	Future resident Future construction worker Current/future utility worker
Residential Area 3	Groundwater	Future resident Future construction worker Current/future utility worker
Residential Area 4	Surface soil Soil	Current/future trespasser Future recreational user Future resident Future construction worker Current/future utility worker
Mixed Residential/ Commercial Area 2	Surface soil Soil Groundwater	Current/future trespasser Future recreational user Future resident Future commercial worker Future construction worker Current/future utility worker
Commercial Area 1	Groundwater	Future construction worker Current/future utility worker
Commercial Area 4	Soil	Future trespasser Future recreational user Future commercial worker Current/future construction worker Current/Future utility worker

A trespasser and recreational user may be exposed to lead in soil at the Site; however, as the exposure frequency for the trespasser and recreational user are only 50.6 days/year and 70 days/year, respectively, the lead exposure for the trespasser and recreational user was considered to be low and not of concern, and therefore, lead exposure was not evaluated further for a trespasser and recreational user. Furthermore, the resident and/or commercial worker exposure to lead was also evaluated in the HHRA, and is considered to be protective of the trespasser and recreational user exposure. Therefore, the fetal 95th percentile blood lead level was conservatively estimated for adult women commercial workers, construction workers, and utility workers within

Residential Area 1, Residential Area 2, Residential Area 3, Residential Area 4, Mixed Residential/Commercial Area 2, Commercial Area 1, and Commercial Area 4 using the model described below in Sections 8.1.3.3.3.1.1 (Adult Lead Exposure Equation) and 8.1.3.3.3.1.2 (Adult Lead Exposure Equation Input Parameters). Lead was not identified as a soil or groundwater COPC for Mixed Residential/Commercial Area 1, Commercial Area 2, Commercial Area 3, or Waterfront Plaza and therefore adult lead exposure was not evaluated or required for these areas of the Site.

8.1.3.4.1.1 ADULT LEAD EXPOSURE EQUATION

The TRW has indicated that the Adult Exposure Equation is a suitable and appropriate model for assessing adult exposures to lead under a commercial setting. The Adult Exposure Equation recommended for use by the TRW is as follows:

$$PbB_{fetal,0.95} = \left(PbB_{adult,0} + PbB_{adult,site}\right) \times GSD_{i,adult}^{1.645} \times R_{fetal/maternal}$$

Where:

$PbB_{fetal,\ 0.95}$ = 95th percentile target blood lead (PbB) concentration in the fetus (µg/dL)

$PbB_{adult,0}$ = typical lead concentration (µg/g) (appropriate average concentration for individual)

$R_{fetal/maternal}$ = mean ratio of fetal to maternal PbB

$GSD_{i,adult}$ = individual Geometric Standard Deviation, an exponent of 1.645 represents the standard normal deviate used to calculate the 95th percentile from a lognormal distribution of blood lead concentration

$PbB_{adult,\ site}$ = adult blood lead concentration (µg/dL) contributed by exposure to lead containing media on site as shown below

$$PbB_{adult,site} = \frac{BKSF \times [\,(PbS \times IR_S \times AF_S \times EF_S) + (PbW \times IR_W \times AF_W \times EF_W)\,]}{AT}$$

Where:

BKSF = Biokinetic slope factor (µg/dL blood lead increase per µg/day lead uptake)

PbS = Soil lead concentration (µg/g)

PbW = Water lead concentration (µg/L)

IR_S = Ingestion rate of soil (g/day)
IR_W = Ingestion rate of water (L/day)
EF_S = Exposure frequency for contact with assessed soils (days/yr)
EF_W = Exposure frequency for contact with assessed water (days/yr)
AF_S = Absolute absorption fraction of lead in soil
AF_W = Absolute absorption fraction of lead in water
AT = Averaging time

8.1.3.4.1.2 ADULT LEAD EXPOSURE EQUATION INPUT PARAMETERS

The basis for selection of input parameters for the above model is discussed below.

(i) Media Lead Concentrations (PbS, PbW):

The average concentrations of lead in the media were used consistent with the basis of the EPC applied for all other COPCs consistent with USEPA 2003a guidance. Average concentrations of lead in Residential Area 1 groundwater, Residential Area 2 groundwater, Residential Area 3 groundwater, Residential Area 4 soil, Mixed Residential/Commercial Area 2 soil and groundwater, Commercial Area 1 groundwater, and Commercial Area 4 soil are as follows:

Commercial Worker, Construction and Utility Workers:

Area	*Soil (mg/kg)*	*Groundwater (µg/L)*
Residential Area 1	Lead not a COPC(1,2)	5.04
Residential Area 2	Lead not a COPC(1,2)	5.04
Residential Area 3	Lead not a COPC(1,2)	5.04
Residential Area 4	80.3(1)/182(2)	Lead not a COPC
Mixed Residential/Commercial Area 2	111(1)/84.1(2)	4.1
Commercial Area 1	Lead not a COPC(1,2)	5.04
Commercial Area 4	Lead not a COPC(1)/57.6(2)	4.1

Notes:
a. Applies to surface soil (undisturbed scenario)
b. Applies to surface and subsurface soil (disturbed scenario)

(ii) Mean Ratio of Fetal to Maternal PbB ($R_{fetal/maternal}$):

Various studies have estimated an average fetal-to-maternal PbB ratio of 0.9 based on a weight of evidence approach. This value has also been used by U.S. EPA in applying the Adult Exposure Model. The value of 0.9 was applied in the modeling.

(iii) Individual Geometric Standard Deviation ($GSD_{i,adult}$):

This parameter is used to assess variability in blood lead concentrations among different individuals. Few data are available regarding GSD values reflecting individual variability. Instead, GSD values reflecting community variability (which would be expected to be greater than individual variability) are frequently applied to estimate individual variability. A value for GSD of 1.8 was applied in this modeling based on the recent update presented in U.S. EPA's, *Transmittal of Update of the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters*, dated June 26, 2009 (U.S. EPA, 2009b).

(iv) Baseline PbB Value ($PbB_{adult,0}$):

This parameter is specific to the population in the Redevelopment Area of interest. At this time, no source of data describing blood lead levels for the population in the vicinity of the Site has been identified. Therefore, published reference data were used to determine a representative value. A value of 1.0 µg/dL was applied for this input parameter based on the recent update presented in U.S. EPA (2009b).

(v) Biokinetic Slope Factor (BKSF in µg/dL per µg/day):

The TRW adopted a BKSF of 0.4, derived for the baseline human health risk assessment for the California Gulch Superfund Site. The default value of 0.4 for the parameter BKSF was applied in the modeling.

(vi) Soil Absolute Absorption Fraction of Lead (AF_s and AF_D):

The TRW uses 12% as the absorbed fraction of lead from soil for adults, based on an absorption factor for soluble lead of 0.20 and a relative bioavailability of 0.6 (soil/soluble). This value was used to evaluate the waste.

(vii) Water Absolute Absorption Fraction of Lead (AF_W):

The TRW uses 20% as the absorbed fraction of lead from water for adults, based on an absorption factor for soluble lead of 0.20.

(viii) Soil Ingestion Rate (IR_s in g/day):

Soil ingestion rates of 0.1 g/day and 0.33 g/day were applied for the commercial worker and construction worker, and utility worker, respectively, consistent with the exposure assumptions for the receptors outlined in Section 8.1.3.3.2.

(ix) Water Ingestion Rate (IR_w in L/day):

Water ingestion rate of 0.08 L/day were used for the construction worker and utility worker based on an incidental ingestion rate of 0.02 L/hr and 4 hours/day exposure time, consistent with the exposure assumptions for these receptors outlined in Section 8.1.3.3.2.

(x) Exposure Frequency (EF_S and EF_W in days/yr):

An exposure frequency of 250 days/year was applied for the commercial worker, an exposure frequency of 120 days/year was applied for the construction worker, and an exposure frequency of 2 days/year was applied for the utility worker, which are consistent with the exposure assumptions applied for the receptors outlined in Section 8.1.3.3.2.

(xi) Averaging Time (AT in days):

The TRW applies default value of 365 days/year based on the average time spent at work by both full-time and part-time workers, which was applied for the commercial worker and utility worker. For the construction worker scenario, an averaging time of 168 days/year was used based on the 120-day per year exposure frequency.

8.1.3.4.2 THE INTEGRATED EXPOSURE UPTAKE BIOKINETIC (IEUBK) MODEL FOR LEAD

The IEUBK model for lead exposure in children was used to determine exposure levels for residents at the Site, based on the assumption that the child resident is considered to be more sensitive than the adult resident. The IEUBK model for lead provides a method for predicting blood lead levels in populations exposed to lead in several different media. The impetus for the development of this model was the U.S. EPA's conclusion that a threshold does not exist for many of the non-cancer effects of lead in infants and young children. The IEUBK Model is a simulation model which uses mathematical equations to estimate the lead level in blood (PbB) of a child (or population of children) in the 0- to 7-year age group who are exposed to lead in various media such as soil, air, diet, water, and other potential sources. Young children are considered to be unimpacted when the model predicts that less than 5 percent of children will have blood lead levels greater than 10 µg/dL (U.S. EPA, 1994). The IEUBKwin32 Model 1.1, Build 11 (U.S. EPA, 2010) was used to determine the blood lead concentration for residents from exposure to Site soil.

For this evaluation, the intake of lead was determined for various direct and secondary exposure pathways, including the ingestion of soil, dust particles and drinking water, inhalation of air and dietary intake (i.e., produce, animal products, and fish). As indicated above, young children are considered to be unimpacted when the model predicts that less than 5 percent of children will have blood lead levels greater than 10 µg/dL. A default lead concentration in air of 0.100 µg/m^3 was used as the input into the IEUBK model. The average concentrations of lead in soil and groundwater were used, consistent with lead guidance. The average concentrations of lead used for Residential Area 1, Residential Area 2, Residential Area 3, Residential Area 4, and Mixed Residential/Commercial Area 2 are as follows:

Area	*Soil (mg/kg)*		*Groundwater (µg/L)*
	Undisturbed Scenario	*Disturbed Scenario*	
Residential Area 1	19.7[1]	20.8[1]	5.04
Residential Area 2	24.7[1]	46.6[1]	5.04
Residential Area 3	31.4[1]	28.9[1]	5.04
Residential Area 4	80.3	182	1.2[2]
Mixed Residential/ Commercial Area 2	111	84.1	4.1

Notes:

1 Lead was not identified as a COPC for Residential Area 1, Residential Area 2, and Residential Area 3 soil. However, for the purposes of this assessment, an arithmetic mean concentration of the lead data collected within the soil of relevant development areas was calculated.

2 Lead was not identified as a COPC for Residential Area 4 groundwater. Therefore, for the purposes of this assessment, an arithmetic mean concentration of the lead data collected within the groundwater of Residential Area 4 was calculated.

Lead was not identified as a soil or groundwater COPC for Mixed Residential/Commercial Area 1, and therefore, residential lead exposure was not evaluated or required for this area of the Site. Residents are not expected to be at all other areas of the Site (i.e., Commercial Areas 1 to 4 and Waterfront Plaza), and therefore, residential lead exposure was not evaluated or required for these areas. The model default values were utilized for the dietary lead intake for each age range. Using these default lead concentrations in air, and the default dietary lead intake levels, the IEUBK model was run to find the determine the blood lead level concentration.

8.1.4 TOXICITY ASSESSMENT

The purpose of the toxicity assessment is to evaluate available evidence regarding the potential for particular contaminants to cause adverse effects in potentially exposed individuals and to provide, where possible, an estimate of the relationship between the extent of exposure to a contaminant and the increased likelihood or severity of adverse effects.

The toxicity assessment is accomplished in two steps: hazard identification and dose-response assessment. The first step, hazard identification, is the process of determining whether exposure to an agent can cause an increase in the incidence of a particular adverse health effect (e.g., cancer and liver damage) and whether the adverse health effect is likely to occur in humans. Typically, this is established based on studies performed on laboratory animals.

The second step, dose-response evaluation, is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant administered or received, and the incidence of adverse health effects in the potentially exposed population. From this quantitative dose-response relationship, numerical values, known as toxicity values (i.e., reference doses and slope factors), are derived. These are used to estimate the incidence or potential for adverse effects as a function of human exposure to the agent. These toxicity values are used in the risk characterization step to estimate the potential for adverse effects occurring in humans at different exposure levels.

The relationship between the dose of a COPC and its toxic response must be determined to conduct a risk characterization. The dose-response relationships for various constituents or constituent groups were derived from published toxicity data. The U.S. EPA have reviewed the published data and developed several sets of values to provide quantitative estimates of the toxicity of chemicals for different effects and routes of exposure. The U.S. EPA (2003d) has recommended a hierarchy for the selection of toxicological criteria in the risk assessment process. This hierarchy was followed to the fullest extent possible in this HHRA:

- Tier 1 - U.S. EPA's Integrated Risk Information System (IRIS) (U.S. EPA, 2012a)

- Tier 2 - U.S. EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) (U.S. EPA, 2011b)
- Tier 3 - Other Toxicity Values

U.S. EPA Regional Screening Level Tables (U.S. EPA, 2012b) were used extensively as a Tier 3 source of toxicity values, even though these are considered a secondary source.

8.1.4.1 DOSE RESPONSE ASSESSMENT

The toxicity values used in risk evaluations are the chronic doses, generally referred to as the reference dose (RfD) and reference concentrations (RfC) (for non-carcinogenic effects), and cancer slope factors (CSF) and inhalation unit risk factors (URF) (for carcinogenic effects). The RfD or RfC is an estimate (with uncertainty spanning approximately an order of magnitude or greater) of a daily exposure level for the human population, including sensitive sub-populations, that is not likely to cause an appreciable risk of deleterious effects during a lifetime. Chronic RfDs or RfCs are specifically developed to be protective for long-term exposure to a compound (e.g., a Superfund program guideline is 7 years to a lifetime). The CSF or URF is a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. The CSF or URF is used to estimate an upper-bound probability of an individual potentially developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.

8.1.4.2 NON-CARCINOGENIC HAZARDS

For substances suspected to cause non-carcinogenic chronic effects, the health criteria are usually expressed as chronic intake levels or RfDs [in units of mg/(kg-day)] or RfCs (in units of mg/m^3) concentrations less than which, no adverse effects are expected. In contrast to the toxicological model used to assess carcinogenic risk, which assumes no concentration threshold, the non-carcinogenic dose-response model postulates a "threshold."

In this risk assessment, chronic RfDs and RfCs are used as the toxicity values for non-carcinogenic health effects. Uncertainty factors are incorporated into the RfDs or RfCs to account for extrapolations from animal toxicity data, data

quality, and to protect sensitive sub-populations. The basis of an RfD or RfC is usually the highest dose/concentration administered to laboratory animals that did not cause observable adverse effects after chronic (usually lifetime) exposure. This is called the No-Observed Adverse Effect Level (NOAEL). The NOAEL is then divided by an uncertainty (safety) factor, and sometimes an additional modifying factor, to obtain the RfD or RfC. In general, an uncertainty factor of 10 is used to account for interspecies variation and another factor of 10 to account for sensitive human populations. Additional factors of 10 are included in the uncertainty factor if the RfD or RfC is based on the Lowest-Observed Adverse Effect Level (LOAEL) instead of the NOAEL, or if data inadequacies are present (e.g., the experiment for which the RfD or RfC was derived had less than lifetime exposure). A modifying factor (MF) typically of 3 or so may also be included to address data sets lacking certain key studies. These factors are multiplied together and act as the denominator to the NOAEL or LOAEL in the calculation of the RfD or RfC as follows:

$$\text{RfD/RfC} = \frac{\text{NOAEL or LOAEL}}{UF_1 \times UF_2 \times UF_3 \ldots}$$

RfDs and RfCs are developed for the oral and the inhalation exposure pathways, respectively. These are an oral reference dose (RfDo) in mg/(kg-day), and RfC in mg/m^3.

The non-cancer RfDs were used to estimate human health effects for oral and dermal exposure routes for the COPCs and are presented in Table I.1.29 of Appendix I.1 (Residential Area 1), Table I.2.29 of Appendix I.2 (Residential Area 2), Table I.3.29 of Appendix I.3 (Residential Area 3), Table I.4.29 of Appendix I.4 (Residential Area 4), Table I.5.24 of Appendix I.5 (Waterfront Plaza), Table I.6.29 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.29 of Appendix I.7 (Mixed Residential/Commercial Area 2), Table I.8.16 of Appendix I.8 (Commercial Area 1), Table I.9.21 of Appendix I.9 (Commercial Area 1), Table I.10.21 of Appendix I.10 (Commercial Area 3), and Table I.11.24 of Appendix I.11 (Commercial Area 4), respectively. The RfCs used for the inhalation exposure route are presented in Table I.1.30 of Appendix I.1 (Residential Area 1), Table I.2.30 of Appendix I.2 (Residential Area 2), Table I.3.30 of Appendix I.3 (Residential Area 3), Table I.4.30 of Appendix I.4 (Residential Area 4), Table I.5.25 of Appendix I.5 (Waterfront Plaza), Table I.6.30 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.30 of Appendix I.7 (Mixed Commercial/Residential Area 2), Table I.8.17 of Appendix I.8 (Commercial

Area 1), Table I.9.22 of Appendix I.9 (Commercial Area 2), Table I.10.22 of Appendix I.10 (Commercial Area 3), and Table I.11.25 of Appendix I.11 (Commercial Area 4), respectively.

8.1.4.3 CARCINOGENIC RISKS

CSFs and URFs are quantitative risk estimates of carcinogenic potency. Slope factors and URFs relate the lifetime probability of excess cancers to the lifetime average exposure dose/concentration of a substance. CSFs and URFs are estimated using mathematical extrapolation models, most commonly the linearized multistage (LMS) model, and are presented as risk per mg/(kg-day) (i.e., mg carcinogen per kg body weight per day) for oral CSF and risk per mg/m^3 for inhalation URF. These models assume low dose-response linearity and thus may not be appropriate for some suspect carcinogens, in particular those that function as promoters. As well, the body's natural repair processes and defense mechanisms may decrease cancer risk at low exposures. Thus, the risks at lower exposures are likely overestimated using the LMS model.

When adequate human epidemiology data are available, maximum likelihood estimates (MLEs) of model parameters are used to generate a CSF or URF. When only animal data are available, the CSF or URF is derived from the largest possible linear slope that is consistent with the data (within the upper 95 percent confidence limit). In other words, the true risk to humans, while not identifiable, is not likely greater than the upper-bound estimate. This is a conservative estimate, and in some cases a linear slope of zero may be as appropriate for the data (i.e., no carcinogenic risk).

Known or suspected human carcinogens were identified based on the U.S. EPA Weight-of-Evidence approach for carcinogenicity classification. The U.S. EPA classification is based on an evaluation of the likelihood that the agent is a human carcinogen. The evidence is characterized separately for human and animal studies as follows:

Group A - Known Human Carcinogen (sufficient evidence of carcinogenicity in humans)

Group B - Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of

carcinogenicity in animals with inadequate or lack of evidence in humans)

Group C - Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)

Group D - Not Classifiable as to Human Carcinogenicity (inadequate or no evidence)

Group E - Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in animal studies)

The COPCs have been classified using the U.S. EPA system.

The following COPCs were considered not classifiable as human carcinogens: copper, manganese, mercury, and selenium.

The following COPCs are considered to be (known, probable, or possible) carcinogens: benzene, methylene chloride, benzo(a)pyrene, dibenz(a,h)anthracene, arsenic, cadmium, lead, and total PCBs.

No information is available regarding the carcinogenicity of the following COPCs: 1,1,1-TCA, ethylbenzene, toluene, xylenes (total), aluminum, antimony, cobalt, iron, and thallium.

Carcinogenic COPCs were assessed based on non-carcinogenic effects where useable toxicity values were available.

The oral and dermal cancer toxicity data (CSFs) used in the HHRA to estimate the risk of cancer for the oral and dermal exposure routes are presented in Table I.1.31 of Appendix I.1 (Residential Area 1), Table I.2.31 of Appendix I.2 (Residential Area 2), Table I.3.31 of Appendix I.3 (Residential Area 3), Table I.4.31 of Appendix I.4 (Residential Area 4), Table I.5.26 of Appendix I.5 (Waterfront Plaza), Table I.6.31 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.31 of Appendix I.7 (Mixed Residential/Commercial Area 2), Table I.8.18 of Appendix I.8 (Commercial Area 1), Table I.9.23 of Appendix I.9 (Commercial Area 2), Table I.10.23 of Appendix I.10 (Commercial Area 3), and Table I.11.26 of Appendix I.11 (Commercial Area 4), respectively. Dermal CSFs were adjusted consistent with U.S. EPA (2004a). The URFs used for the inhalation exposure route are presented in Table I.1.32 of Appendix I.1 (Residential Area 1), Table I.2.32 of Appendix I.2 (Residential Area 2), and Table I.3.32 of Appendix I.3

(Residential Area 3), Table I.4.32 of Appendix I.4 (Residential Area 4), Table I.5.27 of Appendix I.5 (Waterfront Plaza), Table I.6.32 of Appendix I.6 (Mixed Residential/Commercial Area 1), Table I.7.32 of Appendix I.7 (Mixed Residential/Commercial Area 2), Table I.8.19 of Appendix I.8 (Commercial Area 1), Table I.9.24 of Appendix I.9 (Commercial Area 1), Table I.10.24 of Appendix I.10 (Commercial Area 3), and Table I.11.27 of Appendix I.11 (Commercial Area 4), respectively.

8.1.5 RISK CHARACTERIZATION

The objective of this risk characterization is to integrate information developed in the exposure assessment, for complete exposure pathways, for detected COPCs that may have exceeded screening levels, and the toxicity assessment into an evaluation of the potential human health risks associated with potentially completed exposures to potentially contaminated media. The methods used in this risk characterization were based on U.S. EPA guidance for human exposures (U.S. EPA, 1989, 1991a, 1991b, 1995, 2001b, 2002, 2004a, 2008, and 2009a).

8.1.5.1 HAZARD ESTIMATES

The potential for non-cancer health effects from exposure to a COPC were evaluated by comparing an exposure level over a specified time period to a RfD or RfC for a similar time period. This ratio, termed the hazard quotient, is calculated according to the following general equation:

$$HQ = \frac{I}{RfD \text{ or } RfC}$$

Where:

HQ = Hazard quotient (unitless), the ratio of the exposure dose of a chemical to a reference dose not expected to cause adverse effects from a lifetime exposure. A hazard quotient equal to or less than 1 is considered protective of human health.

I = Intake, the chemical dose calculated by applying the exposure scenario assumptions and expressed as mg/(kg-day^{-1}). The intake represents the average daily chemical dose over the expected period of exposure.

RfD = Reference dose, a daily dose believed not to cause an adverse effect from even a lifetime exposure [mg/(kg-day^{-1})]. The RfD is based on experimental data and/or epidemiological studies.

RfC = the Reference Concentration is a daily concentration believed not to cause an adverse effect from even a lifetime exposure [mg/m^3]. The RfC is based on experimental data.

The Hazard Index (HI) for an exposure situation is the sum of the HQs estimated for the individual COPCs. An HI less than 1 is considered health protective for a lifetime exposure and is therefore not an exposure of concern. If the HI is greater than 1, it may be appropriate to reevaluate the toxicity of the individual COPCs to determine if individual chemicals have the same or differing toxicological endpoints that would support conclusions that the HQs should or should not be added.

Non-cancer hazard estimates for children (6 years of exposure for both CT and RME) were established only for the off-Site resident and recreational user receptors. For all adult receptors and trespassers, the non-cancer hazard estimates for the CT and RME scenario were evaluated based on the respective exposure durations.

8.1.5.2 CANCER RISK ESTIMATES

Exposure scenarios may involve potential exposure to more than one carcinogen. To represent the potential carcinogenic effects posed by exposure to multiple carcinogens, it is assumed, in the absence of information on synergistic or antagonistic effects, that these risks are additive. Cancer risks were calculated utilizing the following general equation:

$$\text{Cancer Risk} = \text{L}ADD \times (\text{CSF or URF})$$

Where:

Cancer Risk = Estimated upper bound on additional risk of cancer over a lifetime in an individual exposed to the carcinogen for a specified exposure period (unitless).

LADD = Lifetime average daily dose of the chemical calculated using exposure scenario assumptions and expressed

in mg/(kg-day^{-1}). The intake represents the total lifetime chemical dose averaged over an individual expected lifetime of 70 years.

CSF = Cancer slope factor that models the potential carcinogenic response and is expressed as [mg/(kg-day^{-1})]$^{-1}$.

URF = the inhalation Unit Risk Factor models the potential carcinogenic response and is expressed as [mg/m^3]$^{-1}$.

For estimating cancer risks from exposure to multiple carcinogens from a single exposure route, the following equation was used:

$$Risk_T = \sum_{i=1}^{N} Risk_i$$

Where:

Risk$_T$ = Total cancer risk from route of exposure

Risk$_i$ = Cancer risk for the chemical

N = Number of chemicals

Risk estimates were calculated for a combination of child (6 years) and adult (24 years) exposure for the residential and recreational user scenarios. The potential cumulative risks resulting from exposure to the COPCs were compared to U.S. EPA's risk range of 1×10^{-6} to 1×10^{-4}.

8.1.5.3 RISK QUANTIFICATION SUMMARY

The non-cancer hazard calculations and calculated lifetime cancer risks for Residential Area 1, Residential Area 2, Residential Area 3, Residential Area 4, Waterfront Plaza, Mixed Residential/Commercial Area 1, Mixed Residential/Commercial Area 2, Commercial Area 1, Commercial Area 2, Commercial Area 3, and Commercial Area 4 are presented in Appendices I.1, I.2, I.3, I.4, I.5, I.6, I.7, I.8, I.9, I.10, and I.11, respectively, and are also summarized below.

Residential Area 1

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in Residential Area 1 are presented in Appendix I.1 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Surface Soil[1]	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT	2.5E-07	No	No	4.0E-03	No	I.1.33.CT
			RME	6.1E-07	No	No	9.5E-03	No	I.1.33.RME
Soil[2]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	4.3E-07	No	No	1.7E-02	No	I.1.33.CT
			RME	1.1E-06	Yes	No	4.7E-02	No	I.1.33.RME
Surface Soil[1]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	1.3E-06	Yes	No	3.2E-02	No	I.1.34.CT
			RME	3.8E-06	Yes	No	6.8E-02	No	I.1.34.RME
Soil[2]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	2.2E-06	Yes	No	1.3E-01	No	I.1.34.CT
			RME	6.4E-06	Yes	No	3.0E-01	No	I.1.34.RME
Surface Soil[1]	Resident (Future)	Ingestion Dermal Inhalation	CT	1.3E-05	Yes	No	3.2E-01	No	I.1.35.CT
			RME	1.9E-05	Yes	No	3.4E-01	No	I.1.35.RME
Soil[2]	Resident (Future)	Ingestion Dermal Inhalation	CT	2.2E-05	Yes	No	1.3E+00	Yes	I.1.35.CT
			RME	3.2E-05	Yes	No	1.5E+00	Yes	I.1.35.RME
Surface Soil[1]	Commercial Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.2E-06	Yes	No	2.1E-02	No	I.1.36.CT
			RME	4.6E-06	Yes	No	2.9E-02	No	I.1.36.RME
Soil[2]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	2.1E-06	Yes	No	8.9E-02	No	I.1.36.CT
			RME	7.9E-06	Yes	No	1.4E-01	No	I.1.36.RME
Soil[2]	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	3.2E-07	No	No	1.4E-02	No	I.1.37.CT
			RME	1.9E-06	Yes	No	3.0E-02	No	I.1.37.RME
Soil[2]	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	2.1E-07	No	No	1.2E-01	No	I.1.38.CT
			RME	4.6E-07	No	No	2.5E-01	No	I.1.38.RME
Indoor Air (from soil)	Resident (Future)	Inhalation	CT	1.6E-08	No	No	2.1E-02	No	I.1.35.CT
			RME	7.0E-08	No	No	2.7E-02	No	I.1.35.RME
Indoor Air (from soil)	Commercial Worker (Future)	Inhalation	CT	4.0E-09	No	No	5.1E-03	No	I.1.36.CT
			RME	1.3E-08	No	No	5.9E-03	No	I.1.36.RME
Groundwater	Resident (Future)	Ingestion Dermal Inhalation	CT	2.3E-04	Yes	Yes	1.4E+01	Yes	I.1.35.CT
			RME	5.1E-04	Yes	Yes	1.5E+01	Yes	I.1.35.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.7E-07	No	No	2.4E-02	No	I.1.37.CT
			RME	9.3E-07	No	No	4.7E-02	No	I.1.37.RME
Groundwater	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	1.1E-07	No	No	1.4E-01	No	I.1.38.CT
			RME	2.2E-07	No	No	2.8E-01	No	I.1.38.RME

Notes:

[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.

[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

The cumulative risks/hazards calculated for Residential Area 1 are presented in Section 8.1.5.4.1. A summary of the risk/hazard exceedances for Residential Area 1 is provided in Section 8.1.5.5. The major contributors to risks/hazards for Residential Area 1 are presented in Section 8.1.5.6.1.

Residential Area 2

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in Residential Area 2 are presented in Appendix I.2 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Surface Soil[1]	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT	3.0E-07	No	No	4.7E-03	No	I.2.33.CT
			RME	7.3E-07	No	No	1.1E-02	No	I.2.33.RME
Soil[2]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	3.1E-07	No	No	1.3E-02	No	I.2.33.CT
			RME	7.5E-07	No	No	3.9E-02	No	I.2.33.RME
Surface Soil[1]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	1.6E-06	Yes	No	3.8E-02	No	I.2.34.CT
			RME	4.5E-06	Yes	No	8.1E-02	No	I.2.34.RME
Soil[2]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	1.6E-06	Yes	No	9.9E-02	No	I.2.34.CT
			RME	4.6E-06	Yes	No	2.3E-01	No	I.2.34.RME
Surface Soil[1]	Resident (Future)	Ingestion Dermal Inhalation	CT	1.5E-05	Yes	No	3.8E-01	No	I.2.35.CT
			RME	2.3E-05	Yes	No	4.0E-01	No	I.2.35.RME
Soil[2]	Resident (Future)	Ingestion Dermal Inhalation	CT	1.6E-05	Yes	No	9.8E-01	No	I.2.35.CT
			RME	2.3E-05	Yes	No	1.2E+00	Yes	I.2.35.RME
Surface Soil[1]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	1.5E-06	Yes	No	2.6E-02	No	I.2.36.CT
			RME	5.5E-06	Yes	No	3.4E-02	No	I.2.36.RME
Soil[2]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	1.5E-06	Yes	No	6.8E-02	No	I.2.36.CT
			RME	5.6E-06	Yes	No	1.1E-01	No	I.2.36.RME
Soil[2]	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	2.3E-07	No	No	1.0E-02	No	I.2.37.CT
			RME	1.3E-06	Yes	No	2.4E-02	No	I.2.37.RME
Soil[2]	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	1.6E-07	No	No	1.0E-01	No	I.2.38.CT
			RME	3.3E-07	No	No	2.2E-01	No	I.2.38.RME
Indoor Air (from soil)	Resident (Future)	Inhalation	CT	3.5E-05	Yes	No	1.2E+00	Yes	I.2.35.CT
			RME	1.5E-04	Yes	Yes	1.5E+00	Yes	I.2.35.RME
Indoor Air (from soil)	Commercial Worker (Future)	Inhalation	CT	8.6E-06	Yes	No	2.9E-01	No	I.2.36.CT
			RME	2.7E-05	Yes	No	3.3E-01	No	I.2.36.RME
Groundwater	Resident (Future)	Ingestion Dermal Inhalation	CT	2.3E-04	Yes	Yes	1.4E+01	Yes	I.2.35.CT
			RME	5.1E-04	Yes	Yes	1.5E+01	Yes	I.2.35.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.7E-07	No	No	2.4E-02	No	I.2.37.CT
			RME	9.3E-07	No	No	4.7E-02	No	I.2.37.RME
Groundwater	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	1.1E-07	No	No	1.4E-01	No	I.2.38.CT
			RME	2.2E-07	No	No	2.8E-01	No	I.2.38.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 Assumed that future receptor exposed to a "disturbed" soil scenario.

The cumulative risks/hazards calculated for Residential Area 2 are presented in Section 8.1.5.4.2. A summary of the risk/hazard exceedances for Residential Area 2 is provided in Section 8.1.5.5. The major contributors to risks/hazards for Residential Area 2 are presented in Section 8.1.5.6.2.

Residential Area 3

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in Residential Area 3 are presented in Appendix I.3 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Surface Soil[1]	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT	4.0E-07	No	No	6.2E-03	No	I.3.33.CT
			RME	9.6E-07	No	No	1.5E-02	No	I.3.33.RME
Soil[2]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	4.5E-07	No	No	2.5E-02	No	I.3.33.CT
			RME	1.1E-06	Yes	No	7.1E-02	No	I.3.33.RME
Surface Soil[1]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	2.0E-06	Yes	No	5.0E-02	No	I.3.34.CT
			RME	5.9E-06	Yes	No	1.1E-01	No	I.3.34.RME
Soil[2]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	2.3E-06	Yes	No	1.9E-01	No	I.3.34.CT
			RME	6.6E-06	Yes	No	4.3E-01	No	I.3.34.RME
Surface Soil[1]	Resident (Future)	Ingestion Dermal Inhalation	CT	2.0E-05	Yes	No	5.0E-01	No	I.3.35.CT
			RME	3.0E-05	Yes	No	5.3E-01	No	I.3.35.RME
Soil[2]	Resident (Future)	Ingestion Dermal Inhalation	CT	2.3E-05	Yes	No	1.9E+00	Yes	I.3.35.CT
			RME	3.3E-05	Yes	No	2.1E+00	Yes	I.3.35.RME
Surface Soil[1]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	1.9E-06	Yes	No	3.4E-02	No	I.3.36.CT
			RME	7.2E-06	Yes	No	4.5E-02	No	I.3.36.RME
Soil[2]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	2.2E-06	Yes	No	1.4E-01	No	I.3.36.CT
			RME	8.0E-06	Yes	No	2.1E-01	No	I.3.36.RME
Soil[2]	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	3.3E-07	No	No	2.0E-02	No	I.3.37.CT
			RME	1.9E-06	Yes	No	4.4E-02	No	I.3.37.RME
Soil[2]	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	2.2E-07	No	No	1.8E-01	No	I.3.38.CT
			RME	4.7E-07	No	No	3.8E-01	No	I.3.38.RME
Indoor Air (from soil)	Resident (Future)	Inhalation	CT	7.1E-08	No	No	6.9E-01	No	I.3.35.CT
			RME	3.1E-07	No	No	8.9E-01	No	I.3.35.RME
Indoor Air (from soil)	Commercial Worker (Future)	Inhalation	CT	1.7E-08	No	No	2.5E-01	No	I.3.36.CT
			RME	5.5E-08	No	No	2.8E-01	No	I.3.36.RME
Groundwater	Resident (Future)	Ingestion Dermal Inhalation	CT	2.3E-04	Yes	Yes	1.4E+01	Yes	I.3.35.CT
			RME	5.1E-04	Yes	Yes	1.5E+01	Yes	I.3.35.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.7E-07	No	No	2.4E-02	No	I.3.37.CT
			RME	9.3E-07	No	No	4.7E-02	No	I.3.37.RME
Groundwater	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	1.1E-07	No	No	1.4E-01	No	I.3.38.CT
			RME	2.2E-07	No	No	2.8E-01	No	I.3.38.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

The cumulative risks/hazards calculated for Residential Area 3 are presented in Section 8.1.5.4.3. A summary of the risk/hazard exceedances for Residential Area 3 is provided in Section 8.1.5.5. The major contributors to risks/hazards for Residential Area 3 are presented in Section 8.1.5.6.3.

Residential Area 4

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in Residential Area 4 are presented in Appendix I.4 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Surface Soil[1]	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT	1.2E-06	Yes	No	5.0E-03	No	I.4.33.CT
			RME	4.0E-06	Yes	No	1.2E-02	No	I.4.33.RME
Soil[2]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	1.5E-06	Yes	No	1.6E-01	No	I.4.33.CT
			RME	4.9E-06	Yes	No	4.8E-01	No	I.4.33.RME
Surface Soil[1]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	5.8E-06	Yes	No	4.1E-02	No	I.4.34.CT
			RME	2.0E-05	Yes	No	8.7E-02	No	I.4.34.RME
Soil[2]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	7.2E-06	Yes	No	1.2E+00	Yes	I.4.34.CT
			RME	2.4E-05	Yes	No	2.7E+00	Yes	I.4.34.RME
Surface Soil[1]	Resident (Future)	Ingestion Dermal Inhalation	CT	5.8E-05	Yes	No	4.0E-01	No	I.4.35.CT
			RME	9.8E-05	Yes	No	4.3E-01	No	I.4.35.RME
Soil[2]	Resident (Future)	Ingestion Dermal Inhalation	CT	7.2E-05	Yes	No	1.2E+01	Yes	I.4.35.CT
			RME	1.2E-04	Yes	Yes	1.4E+01	Yes	I.4.35.RME
Surface Soil[1]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	5.6E-06	Yes	No	2.7E-02	No	I.4.36.CT
			RME	2.8E-05	Yes	No	3.7E-02	No	I.4.36.RME
Soil[2]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	7.0E-06	Yes	No	8.7E-01	No	I.4.36.CT
			RME	3.4E-05	Yes	No	1.4E+00	Yes	I.4.36.RME
Soil[2]	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.1E-06	Yes	No	1.2E-01	No	I.4.37.CT
			RME	7.1E-06	Yes	No	2.9E-01	No	I.4.37.RME
Soil[2]	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	7.2E-07	No	No	8.7E-01	No	I.4.38.CT
			RME	1.7E-06	Yes	No	2.0E+00	Yes	I.4.38.RME
Indoor Air (from soil)	Resident (Future)	Inhalation	CT	6.2E-05	Yes	No	1.7E+01	Yes	I.4.35.CT
			RME	2.7E-04	Yes	Yes	2.2E+01	Yes	I.4.35.RME
Indoor Air (from soil)	Commercial Worker (Future)	Inhalation	CT	1.5E-05	Yes	No	4.2E+00	Yes	I.4.36.CT
			RME	4.8E-05	Yes	No	4.8E+00	Yes	I.4.36.RME
Groundwater	Resident (Future)	Ingestion Dermal Inhalation	CT	1.5E-04	Yes	Yes	8.2E+00	Yes	I.4.35.CT
			RME	3.3E-04	Yes	Yes	8.7E+00	Yes	I.4.35.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.0E-07	No	No	1.4E-02	No	I.4.37.CT
			RME	5.8E-07	No	No	4.1E-02	No	I.4.37.RME
Groundwater	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	6.9E-08	No	No	8.1E-02	No	I.4.38.CT
			RME	1.4E-07	No	No	1.6E-01	No	I.4.38.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

The cumulative risks/hazards calculated for Residential Area 4 are presented in Section 8.1.5.4.3. A summary of the risk/hazard exceedances for Residential Area 4 is provided in Section 8.1.5.5. The major contributors to risks/hazards for Residential Area 4 are presented in Section 8.1.5.6.3.

Waterfront Plaza

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in the Waterfront Plaza area are presented in Appendix I.5 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Surface Soil[1]	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT	1.3E-06	Yes	No	2.0E-02	No	I.5.28.CT
			RME	3.1E-06	Yes	No	4.9E-02	No	I.5.28.RME
Soil[2]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	6.3E-07	No	No	1.7E-02	No	I.5.28.CT
			RME	1.5E-06	Yes	No	4.7E-02	No	I.5.28.RME
Surface Soil[1]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	6.6E-06	Yes	No	1.6E-01	No	I.5.29.CT
			RME	1.9E-05	Yes	No	3.5E-01	No	I.5.29.RME
Soil[2]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	3.2E-06	Yes	No	1.3E-01	No	I.5.29.CT
			RME	9.4E-06	Yes	No	2.9E-01	No	I.5.29.RME
Surface Soil[1]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	6.3E-06	Yes	No	1.1E-01	No	I.5.30.CT
			RME	2.4E-05	Yes	No	1.5E-01	No	I.5.30.RME
Soil[2]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	3.1E-06	Yes	No	8.7E-02	No	I.5.30.CT
			RME	1.1E-05	Yes	No	1.4E-01	No	I.5.30.RME
Soil[2]	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	4.7E-07	No	No	1.3E-02	No	I.5.31.CT
			RME	2.7E-06	Yes	No	3.0E-02	No	I.5.31.RME
Soil[2]	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	3.1E-07	No	No	1.2E-01	No	I.5.32.CT
			RME	6.6E-07	No	No	2.5E-01	No	I.5.32.RME
Indoor Air (from soil)	Commercial Worker (Future)	Inhalation	CT	2.0E-08	No	No	2.6E-02	No	I.5.30.CT
			RME	6.4E-08	No	No	3.0E-02	No	I.5.30.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.0E-07	No	No	1.4E-02	No	I.5.31.CT
			RME	5.8E-07	No	No	2.7E-02	No	I.5.31.RME
Groundwater	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	6.9E-08	No	No	8.1E-02	No	I.5.32.CT
			RME	14E-07	No	No	1.6E-01	No	I.5.32.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

The cumulative risks/hazards calculated for the Waterfront Plaza are presented in Section 8.1.5.4.3. A summary of the risk/hazard exceedances for the Waterfront Plaza is provided in Section 8.1.5.5. The major contributors to risks/hazards for the Waterfront Plaza are presented in Section 8.1.5.6.3.

Mixed Residential/Commercial Area 1

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in Mixed Commercial/Residential Area 1 are presented in Appendix I.6 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Surface Soil[1]	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT	2.8E-07	No	No	4.3E-03	No	I.6.33.CT
			RME	6.6E-07	No	No	1.0E-02	No	I.6.33.RME
Soil[2]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	3.8E-07	No	No	1.9E-02	No	I.6.33.CT
			RME	9.2E-07	No	No	5.6E-02	No	I.6.33.RME
Surface Soil[1]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	1.4E-06	Yes	No	3.5E-02	No	I.6.34.CT
			RME	4.1E-06	Yes	No	7.4E-02	No	I.6.34.RME
Soil[2]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	2.0E-06	Yes	No	1.5E-01	No	I.6.34.CT
			RME	5.7E-06	Yes	No	3.4E-01	No	I.6.34.RME
Surface Soil[1]	Resident (Future)	Ingestion Dermal Inhalation	CT	1.4E-05	Yes	No	3.4E-01	No	I.6.35.CT
			RME	2.0E-05	Yes	No	3.7E-01	No	I.6.35.RME
Soil[2]	Resident (Future)	Ingestion Dermal Inhalation	CT	1.9E-05	Yes	No	1.5E+00	Yes	I.6.35.CT
			RME	2.8E-05	Yes	No	1.7E+00	Yes	I.6.35.RME
Surface Soil[1]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	1.3E-06	Yes	No	2.3E-02	No	I.6.36.CT
			RME	5.0E-06	Yes	No	3.1E-02	No	I.6.36.RME
Soil[2]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	1.9E-06	Yes	No	1.0E-01	No	I.6.36.CT
			RME	6.9E-06	Yes	No	1.6E-01	No	I.6.36.RME
Soil[2]	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	2.8E-07	No	No	1.5E-02	No	I.6.37.CT
			RME	1.7E-06	Yes	No	3.4E-02	No	I.6.37.RME
Soil[2]	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	1.9E-07	No	No	1.4E-01	No	I.6.38.CT
			RME	4.0E-07	No	No	3.1E-01	No	I.6.38.RME
Indoor Air (from soil)	Resident (Future)	Inhalation	CT	8.7E-07	No	No	6.5E-01	No	I.6.35.CT
			RME	3.8E-06	Yes	No	8.5E-01	No	I.6.35.RME
Indoor Air (from soil)	Commercial Worker (Future)	Inhalation	CT	2.1E-07	No	No	1.6E-01	No	I.6.36.CT
			RME	6.8E-07	No	No	1.8E-01	No	I.6.36.RME
Groundwater	Resident (Future)	Ingestion Dermal Inhalation	CT	1.5E-04	Yes	Yes	8.2E+00	Yes	I.6.35.CT
			RME	3.3E-04	Yes	Yes	8.7E+00	Yes	I.6.35.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.0E-07	No	No	1.4E-02	No	I.6.37.CT
			RME	5.8E-07	No	No	2.7E-02	No	I.6.37.RME
Groundwater	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	6.9E-08	No	No	8.1E-02	No	I.6.38.CT
			RME	1.4E-07	No	No	1.6E-01	No	I.6.38.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 Assumed that future receptor exposed to a "disturbed" soil scenario.

The cumulative risks/hazards calculated for Mixed Residential/Commercial Area 1 are presented in Section 8.1.5.4.3. A summary of the risk/hazard exceedances for Mixed Residential/Commercial Area 1 is provided in

Section 8.1.5.5. The major contributors to risks/hazards for Mixed Residential/Commercial Area 1 are presented in Section 8.1.5.6.3.

Mixed Residential/Commercial Area 2

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in Mixed Residential/Commercial Area 2 are presented in Appendix I.7 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Surface Soil[1]	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT	1.0E-06	Yes	No	1.1E-02	No	I.7.33.CT
			RME	2.8E-06	Yes	No	2.6E-02	No	I.7.33.RME
Soil[2]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	2.5E-06	Yes	No	5.9E-02	No	I.7.33.CT
			RME	6.8E-06	Yes	No	2.0E-01	No	I.7.33.RME
Surface Soil[1]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	5.0E-06	Yes	No	8.6E-02	No	I.7.34.CT
			RME	1.6E-05	Yes	No	1.8E-01	No	I.7.34.RME
Soil[2]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	1.2E-05	Yes	No	4.3E-01	No	I.7.34.CT
			RME	3.8E-05	Yes	No	1.1E+00	Yes	I.7.34.RME
Surface Soil[1]	Resident (Future)	Ingestion Dermal Inhalation	CT	4.9E-05	Yes	No	8.6E-01	No	I.7.35.CT
			RME	7.7E-05	Yes	No	9.1E-01	No	I.7.35.RME
Soil[2]	Resident (Future)	Ingestion Dermal Inhalation	CT	1.2E-04	Yes	Yes	4.2E+00	Yes	I.7.35.CT
			RME	1.9E-04	Yes	Yes	5.3E+00	Yes	I.7.35.RME
Surface Soil[1]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	4.7E-06	Yes	No	5.8E-02	No	I.7.36.CT
			RME	2.0E-05	Yes	No	7.8E-02	No	I.7.36.RME
Soil[2]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	1.2E-05	Yes	No	3.0E-01	No	I.7.36.CT
			RME	4.9E-05	Yes	No	6.0E-01	No	I.7.36.RME
Soil[2]	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.8E-06	Yes	No	4.6E-02	No	I.7.37.CT
			RME	1.1E-05	Yes	No	1.1E-01	No	I.7.37.RME
Soil[2]	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	1.2E-06	Yes	No	3.4E-01	No	I.7.38.CT
			RME	2.7E-06	Yes	No	7.9E-01	No	I.7.38.RME
Indoor Air (from soil)	Resident (Future)	Inhalation	CT	1.0E-05	Yes	No	3.4E+00	Yes	I.7.35.CT
			RME	4.5E-05	Yes	No	4.5E+00	Yes	I.7.35.RME
Indoor Air (from soil)	Commercial Worker (Future)	Inhalation	CT	2.5E-06	Yes	No	8.4E-01	No	I.7.36.CT
			RME	8.0E-06	Yes	No	9.6E-01	No	I.7.36.RME
Groundwater	Resident (Future)	Ingestion Dermal Inhalation	CT	1.0E-04	Yes	Yes	3.4E+01	Yes	I.7.35.CT
			RME	2.3E-04	Yes	Yes	3.6E+01	Yes	I.7.35.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	7.3E-08	No	No	4.7E-02	No	I.7.37.CT
			RME	4.1E-07	No	No	9.3E-02	No	I.7.37.RME
Groundwater	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	4.9E-08	No	No	2.8E-01	No	I.7.38.CT
			RME	9.8E-08	No	No	5.6E-01	No	I.7.38.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 Assumed that future receptor exposed to a "disturbed" soil scenario.

The cumulative risks/hazards calculated for Mixed Residential/Commercial Area 2 are presented in Section 8.1.5.4.3. A summary of the risk/hazard exceedances for Mixed Residential/Commercial Area 2 is provided in

Section 8.1.5.5. The major contributors to risks/hazards for Mixed Residential/Commercial Area 2 are presented in Section 8.1.5.6.3.

Commercial Area 1

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in Commercial Area 1 are presented in Appendix I.8 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Surface Soil[1]	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT	NC[3]	NC[3]	NC[3]	9.7E-03	No	I.8.20.CT
			RME	NC[3]	NC[3]	NC[3]	4.4E-02	No	I.8.20.RME
Soil[2]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	2.5E-07	No	No	1.5E-02	No	I.8.20.CT
			RME	6.1E-07	No	No	5.3E-02	No	I.8.20.RME
Surface Soil[1]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	NC[3]	NC[3]	NC[3]	4.6E-02	No	I.8.21.CT
			RME	NC[3]	NC[3]	NC[3]	1.2E-01	No	I.8.21.RME
Soil[2]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	1.2E-06	Yes	No	7.6E-02	No	I.8.21.CT
			RME	4.5E-06	Yes	No	1.5E-01	No	I.8.21.RME
Soil[2]	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.9E-07	No	No	1.2E-02	No	I.8.22.CT
			RME	1.1E-06	Yes	No	2.8E-02	No	I.8.22.RME
Soil[2]	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	1.3E-07	No	No	1.3E-01	No	I.8.23.CT
			RME	2.7E-07	No	No	3.0E-01	No	I.8.23.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.7E-07	No	No	2.2E-02	No	I.8.22.CT
			RME	9.3E-07	No	No	4.4E-02	No	I.8.22.RME
Groundwater	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	1.1E-07	No	No	1.3E-01	No	I.8.23.CT
			RME	2.2E-07	No	No	2.7E-01	No	I.8.23.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 Assumed that future receptor exposed to a "disturbed" soil scenario.
3 NC = Not Calculated.

The cumulative risks/hazards calculated for Commercial Area 1 are presented in Section 8.1.5.4.3. A summary of the risk/hazard exceedances for Commercial Area 1 is provided in Section 8.1.5.5. The major contributors to risks/hazards for Commercial Area 1 are presented in Section 8.1.5.6.3.

Commercial Area 2

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in Commercial Area 2 are presented in Appendix I.9 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Soil[1]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	4.6E-07	No	No	1.6E-02	No	I.9.25.CT
			RME	1.1E-06	Yes	No	4.6E-02	No	I.9.25.RME
Soil[1]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	2.3E-06	Yes	No	8.4E-02	No	I.9.26.CT
			RME	8.4E-06	Yes	No	1.3E-01	No	I.9.26.RME
Soil[1]	Utility Worker (Current/Future)	Ingestion Dermal Inhalation	CT	3.4E-07	No	No	1.3E-02	No	I.9.27.CT
			RME	2.0E-06	Yes	No	2.9E-02	No	I.9.27.RME
Soil[1]	Construction Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	2.3E-07	No	No	1.1E-01	No	I.9.28.CT
			RME	4.9E-07	No	No	2.4E-01	No	I.9.28.RME
Indoor Air (from soil)	Commercial Worker (Future)	Inhalation	CT	6.5E-09	No	No	8.4E-03	No	I.9.26.CT
			RME	2.1E-08	No	No	9.6E-03	No	I.9.26.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.0E-07	No	No	1.4E-02	No	I.9.27.CT
			RME	5.8E-07	No	No	2.7E-02	No	I.9.27.RME
Groundwater	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	6.9E-08	No	No	8.1E-02	No	I.9.28.CT
			RME	1.4E-07	No	No	1.6E-01	No	I.9.28.RME

Notes:

[1] Assumed that future receptor exposed to a "disturbed" soil scenario. There were no COPCs identified for surface soil in Commercial Area 2 and therefore, calculation of risks/hazards for the current/future trespasser exposure to surface soil and future commercial worker exposure to surface soil under an "undisturbed" soil scenario was not required.

The cumulative risks/hazards calculated for Commercial Area 2 are presented in Section 8.1.5.4.3. A summary of the risk/hazard exceedances for Commercial Area 2 is provided in Section 8.1.5.5. The major contributors to risks/hazards for Commercial Area 2 are presented in Section 8.1.5.6.3.

Commercial Area 3

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in Commercial Area 3 are presented in Appendix I.10 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Soil[1]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	3.4E-07	No	No	2.4E-02	No	I.10.25.CT
			RME	8.1E-07	No	No	7.3E-02	No	I.10.25.RME
Soil[1]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	1.6E-06	Yes	No	2.0E-01	No	I.10.26.CT
			RME	6.1E-06	Yes	No	2.8E-01	No	I.10.26.RME
Soil[1]	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	2.5E-07	No	No	2.0E-02	No	I.10.27.CT
			RME	1.5E-06	Yes	No	4.5E-02	No	I.10.27.RME
Soil[1]	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	1.7E-07	No	No	2.6E-01	No	I.10.28.CT
			RME	3.5E-07	No	No	5.4E-01	No	I.10.28.RME
Indoor Air (from soil)	Commercial Worker (Future)	Inhalation	CT	1.2E-06	Yes	No	4.0E+00	Yes	I.10.26.CT
			RME	3.9E-06	Yes	No	4.6E+00	Yes	I.10.26.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	1.0E-07	No	No	1.4E-02	No	I.10.27.CT
			RME	5.8E-07	No	No	2.7E-02	No	I.10.27.RME
Groundwater	Construction Worker (Future)	Ingestion Dermal Inhalation	CT	6.9E-08	No	No	8.1E-02	No	I.10.28.CT
			RME	1.4E-07	No	No	1.6E-01	No	I.10.28.RME

Notes:
[1] Assumed that future receptor exposed to a "disturbed" soil scenario. There were no COPCs identified for surface soil in Commercial Area 3 and therefore, calculation of risks/hazards for the current/future trespasser exposure to surface soil and future commercial worker exposure to surface soil under an "undisturbed" soil scenario was not required.

The cumulative risks/hazards calculated for Commercial Area 3 are presented in Section 8.1.5.4.3. A summary of the risk/hazard exceedances for Commercial Area 3 is provided in Section 8.1.5.5. The major contributors to risks/hazards for Commercial Area 3 are presented in Section 8.1.5.6.3.

Commercial Area 4

The non-cancer hazard calculations and calculated potential lifetime cancer risks for receptors in Commercial Area 4 are presented in Appendix I.11 and summarized below.

Medium	*Receptor*	*Route*	*Exposure*	*Carcinogenic Risk*	*Risk ≥ 10^{-6}*	*Risk ≥ 10^{-4}*	*Non-Carcinogenic Hazard Index*	*HI > 1.0*	*Table Reference*
Surface Soil[1]	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT	6.7E-07	No	No	1.6E-02	No	I.11.28.CT
			RME	1.6E-06	Yes	No	5.0E-02	No	I.11.28.RME
Soil[2]	Trespasser (Future)	Ingestion Dermal Inhalation	CT	7.6E-07	No	No	7.2E-02	No	I.11.28.CT
			RME	2.2E-06	Yes	No	2.4E-01	No	I.11.28.RME
Surface Soil[1]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	3.4E-06	Yes	No	1.2E-01	No	I.11.29.CT
			RME	1.0E-05	Yes	No	2.9E-01	No	I.11.29.RME
Soil[2]	Recreational User (Future)	Ingestion Dermal Inhalation	CT	3.7E-06	Yes	No	5.3E-01	No	I.11.29.CT
			RME	1.2E-05	Yes	No	1.3E+00	Yes	I.11.29.RME
Surface Soil[1]	Commercial Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	3.3E-06	Yes	No	8.3E-02	No	I.11.30.CT
			RME	1.2E-05	Yes	No	1.4E-01	No	I.11.30.RME
Soil[2]	Commercial Worker (Future)	Ingestion Dermal Inhalation	CT	3.6E-06	Yes	No	3.7E-01	No	I.11.30.CT
			RME	1.6E-05	Yes	No	6.7E-01	No	I.11.30.RME
Soil[2]	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	5.5E-07	No	No	5.6E-02	No	I.11.31.CT
			RME	3.4E-06	Yes	No	1.3E-01	No	I.11.31.RME
Soil[2]	Construction Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	3.7E-07	No	No	3.8E-01	No	I.11.32.CT
			RME	8.3E-07	No	No	9.0E-01	No	I.11.32.RME
Indoor Air (from soil)	Commercial Worker (Current/ Future)	Inhalation	CT	1.3E-06	Yes	No	7.2E-01	No	I.11.30.CT
			RME	4.0E-06	Yes	No	8.2E-01	No	I.11.30.RME
Groundwater	Utility Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	7.3E-08	No	No	4.7E-02	No	I.11.31.CT
			RME	4.1E-07	No	No	9.3E-02	No	I.11.31.RME
Groundwater	Construction Worker (Current/ Future)	Ingestion Dermal Inhalation	CT	4.9E-08	No	No	2.8E-01	No	I.11.32.CT
			RME	9.8E-08	No	No	5.6E-01	No	I.11.32.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

The cumulative risks/hazards calculated for Commercial Area 4 are presented in Section 8.1.5.4.3. A summary of the risk/hazard exceedances for Commercial Area 4 is provided in Section 8.1.5.5. The major contributors to risks/hazards for Commercial Area 4 are presented in Section 8.1.5.6.3.

8.1.5.4 SUMMATION OF RISKS

A given human population may be exposed to a chemical by several exposure routes and through more than one medium. The purpose of this section is to identify the risks associated with a population that may be exposed to Site COPCs through a combination of exposure pathways.

U.S. EPA (1989) states that risks should be combined across exposure pathways only where the following situation occurs:

a) Reasonable exposure pathway combinations are identified.

b) It appears likely that the same individuals would consistently face the "reasonable maximum exposure" (RME) through more than one pathway.

Instead of encouraging the calculation of combined risks from across exposure pathways, U.S. EPA (1989) cautions that each RME estimate includes many conservative assumptions and that combining estimates is not appropriate unless the combination itself is a RME:

> *"For real world situations in which contaminant concentrations vary over time and space, the same individual may or may not experience the RME for more than one pathway over the same period of time. One individual might face the RME through one pathway, and a different individual face the RME through a different pathway. Only if you can explain why the key RME assumptions for more than one pathway apply to the same individual or sub-population should the RME risks for more than one pathway be combined.*
>
> *In some situations, it may be appropriate to combine one pathway's RME risks with other pathways' risk estimates that have been derived from more typical exposure parameter values". [Emphasis added].*

It is improbable that the same person would experience all potential exposures associated with the Site or even over the periods of years specified in the individual RME scenarios. The HHRA examined the potential for unique receptors chosen to represent potential activities that might occur within the on and off Site locations. The purpose of differentiating between receptors is that each of the receptors has a realistic exposure that depends on the activities they perform. These activities are receptor-specific and are unlikely to overlap. As a result, it is considered inappropriate to add together the estimated risks and hazards for the different exposure routes and pathways, because this would

result in the exaggeration of an appropriate RME for the summed exposures. Therefore, it is unlikely the summation of the RME estimates would result in an underestimation of risk, and this estimate should be evaluated as a conservative estimate of the likely exposure at the site. However, where appropriate and for completeness, both cumulative CT and RME risks and hazards from separate exposure routes and media were combined to estimate total CT and RME exposures.

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for Residential Area 1, Residential Area 2, Residential Area 3, Residential Area 4, Waterfront Plaza, Mixed Residential/Commercial Area 1, Mixed Residential/Commercial Area 2, Commercial Area 1, Commercial Area 2, and Commercial Area 4 are presented in Appendices I.1, I.2, I.3, I.4, I.5, I.6, I.7, I.8, I.9, I.10, and I.11, respectively, and are summarized below. The referenced tables within each of these appendices that present the cumulative HIs and lifetime cancer risks also present the segregated hazards (cumulative) for each non-carcinogenic endpoint that affect a specific target organ at the bottom of each table. Therefore, the HIs for the COPCs that affect the same target organ were summed to provide the segregated hazard. It should be noted that for some COPCs (i.e., iron), toxicity endpoints affecting a specific target organ were not available. For these COPCs, the hazards were summed based on the assumption that they exert the same toxicological effect (identified as "unknown"), which is considered to be a conservative approach.

Residential Area 1

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in Residential Area 1 are presented in Appendix I.1, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Current/Future)	Surface Soil[1]	CT	2.5E-07	No	No	4.0E-03	No	I.1.39.CT
		RME	6.1E-07	No	No	9.5E-03	No	I.1.39.RME
Trespasser (Future)	Soil[2]	CT	4.3E-07	No	No	1.7E-02	No	I.1.39.CT
		RME	1.1E-06	Yes	No	4.7E-02	No	I.1.39.RME
Recreational	Surface Soil[1]	CT	1.3E-06	Yes	No	3.2E-02	No	I.1.40.CT

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
User (Future)		RME	3.8E-06	Yes	No	6.8E-02	No	I.1.40.RME
Recreational User (Future)	Soil[2]	CT	2.2E-06	Yes	No	1.3E-01	No	I.1.40.CT
		RME	6.4E-06	Yes	No	3.0E-01	No	I.1.40.RME
Resident (Future)	Surface Soil[1] Groundwater Indoor Air	CT	2.4E-04	Yes	Yes	1.4E+01	Yes	I.1.41.CT
		RME	5.2E-04	Yes	Yes	1.5E+01	Yes	I.1.41.RME
Resident (Future)	Soil[2] Groundwater Indoor Air	CT	2.5E-04	Yes	Yes	1.5E+01	Yes	I.1.41.CT
		RME	5.4E-04	Yes	Yes	1.6E+01	Yes	I.1.41.RME
Commercial Worker (Future)	Surface Soil[1] Indoor Air	CT	1.2E-06	Yes	No	2.6E-02	No	I.1.42.CT
		RME	4.6E-06	Yes	No	3.4E-02	No	I.1.42.RME
Commercial Worker (Future)	Soil[2] Indoor Air	CT	2.1E-06	Yes	No	9.4E-02	No	I.1.42.CT
		RME	7.9E-06	Yes	No	1.4E-01	No	I.1.42.RME
Utility Worker (Current/ Future)	Soil[2] Groundwater	CT	4.8E-07	No	No	3.7E-02	No	I.1.43.CT
		RME	2.8E-06	Yes	No	7.7E-02	No	I.1.43.RME
Construction Worker (Future)	Soil[2] Groundwater	CT	3.3E-07	No	No	2.6E-01	No	I.1.44.CT
		RME	6.8E-07	No	No	5.4E-01	No	I.1.44.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 Assumed that future receptor exposed to a "disturbed" soil scenario.

As indicated in the table above, only the resident receptor within Residential Area 1 had a cumulative HI above 1. For segregated hazards, cumulative HIs above 1 were observed for the following toxicity endpoints (target organs) and the COPCs that contributed to these effects:

RESIDENT – UNDISTURBED			
TOTAL CT HI = 1.4E+01 ; TOTAL RME HI = 1.5E+01			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
SKIN DISCOLORATION (CT HI = 3.9E+00; RME HI = 3.9E+00)			
Arsenic	CT	3.9E+00	Soil (3.2E-01); Groundwater (3.5E+00)
	RME	3.9E+00	Soil (3.4E-01); Groundwater (3.6E+00)
CENTRAL NERVOUS SYSTEM (CT HI = 6.7E+00; RME HI = 7.4E+00)			
Manganese	CT	6.7E+00	Groundwater (6.7E+00)
	RME	7.4E+00	Groundwater (7.4E+00)

RESIDENT – UNDISTURBED			
TOTAL CT HI = 1.4E+01 ; TOTAL RME HI = 1.5E+01			
Parameter	***Exposure***	***Parameter HI***	***Media (HI)***
UNKNOWN (CT HI = 3.0E+00; RME HI = 3.1E+00)			
Aluminum	CT	5.9E-01	Groundwater (5.9E-01)
	RME	5.9E-01	Groundwater (5.9E-01)
Iron	CT	2.0E+00	Groundwater (2.0E+00)
	RME	2.0E+00	Groundwater (2.0E+00)
Vanadium	CT	4.2E-01	Groundwater (4.2E-01)
	RME	4.9E-01	Groundwater (4.9E-01)

RESIDENT – DISTURBED			
TOTAL CT HI = 1.5E+01; TOTAL RME HI = 1.6E+01			
Parameter	***Exposure***	***Parameter HI***	***Media (HI)***
SKIN DISCOLORATION (CT HI = 4.1E+00; RME HI = 4.1E+00)			
Arsenic	CT	4.1E+00	Soil (5.2E-01); Groundwater (3.5E+00)
	RME	4.1E+00	Soil (5.6E-01); Groundwater (3.6E+00)
CENTRAL NERVOUS SYSTEM (CT HI = 6.9E+00; RME HI = 7.7E+00)			
Manganese	CT	6.9E+00	Soil (2.4E-01); Groundwater (6.7E+00)
	RME	7.7E+00	Soil (3.6E-01); Groundwater (7.4E+00)
UNKNOWN (CT HI = 3.5E+00; RME HI = 3.6E+00)			
Aluminum	CT	6.7E-01	Soil (8.4E-02); Groundwater (5.9E-01)
	RME	6.7E-01	Soil (8.6E-02); Groundwater (5.9E-01)
Cobalt	CT	1.8E-01	Soil (1.8E-01)
	RME	1.8E-01	Soil (1.8E-01)
Iron	CT	2.2E+00	Soil (2.2E-01); Groundwater (2.0E+00)
	RME	2.2E+00	Soil (2.3E-01); Groundwater (2.0E+00)
Vanadium	CT	4.2E-01	Groundwater (4.2E-01)
	RME	4.9E-01	Groundwater (4.9E-01)

Residential Area 2

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in Residential Area 2 are presented in Appendix I.2, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Current/ Future)	Surface Soil[1]	CT	3.0E-07	No	No	4.7E-03	No	I.2.39.CT
		RME	7.3E-07	No	No	1.1E-02	No	I.2.39.RME
Trespasser (Future)	Soil[2]	CT	3.1E-07	No	No	1.3E-02	No	I.2.39.CT
		RME	7.5E-07	No	No	3.9E-02	No	I.2.39.RME
Recreational User (Future)	Surface Soil[1]	CT	1.5E-06	Yes	No	3.8E-02	No	I.2.40.CT
		RME	4.5E-06	Yes	No	8.1E-02	No	I.2.40.RME
Recreational User (Future)	Soil[2]	CT	1.6E-06	Yes	No	9.9E-02	No	I.2.40.CT
		RME	4.6E-06	Yes	No	2.3E-01	No	I.2.40.RME
Resident (Future)	Surface Soil[1] Groundwater Indoor Air	CT	2.8E-04	Yes	Yes	1.5E+01	Yes	I.2.41.CT
		RME	6.8E-04	Yes	Yes	1.7E+01	Yes	I.2.41.RME
Resident (Future)	Soil[2] Groundwater Indoor Air	CT	2.8E-04	Yes	Yes	1.6E+01	Yes	I.2.41.CT
		RME	6.8E-04	Yes	Yes	1.7E+01	Yes	I.2.41.RME
Commercial Worker (Future)	Surface Soil[1] Indoor Air	CT	1.0E-05	Yes	No	3.1E-01	No	I.2.42.CT
		RME	3.3E-05	Yes	No	3.6E-01	No	I.2.42.RME
Commercial Worker (Future)	Soil[2] Indoor Air	CT	1.0E-05	Yes	No	3.5E-01	No	I.2.42.CT
		RME	3.3E-05	Yes	No	4.4E-01	No	I.2.42.RME
Utility Worker (Current/ Future)	Soil[2] Groundwater	CT	3.9E-07	No	No	3.4E-02	No	I.2.43.CT
		RME	2.3E-06	Yes	No	7.1E-02	No	I.2.43.RME
Construction Worker (Future)	Soil[2] Groundwater	CT	2.7E-07	No	No	2.4E-01	No	I.2.44.CT
		RME	5.5E-07	No	No	5.0E-01	No	I.2.44.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

As indicated in the table above, only the resident receptor within Residential Area 2 had a cumulative HI above 1. For segregated hazards, cumulative HIs above 1 were observed for the following toxicity endpoints (target organs) and the COPCs that contributed to these effects:

RESIDENT – UNDISTURBED			
TOTAL CT HI = 1.5E+01 ; TOTAL RME HI = 1.7E+01			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
BLOOD SYSTEM (CT HI = 1.2E+00; RME HI = 1.5E+00)			
Benzene	CT	1.2E+00	Soil to Indoor Air (1.2E+00)
	RME	1.5E+00	Soil to Indoor Air (1.5E+00)
SKIN DISCOLORATION (CT HI = 3.9E+00; RME HI = 4.0E+00)			
Arsenic	CT	3.9E+00	Soil (3.8E-01); Groundwater (3.5E+00)
	RME	4.0E+00	Soil (4.0E-01); Groundwater (3.6E+00)
CENTRAL NERVOUS SYSTEM (CT HI = 6.7E+00; RME HI = 7.4E+00)			
Manganese	CT	6.7E+00	Groundwater (6.7E+00)
	RME	7.4E+00	Groundwater (7.4E+00)
UNKNOWN (CT HI = 3.0E+00; RME HI = 3.1E+00)			
Aluminum	CT	5.9E-01	Groundwater (5.9E-01)
	RME	5.9E-01	Groundwater (5.9E-01)
Iron	CT	2.0E+00	Groundwater (2.0E+00)
	RME	2.0E+00	Groundwater (2.0E+00)
Vanadium	CT	4.2E-01	Groundwater (4.2E-01)
	RME	4.9E-01	Groundwater (4.9E-01)

RESIDENT – DISTURBED			
TOTAL CT HI = 1.6E+01; TOTAL RME HI = 1.7E+01			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
BLOOD SYSTEM (CT HI = 1.2E+00; RME HI = 1.5E+00)			
Benzene	CT	1.2E+00	Soil (7.8E-04); Soil to Indoor Air (1.2E+00)
	RME	1.5E+00	Soil (8.8E-04); Soil to Indoor Air (1.5E+00)
SKIN DISCOLORATION (CT HI = 3.9E+00; RME HI = 4.0E+00)			
Arsenic	CT	3.9E+00	Soil (3.8E-01); Groundwater (3.5E+00)
	RME	4.0E+00	Soil (4.0E-01); Groundwater (3.6E+00)
CENTRAL NERVOUS SYSTEM (CT HI = 7.0E+00; RME HI = 7.8E+00)			
Manganese	CT	7.0E+00	Soil (2.8E-01); Groundwater (6.7E+00)
	RME	7.8E+00	Soil (4.1E-01); Groundwater (7.4E+00)
UNKNOWN (CT HI = 3.3E+00; RME HI = 3.4E+00)			
Aluminum	CT	6.6E-01	Soil (7.6E-02); Groundwater (5.9E-01)
	RME	6.7E-01	Soil (7.8E-02); Groundwater (5.9E-01)
Iron	CT	2.2E+00	Soil (2.5E-01); Groundwater (2.0E+00)
	RME	2.2E+00	Soil (2.5E-01); Groundwater (2.0E+00)
Vanadium	CT	4.2E-01	Groundwater (4.2E-01)
	RME	4.9E-01	Groundwater (4.9E-01)

Residential Area 3

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in Residential Area 3 are presented in Appendix I.3, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Current)	Surface Soil[1]	CT	4.0E-07	No	No	6.2E-03	No	I.3.39.CT
		RME	9.6E-07	No	No	1.5E-02	No	I.3.39.RME
Trespasser (Future)	Soil[2]	CT	4.5E-07	No	No	2.5E-02	No	I.3.39.CT
		RME	1.1E-06	Yes	No	7.1E-02	No	I.3.39.RME
Recreational User (Future)	Surface Soil[1]	CT	2.0E-06	Yes	No	5.0E-02	No	I.3.40.CT
		RME	5.9E-06	Yes	No	1.1E-01	No	I.3.40.RME
Recreational User (Future)	Soil[2]	CT	2.3E-06	Yes	No	1.9E-01	No	I.3.40.CT
		RME	6.6E-06	Yes	No	4.3E-01	No	I.3.40.RME
Resident (Future)	Surface Soil[1] Groundwater Indoor Air	CT	2.5E-04	Yes	Yes	1.5E+01	Yes	I.3.41.CT
		RME	5.3E-04	Yes	Yes	1.6E+01	Yes	I.3.41.RME
Resident (Future)	Soil[2] Groundwater Indoor Air	CT	2.5E-04	Yes	Yes	1.6E+01	Yes	I.3.41.CT
		RME	5.4E-04	Yes	Yes	1.8E+01	Yes	I.3.41.RME
Commercial Worker (Future)	Surface Soil[1] Indoor Air	CT	2.0E-06	Yes	No	2.8E-01	No	I.3.42.CT
		RME	7.3E-06	Yes	No	3.3E-01	No	I.3.42.RME
Commercial Worker (Future)	Surface Soil[2] Indoor Air	CT	2.2E-06	Yes	No	3.9E-01	No	I.3.42.CT
		RME	8.1E-06	Yes	No	4.9E-01	No	I.3.42.RME
Utility Worker (Current/ Future)	Soil[2] Groundwater	CT	5.0E-07	No	No	4.3E-02	No	I.3.43.CT
		RME	2.9E-06	Yes	No	9.1E-02	No	I.3.43.RME
Construction Worker (Future)	Soil[2] Groundwater	CT	3.3E-07	No	No	3.2E-01	No	I.3.44.CT
		RME	6.9E-07	No	No	6.7E-01	No	I.3.44.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

As indicated in the table above, only the resident receptor within Residential Area 3 had a cumulative HI above 1. For segregated hazards, cumulative HIs above 1 were observed for the following toxicity endpoints (target organs) and the COPCs that contributed to these effects:

RESIDENT – UNDISTURBED			
TOTAL CT HI = 1.5E+01 ; TOTAL RME HI = 1.6E+01			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
SKIN DISCOLORATION (CT HI = 4.0E+00; RME HI = 4.1E+00)			
Arsenic	CT	4.0E+00	Soil (5.0E-01); Groundwater (3.5E+00)
	RME	4.1E+00	Soil (5.3E-01); Groundwater (3.6E+00)

CENTRAL NERVOUS SYSTEM (CT HI = 7.3E+00; RME HI = 8.2E+00)			
Manganese	CT	6.7E+00	Groundwater (6.7E+00)
	RME	7.4E+00	Groundwater (7.4E+00)
Mercury	CT	6.0E-01	Soil to Indoor Air (6.0E-01)
	RME	7.7E-01	Soil to Indoor Air (7.7E-01)
UNKNOWN (CT HI = 3.0E+00; RME HI = 3.1E+00)			
Aluminum	CT	5.9E-01	Groundwater (5.9E-01)
	RME	5.9E-01	Groundwater (5.9E-01)
Iron	CT	2.0E+00	Groundwater (2.0E+00)
	RME	2.0E+00	Groundwater (2.0E+00)
Vanadium	CT	4.2E-01	Groundwater (4.2E-01)
	RME	4.9E-01	Groundwater (4.9E-01)

RESIDENT – DISTURBED			
TOTAL CT HI = 1.6E+01; TOTAL RME HI = 1.8E+01			
Parameter	***Exposure***	***Parameter HI***	***Media (HI)***
SKIN DISCOLORATION (CT HI = 4.1E+00; RME HI = 4.2E+00)			
Arsenic	CT	4.1E+00	Soil (5.6E-01); Groundwater (3.5E+00)
	RME	4.2E+00	Soil (5.9E-01); Groundwater (3.6E+00)
CENTRAL NERVOUS SYSTEM (CT HI = 7.7E+00; RME HI = 8.7E+00)			
Manganese	CT	7.0E+00	Soil (3.5E-01); Groundwater (6.7E+00)
	RME	7.9E+00	Soil (5.3E-01); Groundwater (7.4E+00)
Mercury	CT	6.3E-01	Soil (3.7E-02); Soil to Indoor Air (6.0E-01)
	RME	8.1E-01	Soil (4.0E-02); Soil to Indoor Air (7.7E-01)
UNKNOWN (CT HI = 3.6E+00; RME HI = 3.7E+00)			
Aluminum	CT	6.6E-01	Soil (7.4E-02); Groundwater (5.9E-01)
	RME	6.6E-01	Soil (7.5E-02); Groundwater (5.9E-01)
Cobalt	CT	2.2E-01	Soil (2.2E-01)
	RME	2.3E-01	Soil (2.3E-01)
Iron	CT	2.3E+00	Soil (3.0E-01); Groundwater (2.0E+00)
	RME	2.3E+00	Soil (3.1E-01); Groundwater (2.0E+00)
Vanadium	CT	4.2E-01	Groundwater (4.2E-01)
	RME	4.9E-01	Groundwater (4.9E-01)

Residential Area 4

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in Residential Area 4 are presented in Appendix I.4, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Current/ Future)	Surface Soil[1]	CT	1.2E-06	Yes	No	5.0E-03	No	I.4.39.CT
		RME	4.0E-06	Yes	No	1.2E-02	No	I.4.39.RME
Trespasser (Future)	Soil[2]	CT	1.5E-06	Yes	No	1.6E-01	No	I.4.39.CT
		RME	4.9E-06	Yes	No	4.8E-01	No	I.4.39.RME
Recreational User (Future)	Surface Soil[1]	CT	5.8E-06	Yes	No	4.1E-02	No	I.4.40.CT
		RME	2.0E-05	Yes	No	8.7E-02	No	I.4.40.RME
Recreational User (Future)	Soil[2]	CT	7.2E-06	Yes	No	1.2E+00	Yes	I.4.40.CT
		RME	2.4E-05	Yes	No	2.7E+00	Yes	I.4.40.RME
Resident (Future)	Surface Soil[1] Groundwater Indoor Air	CT	2.7E-04	Yes	Yes	2.6E+01	Yes	I.4.41.CT
		RME	7.0E-04	Yes	Yes	3.1E+01	Yes	I.4.41.RME
Resident (Future)	Soil[2] Groundwater Indoor Air	CT	2.8E-04	Yes	Yes	3.7E+01	Yes	I.4.41.CT
		RME	7.2E-04	Yes	Yes	4.5E+01	Yes	I.4.41.RME
Commercial Worker (Future)	Surface Soil[1] Indoor Air	CT	2.1E-05	Yes	No	4.2E+00	Yes	I.4.42.CT
		RME	7.6E-05	Yes	No	4.8E+00	Yes	I.4.42.RME
Commercial Worker (Future)	Soil[2] Indoor Air	CT	2.2E-05	Yes	No	5.1E+00	Yes	I.4.42.CT
		RME	8.3E-05	Yes	No	6.2E+00	Yes	I.4.42.RME
Utility Worker (Current/ Future)	Soil[2] Groundwater	CT	1.2E-06	Yes	No	1.4E-01	No	I.4.43.CT
		RME	7.7E-06	Yes	No	3.3E-01	No	I.4.43.RME
Construction Worker (Future)	Soil[2] Groundwater	CT	7.9E-07	No	No	9.5E-01	No	I.4.44.CT
		RME	1.9E-06	Yes	No	2.1E+00	Yes	I.4.44.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

As indicated in the table above, the recreational user (disturbed scenario only), resident, commercial worker, and construction worker within Residential Area 4 had cumulative HIs above 1. For segregated hazards, cumulative HIs above 1 were observed for the following toxicity endpoints (target organs) and the COPCs that contributed to these effects (there were no segregated hazards above 1 for the construction worker):

RECREATIONAL USER – DISTURBED			
TOTAL CT HI = 1.2E+00; TOTAL RME HI = 2.7E+00			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
IMMUNE SYSTEM (CT HI = 6.3E-00; RME HI = 1.6E+00)			
Total PCBs	CT	HI < 1	Not Applicable
	RME	1.6E+00	Soil (1.6E+00)

RESIDENT – UNDISTURBED			
TOTAL CT HI = 2.6E+01 ; TOTAL RME HI = 3.1E+01			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
BLOOD SYSTEM (CT HI = 1.9E+00; RME HI = 2.4E+00)			
Benzene	CT	1.9E+00	Soil to Indoor Air (1.9E+00)
	RME	2.4E+00	Soil to Indoor Air (2.4E+00)
BODY WEIGHT (CT HI = 9.6E-01; RME HI = 1.2E+00)			
Xylenes	CT	9.6E-01	Soil to Indoor Air (9.6E-01)
	RME	1.2E+00	Soil to Indoor Air (1.2E+00)
SKIN DISCOLORATION (CT HI = 3.5E+00; RME HI = 3.6E+00)			
Arsenic	CT	3.5E+00	Soil (4.0E-01); Groundwater (3.1E+00)
	RME	3.6E+00	Soil (4.3E-01); Groundwater (3.2E+00)
CENTRAL NERVOUS SYSTEM (CT HI = 1.9E+01; RME HI = 2.4E+01)			
Manganese	CT	4.9E+00	Groundwater (4.9E+00)
	RME	5.4E+00	Groundwater (5.4E+00)
Mercury	CT	1.4E+01	Soil to Indoor Air (1.4E+01)
	RME	1.8E+01	Soil to Indoor Air (1.8E+01)
UNKNOWN (CT HI = 1.5E-01; RME HI = 1.5E-01)			
Iron	CT	1.5E-01	Groundwater (1.5E-01)
	RME	1.5E-01	Groundwater (1.5E-01)

RESIDENT – DISTURBED			
TOTAL CT HI = 3.7E+01 ; TOTAL RME HI = 4.5E+01			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
BLOOD SYSTEM (CT HI = 1.9E+00; RME HI = 2.4E+00)			
Benzene	CT	1.9E+00	Soil (1.2E-03); Soil to Indoor Air (1.9E+00)
	RME	2.4E+00	Soil (1.4E-03); Soil to Indoor Air (2.4E+00)
BODY WEIGHT (CT HI = 9.6E-01; RME HI = 1.2E+00)			
Xylenes	CT	9.6E-01	Soil (5.9E-04); Soil to Indoor Air (9.6E-01)
	RME	1.2E+00	Soil (9.3E-04); Soil to Indoor Air (1.2E+00)
IMMUNE SYSTEM (CT HI = 6.3E+00; RME HI = 8.1E+00)			
Total PCBs	CT	6.3E+00	Soil (6.3E+00)
	RME	8.1E+00	Soil (8.1E+00)
SKIN DISCOLORATION (CT HI = 3.7E+00; RME HI = 3.7E+00)			
Arsenic	CT	3.7E+00	Soil (5.4E-01); Groundwater (3.1E+00)
	RME	3.7E+00	Soil (5.8E-01); Groundwater (3.1E+00)

RESIDENT – DISTURBED			
TOTAL CT HI = 3.7E+01 ; TOTAL RME HI = 4.5E+01			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
CENTRAL NERVOUS SYSTEM (CT HI = 2.0E+01; RME HI = 2.5E+01)			
Manganese	CT	5.2E+00	Soil (2.8E-01); Groundwater (4.9E+00)
	RME	5.8E+00	Soil (4.2E-01); Groundwater (5.4E+00)
Mercury	CT	1.5E+01	Soil (3.2E-01); Soil to Indoor Air (1.4E+01)
	RME	1.9E+01	Soil (3.4E-01); Soil to Indoor Air (1.8E+01)
UNKNOWN (CT HI = 4.0E+00; RME HI = 4.0E+00)			
Aluminum	CT	8.5E-02	Soil (8.5E-02)
	RME	8.7E-02	Soil (8.7E-02)
Cobalt	CT	2.6E-01	Soil (2.6E-01)
	RME	2.7E-01	Soil (2.7E-01)
Iron	CT	3.6E+00	Soil (3.5E+00); Groundwater (1.5E-01)
	RME	3.7E+00	Soil (3.5E+00); Groundwater (1.5E-01)

COMMERCIAL WORKER – UNDISTURBED			
TOTAL CT HI = 4.2E+00 ; TOTAL RME HI = 4.8E+00			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
CENTRAL NERVOUS SYSTEM (CT HI = 3.5E+00; RME HI = 4.0E+00)			
Mercury	CT	3.5E+00	Soil to Indoor Air (3.5E+00)
	RME	4.0E+00	Soil to Indoor Air (4.0E+00)

COMMERCIAL WORKER – DISTURBED			
TOTAL CT HI = 5.1E+00 ; TOTAL RME HI = 6.2E+00			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
CENTRAL NERVOUS SYSTEM (CT HI = 3.6E+00; RME HI = 4.1E+00)			
Manganese	CT	2.1E-02	Soil (2.1E-02)
	RME	5.1E-02	Soil (5.1E-02)
Mercury	CT	3.6E+00	Soil (1.1E-01); Soil to Indoor Air (3.5E+00)
	RME	4.1E+00	Soil (1.2E-01); Soil to Indoor Air (4.0E+00)

Waterfront Plaza

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in the Waterfront Plaza are presented in Appendix I.5, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Current/ Future)	Surface Soil[1]	CT	1.3E-06	Yes	No	2.0E-02	No	I.5.33.CT
		RME	3.1E-06	Yes	No	4.9E-02	No	I.5.33.RME
Trespasser (Future)	Soil[2]	CT	6.3E-07	No	No	1.7E-02	No	I.5.33.CT
		RME	1.5E-06	Yes	No	4.7E-02	No	I.5.33.RME
Recreational User (Future)	Surface Soil[1]	CT	6.6E-06	Yes	No	1.6E-01	No	I.5.34.CT
		RME	1.9E-05	Yes	No	3.5E-01	No	I.5.34.RME
Recreational User (Future)	Soil[2]	CT	3.2E-06	Yes	No	1.3E-01	No	I.5.34.CT
		RME	9.4E-06	Yes	No	2.9E-01	No	I.5.34.RME
Commercial Worker (Future)	Surface Soil[1] Indoor Air	CT	6.3E-06	Yes	No	1.4E-01	No	I.5.35.CT
		RME	2.4E-05	Yes	No	1.8E-01	No	I.5.35.RME
Commercial Worker (Future)	Soil[2] Indoor Air	CT	3.1E-06	Yes	No	1.1E-01	No	I.5.35.CT
		RME	1.1E-05	Yes	No	1.7E-01	No	I.5.35.RME
Utility Worker (Current/ Future)	Soil[2] Groundwater	CT	5.7E-07	No	No	2.7E-02	No	I.5.36.CT
		RME	3.3E-06	Yes	No	5.7E-02	No	I.5.36.RME
Construction Worker (Future)	Soil[2] Groundwater	CT	3.8E-07	No	No	2.0E-01	No	I.5.37.CT
		RME	8.0E-07	No	No	4.1E-01	No	I.5.37.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

Mixed Residential/Commercial Area 1

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in Commercial Area 4 are presented in Appendix I.6, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥>10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Current/ Future)	Surface Soil[1]	CT	2.8E-07	No	No	4.3E-03	No	I.6.39.CT
		RME	6.6E-07	No	No	1.0E-02	No	I.6.39.RME
Trespasser (Future)	Soil[2]	CT	3.8E-07	No	No	1.9E-02	No	I.6.39.CT
		RME	9.2E-07	No	No	5.6E-02	No	I.6.39.RME
Recreational User (Future)	Surface Soil[1]	CT	1.4E-06	Yes	No	3.5E-02	No	I.6.40.CT
		RME	4.1E-06	Yes	No	7.4E-02	No	I.6.40.RME
Recreational User (Future)	Soil[2]	CT	2.0E-06	Yes	No	1.5E-01	No	I.6.40.CT
		RME	5.7E-06	Yes	No	3.4E-01	No	I.6.40.RME
Resident (Future)	Surface Soil[1] Indoor Air Groundwater	CT	1.6E-04	Yes	Yes	9.2E+00	Yes	I.6.41.CT
		RME	3.5E-04	Yes	Yes	9.9E+00	Yes	I.6.41.RME
Resident (Future)	Soil[2] Indoor Air Groundwater	CT	1.7E-04	Yes	Yes	1.0E+01	Yes	I.6.41.CT
		RME	3.6E-04	Yes	Yes	1.1E+01	Yes	I.6.41.RME
Commercial Worker (Future)	Surface Soil[1] Indoor Air	CT	1.6E-06	Yes	No	1.8E-01	No	I.6.42.CT
		RME	5.7E-06	Yes	No	2.1E-01	No	I.6.42.RME
Commercial Worker (Future)	Soil[2] Indoor Air	CT	2.1E-06	Yes	No	2.6E-01	No	I.6.42.CT
		RME	7.6E-06	Yes	No	3.4E-01	No	I.6.42.RME
Utility Worker (Current/ Future)	Soil[2] Groundwater	CT	3.9E-07	No	No	2.9E-02	No	I.6.43.CT
		RME	2.2E-06	Yes	No	6.2E-02	No	I.6.43.RME
Construction Worker (Future)	Soil[2] Groundwater	CT	2.6E-07	No	No	2.2E-01	No	I.6.44.CT
		RME	5.4E-07	No	No	4.7E-01	No	I.6.44.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

As indicated in the table above, only the resident receptor within Mixed Residential/Commercial Area 1 had a cumulative HI above 1. For segregated hazards, cumulative HIs above 1 were observed for the following toxicity endpoints (target organs) and the COPCs that contributed to these effects:

RESIDENT – UNDISTURBED			
TOTAL CT HI = 9.2E+00 ; TOTAL RME HI = 9.9E+00			
Parameter	***Exposure***	***Parameter HI***	***Media (HI)***
SKIN DISCOLORATION (CT HI = 3.5E+00; RME HI = 3.5E+00)			
Arsenic	CT	3.5E+00	Soil (3.4E-01); Groundwater (3.1E+00)
	RME	3.5E+00	Soil (3.7E-01); Groundwater (3.2E+00)

RESIDENT – UNDISTURBED			
TOTAL CT HI = 9.2E+00 ; TOTAL RME HI = 9.9E+00			
Parameter	***Exposure***	***Parameter HI***	***Media (HI)***
CENTRAL NERVOUS SYSTEM (CT HI = 5.6E+00; RME HI = 6.3E+00)			
Manganese	CT	4.9E+00	Groundwater (4.9E+00)
	RME	5.4E+00	Groundwater (5.4E+00)
Tetrachloroethene	CT	6.5E-01	Soil to Indoor Air (6.5E-01)
	RME	8.5E-01	Soil to Indoor Air (8.5E-01)

RESIDENT – DISTURBED			
TOTAL CT HI = 1.0E+01; TOTAL RME HI = 1.1E+01			
Parameter	***Exposure***	***Parameter HI***	***Media (HI)***
SKIN DISCOLORATION (CT HI = 3.6E+00; RME HI = 3.7E+00)			
Arsenic	CT	3.6E+00	Soil (4.8E-01); Groundwater (3.1E+00)
	RME	3.7E+00	Soil (5.1E-01); Groundwater (3.2E+00)
CENTRAL NERVOUS SYSTEM (CT HI = 5.9E+00; RME HI = 6.8E+00)			
Manganese	CT	5.3E+00	Soil (3.7E-01); Groundwater (4.9E+00)
	RME	6.0E+00	Soil (5.5E-01); Groundwater (5.4E+00)
Tetrachloroethene	CT	6.5E-01	Soil (3.6E-04); Soil to Indoor Air (6.5E-01)
	RME	8.5E-01	Soil (4.4E-04); Soil to Indoor Air (8.5E-01)

Mixed Residential/Commercial Area 2

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in Commercial Area 4 are presented in Appendix I.7, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Current/ Future)	Surface Soil[1]	CT	1.0E-06	Yes	No	1.1E-02	No	I.7.39.CT
		RME	2.8E-06	Yes	No	2.6E-02	No	I.7.39.RME
Trespasser (Future)	Soil[2]	CT	2.5E-06	Yes	No	5.9E-02	No	I.7.39.CT
		RME	6.8E-06	Yes	No	2.0E-01	No	I.7.39.RME
Recreational User (Future)	Surface Soil[1]	CT	5.0E-06	Yes	No	8.6E-02	No	I.7.40.CT
		RME	1.5E-05	Yes	No	1.8E-01	No	I.7.40.RME
Recreational User (Future)	Soil[2]	CT	1.2E-05	Yes	No	4.3E-01	No	I.7.40.CT
		RME	3.8E-05	Yes	No	1.1E+00	Yes	I.7.40.RME
Resident (Future)	Surface Soil[1] Indoor Air Groundwater	CT	1.6E-04	Yes	Yes	3.8E+01	Yes	I.7.41.CT
		RME	3.5E-04	Yes	Yes	4.1E+01	Yes	I.7.41.RME
Resident (Future)	Soil[2] Indoor Air Groundwater	CT	2.3E-04	Yes	Yes	4.2E+01	Yes	I.7.41.CT
		RME	4.6E-04	Yes	Yes	4.5E+01	Yes	I.7.41.RME
Commercial Worker (Future)	Surface Soil[1] Indoor Air	CT	7.3E-06	Yes	No	9.0E-01	No	I.7.42.CT
		RME	2.8E-05	Yes	No	1.0E+00	Yes	I.7.42.RME
Commercial Worker (Future)	Soil[2] Indoor Air	CT	1.4E-05	Yes	No	1.1E+00	Yes	I.7.42.CT
		RME	5.7E-05	Yes	No	1.6E+00	Yes	I.7.42.RME
Utility Worker (Current/ Future)	Soil[2] Groundwater	CT	1.9E-06	Yes	No	9.2E-02	No	I.7.43.CT
		RME	1.1E-05	Yes	No	2.0E-01	No	I.7.43.RME
Construction Worker (Future)	Soil[2] Groundwater	CT	1.2E-06	Yes	No	6.1E-01	No	I.7.44.CT
		RME	2.8E-06	Yes	No	1.3E+00	Yes	I.7.44.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

As indicated in the table above, the recreational user, resident, commercial worker, and construction worker within Mixed Residential/Commercial Area 2 had cumulative HIs above 1. However, only the resident had segregated hazards above 1. For segregated hazards, cumulative HIs above 1 were observed for the following toxicity endpoints (target organs) and the COPCs that contributed to these effects:

RESIDENT – UNDISTURBED			
TOTAL CT HI = 3.8E+01 ; TOTAL RME HI = 4.1E+01			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
SKIN DISCOLORATION (CT HI = 2.7E+00; RME HI = 2.8E+00)			
Arsenic	CT	2.7E+00	Soil (8.6E-01); Groundwater (1.9E+00)
	RME	2.8E+00	Soil (9.1E-01); Groundwater (1.9E+00)
MORTALITY (CT HI = 1.3E+01; RME HI = 1.3E+01)			
Antimony	CT	1.3E+01	Groundwater (1.3E+01)
	RME	1.3E+01	Groundwater (1.3E+01)
CENTRAL NERVOUS SYSTEM (CT HI = 5.7E+00; RME HI = 6.8E+00)			
Manganese	CT	3.0E+00	Groundwater (3.0E+00)
	RME	3.4E+00	Groundwater (3.4E+00)
Mercury	CT	2.4E+00	Soil to Indoor Air (2.4E+00)
	RME	3.1E+00	Soil to Indoor Air (3.1E+00)
Tetrachloroethene	CT	3.0E-01	Soil to Indoor Air (3.0E-01)
	RME	3.8E-01	Soil to Indoor Air (3.8E-01)
UNKNOWN (CT HI = 5.2E+00; RME HI = 5.2E+00)			
Aluminum	CT	3.7E-01	Groundwater (3.7E-01)
	RME	3.8E-01	Groundwater (3.8E-01)
Iron	CT	4.4E+00	Groundwater (4.4E+00)
	RME	4.5E+00	Groundwater (4.5E+00)
Vanadium	CT	3.4E-01	Groundwater (3.4E-01)
	RME	3.9E-01	Groundwater (3.9E-01)

RESIDENT – DISTURBED			
TOTAL CT HI = 4.2E+01 ; TOTAL RME HI = 4.5E+01			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
SKIN DISCOLORATION (CT HI = 3.9E+00; RME HI = 4.1E+00)			
Arsenic	CT	3.9E+00	Soil (2.1E+00); Groundwater (1.9E+00)
	RME	4.1E+00	Soil (2.2E+00); Groundwater (1.9E+00)
MORTALITY (CT HI = 1.3E+01; RME HI = 1.3E+01)			
Antimony	CT	1.3E+01	Soil (6.2E-02); Groundwater (1.3E+01)
	RME	1.3E+01	Soil (7.1E-02); Groundwater (1.3E+01)
ALOPECIA (CT HI = 1.1E+00; RME HI = 1.8E+00)			
Thallium	CT	1.1E+00	Soil (1.1E+00)
	RME	1.8E+00	Soil (1.8E+00)
CENTRAL NERVOUS SYSTEM (CT HI = 5.9E+00; RME HI = 7.2E+00)			
Manganese	CT	3.3E+00	Soil (2.4E-01); Groundwater (3.0E+00)
	RME	3.7E+00	Soil (3.7E-01); Groundwater (3.4E+00)
Mercury	CT	2.4E+00	Soil (5.3E-02); Soil to Indoor Air (2.4E+00)
	RME	3.1E+00	Soil (7.2E-02); Soil to Indoor Air (3.1E+00)
Tetrachloroethene	CT	3.0E-01	Soil (1.6E-04); Soil to Indoor Air (3.0E-01)
	RME	3.8E-01	Soil (3.5E-04); Soil to Indoor Air (3.8E-01)
PROTEINURIA (CT HI = 1.0E+01; RME HI = 1.1E+01)			
Cadmium	CT	1.0E+01	Groundwater (1.0E+01)
	RME	1.1E+01	Groundwater (1.1E+01)
UNKNOWN (CT HI = 5.9E+00; RME HI = 6.0E+00)			
Aluminum	CT	4.5E-01	Soil (8.1E-02); Groundwater (3.7E-01)
	RME	4.6E-01	Soil (8.3E-02); Groundwater (3.8E-01)
Cobalt	CT	3.0E-01	Soil (3.0E-01)
	RME	3.1E-01	Soil (3.1E-01)
Iron	CT	4.7E+00	Soil (2.8E-01); Groundwater (4.4E+00)
	RME	4.8E+00	Soil (2.9E-01); Groundwater (4.5E+00)

RESIDENT – DISTURBED			
TOTAL CT HI = 4.2E+01 ; TOTAL RME HI = 4.5E+01			
Parameter	*Exposure*	*Parameter HI*	*Media (HI)*
Vanadium	CT	3.9E-01	Soil (5.7E-02); Groundwater (3.4E-01)
	RME	4.9E-01	Soil (9.8E-02); Groundwater (3.9E-01)

Commercial Area 1

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in Commercial Area 1 are presented in Appendix I.8, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Current/ Future)	Surface Soil[1]	CT	NC[3]	NC[3]	NC[3]	9.7E-03	No	I.8.24.CT
		RME	NC[3]	NC[3]	NC[3]	4.4E-02	No	I.8.24.RME
Trespasser (Future)	Soil[2]	CT	2.5E-07	No	No	1.5E-02	No	I.8.24.CT
		RME	6.1E-07	No	No	5.3E-02	No	I.8.24.RME
Commercial Worker (Future)	Surface Soil[1]	CT	NC[3]	NC[3]	NC[3]	4.6E-02	No	I.8.25.CT
		RME	NC[3]	NC[3]	NC[3]	1.2E-01	No	I.8.25.RME
Commercial Worker (Future)	Soil[2]	CT	1.2E-06	Yes	No	7.6E-02	No	I.8.25.CT
		RME	4.5E-06	Yes	No	1.5E-01	No	I.8.25.RME
Utility Worker (Future)	Soil[2] Groundwater	CT	3.5E-07	No	No	3.4E-02	No	I.8.26.CT
		RME	2.0E-06	Yes	No	7.3E-02	No	I.8.26.RME
Construction Worker (Future)	Soil[2] Groundwater	CT	2.4E-07	No	No	2.6E-01	No	I.8.27.CT
		RME	4.9E-07	No	No	5.6E-01	No	I.8.27.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 Assumed that future receptor exposed to a "disturbed" soil scenario.
3 NC = Not Calculated.

Commercial Area 2

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in Commercial Area 2 are presented in Appendix I.9, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥>10^{-6}*	*Risk ≥10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Future)	Soil[1]	CT	4.6E-07	No	No	1.6E-02	No	I.9.29.CT
		RME	1.1E-06	Yes	No	4.6E-02	No	I.9.29.RME
Commercial Worker (Future)	Soil[1] Indoor Air	CT	2.3E-06	Yes	No	9.2E-02	No	I.9.30.CT
		RME	8.4E-06	Yes	No	1.4E-01	No	I.9.30.RME
Utility Worker (Current/ Future)	Soil[1] Groundwater	CT	4.5E-07	No	No	2.6E-02	No	I.9.31.CT
		RME	2.6E-06	Yes	No	5.6E-02	No	I.9.31.RME
Construction Worker (Current/ Future)	Soil[1] Groundwater	CT	3.0E-07	No	No	1.9E-01	No	I.9.32.CT
		RME	6.3E-07	No	No	4.0E-01	No	I.9.32.RME

Notes:
[1] Assumed that future receptor exposed to a "disturbed" soil scenario. There were no COPCs identified for surface soil in Commercial Area 2 and therefore, calculation of risks/hazards for the current/future trespasser exposure to surface soil and future commercial worker exposure to surface soil under an "undisturbed" soil scenario was not required.

Commercial Area 3

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in Commercial Area 3 are presented in Appendix I.10, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Future)	Soil[1]	CT	3.4E-07	No	No	2.4E-02	No	I.10.29.CT
		RME	8.1E-07	No	No	7.3E-02	No	I.10.29.RME
Commercial Worker (Future)	Soil[1] Indoor Air	CT	2.9E-06	Yes	No	4.2E+00	Yes	I.10.30.CT
		RME	1.0E-05	Yes	No	4.8E+00	Yes	I.10.30.RME
Utility Worker (Current/ Future)	Soil[1] Groundwater	CT	3.5E-07	No	No	3.4E-02	No	I.10.31.CT
		RME	2.0E-06	Yes	No	7.2E-02	No	I.10.31.RME
Construction Worker (Future)	Soil[1] Groundwater	CT	2.4E-07	No	No	3.4E-01	No	I.10.32.CT
		RME	4.9E-07	No	No	7.1E-01	No	I.10.32.RME

Notes:
[1] Assumed that future receptor exposed to a "disturbed" soil scenario. There were no COPCs identified for surface soil in Commercial Area 3 and therefore, calculation of risks/hazards for the current/future trespasser exposure to surface soil and future commercial worker exposure to surface soil under an "undisturbed" soil scenario was not required.

As indicated in the table above, only the commercial worker receptor (disturbed scenario only) within Commercial Area 3 had a cumulative HI above 1. For segregated hazards, cumulative HIs above 1 were observed for the following toxicity endpoints (target organs) and the COPCs that contributed to these effects:

COMMERCIAL WORKER – DISTURBED			
TOTAL CT HI = 4.2E+00 ; TOTAL RME HI = 4.8E+00			
Parameter	***Exposure***	***Parameter HI***	***Media (HI)***
CENTRAL NERVOUS SYSTEM (CT HI = 4.1E+00; RME HI = 4.7E+00)			
Manganese	CT	2.6E-02	Soil (2.6E-02)
	RME	6.5E-02	Soil (6.5E-02)
Mercury	CT	4.0E+00	Soil (1.2E-01) and Groundwater (3.9E+00) to Indoor Air
	RME	4.6E+00	Soil (1.2E-01) and Groundwater (3.9E+00) to Indoor Air

Commercial Area 4

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in Commercial Area 4 are presented in Appendix I.11, and summarized below.

Receptor	*Media*	*Exposure*	*Cumulative Carcinogenic Risk*	*Risk ≥10^{-6}*	*Risk ≥>10^{-4}*	*Cumulative Non-Carcinogenic Hazard Index*	*HI >1*	*Appendix Table Reference*
Trespasser (Current/ Future)	Surface Soil[1]	CT	6.7E-07	No	No	1.6E-02	No	I.11.33.CT
		RME	1.6E-06	Yes	No	5.0E-02	No	I.11.33.RME
Trespasser (Future)	Soil[2]	CT	7.6E-07	No	No	7.2E-02	No	I.11.33.CT
		RME	2.2E-06	Yes	No	2.4E-01	No	I.11.33.RME
Recreational User (Future)	Surface Soil[1]	CT	3.4E-06	Yes	No	1.2E-01	No	I.11.34.CT
		RME	1.0E-05	Yes	No	2.9E-01	No	I.11.34.RME
Recreational User (Future)	Soil[2]	CT	3.7E-06	Yes	No	5.3E-01	No	I.11.34.CT
		RME	1.2E-05	Yes	No	1.3E+00	Yes	I.11.34.RME
Commercial Worker (Current/ Future)	Surface Soil[1] Indoor Air	CT	4.5E-06	Yes	No	8.0E-01	No	I.11.35.CT
		RME	1.6E-05	Yes	No	9.6E-01	No	I.11.35.RME
Commercial Worker (Future)	Soil[2] Indoor Air	CT	4.8E-06	Yes	No	1.1E+00	Yes	I.11.35.CT
		RME	2.0E-05	Yes	No	1.5E+00	Yes	I.11.35.RME
Utility Worker (Current/ Future)	Soil[2] Groundwater	CT	6.2E-07	No	No	1.0E-01	No	I.11.36.CT
		RME	3.8E-06	Yes	No	2.3E-01	No	I.11.36.RME
Construction Worker (Current/ Future)	Soil[2] Groundwater	CT	4.2E-07	No	No	6.6E-01	No	I.11.37.CT
		RME	9.2E-07	No	No	1.5E+00	Yes	I.11.37.RME

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

As indicated in the table above, the recreational user, commercial worker, and construction worker within Commercial Area 4 had cumulative HIs above 1. However, there were no segregated hazards above 1.

8.1.5.5 SUMMARY OF EXCEEDANCES

A summary of the risk and hazard exceedances for all exposure media, pathways, and human receptors is presented below:

Residential Area 1

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Surface Soil[1]	Current/Future Trespasser	No	No	No
Soil[2]	Future Trespasser	No	Yes	No
Surface Soil[1]	Future Recreational User	No	Yes	No
Soil[2]	Future Recreational User	No	Yes	No
Surface Soil[1] and Groundwater	Future Resident	Yes	Yes	Yes
Soil[2] and Groundwater	Future Resident	Yes	Yes	Yes
Surface Soil[1]	Future Commercial Worker	No	Yes	No
Soil[2]	Future Commercial Worker	No	Yes	No
Soil[2] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[2] and Groundwater	Future Construction Worker	No	No	No

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

Residential Area 2

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Surface Soil[1]	Current/Future Trespasser	No	No	No
Soil[2]	Future Trespasser	No	No	No
Surface Soil[1]	Future Recreational User	No	Yes	No
Soil[2]	Future Recreational User	No	Yes	No
Surface Soil[1] and Groundwater	Future Resident	Yes	Yes	Yes
Soil[2] and Groundwater	Future Resident	Yes	Yes	Yes
Surface Soil[1]	Future Commercial Worker	No	Yes	No
Soil[2]	Future Commercial Worker	No	Yes	No
Soil[2] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[2] and Groundwater	Future Construction Worker	No	No	No

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

Residential Area 3

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Surface Soil[1]	Current/Future Trespasser	No	No	No
Soil[2]	Future Trespasser	No	Yes	No
Surface Soil[1]	Future Recreational User	No	Yes	No
Soil[2]	Future Recreational User	No	Yes	No
Surface Soil[1] and Groundwater	Future Resident	Yes	Yes	Yes
Soil[2] and Groundwater	Future Resident	Yes	Yes	Yes
Surface Soil[1]	Future Commercial Worker	No	Yes	No
Soil[2]	Future Commercial Worker	No	Yes	No
Soil[2] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[2] and Groundwater	Future Construction Worker	No	No	No

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

Residential Area 4

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Surface Soil[1]	Current/Future Trespasser	No	Yes	No
Soil[2]	Future Trespasser	No	Yes	No
Surface Soil[1]	Future Recreational User	No	Yes	No
Soil[2]	Future Recreational User	No	Yes	Yes
Surface Soil[1] and Groundwater	Future Resident	Yes	Yes	Yes
Soil[2] and Groundwater	Future Resident	Yes	Yes	Yes
Surface Soil[1]	Future Commercial Worker	No	Yes	Yes
Soil[2]	Future Commercial Worker	No	Yes	Yes
Soil[2] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[2] and Groundwater	Future Construction Worker	No	Yes	Yes

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

Waterfront Plaza

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Surface Soil[1]	Current/Future Trespasser	No	Yes	No
Soil[2]	Future Trespasser	No	Yes	No
Surface Soil[1]	Future Recreational User	No	Yes	No
Soil[2]	Future Recreational User	No	Yes	No
Surface Soil[1]	Future Commercial Worker	No	Yes	No
Soil[2]	Future Commercial Worker	No	Yes	No
Soil[2] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[2] and Groundwater	Future Construction Worker	No	No	No

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 Assumed that future receptor exposed to a "disturbed" soil scenario.

Mixed Residential/Commercial Area 1

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Surface Soil[1]	Current/Future Trespasser	No	No	No
Soil[2]	Future Trespasser	No	No	No
Surface Soil[1]	Future Recreational User	No	Yes	No
Soil[2]	Future Recreational User	No	Yes	No
Surface Soil[1]	Future Resident	Yes	Yes	Yes
Soil[2]	Future Resident	Yes	Yes	Yes
Surface Soil[1]	Future Commercial Worker	No	Yes	No
Soil[2]	Future Commercial Worker	No	Yes	No
Soil[2] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[2] and Groundwater	Future Construction Worker	No	No	No

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 Assumed that future receptor exposed to a "disturbed" soil scenario.

Mixed Residential/Commercial Area 2

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Surface Soil[1]	Current/Future Trespasser	No	Yes	No
Soil[2]	Future Trespasser	No	Yes	No
Surface Soil[1]	Future Recreational User	No	Yes	No
Soil[2]	Future Recreational User	No	Yes	Yes
Surface Soil[1]	Future Resident	Yes	Yes	Yes
Soil[2]	Future Resident	Yes	Yes	Yes
Surface Soil[1]	Future Commercial Worker	No	Yes	Yes
Soil[2]	Future Commercial Worker	No	Yes	Yes
Soil[2] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[2] and Groundwater	Future Construction Worker	No	Yes	Yes

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 Assumed that future receptor exposed to a "disturbed" soil scenario.

Commercial Area 1

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Surface Soil[1]	Current/Future Trespasser	NC[3]	NC[3]	No
Soil[2]	Future Trespasser	No	No	No
Surface Soil[1]	Future Commercial Worker	NC[3]	NC[3]	No
Soil[2]	Future Commercial Worker	No	Yes	No
Soil[2] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[2] and Groundwater	Future Construction Worker	No	No	No

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 Assumed that future receptor exposed to a "disturbed" soil scenario.
3 NC = Not Calculated

Commercial Area 2

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Soil[1]	Future Trespasser	No	Yes	No
Soil[1]	Future Commercial Worker	No	Yes	No
Soil[1] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[1] and Groundwater	Current/Future Construction Worker	No	No	No

Notes:
[1] Assumed that future receptor exposed to a "disturbed" soil scenario. There were no COPCs identified for surface soil in Commercial Area 2 and therefore, calculation of risks/hazards for the current/future trespasser exposure to surface soil and future commercial worker exposure to surface soil under an "undisturbed" soil scenario was not required.

Commercial Area 3

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Soil[1]	Future Trespasser	No	No	No
Soil[1]	Future Commercial Worker	No	Yes	Yes
Soil[1] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[1] and Groundwater	Future Construction Worker	No	No	No

Notes:
[1] Assumed that future receptor exposed to a "disturbed" soil scenario.

Commercial Area 4

Primary Media	*Receptor*	*Risk ≥ 10^{-4}*	*Risk ≥ 10^{-6}*	*Exceeds HI = 1.0*
		RME	*RME*	*RME*
Surface Soil[1]	Current/Future Trespasser	No	Yes	No
Soil[2]	Future Trespasser	No	Yes	No
Surface Soil[1]	Future Recreational User	No	Yes	No
Soil[2]	Future Recreational User	No	Yes	Yes
Surface Soil[1]	Current/Future Commercial Worker	No	Yes	No
Soil[2]	Future Commercial Worker	No	Yes	Yes
Soil[2] and Groundwater	Current/Future Utility Worker	No	Yes	No
Soil[2] and Groundwater	Current/Future Construction Worker	No	No	Yes

Notes:
[1] Assumed that future receptor exposed to an "undisturbed" soil scenario.
[2] Assumed that future receptor exposed to a "disturbed" soil scenario.

8.1.5.6 RISK AND HAZARD COPC CONTRIBUTIONS

The contribution to total risk and hazard of each COPC for a specific combined exposure scenario varies, depending on the COPC exposure point concentration and relative toxicity. Frequently, most of the risk estimated for an exposure scenario can be attributed to a few COPCs. The following sub-sections present a summary of the COPCs contributing the majority of the RME risk and/or hazard at the Site.

The COPC contributing the majority of RME risk and/or hazard at the Site across all applicable exposure routes for Residential Area 1, Residential Area 2, Residential Area 3, Residential Area 4, Waterfront Plaza, Mixed Residential/Commercial Area 1, Mixed Residential/Commercial Area 2, Commercial Area 1, Commercial Area 2, Commercial Area 3, and Commercial Area 4 are presented in Appendix I.1, I.2, I.3, I.4, I.5, I.6, I.7, I.8, I.9, I.10, and I.11, respectively, and are summarized below.

The individual chemicals presented in the appendix tables were selected as those COPCs with calculated risks greater than or equal to 1×10^{-6} or those COPCs with calculated hazards greater than 1, which have been summarized in the summary tables presented below. In some cases, COPCs with hazards less than 1 are presented in the summary tables below for completeness when the calculated cancer risks for these same COPCs exceed the cancer risk of 1×10^{-6}. If the cumulative hazard is greater than 1, but there are no individual COPCs with calculated hazards above 1, further evaluation of COPCs contributing to a segregated hazard greater than 1 was conducted. If the segregated hazards are also below 1, it can be concluded that the cumulative hazard is not truly greater than 1. It should be noted that for some COPCs (i.e., iron), toxicity endpoints affecting a specific target organ were not available. For these COPCs, the hazards were summed based on the assumption that they exert the same toxicological effect, which is considered to be a conservative approach.

The summary tables presented in the following subsections list the contributing COPCs along with their risk and/or hazard quotient value as well as the contributing exposure route. Also presented in the summary tables are the total risk and/or hazard associated with these contributing COPCs and the total cumulative risk and/or hazard associated with all COPCs identified in all

exposure media. The percentage that these contributing COPCs contribute to the total cumulative risk and/or hazard is also presented.

Based on the tables presented below, many of the contributing COPCs are due to exposure of metals in soil, primarily arsenic, cobalt, copper, manganese, mercury, and thallium. Based on comparison to the MDEQ Statewide Background Levels (MDEQ, 2012), a significant number of the soil samples collected at the Site had metal concentrations below the background levels, and therefore only a small portion of the soils at the Site may actually result in risks/hazards greater than acceptable levels and above risks/hazards that can be attributed to background.

8.1.5.6.1 RESIDENTIAL AREA 1

Future Trespasser - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.0E-06	-	I.1.45.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.0E-06	-	
Percentage of Cumulative RME Risk/Hazard			92%	-	
Cumulative RME Risk/Hazard Across all Media			1.1E-06	-	I.1.39.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	3.8E-06	-	I.1.46.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			3.8E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			3.8E-06	-	I.1.40.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	6.2E-06	-	I.1.46.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			6.2E-06	-	
Percentage of Cumulative RME Risk/Hazard			97%	-	
Cumulative RME Risk/Hazard Across all Media			6.4E-06	-	I.1.40.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Resident - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.9E-05	3.4E-01	I.1.47.RME
Groundwater	Bis(2-ethylhexyl)phthalate	Ingestion, Dermal, Inhalation	2.0E-06	3.1E-02	
	Arsenic	Ingestion, Dermal, Inhalation	3.7E-04	3.6E+00	
	Chromium VI	Ingestion, Dermal, Inhalation	1.3E-04	5.7E-01	
	Iron	Ingestion, Dermal, Inhalation	NC[2]	2.0E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	7.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			5.2E-04	1.4E+01	
Percentage of Cumulative RME Risk/Hazard			100%	93%	
Cumulative RME Risk/Hazard Across all Media			5.2E-04	1.5E+01	I.1.41.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic.

Future Resident - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	3.1E-05	5.6E-01	I.1.47.RME
	Pentachlorophenol	Ingestion, Dermal, Inhalation	1.0E-06	4.0E-03	
Groundwater	Bis(2-ethylhexyl)phthalate	Ingestion, Dermal, Inhalation	2.0E-06	3.1E-02	
	Arsenic	Ingestion, Dermal, Inhalation	3.7E-04	3.6E+00	
	Chromium VI	Ingestion, Dermal, Inhalation	1.3E-04	5.7E-01	
	Iron	Ingestion, Dermal, Inhalation	NC[2]	2.0E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	7.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			5.4E-04	1.4E+01	
Percentage of Cumulative RME Risk/Hazard			100%	88%	
Cumulative RME Risk/Hazard Across all Media			5.4E-04	1.6E+01	I.1.41.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic.

Future Commercial Worker - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	4.6E-06	-	I.1.48.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			4.6E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			4.6E-06	-	I.1.42.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	7.6E-06	-	I.1.48.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			7.6E-06	-	
Percentage of Cumulative RME Risk/Hazard			96%	-	
Cumulative RME Risk/Hazard Across all Media			7.9E-06	-	I.1.42.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Current/Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.8E-06	-	I.1.49.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.8E-06	-	
Percentage of Cumulative RME Risk/Hazard			64%	-	
Cumulative RME Risk/Hazard Across all Media			2.8E-06	-	I.1.43.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

8.1.5.6.2 RESIDENTIAL AREA 2

Future Recreational User - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	4.5E-06	-	I.2.45.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			4.5E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			4.5E-06	-	I.2.40.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	4.5E-06	-	I.2.45.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			4.5E-06	-	
Percentage of Cumulative RME Risk/Hazard			98%	-	
Cumulative RME Risk/Hazard Across all Media			4.6E-06	-	I.2.40.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Resident - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	2.3E-05	4.0E-01	I.2.46.RME
Soil	Benzene	Indoor Air Inhalation	1.5E-04	1.5E+00	
Groundwater	Bis(2-ethylhexyl)phthalate	Ingestion, Dermal, Inhalation	2.0E-06	3.1E-02	
	Arsenic	Ingestion, Dermal, Inhalation	3.7E-04	3.6E+00	
	Chromium VI	Ingestion, Dermal, Inhalation	1.3E-04	5.7E-01	
	Iron	Ingestion, Dermal, Inhalation	NC[2]	2.0E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	7.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			6.8E-04	1.5E+01	
Percentage of Cumulative RME Risk/Hazard			100%	88%	
Cumulative RME Risk/Hazard Across all Media			6.8E-04	1.7E+01	I.2.41.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic.

Future Resident - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	2.3E-05	4.0E-01	I.2.46.RME
Soil	Benzene	Indoor Air Inhalation	1.5E-04	1.5E+00	
Groundwater	Bis(2-ethylhexyl)phthalate	Ingestion, Dermal, Inhalation	2.0E-06	3.1E-02	
	Arsenic	Ingestion, Dermal, Inhalation	3.7E-04	3.6E+00	
	Chromium VI	Ingestion, Dermal, Inhalation	1.3E-04	5.7E-01	
	Iron	Ingestion, Dermal, Inhalation	NC[2]	2.0E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	7.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			6.8E-04	1.5E+01	
Percentage of Cumulative RME Risk/Hazard			100%	88%	
Cumulative RME Risk/Hazard Across all Media			6.8E-04	1.7E+01	I.2.41.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic.

Future Commercial Worker - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ[2]*	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	5.5E-06	-	I.2.47.RME
Soil	Benzene	Indoor Air Inhalation	2.7E-05	-	
Total RME Risk/Hazard of Contributing COPCs Across all Media			3.3E-05	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			3.3E-05	-	I.2.42.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ[2]*	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	5.5E-06	-	I.2.47.RME
Soil	Benzene	Indoor Air Inhalation	2.7E-05	-	
Total RME Risk/Hazard of Contributing COPCs Across all Media			3.3E-05	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			3.3E-05	-	I.2.42.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Current/Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.3E-06	-	I.2.48.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.3E-06	-	
Percentage of Cumulative RME Risk/Hazard			57%	-	
Cumulative RME Risk/Hazard Across all Media			2.3E-06	-	I.2.43.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

8.1.5.6.3 RESIDENTIAL AREA 3

Future Trespasser - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.1E-06	-	I.3.45.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.1E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			1.1E-06	-	I.3.39.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	5.9E-06	-	I.3.46.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			5.9E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			5.9E-06	-	I.3.40.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	6.6E-06	-	I.3.46.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			6.6E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			6.6E-06	-	I.3.40.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Resident - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	3.0E-05	5.3E-01	I.3.47.RME
Groundwater	Bis(2-ethylhexyl)phthalate	Ingestion, Dermal, Inhalation	2.0E-06	3.1E-02	
	Arsenic	Ingestion, Dermal, Inhalation	3.7E-04	3.6E+00	
	Chromium VI	Ingestion, Dermal, Inhalation	1.3E-04	5.7E-01	
	Iron	Ingestion, Dermal, Inhalation	NC[2]	2.0E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	7.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			5.3E-04	1.4E+01	
Percentage of Cumulative RME Risk/Hazard			100%	88%	
Cumulative RME Risk/Hazard Across all Media			5.3E-04	1.6E+01	I.3.41.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic.

Future Resident - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	3.3E-05	5.9E-01	I.3.47.RME
Groundwater	Bis(2-ethylhexyl)phthalate	Ingestion, Dermal, Inhalation	2.0E-06	3.1E-02	
	Arsenic	Ingestion, Dermal, Inhalation	3.7E-04	3.6E+00	
	Chromium VI	Ingestion, Dermal, Inhalation	1.3E-04	5.7E-01	
	Iron	Ingestion, Dermal, Inhalation	NC[2]	2.0E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	7.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			5.4E-04	1.4E+01	
Percentage of Cumulative RME Risk/Hazard			100%	78%	
Cumulative RME Risk/Hazard Across all Media			5.4E-04	1.8E+01	I.3.41.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic.

Future Commercial Worker - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	7.2E-06	-	I.3.48.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			7.2E-06	-	
Percentage of Cumulative RME Risk/Hazard			99%	-	
Cumulative RME Risk/Hazard Across all Media			7.3E-06	-	I.3.42.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	8.0E-06	-	I.3.48.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			8.0E-06	-	
Percentage of Cumulative RME Risk/Hazard			99%	-	
Cumulative RME Risk/Hazard Across all Media			8.1E-06	-	I.3.42.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Current/Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.9E-06	-	I.3.49.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.9E-06	-	
Percentage of Cumulative RME Risk/Hazard			66%	-	
Cumulative RME Risk/Hazard Across all Media			2.9E-06	-	I.3.43.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

8.1.5.6.4 RESIDENTIAL AREA 4

Current/Future Trespasser - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	2.4E-06	-	I.4.45.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			2.4E-06	-	
Percentage of Cumulative RME Risk/Hazard			60%	-	
Cumulative RME Risk/Hazard Across all Media			4.0E-06	-	I.4.39.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Trespasser - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	1.2E-06	-	I.4.45.RME
	Arsenic	Ingestion, Dermal, Inhalation	1.1E-06	-	
	Total PCBs	Ingestion, Dermal, Inhalation	1.8E-06	-	
Total RME Risk/Hazard of Contributing COPCs Across all Media			4.1E-06	-	
Percentage of Cumulative RME Risk/Hazard			84%	-	
Cumulative RME Risk/Hazard Across all Media			4.9E-06	-	I.4.39.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	3.8E-06	-	I.4.46.RME
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	1.1E-05	-	
	Arsenic	Ingestion, Dermal, Inhalation	4.8E-06	-	
Total RME Risk/Hazard of Contributing COPCs Across all Media			2.0E-05	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			2.0E-05	-	I.4.40.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	3.9E-06	NC[2]	I.4.46.RME
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	5.8E-06	NC[2]	
	Arsenic	Ingestion, Dermal, Inhalation	6.5E-06	1.2E-01	
	Total PCBs	Ingestion, Dermal, Inhalation	8.3E-06	1.6E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			2.4E-05	1.7E+00	
Percentage of Cumulative RME Risk/Hazard			100%	63%	
Cumulative RME Risk/Hazard Across all Media			2.4E-05	2.7E+00	I.4.40.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 NC = not calculated as parameter is considered to be carcinogenic.

Future Resident - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Surface Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	1.9E-05	NC[2]	I.4.47.RME
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	5.5E-05	NC[2]	
	Arsenic	Ingestion, Dermal, Inhalation	2.4E-05	4.3E-01	
Soil	Benzene	Indoor Air Inhalation	2.4E-04	2.4E+00	
	Ethylbenzene	Indoor Air Inhalation	2.8E-05	2.6E-02	
	Xylenes (total)	Indoor Air Inhalation	NC[2]	1.2E+00	
	Mercury	Indoor Air Inhalation	NC[2]	1.8E+01	
Groundwater	Arsenic	Ingestion, Dermal, Inhalation	3.3E-04	3.2E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	5.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			7.0E-04	3.1E+01	
Percentage of Cumulative RME Risk/Hazard			100%	100%	
Cumulative RME Risk/Hazard Across all Media			7.0E-04	3.1E+01	I.4.41.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic or noncarcinogenic.

Future Resident - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	1.9E-05	NC[2]	I.4.47.RME
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	2.9E-05	NC[2]	
	Arsenic	Ingestion, Dermal, Inhalation	3.2E-05	5.8E-01	
	Iron	Ingestion, Dermal, Inhalation	NC[2]	3.5E+00	
	Total PCBs	Ingestion, Dermal, Inhalation	4.1E-05	8.1E+00	
Soil	Benzene	Indoor Air Inhalation	2.4E-04	2.4E+00	
	Ethylbenzene	Indoor Air Inhalation	2.8E-05	2.6E-02	
	Xylenes (total)	Indoor Air Inhalation	NC[2]	1.2E+00	
	Mercury	Indoor Air Inhalation	NC[2]	1.8E+01	
Groundwater	Arsenic	Ingestion, Dermal, Inhalation	3.3E-04	3.2E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	5.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			7.2E-04	4.3E+01	
Percentage of Cumulative RME Risk/Hazard			100%	96%	
Cumulative RME Risk/Hazard Across all Media			7.2E-04	4.5E+01	I.4.41.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic or noncarcinogenic.

Future Commercial Worker - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Surface Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	5.5E-06	NC[2]	I.4.48.RME
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	1.6E-05	NC[2]	
	Arsenic	Ingestion, Dermal, Inhalation	5.9E-06	3.7E-02	
Soil	Benzene	Indoor Air Inhalation	4.3E-05	5.2E-01	
	Ethylbenzene	Indoor Air Inhalation	4.9E-06	5.5E-03	
	Mercury	Indoor Air Inhalation	NC[2]	4.0E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			7.6E-05	4.5E+00	
Percentage of Cumulative RME Risk/Hazard			100%	94%	
Cumulative RME Risk/Hazard Across all Media			7.6E-05	4.8E+00	I.4.42.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic or noncarcinogenic.

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	5.6E-06	NC[2]	I.4.48.RME
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	8.4E-06	NC[2]	
	Arsenic	Ingestion, Dermal, Inhalation	7.9E-06	4.9E-02	
	Total PCBs	Ingestion, Dermal, Inhalation	1.2E-05	8.6E-01	
Soil	Benzene	Indoor Air Inhalation	4.3E-05	5.2E-01	
	Ethylbenzene	Indoor Air Inhalation	4.9E-06	5.5E-03	
	Mercury	Indoor Air Inhalation	NC[2]	4.0E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			8.3E-05	5.4E+00	
Percentage of Cumulative RME Risk/Hazard			100%	87%	
Cumulative RME Risk/Hazard Across all Media			8.3E-05	6.2E+00	I.4.42.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic or noncarcinogenic.

Current/Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	1.1E-06	-	I.4.49.RME
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	1.7E-06	-	
	Arsenic	Ingestion, Dermal, Inhalation	1.9E-06	-	
	Total PCBs	Ingestion, Dermal, Inhalation	2.4E-06	-	
Total RME Risk/Hazard of Contributing COPCs Across all Media			7. 0E-06	-	
Percentage of Cumulative RME Risk/Hazard			91%	-	
Cumulative RME Risk/Hazard Across all Media			7.7E-06	-	I.4.43.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Construction Worker - "Disturbed" soil exposure scenario

As indicated in Table I.4.44.RME, the cumulative cancer risk for the future construction worker is 1.9E-06, which is above the target cancer risk of 1.0E-06; however, there were no COPCs with a calculated cancer risk above 1.0E-06, and therefore there are no COPCs identified as major contributors to cancer risk.

As indicated in Table I.4.44.RME, the cumulative hazard for the construction worker is 2.1, which is above the target hazard of 1; however, there were no COPCs with a calculated hazard above 1. Furthermore, there were no segregated hazards above 1 for non-carcinogenic effects. Therefore, there are no COPCs identified as major contributors to hazard.

8.1.5.6.5 WATERFRONT PLAZA

Current/Future Trespasser - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	3.1E-06	-	I.5.38.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			3.1E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			3.1E-06	-	I.5.33.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Trespasser - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.5E-06	-	I.5.38.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.5E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			1.5E-06	-	I.5.33.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.9E-05	-	I.5.39.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.9E-05	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			1.9E-05	-	I.5.34.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	9.4E-06	-	I.5.39.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			9.4E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			9.4E-06	-	I.5.34.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Commercial Worker - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	2.3E-05	-	I.5.40.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			2.3E-05	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			2.4E-05	-	I.5.35.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.1E-05	-	I.5.40.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.1E-05	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			1.1E-05	-	I.5.35.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Current/Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	2.7E-06	-	I.5.41.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			2.7E-06	-	
Percentage of Cumulative RME Risk/Hazard			82%	-	
Cumulative RME Risk/Hazard Across all Media			3.3E-06	-	I.5.36.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

8.1.5.6.6 MIXED RESIDENTIAL/COMMERCIAL AREA 1

Future Recreational User - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	4.1E-06	-	I.6.45.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			4.1E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			4.1E-06	-	I.6.40.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	5.7E-06	-	I.6.45.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			5.7E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			5.7E-06	-	I.6.40.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Resident - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	2.0E-05	3.7E-01	I.6.46.RME
Soil	Tetrachloroethene	Indoor Air Inhalation	3.8E-06	8.5E-01	
Groundwater	Arsenic	Ingestion, Dermal, Inhalation	3.3E-04	3.2E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	5.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			3.5E-04	9.8E+00	
Percentage of Cumulative RME Risk/Hazard			100%	99%	
Cumulative RME Risk/Hazard Across all Media			3.5E-04	9.9E+00	I.6.41.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 NC = not calculated as parameter is not considered to be carcinogenic.

Future Resident - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	2.8E-05	5.1E-01	I.6.46.RME
Soil	Tetrachloroethene	Indoor Air Inhalation	3.8E-06	8.5E-01	
Groundwater	Arsenic	Ingestion, Dermal, Inhalation	3.3E-04	3.2E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	5.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			3.6E-04	9.9E+00	
Percentage of Cumulative RME Risk/Hazard			100%	90%	
Cumulative RME Risk/Hazard Across all Media			3.6E-04	1.1E+01	I.6.41.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 NC = not calculated as parameter is not considered to be carcinogenic.

Future Commercial Worker - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	5.0E-06	-	I.6.47.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			5.0E-06	-	
Percentage of Cumulative RME Risk/Hazard			88%	-	
Cumulative RME Risk/Hazard Across all Media			5.7E-06	-	I.6.42.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	6.9E-06	-	I.6.47.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			6.9E-06	-	
Percentage of Cumulative RME Risk/Hazard			91%	-	
Cumulative RME Risk/Hazard Across all Media			7.6E-06	-	I.6.42.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Current/Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.7E-06	-	I.6.48.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.7E-06	-	
Percentage of Cumulative RME Risk/Hazard			77%	-	
Cumulative RME Risk/Hazard Across all Media			2.2E-06	-	I.6.43.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

8.1.5.6.7 MIXED RESIDENTIAL/COMMERCIAL AREA 2

Current/Future Trespasser - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.7E-06	-	I.7.45.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.7E-06	-	
Percentage of Cumulative RME Risk/Hazard			61%	-	
Cumulative RME Risk/Hazard Across all Media			2.8E-06	-	I.7.39.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Trespasser - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	1.8E-06	-	I.7.45.RME
	Arsenic	Ingestion, Dermal, Inhalation	4.0E-06	-	
Total RME Risk/Hazard of Contributing COPCs Across all Media			5.8E-06	-	
Percentage of Cumulative RME Risk/Hazard			85%	-	
Cumulative RME Risk/Hazard Across all Media			6.8E-06	-	I.7.39.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	3.2E-06	-	I.7.46.RME
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	2.0E-06	-	
	Arsenic	Ingestion, Dermal, Inhalation	1.0E-05	-	
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.5E-05	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			1.5E-05	-	I.7.40.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Benzo(a)anthracene	Ingestion, Dermal, Inhalation	1.1E-06	NC[2]	I.7.46.RME
	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	8.5E-06	NC[2]	
	Benzo(b)fluoranthene	Ingestion, Dermal, Inhalation	1.1E-06	NC[2]	
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	2.2E-06	NC[2]	
	Arsenic	Ingestion, Dermal, Inhalation	2.5E-05	4.4E-01	
Total RME Risk/Hazard of Contributing COPCs Across all Media			3.8E-05	4.4E-01	
Percentage of Cumulative RME Risk/Hazard			100%	40%	
Cumulative RME Risk/Hazard Across all Media			3.8E-05	1.1E+00	I.7.40.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 NC = not calculated as parameter is considered to be carcinogenic.

As indicated in Table I.7.40.RME, the cumulative hazard for the recreational user is 1.1, which is above the target hazard of 1; however, there were no COPCs with a calculated hazard above 1. Furthermore, there were no segregated hazards above 1 for non-carcinogenic effects. Therefore, there are no COPCs identified as major contributors to hazard.

Future Resident - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Surface Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	1.6E-05	NC[2]	I.7.47.RME
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	1.0E-05	NC[2]	
	Arsenic	Ingestion, Dermal, Inhalation	5.1E-05	9.1E-01	
Soil	Benzene	Indoor Air Inhalation	3.5E-05	3.4E-01	
	Ethylbenzene	Indoor Air Inhalation	8.4E-06	7.8E-03	
	Tetrachloroethene	Indoor Air Inhalation	1.7E-06	3.8E-01	
	Mercury	Indoor Air Inhalation	NC[2]	3.1E+00	
Groundwater	Antimony	Ingestion, Dermal, Inhalation	NC[2]	1.3E+01	
	Arsenic	Ingestion, Dermal, Inhalation	2.0E-04	1.9E+00	
	Cadmium	Ingestion, Dermal, Inhalation	NC[2]	1.1E+01	
	Chromium VI	Ingestion, Dermal, Inhalation	3.4E-05	1.5E-01	
	Iron	Ingestion, Dermal, Inhalation	NC[2]	4.5E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	3.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			3.5E-04	3.9E+01	
Percentage of Cumulative RME Risk/Hazard			100%	95%	
Cumulative RME Risk/Hazard Across all Media			3.5E-04	4.1E+01	I.7.41.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic or non-carcinogenic.

Future Resident - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Benzo(a)anthracene	Ingestion, Dermal, Inhalation	5.4E-06	NC[2]	I.7.47.RME
	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	4.2E-05	NC[2]	
	Benzo(b)fluoranthene	Ingestion, Dermal, Inhalation	5.3E-06	NC[2]	
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	1.1E-05	NC[2]	
	Indeno(1,2,3-cd)pyrene	Ingestion, Dermal, Inhalation	1.7E-06	NC[2]	
	Arsenic	Ingestion, Dermal, Inhalation	1.2E-04	2.2E+00	
	Thallium	Ingestion, Dermal, Inhalation	NC[2]	1.8E+00	
Soil	Benzene	Indoor Air Inhalation	3.5E-05	3.4E-01	
	Ethylbenzene	Indoor Air Inhalation	8.4E-06	7.8E-03	
	Tetrachloroethene	Indoor Air Inhalation	1.7E-06	3.8E-01	
	Mercury	Indoor Air Inhalation	NC[2]	3.1E+00	
Groundwater	Antimony	Ingestion, Dermal, Inhalation	NC[2]	1.3E+01	
	Arsenic	Ingestion, Dermal, Inhalation	2.0E-04	1.9E+00	
	Cadmium	Ingestion, Dermal, Inhalation	NC[2]	1.1E+01	
	Chromium VI	Ingestion, Dermal, Inhalation	3.4E-05	1.5E-01	
	Iron	Ingestion, Dermal, Inhalation	NC[2]	4.5E+00	
	Manganese	Ingestion, Dermal, Inhalation	NC[2]	3.4E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			4.6E-04	4.2E+01	
Percentage of Cumulative RME Risk/Hazard			100%	93%	
Cumulative RME Risk/Hazard Across all Media			4.6E-04	4.5E+01	I.7.41.RME

Notes:

1 Assumed that future receptor exposed to a "disturbed" soil scenario.

2 NC = not calculated as parameter not considered to be carcinogenic or non-carcinogenic.

Future Commercial Worker - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Surface Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	4.7E-06	NC[2]	I.7.48.RME
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	3.0E-06	NC[2]	
	Arsenic	Ingestion, Dermal, Inhalation	1.2E-05	7.8E-02	
Soil	Benzene	Indoor Air Inhalation	6.2E-06	7.4E-02	
	Ethylbenzene	Indoor Air Inhalation	1.5E-06	1.7E-03	
Total RME Risk/Hazard of Contributing COPCs Across all Media			2.8E-05	1.5E-01	
Percentage of Cumulative RME Risk/Hazard			100%	15%	
Cumulative RME Risk/Hazard Across all Media			2.8E-05	1.0E+00	I.7.42.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic or non-carcinogenic.

As indicated in Table I.7.42.RME, the cumulative hazard for the commercial worker (undisturbed scenario) is 1.0, which equal to the target hazard of 1. There were no COPCs with a calculated hazard above 1. Furthermore, there were no segregated hazards above 1 for non-carcinogenic effects. Therefore, there are no COPCs identified as major contributors to hazard.

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Benzo(a)anthracene	Ingestion, Dermal, Inhalation	1.6E-06	NC[2]	I.7.48.RME
	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	1.2E-05	NC[2]	
	Benzo(b)fluoranthene	Ingestion, Dermal, Inhalation	1.6E-06	NC[2]	
	Dibenzo(a,h)anthracene	Ingestion, Dermal, Inhalation	3.3E-06	NC[2]	
	Arsenic	Ingestion, Dermal, Inhalation	3.0E-05	1.9E-01	
Soil	Benzene	Indoor Air Inhalation	6.2E-06	7.4E-02	
	Ethylbenzene	Indoor Air Inhalation	1.5E-06	1.7E-03	
Total RME Risk/Hazard of Contributing COPCs Across all Media			5.7E-05	2.6E-01	
Percentage of Cumulative RME Risk/Hazard			100%	16%	
Cumulative RME Risk/Hazard Across all Media			5.7E-05	1.6E+00	I.7.42.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 NC = not calculated as parameter not considered to be carcinogenic or non-carcinogenic.

As indicated in Table I.7.42.RME, the cumulative hazard for the commercial worker (disturbed scenario) is 1.6, which above the target hazard of 1; however,

there were no COPCs with a calculated hazard above 1. Furthermore, there were no segregated hazards above 1 for non-carcinogenic effects. Therefore, there are no COPCs identified as major contributors to hazard.

Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Benzo(a)pyrene	Ingestion, Dermal, Inhalation	2.5E-06	-	I.7.49.RME
	Arsenic	Ingestion, Dermal, Inhalation	7.2E-06	-	
Total RME Risk/Hazard of Contributing COPCs Across all Media			9.7E-06	-	
Percentage of Cumulative RME Risk/Hazard			88%	-	
Cumulative RME Risk/Hazard Across all Media			1.1E-05	-	I.7.43.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Construction Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.7E-06	2.9E-01	I.7.50.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.7E-06	2.9E-01	
Percentage of Cumulative RME Risk/Hazard			61%	22%	
Cumulative RME Risk/Hazard Across all Media			2.8E-06	1.3E+00	I.7.44.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.

As indicated in Table I.7.44.RME, the cumulative hazard for the construction worker is 1.3, which above the target hazard of 1; however, there were no COPCs with a calculated hazard above 1. Furthermore, there were no segregated hazards above 1 for noncarcinogenic effects. Therefore, there are no COPCs identified as major contributors to hazard.

8.1.5.6.8 COMMERCIAL AREA 1

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	4.5E-06	-	I.8.28.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			4.5E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			4.5E-06	-	I.8.25.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Current/Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.1E-06	-	I.8.29.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.1E-06	-	
Percentage of Cumulative RME Risk/Hazard			55%	-	
Cumulative RME Risk/Hazard Across all Media			2.0E-06	-	I.8.26.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

8.1.5.6.9 COMMERCIAL AREA 2

Future Trespasser - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.1E-06	-	I.9.33.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.1E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			1.1E-06	-	I.9.29.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	8.4E-06	-	I.9.34.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			8.4E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			8.4E-06	-	I.9.30.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario. There were no COPCs identified for surface soil in Commercial Area 2 and therefore, calculation of risks/hazards for the future commercial worker exposure to surface soil under an "undisturbed" soil scenario was not required.
2 The cumulative hazard was below the target hazard of 1.

Current/Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	2.0E-06	-	I.9.35.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			2.0E-06	-	
Percentage of Cumulative RME Risk/Hazard			77%	-	
Cumulative RME Risk/Hazard Across all Media			2.6E-06	-	I.9.31.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

8.1.5.6.10 COMMERCIAL AREA 3

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	6.1E-06	3.8E-02	I.10.33.RME
Soil	Benzene	Indoor Air Inhalation	3.9E-06	4.6E-02	
	Mercury	Indoor Air Inhalation	NC[2]	4.5E+00	
Total RME Risk/Hazard of Contributing COPCs Across all Media			9.9E-06	4.6E+00	
Percentage of Cumulative RME Risk/Hazard			99%	96%	
Cumulative RME Risk/Hazard Across all Media			1.0E-05	4.8E+00	I.10.30.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario. There were no COPCs identified for surface soil in Commercial Area 3 and therefore, calculation of risks/hazards for the future commercial worker exposure to surface soil under an "undisturbed" soil scenario was not required.
2 NC = not calculated as parameter is not considered to be carcinogenic.

Current/Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.5E-06	-	I.10.34.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.5E-06	-	
Percentage of Cumulative RME Risk/Hazard			75%	-	
Cumulative RME Risk/Hazard Across all Media			2.0E-06	-	I.10.31.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

8.1.5.6.11 COMMERCIAL AREA 4

Current/Future Trespasser - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.6E-06	-	I.11.38.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.6E-06	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			1.6E-06	-	I.11.33.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Trespasser Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.2E-06	-	I.11.38.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.2E-06	-	
Percentage of Cumulative RME Risk/Hazard			55%	-	
Cumulative RME Risk/Hazard Across all Media			2.2E-06	-	I.11.33.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.0E-05	-	I.11.39.RME
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.0E-05	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			1.0E-05	-	I.11.34.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Recreational User - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	7.1E-06	1.3E-01	I.11.39.RME
	Total PCBs	Ingestion, Dermal, Inhalation	4.6E-06	9.1E-01	
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.2E-05	1.0E+00	
Percentage of Cumulative RME Risk/Hazard			100%	77%	
Cumulative RME Risk/Hazard Across all Media			1.2E-05	1.3E+00	I.11.34.RME

Notes:
1 Assumed that future receptor exposed to a "disturbed" soil scenario.

As indicated in Table I.11.34.RME, the cumulative hazard for the recreational user is 1.3, which above the target hazard of 1; however, there were no COPCs with a calculated hazard above 1. Furthermore, there were no segregated hazards above 1 for noncarcinogenic effects. Therefore, there are no COPCs identified as major contributors to hazard.

Current/Future Commercial Worker - "Undisturbed" surface soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Surface Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	1.2E-05	-	I.11.40.RME
Soil	Benzene	Indoor Air Inhalation	2.5E-06	-	
	Tetrachloroethene	Indoor Air Inhalation	1.6E-06	-	
Total RME Risk/Hazard of Contributing COPCs Across all Media			1.6E-05	-	
Percentage of Cumulative RME Risk/Hazard			100%	-	
Cumulative RME Risk/Hazard Across all Media			1.6E-05	-	I.11.35.RME

Notes:
1 Assumed that future receptor exposed to an "undisturbed" soil scenario.
2 The cumulative hazard was below the target hazard of 1.

Future Commercial Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	8.7E-06	5.4E-02	I.11.40.RME
	Total PCBs	Ingestion, Dermal, Inhalation	6.8E-06	4.8E-01	
Soil	Benzene	Indoor Air Inhalation	2.5E-06	2.9E-02	
	Tetrachloroethene	Indoor Air Inhalation	1.6E-06	4.2E-01	
Total RME Risk/Hazard of Contributing COPCs Across all Media			2.0E-05	9.8E-01	
Percentage of Cumulative RME Risk/Hazard			100%	65%	
Cumulative RME Risk/Hazard Across all Media			2.0E-05	1.5E+00	I.11.35.RME

Notes:
[1] Assumed that future receptor exposed to a "disturbed" soil scenario.

As indicated in Table I.11.35.RME, the cumulative hazard for the commercial worker is 1.5, which above the target hazard of 1; however, there were no COPCs with a calculated hazard above 1. Furthermore, there were no segregated hazards above 1 for noncarcinogenic effects. Therefore, there are no COPCs identified as major contributors to hazard.

Current/Future Utility Worker - "Disturbed" soil exposure scenario

Media	*Contributing COPC*	*Exposure Route*	*Risk*	*HQ*[2]	*Table Reference*
Soil[1]	Arsenic	Ingestion, Dermal, Inhalation	2.1E-06	-	I.11.41.RME
	Total PCBs	Ingestion, Dermal, Inhalation	1.3E-06	-	
Total RME Risk/Hazard of Contributing COPCs Across all Media			3.4E-06	-	
Percentage of Cumulative RME Risk/Hazard			89%	-	
Cumulative RME Risk/Hazard Across all Media			3.8E-06	-	I.11.36.RME

Notes:
[1] Assumed that future receptor exposed to a "disturbed" soil scenario.
[2] The cumulative hazard was below the target hazard of 1.

Future Construction Worker - "Disturbed" soil exposure scenario

As indicated in Table I.11.37.RME, the cumulative hazard for the construction worker is 1.5, which is above the target hazard of 1; however, there were no COPCs with a calculated hazard above 1. Furthermore, there were no segregated hazards above 1 for non-carcinogenic effects. Therefore, there are no COPCs identified as major contributors to hazard.

8.1.5.7 HAZARD ASSESSMENT FOR LEAD EXPOSURES

8.1.5.7.1 ADULT LEAD MODEL

The estimated 95th percentile for fetal blood levels lead for future female adult commercial workers, construction workers, and utility workers (as applicable) in Residential Area 1, Residential Area 2, Residential Area 3, Residential Area 4, Mixed Commercial/Residential Area 2, Commercial Area 1, and Commercial Area 4 and are presented in Appendix I.1, I.2, I.3, I.4, I.7, I.8, and I.11, respectively, and summarized below.

Area	*Exposure Media*	*95th percentile for fetal blood lead (µg/dL)*				*>10* µg/dL	*Appendix Table Reference*
		Future Commercial Worker		*Future Utility Worker*	*Future Construction Worker*		
		Undisturbed Surface Soil Exposure Scenario	*Disturbed Soil Exposure Scenario*				
Residential Area 1	Groundwater	NC[1]	NC[1]	2.4	2.4	No	I.1.50
Residential Area 2	Groundwater	NC[1]	NC[1]	2.4	2.4	No	I.2.49
Residential Area 3	Groundwater	NC[1]	NC[1]	2.4	2.4	No	I.3.50
Residential Area 4	Soil and Groundwater	3.0	3.8	2.4	7.3	No	I.4.50
Mixed Residential/ Commercial Area 2	Soil and Groundwater	3.2	3.0	2.4	4.6	No	I.7.51
Commercial Area 1	Groundwater	NC[1]	NC[1]	2.4	2.4	No	I.8.30
Commercial Area 4	Soil and Groundwater	NC[1]	2.8	2.4	3.9	No	I.11.42

Notes:
[1] NC = Not Calculated.

As shown in the above table, none of the 95th percentile fetal blood levels for a future female adult commercial worker, construction worker, or utility worker are above the TRW recommended fetal blood lead of 10 µg/dL.

8.1.5.7.2 IEUBK LEAD MODEL

The IEUBK Model was used to determine the blood lead level within a child resident exposed to lead within Residential Area 1 groundwater, Residential Area 2 groundwater, Residential Area 3 groundwater, Residential Area 4 soil,

and Mixed Commercial/Residential Area 2 groundwater and soil. Lead was also identified for Commercial Area 1 groundwater and Commercial Area 4 soil and groundwater; however, residents are not expected to be present following the future re-development of Commercial Area 1 and Commercial Area 4. The IEUBK Model inputs and outputs are presented in Appendix I.13. The IEUBK model outputs indicate that the percent of young children that could have a blood lead level greater than 10 µg/dL for Residential Area 1, Residential Area 2, Residential Area 3, Residential Area 4, and Mixed Residential/Commercial Area 2 ranged from 0.000 to 0.103, which is less than the target of 5 percent. Therefore, Residential Area 1 groundwater, Residential Area 2 groundwater, Residential Area 3 groundwater, Residential Area 4 soil, and Mixed Residential/Commercial Area 2 groundwater and soil do not pose an unacceptable risk to residents from lead exposure.

8.1.6 UNCERTAINTY ANALYSIS

The purpose of this section is to provide a summary and discussion regarding the uncertainties associated with the HHRA evaluation. The various uncertainties are discussed below in the following sections.

8.1.6.1 SAMPLING PROCEDURE BIAS

The sampling strategy is a factor that impacts the health evaluation for chemicals at the Site. Often in the sampling procedures, samples are taken from locations that are visibly contaminated or where contamination would be expected and not from areas of the Site that are potentially uncontaminated. This creates a sampling bias toward worst-case (higher) exposure point concentrations in the media sampled. The utilization of such biased data in the HHRA increases the conservative or health-protective nature of the health risk and hazard assessment.

The data used to estimate the EPCs for the Site were primarily collected in a biased manner. The media samples were collected from areas of known contamination, and should represent the highest COPC concentrations. Sampling rounds usually focused on additional characterization and delineation of the more heavily contaminated areas, thus introducing a high bias in the

EPCs. Therefore, these methods were utilized as a conservative measure of exposure and will likely overestimate actual exposure and risks and hazards.

These areas of high contamination have no relationship with the various development areas that were identified based on the conceptual redevelopment plan. Therefore, it is conceivable that certain development areas may have larger data sets compared to others.

All development areas of the Site had a sufficient number of soil samples (minimum sample size between 8 and 10 soil samples as identified by U.S. EPA, 2010), with the exception of Waterfront Plaza and Commercial Area 3. Based on the conceptual redevelopment plan, there was one surface soil sample and 3 surface and subsurface soils samples available for the Waterfront Plaza. Therefore, 4 surface soil samples and 9 surface and subsurface soil samples collected adjacent to Waterfront Plaza and within Residential Areas 3 and 4 were combined to form the Waterfront Plaza soil dataset to permit evaluation of soil exposure within this development area. Based on the conceptual redevelopment plan, there were 6 surface soil samples and 15 surface and subsurface soil samples available for Commercial Area 3. The number of surface soil samples for both Waterfront Plaza and Commercial Area 3 are less than the U.S. EPA (2010) recommended minimum sample size of 8 to 10 samples; however, given that the potentially contaminating activities within these development areas were very limited and investigated and that the HHRA also included evaluation of all receptors to the combined surface and subsurface soils, which has a sufficient sample size, it is expected that the low sample size for surface soil at Waterfront Plaza and Commercial Area 3 would not be identified as a significant uncertainty in the datasets for these areas.

For groundwater, many of the development areas had sample sizes less than the U.S. EPA (2010) recommended minimum sample size of 8 to 10 samples. Therefore, to supplement relative small sample sizes in the development areas, the groundwater data for the Site was separated into three areas (Area 1, Area 2, and Area 3) consistent with the separation of the Site during the Site Characterization and that followed by the HHRA in the previous submission (see Figure 1.2 of the RI report). To determine which Area (Area 1, Area 2, or Area 3) each development area occurs, the conceptual redevelopment plan presented on Figure 8.1 of the RI report was overlaid on Figure 1.2 of the RI report (some overlap occurred). For example, Residential Area 4 on Figure 8.1 of the RI Report is located within Area 1 on Figure 1.2 of the RI report. Therefore, the

groundwater dataset for Residential Area 4 would be the Area 1 groundwater dataset. The following bullets summarize the distribution of the groundwater datasets:

- Area 1 groundwater data was applied in Residential Areas 1, 2, and 3 and Commercial Area 1
- Area 2 groundwater data was applied in Commercial Area 4 and Mixed Residential/Commercial Area 2
- Area 3 groundwater data was applied in Commercial Areas 2 and 3, Mixed Residential/Commercial Area 1, Residential Area 4, and Waterfront Plaza

Concentrations of trivalent chromium and hexavalent chromium were calculated based on the total chromium analysis using the recommended ratio of 1:6 hexavalent chromium to trivalent chromium, as per U.S. EPA Regional Screening Levels User's Guide, November 2011 (U.S. EPA, 2011a). CRA conducted soil sampling within each development area to confirm that the ratio of 1:6 hexavalent chromium to trivalent chromium was appropriate for the Site. Based on the analytical results (see Table A.12), hexavalent chromium was not detected in these soil samples. The results also indicate that total chromium was made up entirely of trivalent chromium. Given this information, the use of the ratio of 1:6 hexavalent chromium to trivalent chromium in the HHRA is considered to be a conservative approach.

8.1.6.2 EXPOSURE POINT CONCENTRATION ESTIMATES

EPCs for media that were not measured directly will have more uncertainty because they have been estimated using modeling. The uncertainty in the estimation of COPC concentration of media such as indoor air is different for each model. U.S. EPA-approved models were used to estimate these media concentration, and although there is uncertainty, its impact on the risk assessment is generally to estimate upper bound concentrations. Furthermore, the COPC concentrations were assumed to remain constant over the exposure duration when in fact they could either increase or decrease over this time. Overall, the use of the 95% upper confidence limit concentration as the EPC will likely overestimate actual exposure and risks and hazards. The 95% upper confidence limit concentration was greater than the maximum concentration for iron in Residential Area 1 groundwater, Residential Area 2 groundwater, Residential Area 3 groundwater, Residential Area 4 groundwater, Waterfront

Plaza groundwater, Mixed Residential/Commercial Area 1 groundwater, and Commercial Area 1 groundwater and for arsenic in Waterfront Plaza surface soil. In cases where the 95% upper confidence limit concentration exceeded the maximum concentration, the data distribution was skewed, with a couple of samples with concentration at least 2-fold higher than the other samples.

There were two groundwater sample points, VA-1 and VA-2 that were included in the calculation of the groundwater EPCs. These sample points represent grab groundwater samples from the vertical aquifer sampling conducted within Residential Area 1 (VA-1) (i.e., Area 1 groundwater) and Mixed Residential/Commercial Area 2 (VA-2) (i.e., Area 2 groundwater). As these were grab groundwater samples, the presence of sediment within these samples likely resulted in increased metal concentrations. Therefore, the groundwater EPCs and subsequent risk/hazard calculations for metals in groundwater were likely overestimated for Area 1 and Area 2.

8.1.6.3 EXPOSURE SCENARIO ASSUMPTIONS

This section discusses the uncertainty associated with the primary exposure scenario assumptions such as land use and frequency of exposure. Because the exposure scenarios are often not based on actual exposure data, but rather on assumptions about future exposure patterns they can require professional judgment. U.S. EPA has compiled data on exposure patterns over time and the exposure values used in the HHRA are considered conservative in nature.

The HHRA attempts to estimate the potential point exposures for both the "average" CT and the RME scenarios. In order to accomplish this goal, a series of standardized U.S. EPA exposure assumptions were utilized, where available and applicable. In the absence of available or applicable exposure assumptions, professional judgment was used to establish the necessary assumptions protective of human health. The CT exposure scenario represents an "average" exposure scenario that is reasonably expected to occur. The RME scenario represents the "reasonable maximum" exposure expected to occur. The exposure scenarios (CT and RME) were developed to evaluate possible risk under both current and future land use conditions. For the CT exposure scenarios, the CT EPC was the same as the RME EPC and both were based on the maximum detected concentration. This will result in an overestimation of the risks and hazards for the CT exposure scenarios.

The major uncertainties regarding the physical exposure scenarios used in the HHRA are summarized as follows:

i) Long-term exposure point concentrations are inherently uncertain because COPC concentrations are assumed to remain constant over time. The assumptions that the measured concentrations are equivalent during sampling and exposure over the duration of exposure will overestimate the intake and resulting risk.

ii) For most COPCs, the HHRA assumed that 100% absorption occurs after oral ingestion. Actual absorption rates of ingested contaminants may vary based on individual COPC absorption rates. Thus, assumption of 100% absorption of ingested COPCs overestimates the associated risks.

iii) For most COPCs, the HHRA assumed that 100% absorption occurs after inhalation. Actual lung absorption rates may vary based on individual COPC absorption rates. Thus, assumption of 100% lung absorption COPCs overestimates the associated risks.

There is the potential that any specific individual could be a member of more than one receptor group. For example, a commercial worker could also be a recreational user. These multiple receptor exposure pathways were not evaluated in the HHRA. It is recognized that this represents a form of uncertainty; however, based on the discussion below, this form of uncertainty is deemed overly conservative and is not expected to change the outcome of the HHRA.

- For Residential Areas 1 to 4 and Mixed Residential/Commercial Areas 1 and 2, a resident was evaluated assuming that they are present within these areas for a period of 350 days per year (7 days per week for 50 weeks per year). Although the resident could also be a recreational user for the remainder of the year (2 weeks per year), it would be overly conservative and unrealistic to assume that the resident would never leave the Site over the course of the year. Furthermore, the resident is always considered to be the most sensitive receptor, and any measures required within Residential Areas 1 to 4 and Mixed Residential/Commercial Areas 1 and 2 would be based on the protection of residents.
- For the Waterfront Plaza and Commercial Areas 1 to 4, a commercial worker was evaluated assuming that they are present within these areas of the Site

for a period of 8 hours per day 250 days per year (5 days per week for 50 weeks per year). There is the potential that the commercial worker could go back to a different area of the Site after work hours, or on the weekends, or during vacation time; however, any area where any recreational activities could occur the most sensitive receptor (i.e., resident) has been evaluated, with the exception of the Waterfront Plaza and Commercial Area 4.

- There are also other potential combinations, including a utility worker and a construction worker as recreational users; however, these combinations are not expected to change the results of the HHRA due to the low exposure frequency/duration for these receptors.

8.1.6.4 DOSE RESPONSE

One of the major uncertainties in estimating site-specific risk is the application of published toxicity information. Factors introducing uncertainty associated with toxicity value application are as follows:

i) Applicability of animal toxicity data - chemicals may be assumed to be human carcinogens based on animal studies even when there is limited or no available evidence that the chemical is a human carcinogen.

ii) Differences in chemical concentrations - CSFs are derived from high concentration animal studies and therefore may not be applicable to low concentration exposures.

iii) In general, assumptions in toxicity values - CSFs are developed in a conservative manner, so there is uncertainty in the outcome. Often U.S. EPA will include uncertainty factors to account for this uncertainty in the extrapolation from animal exposure to human outcome.

iv) Assumptions in toxicity values (non-carcinogenic Hazard) - RfDs are also established with uncertainty safety factors when extrapolating to human outcome.

8.1.6.5 THEORETICAL NATURE OF RISK ESTIMATES

A human health risk assessment assigns a numerical value to the excess probability (above background cancer rates) of a case of cancer developing in a population exposed to a specified amount of chemical that is a known or suspect

carcinogen. This numerical value is presented as an upper limit excess cancer risk such as $1.0E^{-4}$, or one additional cancer case in 10,000 people exposed to the chemical and at the specific chemical concentration for their entire lifetime, which is assumed to be 70 years. The model that is applied to calculate this numerical risk value is a combination of the exposure estimate and dose response values, and so will potentially include the uncertainty in each set of values. The cancer risk model and the assumptions used to estimate exposure are expected to be protective of the most sensitive populations. The true risk is expected to be lower than that calculated, and may quite reasonably approach zero. Thus, risk estimates are overestimated by the HHRA methodology itself. However, for certain individuals, who engage in activities at rates higher than those assumed in the HHRA, exposure and risk may be higher.

For evaluating hazards for a particular non-carcinogenic toxicity endpoint, there were several COPCs that do not have published toxicity endpoints, including aluminum, cobalt, iron, and vanadium. Therefore, the HIs for these COPCs were summed to provide a segregated hazard for "unknown" effects. The actual toxicological effects that these COPCs exert are not known. Therefore, it was conservatively assumed that these COPCs exert that same toxicological effect. Given that these COPCs likely have different toxicological endpoints, the approach used in the HHRA likely overestimates hazard associated with "unknown" effects.

9.0 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT

This section presents the methods and results for a SLERA conducted in accordance with U.S. EPA's 8-step process for Ecological Risk Assessments (ERAs). SLERA consists of Step 1 (screening-level problem formulation) and Step 2 (screening-level exposure estimation and risk calculation). Step 3a, refinement of the chemicals identified as Constituents of Potential Ecological Concern (COPECs), will be provided at a future date as addendum to this RI Report.

As a Baseline Ecological Risk Assessment (BERA)(CDM, 2003) has been completed for the Kalamazoo River and adjacent aquatic habitats, the SLERA presented in this section addresses risk to ecological receptors in the terrestrial habitats adjacent to the Kalamazoo River. The assessment area for the SLERA consists of the following 11 redevelopment areas:

- Residential Area 1
- Residential Area 2
- Residential Area 3
- Residential Area 4
- Waterfront Plaza
- Mixed Residential/Commercial Area 1
- Mixed Residential/Commercial Area 2
- Commercial Area 1
- Commercial Area 2
- Commercial Area 3
- Commercial Area 4

Under current conditions, much of the assessment area is characterized by buildings and former parking areas. Although the presence of buildings and parking surfaces eliminates complete exposure pathways, the SLERA conservatively assumes that ecological receptors may be exposed to surface soil. Future development of the entire assessment area is proposed. As development will result in some incomplete exposure pathways, the Step 3a refinement document will consider potential for risk to ecological receptors posed by conditions expected with future development.

Section 9.1 presents Step 1 of the screening process: the problem formulation step. This section includes a description of the ecological setting, identification of known or suspected contaminants, a general discussion of the fate and transport of contaminants, identification of potentially complete exposure pathways, presentation of a Conceptual Site Model, selection of assessment and measurement endpoints, and an ecological effects evaluation.

Section 9.2 presents Step 2 of the screening process: the exposure estimate and risk calculation step. This section presents the estimates of exposure concentrations and risk calculations for current conditions.

Section 9.3 summarizes the constituents identified as COPECs for each development area.

Section 9.4 is a discussion of the uncertainties associated with the SLERA.

Section 9.5 identifies the path forward for the ecological risk assessment process.

9.1 STEP 1 - SCREENING-LEVEL PROBLEM FORMULATION

9.1.1 ECOLOGICAL SETTING

9.1.1.1 HABITATS AND COVER TYPES

The Kalamazoo River borders the Site to the north. As defined in the Consent Decree, the assessment area is defined from the top of the river bank landward. The assessment area is bordered by the Mill Race to the east, with the Plainwell central business units located beyond the Mill Race. The assessment area is bordered to the south by Allegan Road with residential properties located beyond. The western portion of the assessment area is bordered by mixed residential and commercial property and the City of Plainwell Water Renewal Plant.

Several structures are currently present within the assessment area. These structures consist of: two water towers; an aboveground storage unit with secondary containment structure; structures associated with a former on-Site WWTP, including a primary clarifier, two secondary clarifiers, and an activated

sludge aeration tank; the former Mill Buildings; the former Sludge Dewatering Building; and smaller former ancillary buildings (i.e., guard shacks, pump houses, etc.). Much of the assessment area is currently paved or under buildings and, based on current plans, will likely remain so into the future. As a conservative measure for the screening process, the SLERA assumes that ecological receptors are potentially exposed to surface at all locations samples. For the refinement process in Step 3a, samples collected at locations where a complete exposure will not exist will be eliminated from the dataset.

The topography of the assessment area is generally flat and gently sloping toward the north to the Kalamazoo River and to the east towards the Mill Race. Based on the United States Geological Survey (USGS) 7.5 minute topographic map (Otsego, Michigan, 7.5 minute quadrangle) and aerial topography, surface elevations range from 720 to 730 feet above mean sea level (AMSL). There is no surface water or sediment within the assessment area.

The former WWTP and lagoons are located in the western portion of the assessment area. Structures associated with the WWTP are still standing, and are surrounded by grass that appears to be regularly mowed. The Kalamazoo River is to the north of assessment area. The steep river banks are vegetated with trees and shrubs. An area of mature trees, approximately three acres in size, is located to the south of the WWTP.

The Plainwell Mill is located in the eastern portion of the assessment area. Currently, the majority of this area is covered with either buildings or impervious surfaces. Some small areas of grass appear to be regularly mowed in this area.

9.1.1.2 WILDLIFE

Field surveys conducted by Camp, Dresser and McKee (CDM) as part of the BERA for the Kalamazoo River produced a list of species that were either observed in the vicinity of the assessment area, or are likely to occur. In lieu of a field survey specific to the current SLERA, the species list developed by CDM identifies the wildlife likely to occur within the assessment area for this SLERA. The species list is provided as Appendix J.1.

A diversity of wildlife potentially occurs along the Kalamazoo River and adjacent habitats. Wildlife expected to be presented within the assessment area includes birds, mammals, and amphibians and reptiles representative of all trophic levels. The most valuable areas for wildlife within the assessment area are a large wooded area in the western portion of the assessment area and the wooded riparian corridor of the Kalamazoo River. The majority of the large wooded area is within Commercial Area 1. The northern portion of the wooded area is within Residential Area 1. All four Residential Areas, the Waterfront Plaza, Mixed Residential/Commercial Area 2, and Commercial Area 4 abut the Kalamazoo River.

9.1.2 SPECIES AND HABITATS OF CONCERN

9.1.2.1 SPECIES OF CONCERN

The BERA for the Kalamazoo River identified several species of concern that potentially occur along the Kalamazoo River. Species of potential concern that potentially occur on or in the vicinity of the assessment area include white false indigo (*Baptisia alba*), bald eagle (*Haliaeetus leucocephalus*), great blue heron (*Ardea herodias*), red-shouldered hawk (*Buteo lineatus*), eastern box turtle (*Terrapene carolina carolina*), and marbled salamander (*Ambystoma opacum*). According to the BERA for the Kalamazoo River, bald eagles are known to nest along the Kalamazoo River in the vicinity of the assessment area. A rookery of great blue herons is present along the Kalamazoo River downstream of Lake Allegan.

A field survey for species of concern specific to the assessment area for this SLERA has not been conducted. The list of species of concern provided in the BERA for the Kalamazoo River has been modified for the habitats present within the assessment area. This modified list is provided as Appendix J.2.

9.1.2.2 HABITATS OF CONCERN

The BERA for the Kalamazoo River identified several habitats of concern that potentially occur along the Kalamazoo River. Of the habitats of concern identified in the BERA, only the rookery of great blue heron downstream of Lake Allegan is of potential concern for the assessment area for the current SLERA.

9.1.3 KNOWN AND SUSPECTED CONTAMINANTS

The BERA for the Kalamazoo River focused on risk to ecological receptors posed by PCBs. Consequently, PCBs are potentially associated with the assessment area for this SLERA. In addition to PCBs, this SLERA evaluates the potential for risk posed by VOCs, benzene, toluene, ethylbenzene, and xylenes (BTEX), SVOCs, PAHs, metals, and cyanide.

9.1.4 CONTAMINANT TRANSPORT AND FATE

There are several potential mechanisms for transport of constituents from one or more source areas to habitats that potentially support ecological receptors. One such mechanism is surface flow during storm events. Constituents dissolved in stormwater, or adsorbed to particles suspended in stormwater, may be transported from source areas to habitats within or immediately adjacent to the assessment. Stormwater runoff from assessment area appears to flow generally to the north toward the Kalamazoo River. The fate of constituents in surface flow is dependent on the chemical and physical properties of the constituents and their interaction with the physical and biological properties of the habitats. For example, VOCs transported in surface runoff will likely volatilize to the atmosphere. Hydrophobic compounds will likely leave solution and become bound to organic matter in soil. Other less hydrophobic compounds may remain in solution.

Wind is another potential mechanism for transport of chemical constituents from source areas to ecological receptors. Constituents transported by wind may be deposited in the terrestrial habitats within the assessment area.

Chemical constituents may also be transported from source areas to habitats that support ecological receptors via groundwater flow. Ecological receptors are exposed to Site-related chemicals in areas where groundwater discharges to streams or at the ground surface (e.g., wetlands). Areas of groundwater discharge do not appear to be present within the assessment area. Although Site-related constituents are likely transported in groundwater, ecological receptors within the assessment area are not exposed to groundwater. Section 2.4.3 of this RI Report provides a discussion of the regional hydrogeology within the vicinity of the assessment area. Figures 2.20 through 2.24 and Table 2.36 present data on groundwater elevations in monitoring wells during

monitoring events conducted in 2010 and 2012. Section 3.3 discusses groundwater contamination and migration trends.

9.1.5 POTENTIALLY COMPLETE EXPOSURE PATHWAYS

A complete exposure pathway must have the following components:

(1) An anthropogenic source of a chemical constituent.

(2) A mechanism for transport of the constituent from the source to one or more ecological receptors.

(3) Exposure of ecological receptors to the constituent (exposure route).

Mechanisms for the transport of constituents from the source to ecological receptors are discussed in Section 9.2.4. Exposure routes include direct contact, ingestion, dermal absorption, and inhalation. In ecological risk assessment, the dermal absorption and inhalation exposure routes are generally not considered to be significant. Accordingly, this SLERA does not consider dermal absorption and inhalation.

Potentially complete exposure routes for soil, which is the only medium considered in this SLERA, are:

- Direct contact of soil invertebrates and plants with soil
- Ingestion and absorption by soil invertebrates
- Uptake and absorption of constituents in soil by plants
- Incidental ingestion of soil and Bioaccumulative Chemicals of Concern (BCOCs) by insectivores and omnivores via food web transfer
- Incidental ingestion of soil and constituents taken up and bioaccumulated in plant tissue by herbivores and omnivores via food web transfer
- Ingestion of soil and BCOCs by carnivores via food web transfer

Figure 9.1 is a CSM of the potentially complete exposure pathways for the SLERA.

Groundwater from the Site potentially discharges into the Kalamazoo River. The BERA conducted for the Kalamazoo River by CDM (2003) addressed the potential risk to semi-aquatic predators of aquatic life adjacent to the Kalamazoo

River. There are no known areas of groundwater discharge within the assessment area for this SLERA. Consequently, this SLERA does not address risk to semi-predators associated with the Kalamazoo River.

9.1.6 ASSESSMENT AND MEASUREMENT ENDPOINTS

9.1.6.1 ASSESSMENT ENDPOINTS

Assessment endpoints are explicit expressions of environmental values or characteristics to be protected at a site, and reflect societal and ecological values (Suter, 1993). Societal values address the need to protect species that are endangered, threatened, or of special interest, important as game or commercial species, or that are recognized as having aesthetic value. Table J.3 identifies the assessment endpoints for the SLERA. The assessment endpoints for soil are the species richness and productivity of the terrestrial plant and soil invertebrate communities, and the relative and absolute densities of avian and mammalian insectivores, herbivores, omnivores, and carnivores.

BCOCs are constituents that have the potential to bioaccumulate and bioconcentrate in food webs. For this SLERA, the BCOCs for soil are those identified by the Texas Commission on Environment Quality (TCEQ, 2006).

- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Zinc
- PCBs
- Hexachlorobenzene
- Pentachlorophenol

Constituents classified as BCOCs may pose risk to upper trophic level consumers of receptors directly exposed to site-related constituents in soil. Accordingly, assessment endpoints for this SLERA include predatory birds and mammals that potentially forage within the assessment area.

9.1.6.2 MEASUREMENT ENDPOINTS

Data needed to deal directly with the assessment endpoints are difficult to generate and rarely available. Therefore, measurement endpoints are used to bridge the gap. Measurement endpoints are measurable responses to stressors related to assessment endpoints, and are intended to provide a basis for assessing risk potential for the assessment endpoint. They may be defined in terms of an unacceptable level of impact to ecological receptors, such as a certain relative percent decrease in survival, growth or reproduction of ecological populations (Suter, 1993).

For this SLERA, Ecological Screening Values (ESVs) are used as the measurement endpoints. Table J.4 identifies the measurement endpoints associated with each of the assessment endpoints identified in Section 9.2.6.1. The ESVs, which are discussed in Section 9.2.7.2, are assumed to provide conservative and representative benchmarks of ecological effects for the assessment endpoints.

9.1.7 ECOLOGICAL EFFECTS EVALUATION

9.1.7.1 DATABASE FOR SCREENING-LEVEL ASSESSMENT

This SLERA addresses the terrestrial habitats from the top of the bank of the Kalamazoo River landward. Groundwater from the Site likely discharges into the Kalamazoo River; however, any discharge is outside the assessment area for this SLERA. Potential risk to ecological receptors associated with the Kalamazoo River is addressed elsewhere (CDM, 2003). Accordingly, soil is the only medium evaluated.

The dataset for the SLERA consists of soil samples at a depth of 1-foot bgs, or shallower. This is the depth of exposure for most ecological receptors. Samples collected at depth intervals of 0 to 2 feet bgs and 0.5 to 1.5 feet bgs were assumed to be representative of the midpoint of the depth interval (1-foot). Consequently, samples from the 0 to 2-foot bgs and 0.5 to 1.5-foot bgs depth intervals are included in the dataset.

Most of the samples in the dataset for the SLERA were collected in 2010. Some samples were also collected in 1994, 1997, 1999, 2000, 2006, and 2012. The majority of the samples were collected by RMT during the Phase I RI and CRA during the Phase II and Additional RI from 2008 to 2012. Samples were collected

in 1994 by BBL. Samples in 1997 were collected by Environmental Resources Management (ERM). Samples were collected in 2006 by RMT.

9.1.7.2 ECOLOGICAL SCREENING VALUES

The objective of a SLERA is to eliminate those constituents that, with a high degree of certainty, have a low probability of posing risk to one or more ecological receptors. To ensure that the potential for risk is not incorrectly dismissed, screening-level assessments are very conservative, that is, assumptions regarding exposure and toxicological effects are biased toward identifying risk. This includes selection of conservative ESVs.

ESVs are conservative benchmark concentrations used to determine the potential for risk to ecological receptors. Because ESVs are conservative, it can be concluded with a high level of certainty that constituents with maximum concentrations below their ESVs do not pose risk to ecological receptors. Alternatively, constituents with maximum concentrations that exceed their ESVs do not necessarily indicate risk or adverse impacts to ecological receptors. Rather, it only indicates that the potential for risk exists and that further assessment should be completed.

For the SLERA, ESVs are taken from a variety of sources recognized by the U.S. EPA and state regulatory agencies. Sources of ESVs were searched using the Ecological Benchmark Tool developed and maintained by Oak Ridge National Laboratory (ORNL). The Ecological Benchmark Tool can be accessed through ORNL's website at: http://rais.ornl.gov/cgi-bin/eco/ECO_select. A hierarchical approach was used in the selection of appropriate ESVs. The first tier in the hierarchy considered the most recently developed ESVs, which typically have the strongest and most contemporary scientific basis. Whenever multiple benchmarks were available within a tier, the lowest value was selected as the ESV to maintain a level of conservatism commensurate with a screening-level assessment.

The first tier in the selection of ESVs consisted of the U.S. EPA Ecological Soil Screening Levels (ECO-SSLs)(U.S. EPA, 2003e). The rationale for using ECO-SSLs as the first tier is that they have a strong technical basis and have recently been developed or revised by U.S. EPA. If multiple ECO-SSLs were available for a given constituent (developed for avian, invertebrate, mammalian, or plant receptors), then the lowest of the available ECO-SSLs was selected as the

ESV. If an ECO-SSL was not available, the second tier in the hierarchy was the Ecological Screening Levels (ESLs) identified by U.S. EPA, Region 5. If neither an ECO-SSL nor ESL was available, all other available ecological benchmarks were considered as the third tier. If more than one third tier benchmark was available, the lowest of the available benchmarks was selected as the ESV.

Tier I Benchmarks

The lowest value of the following benchmarks was selected as the ESV:

- U.S. EPA ECO-SSL for avian receptors
- U.S. EPA ECO-SSL for soil invertebrates
- U.S. EPA ECO-SSL for mammalian receptors
- U.S. EPA ECO-SSL for plants

Tier II Benchmarks

- U.S. EPA Region 5 ESL (U.S. EPA, 2003b)

Tier III Benchmarks

The lowest of the following benchmarks was selected as the ESV:

- ORNL ecological screening benchmarks for soil and litter invertebrates (Efroymson et al., 1997a)
- ORNL ecological screening benchmarks for terrestrial plants (Efroymson et al., 1997b)
- U.S. EPA Region 4 soil screening benchmark (U.S. EPA, 2001a)
- Dutch Intervention Level (Netherlands Ministry of Housing, Spatial Planning and Environment, 2000)

Table J.4 identifies the ESVs for the SLERA.

9.2 STEP 2 - SCREENING-LEVEL EXPOSURE ESTIMATE AND RISK CALCULATION

9.2.1 EXPOSURE ESTIMATES

For those constituents detected in one or more samples, the maximum concentration of a constituent in soil was compared to its ESV (i.e., measurement endpoint). A Screening Quotient (SQ), the maximum concentration divided by the ESV, was calculated and used to determine if the constituent has the potential to pose risk to ecological receptors. A SQ greater than one (unity) identifies a potential for risk. Those constituents with a SQ greater than unity were identified as Site-wide COPECs. The bioavailability of all constituents was conservatively assumed to be 100 percent. Accordingly, reported concentrations were not adjusted for bioavailability.

The above process was initially conducted for the entire dataset of samples for the 0 to 1-foot bgs depth interval (including the 0 to 2-foot and 0.5 to 1.5-foot depth intervals). For those constituents identified as COEPCs in the initial screen, the process was repeated for the individual development areas. Constituents with a Frequency of Detection (FOD) of 5 percent or less were not identified as COPECs, provided the constituent was an analyte for a minimum of 20 samples. As such, four essential nutrients were not identified as COPECs; calcium, magnesium, potassium, and sodium. Calcium, magnesium, potassium, and sodium are essential nutrients, which are constituents that serve an important role in biological processes. A constituent was identified as a COPEC if it was detected and an ESV is not available.

The screening process considered risk posed by BCOCs (as identified by TCEQ, 2006) to upper trophic level receptors. If the SQ for a BCOC was less than unity, the source of the BCOC was considered. As an example, the SQ for cadmium is less than unity for some of the development areas. The ESV for cadmium is the ECO-SSL for avian receptors. Because the ESV takes into account bioaccumulative effects, it can reasonably be concluded cadmium does not pose risk to upper trophic level receptors. If the ESV had been based on soil invertebrates or terrestrial plants, then potential for risk to upper trophic level receptors (birds and mammals) would be evaluated by considering 95 percent Upper Confidence Limits (UCLs) or using conservative food chain models in Step 3a. Food chain models were not used in the SLERA as all BCOCs detected were either identified as COPECs or carried forward to Step 3 or were based on ESVs for upper trophic level receptors.

The LODs were evaluated for those constituents that were not detected in any samples for the Site-wide dataset and an ESV was available. The rationale is that, if a constituent is not detected, but the LODs are greater than its ESV, the presence of the constituent at detectable concentrations cannot be eliminated. A constituent was identified as a COPEC if it was not detected, but less than 20 percent of all samples for the entire dataset or within a sub-area had LODs below its ESV. Constituents that were not detected and do have an available ESV, and whose laboratory detection limit was below the ESV, were eliminated from further evaluation.

9.2.2 RISK CALCULATION

9.2.2.1 SITE-WIDE DATA FOR SURFACE SOIL

CONSTITUENTS DETECTED IN SOIL

Table J.5 identifies the constituents detected in surface soil within the assessment area. Information presented in Table J.5 includes the ESV, if available, the number of samples, the number of samples with detected concentrations, FOD, maximum concentration, location of the sample with the maximum concentration, the SQ, identification of BCOCs, and the rationale for retaining or eliminating the constituent as a COPEC.

VOCs

Table J.5 identifies the constituents detected in surface soil. Twenty-three VOCs, exclusive of BTEX, were detected. The maximum concentrations of 1,1,2,2-trichloroethane, 1,1,1-trichloroethane, 1,2-dibromomethane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-butanone, chloroform, chloromethane, methyl tert butyl ether (MTBE), methylene chloride, tetrachoroethene (PCE), trichloroethene (TCE), trichlorofluoromethane, and vinyl chloride are below their ESVs. None of these 14 VOCs is a BCOC. Based on SQs less than unity, 1,1,2,2-trichloroethane, 1,1,1-trichloroethane, 1,2-dibromomethane,, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-butanone, chloroform, chloromethane, methyl tert butyl ether (MTBE), methylene chloride, PCE, TCE, trichlorofluoromethane, and vinyl chloride are eliminated as Site-wide COPECs.

The SQ for acetone (3.4) exceeds unity. Consequently, acetone is carried forward as a Site-wide COPEC. Acetone is not a BCOC. Of the remaining VOCs, 1,2,4-trimethylbenzene was detected in 3 of 6 surface soil samples, 1,3,5-tricmethylbezene was detected in 2 of 6 samples, and isopropylbenzene (cumene) was detected in 40 of 232 samples. Of the remaining five VOCs, 2-phenylbutane, cymene (p-isopropyltoluene), n-butylbenzene, n-propylbenzene, and tetrahydrofuran were detected in the only sample analyzed for these VOCs. Based on the absence of ESVs, 1,2,4-trimethylbenzene, 1,3,5-trimethylbezene, 2-phenylbutane, cymene, isopropylbenzene, n-butylbenzene, n-propylbenzene, and tetrahydrofuran are carried forward as Site-wide COPECs. None of these 8 VOCs is a BCOC.

BTEX

Four BTEX constituents were detected in surface soil. The SQ for ethylbenzene (0.83) is below unity. Ethylbenzene, which is not a BCOC, is eliminated as a COPEC.

The SQs for benzene (13), toluene (4.6), o-xylene (1.2), and m&p-xylene (1.7) exceed unity. Accordingly, benzene, toluene, o-xylene, and m&p-xylene are carried forward as Site-wide COPECs. None of these BTEX constituents is a BCOC.

SVOCs

Eleven SVOCS, exclusive of PAHs, were detected in surface soil. The SQs for 4-methylphenol (0.0004), butylbenzylphthalate (0.28), diethyl phthalate (0.002), dimethyl phthalate (0.000002), di-n-octylphthalate (0.001), and phenol (0.01) are below unity. None of these six SVOCs are BCOCs. Consequently, 4-methylphenol, butylbenzyl phthalate, diethyl phthalate, di-n-octylphthalate, dimethylphthalate, and phenol are eliminated as COPECs.

The SQs for bis(2-ethylhexyl)phthalate (3.8), di-n-butylphthalate (4.1), and pentachlorophenol (333) are greater than unity. The FODs for di-n-butylphthalate (1.3 percent) and pentachlorophenol (3.5 percent) are less 5 percent. The number of samples analyzed for di-n-butylphthalate and pentachlorophenol are 227 and 173, respectively. Based on a FOD less than 5 percent, di-n-butylphthalate and pentachlorophenol are eliminated as COPECs.

Bis(2-ethylhexyl)phthalate is carried forward as a Site-wide COPEC. Bis(2-ethylhexyl)phthalate is not a BCOC.

Carbazole was detected in 42 of 228 samples and dibenzofuran was detected in 51 of 229 samples. An ESV is not available for either of these SVOCs. Based on the absence of ESVs, carbazole and dibenzofuran are carried forward as COPECs. Neither is a BCOC.

PAHs

PAHs were evaluated as low molecular weight (LMW) PAHs (2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene) and high molecular weight (HMW) PAHs (benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthrancene, fluoranthene, pyrene). Benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene were evaluated individually as "other" PAHs.

The SQs for all of the "other" PAHs are below unity. The SQs are 0.32 for benzo(b)fluoranthene, 0.064 for benzo(g,h,i)perylene, 0.036 for benzo(k)fluoranthene, and 0.054 for indeno(1,2,3-c,d) pyrene. None of these "other" PAHs is a BCOC. Consequently, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, and indeno(1,2,3-c,d) pyrene are eliminated as COPECs.

The sums of the LMW and HWM PAHs are based, conservatively, on the maximum concentration of each of the individual PAHs. Because the maximum concentrations may not be from the same sample, the sum of PAHs for the LMW and HMW PAHs does not necessary equal the sum of the maxima for the individual PAHs. The SQs for both the sum of the LMW PAHs (3.0) and sum of the HMW PAHs (57) exceed unity. None of the PAHs is a BCOC. Based on SQs greater than unity, all of the LMW PAHS (2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene) and HMW PAHs (benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthrancene, fluoranthene, pyrene) are carried forward as COPECs.

PCBs

PCBs were evaluated as total PCBs. One or more of the individual Aroclors was detected in 111 of 268 samples. Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, and Aroclor 1260 were detected. Aroclor 1254 was the most frequently detected (86 of 259 samples). Aroclor 1260 was the second most frequently detected aroclor (43 of 255 samples). Aroclor 1016, Aroclor 1221, Aroclor 1232 Aroclor 1242, and Aroclor 1248 were detected in less than 5 percent of the samples. The SQ for total PCBs (33,133) exceeds unity. Based on a SQ greater than unity, total PCBs, and each of the detected individual Aroclors, are carried forward as Site-wide COPECs. All of the Aroclors are BCOCs.

Metals

Twenty-three metals were detected in one or more surface soil samples. The SQs for beryllium (0.11), silver (0.17), and thallium (0.70) are below their ESVs. None of these three metals is a BCOC. Based on SQs less than unity, beryllium, silver, and thallium are eliminated as COPECs.

U.S. EPA has published an ECO-SSL document for aluminum (U.S. EPA, 2003b). A numerical ESV is not identified for aluminum. Alternatively, soil pH is used as an indicator of the potential toxicity of aluminum, which is assumed to pose risk to ecological receptors at a pH lower than 5.5. As the soils on the Site are not acidic, aluminum is not carried forward as a COPEC.

ESVs are not available for calcium, potassium, magnesium, and sodium. These metals are essential nutrients, which are required by many organisms to maintain biological and physiological processes. As essential nutrients, calcium, potassium, magnesium, and sodium are eliminated as COPECs.

The SQs for antimony (202), arsenic (7.5), barium (2.6), cadmium (11), chromium (2.5), cobalt (2.9), copper (91), iron (426), lead (212), manganese (18), mercury (56), nickel (1.6), selenium (8.7), vanadium (6.9), and zinc (100) exceed their ESVs. Based on SQs that exceed unity, these 15 metals are carried forward as COPECs. Based on an SQ that exceeds unity, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, vanadium, and zinc are carried forward as Site-wide COPECs. Of these metals,

cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc are BCOCs.

General Chemical Constituents

Total cyanide was detected in 22 of 27 surface soil samples analyzed for this constituent. The SQ (1.9) exceeds unity. Based on an SQ greater than unity, total cyanide is carried forward as a Site-wide COPEC. Total cyanide is not a BCOC.

CONSTITUENTS NOT DETECTED WITH LODs ABOVE ESVs

Table J.6 identifies those constituents that were not detected in surface soil and have ESVs provided in Table J.4. Information presented in Table J.6 includes the ESV, if available, the number of samples, the minimum and maximum LODs, the number of samples with LODs less than and greater than the ESV, the percentage of samples with LODs greater than the ESV, identification of the BCOCs. For screening, constituents with less than 20 percent of samples with LODs greater than the LODs were identified as COPECs.

VOCs

Twenty-eight VOCs have available ESVs and were not detected in any of the samples of surface soil. Table J.6 identifies the 28 VOCs. Only 1,2-dibromo-3-chloropropane has less than 20 percent of the LODs below the ESV. Of the 129 samples analyzed for this constituent, the LOD is below the ESV of 35.2 µg/kg for only 4 samples (3.1 percent). Consequently, 1,2-dibromo-3-chloropropane is carried forward as a Site-wide COPEC.

For the remaining 27 VOCs, the percent of LODs below their ESVs range from 50 percent for acrylonitrile to 100 percent (numerous constituents). These remaining 27 VOCs, which are identified in Table J.6, are eliminated as COPECs.

SVOCs

Twenty-three SVOCs have available ESVs and were not detected in any of the samples in for the Site-wide dataset. Table J.6 identifies the 23 SVOCs. Of these 23 SVOCs, 2,4-dimethylphenol (2.2 percent), 2-chlorophenol (1.2 percent), 4,6-dinitro-2-methylphenol (0.58 percent), hexachlorobenzene (1.3 percent), and hexachlorobutadiene (1.3 percent) have less than 20 percent of the LODs below their ESVs. Consequently, 2,4-dimethylphenol,

2-chlorophenol4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene are carried forward as Site-wide COPECs. Hexachlorobenzene is a BCOC.

For the remaining 18 VOCs, the percent of LODs below their ESVs range from 50 percent for 2,4-dinitrophenol to 100 percent (numerous constituents). These remaining 18 SVOCs, which are identified in Table J.6, are eliminated as COPECs.

CONSTITUENTS NOT DETECTED AND NO ESV

Table J.7 identifies those constituents that were not detected in surface soil and do not have an ESV. Information presented in Table J.7 includes the number of samples, the minimum and maximum LODs, and identification of the BCOCs.

VOCs

Nine VOCs were not detected and do not have ESVs. The nine VOCs are 1,2,3-triclorobenzene, bromobenzene, chlorobromomethane, chloroethane, cis-1,2-dichloroethene, cis-1,2-dichoropropene, ethyl ether, tert-butylbenzene, and trans-1,4-dichloro-2-butene. None of these VOCs is a BCOC. Because they were not detected and do have an ESV, 1,2,3-triclorobenzene, bromobenzene, chlorobromomethane, chloroethane, cis-1,2-dichloroethene, cis-1,2-dichoropropene, ethyl ether, tert-butylbenzene, and trans-1,4-dichloro-2-butene are eliminated as COPECs.

SVOCs

Two SVOCs, 1-methylnaphthalene and 3,4-dimethylphenol , were not detected in surface soil and do not have an ESV. Neither is a BCOC. These two SVOCs are eliminated as COPECs.

9.2.2.2 RESIDENTIAL AREA 1

Table J.8 identifies the Site-wide COPECs detected in surface soil in Residential Area 1. Information presented in Table J.8 is similar to that provided in Table J.6.

VOCs

Two VOCs, exclusive of BTEX, were detected. The SQ for acetone (0.33) is below unity. This constituent is not a BCOC. Based on a SQ below unity, acetone is eliminated as a COPEC for Residential Area 1.

Isopropylbenzene was detected in 3 of the 28 samples, at a maximum concentration of 50 µg/kg. An ESV is not available for isopropylbenzene. Based on the absence of an ESV, isopropylbenzene is identified as a COPEC for Residential Area 1. Isopropylbenzene is not a BCOC.

BTEX

All four BTEX constituents identified as Site-wide COPECs were detected in Residential Area 1. The SQs for benzene (0.15), toluene (0.12), o-xylene (0.057), and m&p-xylene (0.082) are all below unity. None of these BTEX constituents is a BCOC. Based on SQs less than unity, benzene, toluene, o-xylene, and m&p-xylene are eliminated as COPECs for Residential Area 1.

SVOCs

Three SVOCS identified as Site-wide COPECs, exclusive of PAHs, were detected in Residential Area 1. The SQ for bis(2-ethylhexyl)phthate (3.8) exceeds unity. Carbazole and dibenzofuran were both detected in 2 of 28 samples. ESVs are not available for either carbazole or dibenzofuran. Bis(2-ethylhexyl)phthalate is identified as COPEC for Residential Area 1 based on a SQ greater than unity. Carbazole and dibenzofuran are identified as COPECs based on the based on the absence of ESVs. None of these three SVOCs is a BCOC.

PAHs

The SQ for the sum of the LMW PAHs (0.12) is below unity, whereas the SQ for the sum of the HMW PAHs (7.4) exceeds unity. None of the LMW or HMW PAHs is a BCOC. Based on a SQ below unity, all LMW PAHs are eliminated as COPECs for Residential Area 1. The HMW PAHs are identified as COPECs based on a SQ greater than unity for the sum of the HMW PAHs.

PCBs

One or more of the individual Aroclors was detected in 24 of 34 samples in Residential Area 1. Aroclor 1016, Aroclor 1221, Aroclor 1242, Aroclor 1248, Aroclor 1254, and Aroclor 1260 were detected. Aroclor 1254 was the most frequently detected Aroclor (21 of 33 samples). The SQ for total PCBs (3,584) exceeds the ESV. Based on a SQ greater than unity, total PCBs are identified as COPECs for Residential Area 1. All of the individual Aroclors are BCOCs.

Metals

All 15 metals identified as Site-wide COPECs were detected in one or more surface soil samples in Residential Area 1. The SQs for arsenic (0.90), barium (0.69), chromium (0.69), cobalt (0.45), and nickel (0.82) are below unity. Arsenic, barium, and cobalt are not BCOCs. Based on a SQ less than unity, these three metals are eliminated as COPECs for Residential Area 1. Chromium and nickel are BCOCs. Chromium can be eliminated as an ESV because the ESV is the ECO-SSL for avian receptors, which takes into account the bioaccumulation of chromium. Conversely, nickel is identified as a COPEC because the ESV is the ECO-SSL for plants.

The SQs for antimony (3.3), cadmium (3.1), copper (1.8), iron (116), lead (6.1), manganese (4.5), mercury (3.3), selenium (3.1), vanadium (3.6), and zinc (2.8) exceed unity. Antimony is eliminated as a COPEC for Residential Area 1 because it is not a BCOC and the FOD (3.6 percent) is less than 5 percent for 28 samples. Based on SQs that exceed unity, cadmium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc are identified as COPECs. Of these nine metals, cadmium, copper, lead, mercury, selenium, and zinc are BCOCs.

General Chemical Constituents

Total cyanide was detected in both samples from Residential Area 1 analyzed for total cyanide. The SQ (0.68) is below unity. Total cyanide is not a BCOC. Based on an SQ below unity, total cyanide is eliminated as a COPEC for Residential Area 1.

Ecological Considerations

The primary feature of Residential Area 1 is the wastewater treatment facility, which is located in the eastern portion of this redevelopment area. Vegetative cover is present in the western portion of this area. The former wastewater sludge dewatering lagoons were located in this western area. The riparian corridor of the Kalamazoo River forms the northern border of this redevelopment area. Redevelopment of this area will likely result in the loss of the majority of the existing vegetation. However, some of the surface soil is likely to be converted to lawn or landscaped areas. The portion of this redevelopment area adjacent to the Kalamazoo River is also likely to remain. The refinement process in Step 3a will consider those areas most likely to remain under the current redevelopment plan.

9.2.2.3 RESIDENTIAL AREA 2

Table J.9 identifies the Site-wide COPECs detected in surface soil in Residential Area 2. Information presented in Table J.9 is similar to that provided in Table J.6.

VOCs

Acetone is the only VOC identified as a Site-wide COPEC detected in Residential Area 2. The SQ for the single sample analyzed for acetone (0.12) is below unity. Acetone is not a BCOC. Based on a SQ less than unity, acetone is eliminated as a COPEC for Residential Area 2.

BTEX

All BTEX constituents identified as Site-wide COPECs were detected in Residential Area 2. The SQs for benzene (0.035), toluene (0.008), o-xylene (0.003), and m&p-xylene (0.004) are below unity. None of the BTEX constituents is a BCOC. Based on SQs less than unity, benzene, toluene, o-xylene, and m&p-xylene are eliminated as COPECs for Residential Area 2.

SVOCs

Bis(2-ethylhexyl)phthalate is the only SVOC identified as a Site-wide COPEC detected in Residential Area 2. The SQ is below unity.

Bis(2-ethylhexyl)phthalate is not a BCOC. Based on a SQ below unity, bis(2-ethylhexyl)phthalate is eliminated as a COPEC for Residential Area 2.

PAHs

The SQ for the sum of the LMW PAHs (0.038) is below unity, whereas the SQ for the sum of the HMW PAHs (1.4) exceeds unity. None of the LMW or HMW PAHs is a BCOC. Based on a SQ below unity, all LMW PAHs are eliminated as COPECs for Residential Area 2. The HMW PAHs are identified as COPECs based on a SQ greater than unity for the sum of the HMW PAHs.

PCBs

One or more of the individual Aroclors was detected in 10 of the 14 samples in Residential Area 2. The Aroclors detected are Aroclor 1221, Aroclor 1248, Aroclor 1254, and Aroclor 1260. Aroclor 1254 was the most frequently detected Aroclor (9 of 14 samples). The SQ for total PCBs (684) exceeds unity. Based on a SQ greater than unity, total PCBs are identified as COPECs for Residential Area 2. Each of the individual Aroclors are BCOCs.

Metals

Thirteen of the 15 metals identified as Site-wide COPECs were detected in Residential Area 2. The SQs for arsenic (0.75), barium (0.27), chromium (0.92), cobalt (0.42), and nickel (0.34) are below unity. Arsenic, barium, and cobalt are not BCOCs. Based on a SQ less than unity, these three metals are eliminated as COPECs for Residential Area 2. Chromium and nickel are BCOCs. Chromium can be eliminated as a COPEC because the ESV is the ECO-SSL for avian receptors, which takes into account the bioaccumulation of chromium. Nickel is identified as a COPEC because the ESV is the ECO-SSL for plants.

The SQs for copper (1.6), iron (76), lead (4.1), manganese (3.2), selenium (1.5), vanadium (2.4), and zinc (1.3) exceed unity. The SQ for mercury (1.0) is equal to unity. Based on SQs that exceed unity, copper, iron, lead, manganese, selenium, vanadium, and zinc are identified as COPECs. Of these nine metals, cadmium, copper, lead, selenium, and zinc are BCOCs. Although the SQ for mercury is equal to unity, it is identified as COPEC because it is a BCOC.

Ecological Considerations

The major feature of Residential Area 2 is the primary clarifier for the wastewater treatment facility. The area around the clarifier is currently vegetated, and includes the riparian corridor of the Kalamazoo River. All of the samples collected from Residential Area 2 are from vegetated areas that potentially support ecological receptors. Redevelopment of this area will likely result in the loss of the majority of the existing vegetation. However, some of the surface soil likely to be converted to lawn or landscaped areas. The portion of this redevelopment area adjacent to the Kalamazoo River is also likely to remain. The refinement process in Step 3a will consider those areas most likely to remain under the current redevelopment plan.

9.2.2.4 RESIDENTIAL AREA 3

Table J.10 identifies the Site-wide COPECs detected in surface soil in Residential Area 3. Information presented in Table J.10 is similar to that provided in Table J.6.

VOCs

Acetone is the only VOC identified as a Site-wide COPEC detected in Residential Area 3. The SQ for the single sample analyzed for acetone (0.12) is below unity. Acetone is not a BCOC. Based on a SQ less than unity, acetone is eliminated as a COPEC for Residential Area 3.

BTEX

All four BTEX constituents identified as Site-wide COPECs were detected in Residential Area 3. The SQs for benzene (0.15), toluene (0.073), o-xylene (0.025), and m&p-xylene (0.038) are all below unity. None of these BTEX constituents is a BCOC. Based on SQs less than unity, benzene, toluene, o-xylene, and m&p-xylene are eliminated as COPECs for Residential Area 3.

SVOCs

Three SVOCS identified as Site-wide COPECs, exclusive of PAHs, were detected in Residential Area 3. Carbazole and dibenzofuran were both detected in one of 11 samples. ESVs are not available for either carbazole or dibenzofuran.

Carbazole and dibenzofuran are identified as COPECs for Residential Area 3 based on the absence of ESVs. Neither of these SVOCs is a BCOC.

The SQ for bis(2-ethylhexyl)phthate (0.21) is below unity. Based on a SQ below unity, bis(2-ethylhexyl)phthalate, which is not a BCOC, is eliminated as a COPEC for Residential Area 3.

PAHs

The SQ for the sum of the LMW PAHs (0.047) is below unity, whereas the SQ for the sum of the HMW PAHs (1.6) exceeds unity. None of the LMW or HMW PAHs is a BCOC. Based on a SQ below unity, all LMW PAHs are eliminated as COPECs for Residential Area 3. The HMW PAHs are identified as COPECs based on a SQ greater than unity for the sum of the HMW PAHs.

PCBs

One or more of the individual Aroclors was detected in 15 of 19 samples in Residential Area 3. Aroclor 1016, Aroclor 1221, Aroclor 1254, and Aroclor 1260 were detected. Aroclor 1254 and Aroclor 1260 were both detected in eight of 12 samples. The SQ for total PCBs (1,205) exceeds the ESV. Based on a SQ greater than unity, total PCBs are identified as COPECs for Residential Area 3. All of the individual Aroclors are BCOCs.

Metals

All 15 metals identified as Site-wide COPECs were detected in one or more surface soil samples in Residential Area 3. The SQs for barium (0.35), cadmium (0.83), cobalt (0.85), and nickel (0.77) are below unity. Barium and cobalt are not BCOCs. Based on a SQ less than unity, these two metals are eliminated as COPECs for Residential Area 3. Cadmium and nickel are BCOCs. Cadmium can be eliminated as a COPEC because the ESV is the ECO-SSL for mammalian receptors, which takes into account the bioaccumulation of cadmium. Nickel is identified as a COPEC because the ESV is the ECO-SSL for plants.

The SQs for antimony (1.5), arsenic (1.1), chromium (1.4), copper (1.3), iron (129), lead (5.8), manganese (3.2), mercury (22), selenium (2.1), vanadium (6.9), and zinc (2.4) exceed unity. Based on SQs that exceed unity, antimony, arsenic, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and

zinc are identified as COPECs for Residential Area 3. Of these 11 metals, chromium, copper, lead, mercury, selenium, and zinc are BCOCs.

General Chemical Constituents

Total cyanide was detected in the only sample from Residential Area 3 analyzed for total cyanide. The SQ (0.75) is below unity. Total cyanide is not a BCOC. Based on an SQ below unity, total cyanide is eliminated as a COPEC for Residential Area 3.

Ecological Considerations

Major features of Residential Area 3 included a former aeration basin and secondary clarifier for the waste water treatment facility. A service road transects the area. This redevelopment area is currently vegetated, and includes the riparian corridor of the Kalamazoo River and a small wooded area in the northeastern portion of the area. All of the samples collected from Residential Area 3 are from vegetated areas that potentially support ecological receptors. Redevelopment of this area will likely result in the loss of the majority of the existing vegetation. However, some of the surface soil likely to be converted to lawn or landscaped areas. The portion of this redevelopment area adjacent to the Kalamazoo River is also likely to remain. The refinement process in Step 3a will consider those areas most likely to remain under the current redevelopment plan.

9.2.2.5 RESIDENTIAL AREA 4

Table J.11 identifies the Site-wide COPECs detected in surface soil in Residential Area 4. Information presented in Table J.11 is similar to that provided in Table J.6.

VOCs

Two VOCs, exclusive of BTEX, were detected. The SQ for acetone (3.4) exceeds below unity. Based on a SQ greater unity, acetone is identified as a COPEC for Residential Area 4. Acetone is not a BCOC.

Isopropylbenzene was detected in 7 of the 11 samples, at a maximum concentration of 1,400 µg/kg. An ESV is not available for isopropylbenzene.

Based on the absence of an ESV, isopropylbenzene is carried forward as a COPEC for Residential Area 4. Isopropylbenzene is not a BCOC.

BTEX

All four BTEX constituents identified as Site-wide COPECs were detected in Residential Area 4. The SQs for benzene (13), toluene (4.6), o-xylene (1.2), and m&p-xylene (1.7) are all below unity. None of these BTEX constituents is a BCOC. Based on SQs greater than unity, benzene, toluene, o-xylene, and m&p-xylene are identified as COPECs for Residential Area 4.

SVOCs

Three SVOCS identified as Site-wide COPECs, exclusive of PAHs, were detected in Residential Area 4. Carbazole was detected in 6 of 11 samples; dibenzofuran was detected in 8 of 11 samples. ESVs are not available for either carbazole or dibenzofuran. Carbazole and dibenzofuran are identified as COPECs for Residential Area 4 based on the absence of ESVs. Neither of these SVOCs is a BCOC.

The SQ for bis(2-ethylhexyl)phthate (0.14) is below unity. Based on a SQ below unity, bis(2-ethylhexyl)phthalate, which is not a BCOC, is eliminated as a COPEC for Residential Area 4.

PAHs

The SQ for the sum of the LMW PAHs (0.94) is below unity, whereas the SQ for the sum of the HMW PAHs (54) exceeds unity. None of the LMW or HMW PAHs is a BCOC. Based on a SQ below unity, all LMW PAHs are eliminated as COPECs for Residential Area 4. The HMW PAHs are identified as COPECs based on a SQ greater than unity for the sum of the HMW PAHs.

PCBs

One or more of the individual Aroclors was detected in 6 of 11 samples in Residential Area 4. Aroclor 1248, Aroclor 1254, and Aroclor 1260 were detected. Aroclor 1254 was the most frequently detected aroclor (5 of 11 samples). The SQ for total PCBs (1,205) exceeds the ESV. Based on a SQ greater than unity, total PCBs are identified as COPECs for Residential Area 4. All of the individual Aroclors are BCOCs.

Metals

All 15 metals identified as Site-wide COPECs were detected in one or more surface soil samples in Residential Area 4. The SQs for barium (0.59), cobalt (0.54), and nickel (0.35) are below unity. Barium and cobalt are not BCOCs. Based on a SQ less than unity, these two metals are eliminated as COPECs for Residential Area 4. Nickel is a BCOC. Nickel is identified as a COPEC because the ESV is the ECO-SSL for plants.

The SQs for antimony (5.6), arsenic (1.2), cadmium (11), chromium (1.1), copper (7.9), iron (94), lead (90), manganese (3.2), mercury (56), selenium (8.7), vanadium (2.4), and zinc (9.8) exceed unity. Based on SQs that exceed unity, antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc are identified as COPECs for Residential Area 4. Of these 12 metals, cadmium, chromium, copper, lead, mercury, selenium, and zinc are BCOCs.

General Chemical Constituents

Total cyanide was detected in 3 of 6 samples from Residential Area 4 analyzed for total cyanide. The SQ (1.4) is exceeds unity. Total cyanide is not a BCOC. Based on an SQ greater than unity, total cyanide is identified as a COPEC for Residential Area 4.

Ecological Considerations

Major features of Residential Area 4 included a former coal pile area and primary clarifier for the wastewater treatment facility. This redevelopment area is currently vegetated, and includes the riparian corridor of the Kalamazoo River and a small wooded area in the northeastern portion of the area. All of the samples collected from Residential Area 4 are from vegetated areas that potentially support ecological receptors. Redevelopment of this area will likely result in the loss of the majority of the existing vegetation. However, some of the surface soil is likely to be converted to lawn or landscaped areas. The portion of this redevelopment area adjacent to the Kalamazoo River is also likely to remain. The refinement process in Step 3a will consider those areas most likely to remain under the current redevelopment plan.

9.2.2.6 WATERFRONT PLAZA

Table J.12 identifies the Site-wide COPECs detected in surface soil in the Waterfront Plaza area. Information presented in Table J.12 is similar to that provided in Table J.6. Data from a single sample are available. Metals are the only constituent group detected.

Metals

Eleven of the 15 metals identified as Site-wide COPECs were detected in the single surface soil sample in Waterfront Plaza area. The SQs for arsenic (0.17), barium (0.048), chromium (0.15), cobalt (0.15), copper (0.071), lead (0.49), manganese (0.59), nickel (0.12), vanadium (0.90), and zinc (0.35) are below unity. Arsenic, barium, cobalt, manganese, vanadium are not BCOCs. Based on a SQ less than unity, these 5 metals are eliminated as COPECs for the Waterfront Plaza area. Chromium, copper, lead, nickel, and zinc are BCOCs. Cadmium can be eliminated as an ESV because the ESV is the ECO-SSL for mammalian receptors, which takes into account the bioaccumulation of cadmium. Similarly, chromium, copper, lead, and zinc are eliminated because their ESVs are ECO-SSLs for avian receptors. Nickel is identified as a COPEC because the ESV is the ECO-SSL for plants.

The SQ for iron (23) exceeds unity. Based on an SQ that exceeds unity, iron is identified as a COPEC for Waterfront Plaza area. Iron is not a BCOC.

The primary feature of the Waterfront Plaza redevelopment area is an access road to the wastewater treatment facility. The rest of the area is currently vegetated, including a portion of the riparian corridor of the Kalamazoo River. The only sample collected from this redevelopment area is from the southeastern corner of the area. Because the area of the single sample will likely be disturbed by redevelopment and there are not samples from the area within the riparian corridor, the refinement process in Step 3a will not address the Waterfront Plaza redevelopment area.

9.2.2.7 MIXED RESIDENTIAL/COMMERCIAL AREA 1

Table J.13 identifies the Site-wide COPECs detected in surface soil in Mixed Residential/Commercial Area 1. Information presented in Table J.13 is similar to

that provided in Table J.6. No VOCs, exclusive of BTEX, individual Aroclors, or total PCBs were detected in Mixed Residential/Commercial Area 1.

BTEX

Three of the four BTEX constituents identified as Site-wide COPECs were detected in Mixed Residential/Commercial Area 1. The SQs for toluene (0.005), o-xylene (0.002), and m&p-xylene (0.002) are all below unity. None of these BTEX constituents is a BCOC. Based on SQs greater than unity, toluene, o-xylene, and m&p-xylene are identified as COPECs for Mixed Residential/Commercial Area 1.

SVOCs

Two SVOCS identified as Site-wide COPECs, exclusive of PAHs, were detected in Mixed Residential/Commercial Area 1. Carbazole was detected in 1 of 11 samples. An ESV is not available for carbazole. Carbazole, which is not a BCOC, is identified as a COPEC for Mixed Residential/Commercial Area 1 based on the absence of an ESV.

The SQ for bis(2-ethylhexyl)phthate (0.12) is below unity. Based on a SQ below unity, bis(2-ethylhexyl)phthalate, which is not a BCOC, is eliminated as a COPEC for Mixed Residential/Commercial Area 1.

PAHs

The SQ for the sum of the LMW PAHs (0.056) is below unity, whereas the SQ for the sum of the HMW PAHs (3.5) exceeds unity. None of the LMW or HMW PAHs is a BCOC. Based on a SQ below unity, all LMW PAHs are eliminated as COPECs for Mixed Residential/Commercial Area 1. The HMW PAHs are identified as COPECs based on a SQ greater than unity for the sum of the HMW PAHs.

Metals

Fourteen of the 15 metals identified as Site-wide COPECs were detected in one or more surface soil samples in Mixed Residential/Commercial Area 1. The SQs for barium (0.90), chromium (0.50), and copper (0.62) are below unity. The SQ for nickel is equal to unity (1.0). Barium is not a BCOC. Based on a SQ less than

unity, barium is eliminated as a COPEC. Chromium, copper, and nickel are BCOCs. Chromium and copper are eliminated as COPECs because their ESVs are ECO-SSLs for avian receptors, which take bioaccumulation into account. Nickel is identified as a COPEC because the ESV is the ECO-SSL for plants.

The SQs for arsenic (1.1), cadmium (2.6), cobalt (2.3), iron (51), lead (15), manganese (8.5), mercury (1.6), selenium (1.2), vanadium (1.8), and zinc (2.3) exceed unity. Based on SQs that exceed unity, arsenic, cadmium, cobalt, iron, lead, manganese, mercury, selenium, vanadium, and zinc are identified as COPECs for Mixed Residential/Commercial Area 1. Of these 10 metals, cadmium, lead, mercury, selenium, and zinc are BCOCs.

General Chemical Constituents

Total cyanide was detected in both surface soil samples from Mixed Residential/Commercial Area 1 analyzed for total cyanide. The SQ (0.90) is less than unity. Total cyanide is not a BCOC. Based on an SQ less than unity, total cyanide is eliminated as a COPEC for Mixed Residential/Commercial Area 1.

Ecological Considerations

The majority of Mixed Residential/Commercial Area 1 consists of the former building slab and parking areas for the former Specialty Minerals, Inc. Building. Small patches of vegetation are currently present adjacent to Allegan Street and in the northernmost portion of the area. Only one of the 14 samples collected in this redevelopment is in an area of vegetative cover (adjacent to an entry road off Allegan Street). Based on the likelihood that the entire area will be disturbed as a result of redevelopment and the availability of a single sample near the entrance off Allegan Street, the refinement process in Step 3a will not address Mixed Residential/Commercial Area 1.

9.2.2.8 MIXED RESIDENTIAL/COMMERCIAL AREA 2

Table J.14 identifies the Site-wide COPECs detected in surface soil in Mixed Residential/Commercial Area 2. Information presented in Table J.14 is similar to that provided in Table J.6.

VOCs

Nine VOCs, exclusive of BTEX, were detected. Acetone is the only VOC detected with an available ESV. The SQ for acetone (2.2) exceeds unity. Acetone is not a BCOC. Based on a SQ greater than unity, acetone is identified as a COPEC for Mixed Residential/Commercial Area 2.

Of the remaining VOCs, 1,2,4-trimethylbenzene was detected in three of six samples, and 1,3,5-trimethylbenzene was detected in two of six samples, and isopropylbenzene was detected in 19 of the 58 samples Of the other five VOCs, 2-phenylbutane, cymene, n-butylbenzene, n-propylbenzene, and tetrahydrofuran were detected in the only sample analyzed for these constituents. ESVs are not available for these eight VOCs. Based on the absence of ESVs, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene 2-phenylbutane, cymene, isopropy lbenzene, n-butylbenzene, n-propylbenzene, and tetrahydrofuran, are identified, as COPECs for Mixed Residential/Commercial Area 2. None of these VOCs is a BCOC.

BTEX

All four BTEX constituents identified as Site-wide COPECs were detected in Mixed Residential/Commercial Area 2. The SQs for benzene (2.8), toluene (2.4), o-xylene (1.1), and m&p-xylene (1.6) exceed unity. Based on SQs greater than unity, benzene, toluene, o-xylene, and m&p-xylene are identified as COPECs for Mixed Residential/Commercial Area 2.

SVOCs

Three SVOCS identified as Site-wide COPECs, exclusive of PAHs, were detected in Mixed Residential/Commercial Area 2. Carbazole was detected in 20 of 57 samples; dibenzofuran was detected in 27 of 57 samples. ESVs are not available for either carbazole or dibenzofuran. Carbazole and dibenzofuran are identified as COPECs for Mixed Residential/Commercial Area 2 based on the absence of ESVs. Neither of these SVOCs is a BCOC.

The SQ for bis(2-ethylhexyl)phthate (0.80) is below unity. Based on a SQ below unity, bis(2-ethylhexyl)phthalate, which is not a BCOC, is eliminated as a COPEC for Mixed Residential/Commercial Area 2.

PAHs

The SQs for the sum of the LMW PAHs (3.0) sum of the HMW PAHs (57) exceed unity. Based on SQs greater than unity, all LMW PAHs and all HMW PAHs are identified as COPECs for Mixed Residential/Commercial Area 2. None of the LMW or HMW PAHs is a BCOC.

PCBs

One or more of the individual Aroclors was detected in 27 of 60 samples in Mixed Residential/Commercial Area 2. Aroclor 1221, Aroclor 1248, Aroclor 1254, and Aroclor 1260 were detected. Aroclor 1254 was the most frequently detected Aroclor (22 of 59 samples). The SQ for total PCBs (3,313) exceeds the ESV. Based on a SQ greater than unity, total PCBs are identified as COPECs for Mixed Residential/Commercial Area 2. Each of the individual Aroclors are BCOCs.

Metals

All 15 metals identified as Site-wide COPECs were detected in one or more surface soil samples in Mixed Residential/Commercial Area 2. The SQs for all 15 metals exceed unity. The SQs are 202 for antimony, 5.7 for arsenic, 2.6 for barium, 6.4 for cadmium, 3.3 for chromium, 2.9 for cobalt, 91 for copper, 313 for iron, 212 for lead, 5.0 for manganese, 40 for mercury, 1.6 for nickel, 5.8 for selenium, 5.0 for vanadium, and 100 for zinc. These 15 metals are identified as COPECs for Mixed Residential/Commercial Area 2. Cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc are BCOCs.

General Chemical Constituents

Total cyanide was detected in all five samples from Mixed Residential/Commercial Area 2 analyzed for total cyanide. The SQ (1.9) for total cyanide exceeds unity. Based on an SQ greater than unity, total cyanide is identified as a COPEC for Mixed Residential/Commercial Area 2. Total cyanide is not a BCOC.

Ecological Considerations

The vast majority of Mixed Residential/Commercial Area 2 consists of the buildings and parking areas associated with the former Mill Buildings. The only

vegetative cover within this redevelopment area is along the riparian corridor of the Kalamazoo River. Ten of the 57 samples collected are from areas of vegetative cover. The refinement process in Step 3a will consider these 10 samples.

9.2.2.9 COMMERCIAL AREA 1

Table J.15 identifies the Site-wide COPECs detected in surface soil in Commercial Area 1. Information presented in Table J.15 is similar to that provided in Table J.6.

VOCs

Acetone is the only VOC identified as a Site-wide COPEC detected in Commercial Area 1. The SQ for the single sample analyzed for acetone (0.18) is below unity. Acetone is not a BCOC. Based on a SQ less than unity, acetone is eliminated as a COPEC for Commercial Area 1.

BTEX

Three of the four BTEX constituents identified as Site-wide COPECs were detected in Commercial Area 1. The SQs for toluene (0.018), o-xylene (0.009), and m&p-xylene (0.013) are all below unity. None of these BTEX constituents is a BCOC. Based on SQs less than unity, toluene, o-xylene, and m&p-xylene are eliminated as COPECs for Commercial Area 1.

SVOCs

Three SVOCS identified as Site-wide COPECs, exclusive of PAHs, were detected in Commercial Area 1. Carbazole and dibenzofuran were both detected in 1 of 11 samples. ESVs are not available for either carbazole or dibenzofuran. Carbazole and dibenzofuran are identified as COPECs for Commercial Area 1 based on the absence of ESVs. Neither of these SVOCs is a BCOC.

The SQ for bis(2-ethylhexyl)phthate (0.17) is below unity. Based on a SQ below unity, bis(2-ethylhexyl)phthalate, which is not a BCOC, is eliminated as a COPEC for Commercial Area 1.

PAHs

The SQ for the sum of the LMW PAHs (0.10) is below unity, whereas the SQ for the sum of the HMW PAHs (7.5) exceeds unity. None of the LMW or HMW PAHs is a BCOC. Based on a SQ below unity, all LMW PAHs are eliminated as COPECs for Commercial Area 1. The HMW PAHs are identified as COPECs based on a SQ greater than unity for the sum of the HMW PAHs.

PCBs

One or more of the individual Aroclors was detected in 1 of 11 samples in Commercial Area 1. Aroclor 1254 and Aroclor 1260 were detected. The SQ for total PCBs (3,072) exceeds the ESV. Based on a SQ greater than unity, total PCBs are identified as COPECs for Commercial Area 1. Aroclor 1254 and Aroclor 1260 are BCOCs.

Metals

Fourteen of the 15 metals identified as Site-wide COPECs were detected in one or surface soil samples in Commercial Area 1. The SQs for arsenic (0.56), barium (0.39), cadmium (0.83), chromium (0.58), cobalt (0.45), and nickel (0.31) are below unity. Arsenic, barium, and cobalt are not BCOCs. Based on a SQ less than unity, these three metals are eliminated as COPECs for Commercial Area 1. Cadmium, chromium, and nickel are BCOCs. Cadmium and chromium are eliminated as COPECs because their ESVs are ECO-SSLs for mammalian or avian receptors, which take bioaccumulation into account. Nickel is identified as a COPEC because the ESV is the ECO-SSL for plants.

The SQs for copper (1.1), iron (71), lead (7.7), manganese (6.9), mercury (2.4), selenium (1.9), vanadium (2.6), and zinc (1.6) exceed unity. Based on SQs that exceed unity, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc are identified as COPECs for Commercial Area 1. Of these eight metals, copper, lead, mercury, selenium, and zinc are BCOCs.

Ecological Considerations

Residential Area 1 is completely vegetated, with woodland being the primary cover type. This area does not abut the Kalamazoo River. Redevelopment of this area will likely eliminate the much of the current vegetative cover. However, some of the current surface soil may remain and be converted to lawn and

landscaped areas, which may still attract wildlife. The refinement process in Step 3a will consider those areas most likely to remain relatively undisturbed under the current redevelopment plan.

9.2.2.10 COMMERCIAL AREA 2

Table J.16 identifies the Site-wide COPECs detected in surface soil in Commercial Area 2. Information presented in Table J.16 is similar to that provided in Table J.6. No VOCs, exclusive of BTEX, were detected in Commercial Area 2.

BTEX

All four BTEX constituents identified as Site-wide COPECs were detected in Commercial Area 2. The SQs for benzene (0.063), toluene (0.003), o-xylene (0.023), and m&p-xylene (0.007) are all below unity. None of these BTEX constituents is a BCOC. Based on SQs greater than unity, toluene, o-xylene, and m&p-xylene are identified as COPECs for Commercial Area 2.

SVOCs

Two SVOCS identified as Site-wide COPECs, exclusive of PAHs, were detected in Commercial Area 2. Carbazole was detected in 1 of 22 samples, with a FOD of 4.5 percent. An ESV is not available for carbazole. However, carbazole, which is not a BCOC, is eliminated as a COPEC for Commercial Area 2 based on a FOD less than 5 percent with 22 samples.

The SQ for bis(2-ethylhexyl)phthate (0.29) is below unity. Based on a SQ below unity, bis(2-ethylhexyl)phthalate, which is not a BCOC, is eliminated as a COPEC for Commercial Area 2.

PAHs

The SQ for the sum of the LMW PAHs (0.049) is below unity, whereas the SQ for the sum of the HMW PAHs (4.1) exceeds unity. None of the LMW or HMW PAHs is a BCOC. Based on a SQ below unity, all LMW PAHs are eliminated as COPECs for Commercial Area 2. The HMW PAHs are identified as COPECs based on a SQ greater than unity for the sum of the HMW PAHs.

PCBs

Aroclor 1254 was detected in 1 of 22 samples in Commercial Area 2, with a FOD of 4.5 percent. The SQ for total PCBs (361), which is based on the single detection of Aroclor 1254, exceeds the ESV. However, total PCBs are eliminated as a COPEC for Commercial Area 2 based on a FOD less than 5 percent with 22 samples.

Metals

Fourteen of the 15 metals identified as Site-wide COPECs were detected in one or more surface soil samples in Commercial Area 2. The SQs for barium (0.31), chromium (0.54), cobalt (0.38), and copper (0.49), and nickel (0.38) are below unity. Barium and cobalt are not BCOCs. Based on SQs less than unity, barium and cobalt are eliminated as COPECs. Chromium and copper are BCOCs. However, chromium and copper are eliminated as COPECs because their ESVs are ECO-SSLs for avian receptors, which take bioaccumulation into account. Nickel is identified as a COPEC because the ESV is the ECO-SSL for plants.

The SQs for arsenic (1.9), cadmium (3.6), iron (70), lead (8.2), manganese (4.1), mercury (1.9), selenium (2.3), vanadium (2.7), and zinc (1.9) exceed unity. Based on SQs that exceed unity, arsenic, cadmium, iron, lead, manganese, mercury, selenium, vanadium, and zinc are identified as COPECs for Commercial Area 2. Of these nine metals, cadmium, lead, mercury, selenium, and zinc are BCOCs.

General Chemical Constituents

Total cyanide was detected in 3 of 4 samples from Commercial Area 2 analyzed for total cyanide. The SQ (1.8) exceeds than unity. Based on an SQ greater than unity, total cyanide is identified as a COPEC for Commercial Area 2. Total cyanide is not a BCOC.

Ecological Considerations

Major features of Commercial Area 2 include the former Sludge Dewatering Building and associated parking areas and concrete pads of the former Quality Products Building. Areas of vegetative cover are present in the southern portion of the redevelopment area adjacent to Allegan Street and the western portion at boundary with the residences on Prospect Avenue. Ten of the 23 samples for this

redevelopment area were taken in areas of vegetative cover. Redevelopment of this area will likely eliminate the much of the current vegetative cover. However, some of the current surface soil may remain in the two areas that have vegetative cover. The refinement process in Step 3a will consider those areas most likely to remain under the current redevelopment plan.

9.2.2.11 COMMERCIAL AREA 3

Table J.17 identifies the Site-wide COPECs detected in surface soil in Commercial Area 3. Information presented in Table J.17 is similar to that provided in Table J.6. None of the individual Aroclors or total PCBs was detected in Commercial Area 3.

VOCs

Two VOCs, exclusive of BTEX, were detected. The SQ for acetone (0.19) is below unity. This constituent is not a BCOC. Based on a SQ below unity, acetone is eliminated as a COPEC for Commercial Area 3.

Isopropylbenzene was detected in 3 of the 8 samples, at a maximum concentration of 520 µg/kg. An ESV is not available for isopropylbenzene. Based on the absence of an ESV, isopropylbenzene is identified as a COPEC for Commercial Area 3. Isopropylbenzene is not a BCOC.

BTEX

All four BTEX constituents identified as Site-wide COPECs were detected in Commercial Area 3. The SQs for benzene (0.51), toluene (0.40), o-xylene (0.092), and m&p-xylene (0.17) are all below unity. None of these BTEX constituents is a BCOC. Based on SQs less than unity, benzene, toluene, o-xylene, and m&p-xylene are eliminated as COPECs for Commercial Area 3.

SVOCs

Two SVOCS identified as Site-wide COPECs, exclusive of PAHs, were detected in Commercial Area 3. Dibenzofuran was detected in 3 of 8 samples. An ESV is not available for dibenzofuran. Dibenzofuran, which is not a BCOC, is identified as a COPEC for Commercial Area 3 based on the absence of an ESV.

The SQ for bis(2-ethylhexyl)phthate (0.049) is below unity. Based on a SQ below unity, bis(2-ethylhexyl)phthalate, which is not a BCOC, is eliminated as a COPEC for Commercial Area 3.

PAHs

The SQ for the sum of the LMW PAHs (0.048) is below unity, whereas the SQ for the sum of the HMW PAHs (1.2) exceeds unity. None of the LMW or HMW PAHs is a BCOC. Based on a SQ below unity, all LMW PAHs are eliminated as COPECs for Commercial Area 3. The HMW PAHs are identified as COPECs based on a SQ greater than unity for the sum of the HMW PAHs.

Metals

All 15 metals identified as Site-wide COPECs were detected in one or more surface soil samples in Commercial Area 3. The SQs for arsenic (1.0), barium (0.89), chromium (0.50), cobalt (0.52), copper (0.81), and nickel (0.89) are below unity. Arsenic, barium and cobalt are not BCOCs. Based on a SQ less than unity, these three metals are eliminated as COPECs for Commercial Area 3. Chromium, copper, and nickel are BCOCs. Chromium and copper are eliminated as COPECs because the ESVs are the ECO-SSLs for avian receptors, which take bioaccumulation into account. Nickel is identified as a COPEC because the ESV is the ECO-SSL for plants.

The SQs for antimony (1.1), cadmium (3.1), iron (74), lead (7.9), manganese (3.4), mercury (47), selenium (5.0), vanadium (2.3), and zinc (1.5) exceed unity. Based on SQs that exceed unity, antimony, cadmium, iron, lead, manganese, mercury, selenium, vanadium, and zinc are identified as COPECs for Commercial Area 3. Of these nine metals, cadmium, lead, mercury, selenium, and zinc are BCOCs.

General Chemical Constituents

Total cyanide was detected in the only sample from Commercial Area 3 analyzed for total cyanide. The SQ (1.7) exceeds unity. Based on an SQ greater than unity, total cyanide is identified as a COPEC for Commercial Area 3. Total cyanide is not a BCOC.

Ecological Considerations

Commercial Area 3 consists primarily of the parking lot for the former Mill Buildings. A thin strip of vegetation is present at the southernmost border of the area near Allegan Street. Another small area of vegetative cover is present in the southeastern corner of the area, which is also near Allegan Street. Two of the 10 samples for this redevelopment area were collected in areas of vegetative cover. The two areas of vegetative cover are very small and, given their proximity to Allegan Street and isolation from other vegetative cover, are not likely to provide habitat for ecological receptors. Based on these factors, the refinement process in Step 3a will not address Mixed Residential/Commercial Area 3.

9.2.2.12 COMMERCIAL AREA 4

Table J.18 identifies the Site-wide COPECs detected in surface soil in Commercial Area 4. Information presented in Table J.18 is similar to that provided in Table J.6.

VOCs

Two VOCs, exclusive of BTEX, were detected. The SQ for acetone (0.38) is below unity. This constituent is not a BCOC. Based on a SQ below unity, acetone is eliminated as a COPEC for Commercial Area 4.

Isopropylbenzene was detected in six of the 60 samples, at a maximum concentration of 78 µg/kg. An ESV is not available for isopropylbenzene. Based on the absence of an ESV, isopropylbenzene is identified as a COPEC for Commercial Area 4. Isopropylbenzene is not a BCOC.

BTEX

All four BTEX constituents identified as Site-wide COPECs were detected in Commercial Area 4. The SQ for benzene (1.4) exceeds unity. Based on an SQ greater than unity, benzene is identified as a COPEC for Commercial Area 4. Benzene is not a BCOC.

The SQs for toluene (0.22), o-xylene (0.062), and m&p-xylene (0.094) are all below unity. None of these BTEX constituents is a BCOC. Based on SQs less than unity, toluene, o-xylene, and m&p-xylene are eliminated as COPECs for Commercial Area 4.

SVOCs

Three SVOCS identified as Site-wide COPECs, exclusive of PAHs, were detected in Commercial Area 4. Carbazole was detected in 10 of 57 samples and dibenzofuran was detected in nine of 58 samples. ESVs are not available for either carbazole or dibenzofuran. Carbazole and dibenzofuran are identified as COPECs for Commercial Area 4 based on the absence of ESVs. Neither of these SVOCs is a BCOC.

The SQ for bis(2-ethylhexyl)phthate (0.38) is below unity. Based on a SQ below unity, bis(2-ethylhexyl)phthalate, which is not a BCOC, is eliminated as a COPEC for Commercial Area 4.

PAHs

The SQ for the sum of the LMW PAHs (0.39) is below unity, whereas the SQ for the sum of the HMW PAHs (18) exceeds unity. None of the LMW or HMW PAHs is a BCOC. Based on a SQ below unity, all LMW PAHs are eliminated as COPECs for Commercial Area 4. The HMW PAHs are identified as COPECs based on a SQ greater than unity for the sum of the HMW PAHs.

PCBs

One or more of the individual Aroclors was detected in 27 of 75 samples in Commercial Area 4. All seven of the Aroclors analyzed for were detected. Aroclor 1254 was the most frequently detected aroclor (19 of 75 samples). The SQ for total PCBs (33,133) exceeds the ESV. Based on a SQ greater than unity,

total PCBs are identified as COPECs for Commercial Area 4. Each of the individual Aroclors are BCOCs.

Metals

All 15 metals identified as Site-wide COPECs were detected in one or more surface soil samples in Commercial Area 4. The SQs for cobalt (0.82) and nickel (0.61) are below unity. Cobalt is not a BCOC. Based on a SQ less than unity, cobalt is eliminated as a COPEC for Commercial Area 4. Nickel is a BCOC. Nickel is identified as a COPEC because the ESV is the ECO-SSL for plants.

The SQs for antimony (32), arsenic (4.2), barium (1.5), cadmium (4.7), chromium (1.5), copper (11), iron (426), lead (50), manganese (18), mercury (8.0), selenium (2.9), vanadium (6.3), and zinc (17) exceed unity. Based on SQs that exceed unity, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc are identified as COPECs for Commercial Area 4. Of these 13 metals, cadmium, chromium, copper, lead, mercury, selenium, and zinc are BCOCs.

General Chemical Constituents

Total cyanide was detected in 5 of 6 samples from Commercial Area 4 analyzed for total cyanide. The SQ (1.8) exceeds unity. Based on an SQ greater than unity, total cyanide is identified as a COPEC for Commercial Area 4. Total cyanide is not a BCOC.

Ecological Considerations

The majority of Commercial Area 4 consists of the former Mill Buildings and associated parking lots. The Kalamazoo River forms the northern border of this redevelopment area. The Mill Race forms the eastern boundary. Vegetative cover is present along both the Kalamazoo River and Mill Race, and potentially provides habitat for ecological receptors. At least 17 of the 61 samples were collected from areas of vegetative cover. Whereas redevelopment will likely disturbed most of this area, surface soil in the areas of vegetative cover immediately adjacent to the Kalamazoo River and Mill Race may remain undisturbed. The refinement process in Step 3a will consider those areas most likely to remain under the current redevelopment plan.

9.3 SCREENING SUMMARY

The screening process identified a total of 42 individual constituents or groups of constituents as COPECs. The COPECs consist of 10 VOCs, four BTEX constituents, nine SVOCs, LMW PAHs, HMW PAHs, total PCBs, 15 metals, and total cyanide. A constituent or group of constituents was identified as a COPECs if:

1. The maximum detected concentration exceeded the ESV (SQ > 1.0).
2. The maximum detected concentration was less than the ESV, the constituent is a BCOC, and the ESV is not an ECO-SSL for avian or mammalian receptors.
3. The constituent was detected and an ESV is not available.
4. The constituent was not detected, but the LODs for more than 20 percent of the samples exceed its ESV.

Table J.19 identifies the constituents and groups of constituents identified as COPECs for each development area. For those COPECs with SQs greater than unity, the numerical value for the SQ is identified.

9.4 ANALYSIS OF UNCERTAINTIES

Evaluation of risk to ecological receptors is typically associated with several areas of uncertainty. In the absence of data, assumptions must be made regarding exposure concentrations and responses of ecological receptors to chemical stressors. To avoid incorrectly dismissing the potential of risk, exposure concentrations and other assumptions are biased toward identifying risk. As a result of this bias, it can be concluded with a high level of certainty that chemical constituents with SQs below or equal to one do not pose risk to ecological receptors. However, a SQ greater than one does not necessarily demonstrate that risk exists; only that further evaluation is required.

Because this is a screening-level assessment, uncertainty is strongly biased toward the side of conservatism. The maximum concentrations were compared to conservative ESVs, which are generally no-effects concentrations rather than concentrations at which ecologically significant effects are observed. Maximum concentrations overestimate exposure for upper trophic level receptors, which

forage over some defined area rather than forage at the single point of maximum concentration. Bioavailability of all chemical constituents to all ecological receptors was assumed to be 100 percent. The actual bioavailability of the chemical constituents in assessment area is likely less.

Some constituents were identified as COPECs because the LODs for all samples or 80 percent of more of the samples exceed their ESVs. For these constituents, it is uncertain if the constituents are present at concentrations that pose risk to ecological receptors.

Some constituents were not detected and do not have ESVs. Constituents in this group were not carried forward as COPECs. The absence of an ESV was assumed to indicate that these constituents do not have ESVs because they are not significant drivers for risk to ecological receptors.

9.5 ADDITIONAL EVALUATION RECOMMENDATIONS

The next step in the ERA process is refinement of the constituents identified in the screening steps as COPECs. The refinement of COPECs is Step 3a of the U.S. EPA 8-step process. The 42 constituents identified as COPECs are evaluated further and refined based on several Site-specific factors, including alternative ecological benchmarks, reasonable maximum exposure (RME) scenarios, and historical use and generation. Whereas the screening process considered only the most sensitive receptor group, the refinement process will evaluate risk to terrestrial plants, soil invertebrates, avian receptors, and mammalian receptors. Ecological benchmarks specific to these four receptor groups are available for many of the constituents identified as COPECs. For metals, background concentrations specific to Michigan will be considered. Only those benchmarks above natural background concentrations will be used in the refinement process. Additionally, based on the anticipated future redevelopment of the individual areas across the Site and evaluated herein, the effects of redevelopment activities on the relevance and completeness exposure pathways will also be considered.

10.0 SUMMARY AND CONCLUSIONS

10.1 SUMMARY

10.1.1 NATURE AND EXTENT OF CONTAMINATION

10.1.1.1 SITE-WIDE HISTORICAL FILL MATERIAL (PORTIONS OF ALL REDEVELOPMENT AREAS)

Based on the review of available information and observations during the subsurface RI activities, fill materials of various compositions (i.e., various soil types, brick, concrete, coal, fly ash, etc.) have been utilized in numerous areas of the Site. A number of metals have been identified in exceedance of the Part 201 Residential and Non-Residential Cleanup Criteria in both soil and groundwater, which can be potentially attributed to the fill material. Additionally, a number of locations also exceed the Michigan SDBLs, as well as the Allegan County-specific values for a variety of metals provided on the United States Geological Survey (USGS) website. Based on observations during the RI activities, it appears that the majority of the exceedances in soil are located within or immediately below areas of various fill materials.

In general, the majority of the metals exceedances are limited to Part 201 Residential and/or Non-Residential DWPC and GSIPC in soil, and Part 201 Residential and/or Non-Residential DWC and GSIC in groundwater. Based on the results of the SPLP analysis, manganese, mercury, silver, copper, arsenic, selenium, and chromium, were identified to have the potential to leach at concentrations that exceed either the Part 201 DWC and/or GSIC.

Additional exceedances in various locations across the Site to the Part 201 Residential and/or Non-Residential DCC were noted for lead and arsenic in soil, with the predominant metal being arsenic. Arsenic and manganese were identified at one location each above the Part 201 Residential PSIC. Manganese was also identified above the Part 201 Non-Residential PSIC in three locations.

Arsenic is present at varying concentrations throughout the majority of the Site. A total of 574 data points exist for arsenic, of which 234 exceed the Part 201 Generic Residential Direct Contact Criterion for arsenic, with 15 of those exceedances also exceeding the Part 201 Generic Non-Residential Direct Contact Criterion for arsenic. The only other exceedance of Part 201 soil criteria, which is not related to protection of groundwater, is one sample exceeding the Part 201

Generic Residential Particulate Soil Inhalation Criterion. Previous experience with determination of site-specific background concentrations for arsenic suggests that the background concentration can vary significantly from site to site, but very rarely is higher than the high teens in milligrams per kilogram (i.e., values of background arsenic concentration higher than 17 or 18 mg/kg are very rare). No information is available to suggest that the background concentration for arsenic would be in this high a range for this Site (e.g., data from less developed portions of the Site data from background calculations at nearby sites). Hypothetically speaking, if the concentration of arsenic was as high as 17 or 18 mg/kg, a significant number of exceedances of background concentrations would be present at the Site. Therefore, even if a site-specific background concentration for arsenic was determined, there would still be wide spread exceedances of arsenic at the Site, including but not limited to the exceedances of the Part 201 Generic Non-Residential Direct Contact Criterion and the Residential Particulate Soil Inhalation Criterion.

Lead is present at a limited number of locations across the Site above Part 201 Generic Residential and Non-Residential Direct Contact Criteria and is likely not due to background conditions (i.e., the concentrations of significantly higher than anticipated site-specific background concentrations). These exceedances would therefore be retained for considerations of remedial activities in the Feasibility Study (FS) regardless of site-specific background concentrations are determined. Similarly, manganese is present above the non-groundwater protection cleanup criteria in three locations as a particulate inhalation issue and is not indicative of a background situation. These concentration are also sufficiently high that they would not likely be eliminated from further consideration in the FS regardless of site-specific background concentrations are determined.

The remaining soil exceedances of Part 201 Cleanup Criteria at the Site relate to groundwater protection criteria (i.e., either soil criteria protective of drinking water or soil criteria protective of the groundwater surface water interface). Although site-specific background calculations would likely have some benefit to reducing the number of parameters or locations that require further consideration in the FS, these issues would not be completely eliminated.

Additionally, even if there was a significant benefit to determining site-specific background concentrations of metals in soil, collection of representative background soil samples would be extremely challenging to complete at the Site or off-Site in proximity to the Site due to historical operations conducted on-Site

and in the area. For example, arsenic, a known historical agricultural chemical, is one of the primary metals of concern identified above the Part 201 Generic Residential and Non-Residential Cleanup Criteria throughout the Site. Representative sample collection in a historical agricultural setting in the vicinity of the Site would present an issue.

With respect to groundwater, determination of representative background concentrations of metals would also be a challenge and would add limited value to the decision making process for this Site. Given the influence of the Mill Race and the Kalamazoo River on the groundwater flow patterns at the Site, it would be challenging to determine a suitable number of upgradient monitoring locations which could be used to establish background concentrations of metals in groundwater.

10.1.1.2 FORMER WASTEWATER TREATMENT AREA (RESIDENTIAL AREAS 1 THROUGH 4 AND MIXED RESIDENTIAL/COMMERCIAL AREA 2)

Based on the results summarized in Section 5.4.1.1, various VOCs, SVOCs, metals, and inorganics are present in soil above the Part 201 Residential and/or Non-Residential DWPC. Additionally, various VOCs, SVOCs, metals, and inorganics are present in soil above the Part 201 GSIPC. SPLP results for soil samples indicate that some metals have the potential to leach at concentrations in exceedance of the Part 201 GSIC. Numerous exceedances of the Part 201 Residential DCC for arsenic are present across this area, which appear to be related to historical placement of fill material, as discussed above. This includes both the areas known to have been utilized as historical lagoons, and the surrounding areas to the north (along the Kalamazoo River) and to the east (former aeration basin and secondary clarifier areas) in Residential Areas 1 through 3 and Waterfront Plaza, as well as the former primary clarifier in Residential Area 4 and Mixed Residential/Commercial Area 2. Based on a correlation of observed paper residuals and various fill materials in this area to the exceedances of VOCs and SVOCs identified in soil above the Part 201 Cleanup Criteria, it appears that the exceedances of the phenolic compounds are associated with noted paper residuals, with the remainder associated with various sandy fill materials.

10.1.1.3 FORMER SUBSTATION/AREA NORTH OF MILL BUILDING (COMMERCIAL AREA 4)

A former substation, that was owned and operated by Consumers Energy, was historically present to the north of Buildings 11 and 11A. Subsequent to the off-Site ERA and evidence of impacts to the north of the former substation, an investigation was conducted as part of the RI to evaluate potential issues in this area. Oily soils were observed in this area during the installation of test pits (see Section 5.2.1.2), with detections of TPH-DRO as high as 3,300 ppm (there is no Part 201 Cleanup Criteria for TPH). Various PAHs, tetrachloroethene, methylene chloride, trichloroethene, and 1,1,1-trichloroethene have been detected in soil samples in this area, along with various metals, at concentrations above the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and Residential DCC. Historical information indicates that Building 11 was constructed in 1906 and was used for storage and maintenance activities, and Building 11A was constructed in 1940 and was used for maintenance activities, which may have included the use and storage of solvents and/or petroleum products utilized during routine maintenance activities.

10.1.1.4 NON-SPECIFIC HISTORICAL OPERATIONAL IMPACTS (RESIDENTIAL AREA 3, WATERFRONT PLAZA, MIXED RESIDENTIAL/COMMERCIAL AREAS 1 AND 2, AND COMMERCIAL AREAS 2, 3 AND 4)

The non-specific historical operational impacts include the MW-16 area, the Mill Buildings (except Buildings 11 and 11A, as discussed above), one former water tower, one current water tower (Mixed Residential/Commercial Area 2 and Commercial Areas 3 and 4), the former Sludge Dewatering and former Quality Products Buildings (Residential Area 3, Waterfront Plaza, and Commercial Area 2), and former Specialty Minerals Building (Mixed Residential/Commercial Area 1 and Commercial Area 2). Suspected areas relating to general historical operations within the aforementioned structures were also considered as potential source areas. Specifically related to the Mill Buildings in Mixed Residential/Commercial Area 2 and Commercial Areas 3 and 4, additional potential areas where multiple sample locations indicated exceedances of similar organic constituents included the Train Shed, Building 6A, the parking lot east of Buildings 9F and 9E, Building 7, former Buildings 3A and 28, and former Buildings 9C and 9A. Additionally, during redevelopment activities conducted

at the former Sludge Dewatering Building, two small below grade structures in series were encountered.

During the 2010 RI field activities, PCBs were identified in a soil sample from MW-16 above the Part 201 Residential DCC. Based on the identified detection and redevelopment activities that were proposed in this area, further evaluation was completed in 2012 to delineate the extent of PCB impacts in soil in the vicinity of MW-16.

Various PAHs, PCBs, benzene, ethylbenzene, toluene, tetrachloroethene, methylene chloride, trichloroethene, and 1,1,1-trichloroethene have been detected in soil samples in these areas, along with various metals, at concentrations above the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and DCC.

10.1.1.5 NON-SPECIFIC SUPPORT OPERATIONAL AREA IMPACTS (RESIDENTIAL AREA 4, MIXED RESIDENTIAL/COMMERCIAL AREA 1, WATERFRONT PLAZA, AND COMMERCIAL AREA 3)

The non-specific support operations include the areas defined by Residential Area 4, Waterfront Plaza, a portion of Mixed Residential/Commercial Area 1, and a portion of Commercial Area 3, which are primarily located on the northern portion of this area, along the Kalamazoo River, and may be related to historical filling activities in this area.

Various PAHs, benzene, ethylbenzene, toluene, methylene chloride, and xylenes, have been detected in soil samples in these areas, along with various metals, at concentrations above the Part 201 Residential and/or Non-Residential DWPC and GSIPC. Additionally, PAHs and PCBs were detected in soil above the Residential DCC.

10.1.1.6 FORMER COAL STORAGE PILE AREA (RESIDENTIAL AREA 4)

The impacts to soil in this area include exceedances of the Part 201 Generic Cleanup Criteria for the listed constituents, which include inorganics discussed above as being associated with fill materials. However, several of these inorganics could also be the result of storage and handling practices associated with coal in this area, in conjunction with impacts from other fill materials in this

area; although, insufficient data is available to differentiate the source of the impacts.

Various PAHs, benzene, ethylbenzene, toluene, and xylenes, have been detected in soil samples in these areas, along with various metals, at concentrations above the Part 201 Residential and/or Non-Residential DWPC and GSIPC. Additionally, arsenic and lead were detected in soil above the Residential DCC, and lead and PCBs were detected above the Non-Residential DCC. Benzene was detected above the Part 201 Residential SVIAC in one location.

10.1.1.7 FORMER NO. 6 FUEL OIL AST AREA (MIXED RESIDENTIAL/COMMERCIAL AREA 2)

This area includes the former 200,000-gallon No. 6 fuel oil AST and a portion of the below grade process piping distribution system. Historical fuel oil releases to the ground surface in this area have been documented. The historical operation of railroad tracks and below grade product delivery systems also occurred in this area. During redevelopment activities, product was observed in the below grade piping in the former No. 6 fuel oil AST area to the former power house area. Product observed in the lines was containerized at the point where the piping formerly entered the AST area structures, and was characterized and disposed off Site during the redevelopment activities. No below grade evaluation of the piping line was completed during the redevelopment activities.

Various PAHs, tetrachloroethene, methylene chloride, benzene, and ethylbenzene, have been detected in soil samples in these areas, along with various metals, at concentrations above the Part 201 Residential and/or Non-Residential DWPC and GSIPC. Additionally, arsenic, benzo(a)pyrene and dibenzo(a,h)anthracene were detected in soil above the Residential DCC.

10.1.1.8 COAL TUNNEL AREA (MIXED RESIDENTIAL/COMMERCIAL AREA 2)

Various VOCs, SVOCs, and metals are present in soil above Part 201 DWPC and/or GSIPC in the area of the coal tunnel. In addition, manganese was detected in groundwater above the Part 201 DWC and mercury was detected in groundwater above the Part 201 GSIC. Review of SPLP data for cobalt, manganese, mercury, selenium, and/or silver did not indicate an exceedance of

the Part 201 GSIC for the leachate from soil samples collected. It should be noted that SPLP analysis was not conducted on all constituents that exceeded the Part 201 GSIPC. Benzo(a)pyrene, benzo(a)anthracene, dibenzo(a,h)anthracene, and arsenic are present in soil above Part 201 DCC. The benzo(a)pyrene, benzo(a)anthracene, and dibenzo(a,h)anthracene exceedances are associated with the soil sample from CTP-4, along the piping run for the No. 6 fuel oil AST, to the east of the coal tunnel, adjacent to the coal hopper/Building 5E. The arsenic exceedances are associated with soil samples from multiple locations.

Based on the results for the samples in the vicinity of the coal tunnel, it appears that soils have been impacted by historical operations conducted at the Site, which were not specifically related to the operation of the coal tunnel. Impacts have been identified associated with the former Fuel Oil No. 6 product delivery piping that traversed the coal tunnel in the direction of the boiler room and in areas historically known to have been used for the exterior storage of coal and fly ash. Visual observations of the accessible portions of the coal tunnel noted the presence of approximately 12 to 18 inches of liquid, described as a "heavy fuel oil with a layer of water over the top," was observed covering the bottom of the concrete floor of the tunnel. The thickness of the water was identified as approximately 1 to 2 inches, with the balance being the "heavy fuel oil." Due to the presence of the liquid, a visual evaluation of the condition of floor of the coal tunnel could not be conducted. Impacts to the soil immediately underlying the coal tunnel could not be determined; however, groundwater in the downgradient direction of the coal tunnel did not exhibit impacts from petroleum products and no free product was observed in the monitoring well (MW-2). Based on the January and February 2010 groundwater contours, the positions of MW-2 and MW-19 are not located immediately downgradient of the coal tunnel. Subsequently, an additional monitoring well (MW-22) was installed in August 2012 to further evaluate groundwater in this area. Observations and analytical results for groundwater samples collected in August 2012 were consistent with those for MW-2 and MW-19.

10.1.2 FATE AND TRANSPORT

Many factors control the partitioning of a chemical in the environment. An understanding of the general fate and transport characteristics of the constituents identified in media is important when predicting future theoretical exposure, linking sources with currently contaminated media, and identifying potentially

complete pathways to Site media. Therefore, the fate and transport analysis conducted at this stage of the exposure assessment is meant to identify media that are likely to receive Site-related chemicals identified above Part 201 Cleanup Criteria. The potential contaminant transport mechanisms at the Site are:

- Movement with wind
- Movement with surface water
- Movement during future Site re-use construction disturbance
- Movement of constituents leached from soil
- Movement with groundwater
- Movement of VOCs (from soil and groundwater) within subsurface gas

The exposure of soil at the surface may result in the transport of dust and VOCs by wind. As previously stated, cover material is present, but limited in some areas of the Site. The existing cover likely does not totally prevent upward migration of chemicals within vapors. The existing cover has also been found to contain detectable concentrations of chemicals. The presence of chemicals within the existing cover may contribute to chemical migration of VOCs or fugitive dust. VOCs in the air will be subject to dispersion by the wind and photolysis due to exposure to sunlight, thereby limiting their concentrations.

The exposure of soil at the surface may also result in the transport of dissolved or suspended contaminants along surface water drainage pathways. As discussed earlier, the potential for this to occur is limited because of the topography of the Site. Organic chemicals dissolved in surface water may be subject to adsorption, hydrolysis, or photolysis. VOCs may also volatilize during transport in surface water.

Construction activities may also result in disturbance of contaminants in the various media. Contaminants attached to soil particulates may become suspended in the air column and transported by wind. Additionally, contaminants may be moved from the subsurface to the ground surface during excavation and/or earthwork.

Movement of leached constituents is another potential contaminant transport mechanism. Leached constituents can be produced through infiltration of

precipitation into impacted surface soils. Once leached constituents have been produced, the following migration pathways are possible:

1. Leached constituents can be transferred to subsurface soil from percolation away from the surface soils. This transfer may occur through the process of mechanical filtration, precipitation, and/or sorption.
2. Leached constituents can percolate through the soil underlying and impact the underlying aquifer(s).
3. VOCs in leached material can migrate through the vadose zone via diffusion to ambient and/or indoor air.

Movement with groundwater is a potential transport mechanism. Once the chemicals have entered the groundwater, the following migration pathways are possible:

1. Lateral groundwater migration toward the Kalamazoo River.
2. Impacted groundwater can migrate vertically to deeper aquifers.
3. VOCs in groundwater can migrate through the vadose zone via diffusion to ambient and/or indoor air.

During groundwater transport, the contaminants released to the groundwater will be subject to dispersion, adsorption, volatilization, and biotic and abiotic degradation.

10.1.3 HUMAN HEALTH RISK ASSESSMENT

The tables below provide a summary of the results of the HHRA for each development area.

Residential Area 1

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	No	No	No	I.1.39.RME
	Disturbed	No	Yes Arsenic (S)	No	I.1.39.RME
Recreational User	Undisturbed	No	Yes Arsenic (SS)	No	I.1.40.RME
	Disturbed	No	Yes Arsenic (S)	No	I.1.40.RME
Resident	Undisturbed	Yes Arsenic (GW) Chromium VI (GW)	Yes Arsenic (SS) Arsenic (GW) Chromium VI (GW)	Yes Arsenic (GW) Iron (GW) Manganese (GW)	I.1.41.RME
	Disturbed	Yes Arsenic (GW) Chromium VI (GW)	Yes Pentachlorophenol (S) Arsenic (S) Bis(2-ethylhexyl)phthalate (GW) Arsenic (GW) Chromium VI (GW)	Yes Arsenic (GW) Iron (GW) Manganese (GW)	I.1.41.RME
Commercial Worker	Undisturbed	No	Yes Arsenic (SS)	No	I.1.42.RME
	Disturbed	No	Yes Arsenic (S)	No	I.1.42.RME
Utility Worker	Disturbed	No	Yes Arsenic (S)	No	I.1.43.RME
Construction Worker	Disturbed	No	No	No	I.1.44.RME

Notes:
SS = surface soil
S = surface and subsurface soil
GW = groundwater

(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.

(2) "Yes" means the cumulative risk was equal to or greater than 10-6 and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.

(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

As indicated in the table above, only the resident receptor had a cumulative HI above 1 for Residential Area 1. For segregated hazards, cumulative HIs were observed for skin discoloration (arsenic in soil and groundwater), effects on the central nervous system (manganese in soil and groundwater), and unknown effects (aluminum and iron in soil and groundwater, cobalt in soil, and vanadium in groundwater).

Residential Area 2

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	No	No	No	I.2.39.RME
	Disturbed	No	No	No	I.2.39.RME
Recreational User	Undisturbed	No	Yes Arsenic (SS)	No	I.2.40.RME
	Disturbed	No	Yes Arsenic (S)	No	I.2.40.RME
Resident	Undisturbed	Yes Benzene (S-IA) Arsenic (GW) Chromium VI (GW)	Yes Arsenic (SS) Benzene (S-IA) Arsenic (GW) Chromium VI (GW)	Yes Benzene (S-IA) Arsenic (GW) Iron (GW) Manganese (GW)	I.2.41.RME
	Disturbed	Yes Benzene (S-IA) Arsenic (GW) Chromium VI (GW)	Yes Arsenic (S) Benzene (S-IA) Bis(2-ethylhexyl)phthalate (GW) Arsenic (GW) Chromium VI (GW)	Yes Benzene (S-IA) Arsenic (GW) Iron (GW) Manganese (GW)	I.2.41.RME
Commercial Worker	Undisturbed	No	Yes Arsenic (SS) Benzene (S-IA)	No	I.2.42.RME
	Disturbed	No	Yes Arsenic (S) Benzene (S-IA)	No	I.2.42.RME
Utility Worker	Disturbed	No	Yes Arsenic (S)	No	I.2.43.RME
Construction Worker	Disturbed	No	No	No	I.2.44.RME

Notes:
SS = surface soil
S = surface and subsurface soil
GW = groundwater
S-IA = surface and subsurface soil to indoor air

(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.

(2) "Yes" means the cumulative risk was equal to or greater than 10^{-6} and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.

(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

As indicated in the table above, only the resident receptor had a cumulative HI above 1 for Residential Area 2. For segregated hazards, cumulative HIs were observed for effects on the blood system (benzene in soil), skin discoloration (arsenic in soil and groundwater), effects on the central nervous system (manganese in soil and groundwater), and unknown effects (aluminum and iron in soil and groundwater and vanadium in groundwater).

Residential Area 3

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	No	No	No	I.3.39.RME
	Disturbed	No	Yes Arsenic (SS)	No	I.3.39.RME
Recreational User	Undisturbed	No	Yes Arsenic (SS)	No	I.3.40.RME
	Disturbed	No	Yes Arsenic (S)	No	I.3.40.RME
Resident	Undisturbed	Yes Arsenic (GW) Chromium VI (GW)	Yes Arsenic (SS) Bis(2-ethylhexyl)phthalate (GW) Arsenic (GW) Chromium VI (GW)	Yes Arsenic (GW) Iron (GW) Manganese (GW)	I.3.41.RME
	Disturbed	Yes Arsenic (GW) Chromium VI (GW)	Yes Arsenic (S) Bis(2-ethylhexyl)phthalate (GW) Arsenic (GW) Chromium VI (GW)	Yes Arsenic (GW) Iron (GW) Manganese (GW)	I.3.41.RME
Commercial Worker	Undisturbed	No	Yes Arsenic (SS)	No	I.3.42.RME
	Disturbed	No	Yes Arsenic (S)	No	I.3.42.RME
Utility Worker	Disturbed	No	Yes Arsenic (S)	No	I.3.43.RME
Construction Worker	Disturbed	No	No	No	I.3.44.RME

Notes:
SS = surface soil
S = surface and subsurface soil
GW = groundwater

(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.

(2) "Yes" means the cumulative risk was equal to or greater than 10^{-6} and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.

(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

As indicated in the table above, only the resident receptor had a cumulative HI above 1 for Residential Area 3. For segregated hazards, cumulative HIs were observed for skin discoloration (arsenic in soil and groundwater), effects on the central nervous system (manganese in soil and groundwater and mercury in soil), and unknown effects (aluminum and iron in soil and groundwater, cobalt in soil, and vanadium in groundwater).

Residential Area 4

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	No	Yes Dibenz(a,h)anthracene (SS)	No	I.4.39.RME
	Disturbed	No	Yes Dibenz(a,h)anthracene (S) Arsenic (S) Total PCBs (S)	No	I.4.39.RME
Recreational User	Undisturbed	No	Yes Benzo(a)pyrene (SS) Dibenz(a,h)anthracene (SS) Arsenic (SS)	No	I.4.40.RME
	Disturbed	No	Yes Benzo(a)pyrene (S) Dibenz(a,h)anthracene (S) Arsenic (S) Total PCBs (S)	Yes Total PCBs (S)	I.4.40.RME
Resident	Undisturbed	Yes Benzene (S-IA) Arsenic (GW)	Yes Benzo(a)pyrene (SS) Dibenz(a,h)anthracene (SS) Arsenic (SS) Benzene (S-IA) Ethylbenzene (S-IA) Arsenic (GW)	Yes Benzene (S-IA) Xylene (S-IA) Mercury (S-IA) Arsenic (GW) Manganese (GW)	I.4.41.RME
	Disturbed	Yes Benzene (S-IA) Arsenic (GW)	Yes Benzo(a)pyrene (S) Dibenz(a,h)anthracene (S) Arsenic (S) Total PCBs (S) Benzene (S-IA) Ethylbenzene (S-IA) Arsenic (GW)	Yes Iron (S) Total PCBs (S) Benzene (S-IA) Xylene (S-IA) Mercury (S-IA) Arsenic (GW) Manganese (GW)	I.4.41.RME
Commercial Worker	Undisturbed	No	Yes Benzo(a)pyrene (SS) Dibenz(a,h)anthracene (SS) Arsenic (SS) Benzene (S-IA) Ethylbenzene (S-IA)	Yes Mercury (S-IA)	I.4.42.RME
	Disturbed	No	Yes Benzo(a)pyrene (S) Dibenz(a,h)anthracene (S) Arsenic (S) Total PCBs (S) Benzene (S-IA) Ethylbenzene (S-IA)	Yes Mercury (S-IA)	I.4.42.RME
Utility Worker	Disturbed	No	Yes Benzo(a)pyrene (S) Dibenz(a,h)anthracene (S) Arsenic (S) Total PCBs (S)	No	I.4.43.RME
Construction Worker	Disturbed	No	Yes No Individual COPCs	Yes No individual COPCs	I.4.44.RME

Notes:
SS = surface soil
S = surface and subsurface soil
GW = groundwater
S-IA = surface and subsurface soil to indoor air

(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.
(2) "Yes" means the cumulative risk was equal to or greater than 10^{-6} and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.
(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

As indicated in the table above, the recreational user, resident, commercial worker, and construction worker receptors had cumulative HIs above 1 for Residential Area 4. For the recreational user segregated hazards, a cumulative HI was observed for effects on the immune system (PCBs in soil). For the resident segregated hazards, cumulative HIs were observed for effects on the blood system (benzene in soil), effects on body weight (xylene in soil), skin discoloration (arsenic in soil and groundwater), effects on the central nervous system (manganese in soil and groundwater and mercury in soil), and unknown effects (aluminum and cobalt in soil and iron in soil and groundwater). For the commercial worker segregated hazards, a cumulative HI was observed for effects on the central nervous system (manganese and mercury in soil). There were no segregated hazards above 1 for the construction worker.

Waterfront Plaza

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	No	Yes Arsenic (SS)	No	I.5.33.RME
	Disturbed	No	Yes Arsenic (S)	No	I.5.33.RME
Recreational User	Undisturbed	No	Yes Arsenic (SS)	No	I.5.34.RME
	Disturbed	No	Yes Arsenic (S)	No	I.5.34.RME
Commercial Worker	Undisturbed	No	Yes Arsenic (SS)	No	I.5.35.RME
	Disturbed	No	Yes Arsenic (S)	No	I.5.35.RME
Utility Worker	Disturbed	No	Yes Arsenic (S)	No	I.5.36.RME
Construction Worker	Disturbed	No	No	No	I.5.37.RME

Notes:
SS = surface soil
S = surface and subsurface soil
(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.
(2) "Yes" means the cumulative risk was equal to or greater than 10^{-6} and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.
(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

Mixed Residential/Commercial Area 1

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	No	No	No	I.6.39.RME
	Disturbed	No	No	No	I.6.39.RME
Recreational User	Undisturbed	No	Yes Arsenic (SS)	No	I.6.40.RME
	Disturbed	No	Yes Arsenic (S)	No	I.6.40.RME
Resident	Undisturbed	Yes Arsenic (GW)	Yes Arsenic (SS) Tetrachloroethene (S-IA) Arsenic (GW)	Yes Arsenic (GW) Manganese (GW)	I.6.41.RME
	Disturbed	Yes Arsenic (GW)	Yes Arsenic (S) Tetrachloroethene (S-IA) Arsenic (GW)	Yes Arsenic (GW) Manganese (GW)	I.6.41.RME
Commercial Worker	Undisturbed	No	Yes Arsenic (SS)	No	I.6.42.RME
	Disturbed	No	Yes Arsenic (S)	No	I.6.42.RME
Utility Worker	Disturbed	No	Yes Arsenic (S)	No	I.6.43.RME
Construction Worker	Disturbed	No	No	No	I.6.44.RME

Notes:
SS = surface soil
S = surface and subsurface soil
GW = groundwater
S-IA = surface and subsurface soil to indoor air

(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.

(2) "Yes" means the cumulative risk was equal to or greater than 10^{-6} and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.

(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

As indicated in the table above, only the resident receptors had a cumulative HI above 1 for Mixed Residential/Commercial Area 1. For segregated hazards, a cumulative HI was observed for skin discoloration (arsenic in soil and groundwater) and effects on the central nervous system (manganese in soil and groundwater and tetrachloroethene in soil).

Mixed Residential/Commercial Area 2

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	No	Yes Arsenic (SS)	No	I.7.39.RME
	Disturbed	No	Yes Benzo(a)pyrene (S) Arsenic (S)	No	I.7.39.RME
Recreational User	Undisturbed	No	Yes Benzo(a)pyrene (SS) Dibenz(a,h)anthracene (SS) Arsenic (SS)	No	I.7.40.RME
	Disturbed	No	Yes Benzo(a)anthracene (S) Benzo(a)pyrene (S) Benzo(b)fluoranthene (S) Dibenz(a,h)anthracene (S) Arsenic (S)	Yes No Individual COPCs	I.7.40.RME
Resident	Undisturbed	Yes Arsenic (GW)	Yes Benzo(a)pyrene (SS) Dibenz(a,h)anthracene (SS) Arsenic (SS) Benzene (S-IA) Ethylbenzene (S-IA) Tetrachloroethene (S-IA) Arsenic (GW) Chromium VI (GW)	Yes Mercury (S-IA) Antimony (GW) Arsenic (GW) Cadmium (GW) Iron (GW) Manganese (GW)	I.7.41.RME
	Disturbed	Yes Arsenic (S) Arsenic (GW)	Yes Benzo(a)anthracene (S) Benzo(a)pyrene (S) Benzo(b)fluoranthene (S) Dibenz(a,h)anthracene (S) Arsenic (S) Benzene (S-IA) Ethylbenzene (S-IA) Tetrachloroethene (S-IA) Arsenic (GW) Chromium VI (GW)	Yes Arsenic (S) Thallium (S) Mercury (S-IA) Antimony (GW) Arsenic (GW) Cadmium (GW) Iron (GW) Manganese (GW)	I.7.41.RME
Commercial Worker	Undisturbed	No	Yes Benzo(a)pyrene (SS) Dibenz(a,h)anthracene (SS) Arsenic (SS) Benzene (S-IA) Ethylbenzene (S-IA)	Yes No Individual COPCs	I.7.42.RME
	Disturbed	No	Yes Benzo(a)anthracene (S) Benzo(a)pyrene (S) Benzo(b)fluoranthene (S) Dibenz(a,h)anthracene (S) Arsenic (S) Benzene (S-IA) Ethylbenzene (S-IA)	Yes No Individual COPCs	I.7.42.RME
Utility Worker	Disturbed	No	Yes Benzo(a)pyrene (S) Arsenic (S)	No	I.7.43.RME
Construction Worker	Disturbed	No	Yes Arsenic (S)	Yes No individual COPCs	I.7.44.RME

Notes:
SS = surface soil
S = surface and subsurface soil

GW = groundwater
S-IA = surface and subsurface soil to indoor air
(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.
(2) "Yes" means the cumulative risk was equal to or greater than 10^{-6} and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.
(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

As indicated in the table above, the recreational user, resident, commercial worker, and construction worker receptors had cumulative HIs above 1 for Mixed Residential/Commercial Area 2. For the resident segregated hazards, cumulative HIs were observed for mortality (antimony in soil and groundwater), skin discoloration (arsenic in soil and groundwater), effects on the central nervous system (manganese in soil and groundwater and mercury and tetrachloroethene in soil), alopecia (thallium in soil), proteinuria (cadmium in groundwater), and unknown effects (aluminum, iron, and vanadium in soil and groundwater and cobalt in soil). There were no segregated hazards above 1 for the recreational user, commercial worker, and construction worker.

Commercial Area 1

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	No	No	No	I.8.24.RME
	Disturbed	No	No	No	I.8.24.RME
Commercial Worker	Undisturbed	No	No	No	I.8.25.RME
	Disturbed	No	Yes Arsenic (S)	No	I.8.25.RME
Utility Worker	Disturbed	No	Yes Arsenic (S)	No	I.8.26.RME
Construction Worker	Disturbed	No	No	No	I.8.27.RME

Notes:
S = surface and subsurface soil
(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.
(2) "Yes" means the cumulative risk was equal to or greater than 10^{-6} and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.
(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

Commercial Area 2

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	NA	NA	NA	NA
	Disturbed	No	Yes Arsenic (S)	No	I.9.29.RME
Commercial	Undisturbed	NA	NA	NA	NA

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Worker	Disturbed	No	Yes Arsenic (S)	No	I.9.30.RME
Utility Worker	Disturbed	No	Yes Arsenic (S)	No	I.9.31.RME
Construction Worker	Disturbed	No	No	No	I.9.32.RME

Notes:
NA, not applicable as there were no COPCs identified for surface soil (undisturbed scenario)
S = surface and subsurface soil
(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.
(2) "Yes" means the cumulative risk was equal to or greater than 10^{-6} and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.
(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

Commercial Area 3

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	NA	NA	NA	NA
	Disturbed	No	No	No	I.10.29.RME
Commercial Worker	Undisturbed	NA	NA	NA	NA
	Disturbed	No	Yes Arsenic (S) Benzene (S-IA)	Yes Mercury (S-IA)	I.10.30.RME
Utility Worker	Disturbed	No	Yes Arsenic (S)	No	I.10.31.RME
Construction Worker	Disturbed	No	No	No	I.10.32.RME

Notes:
NA, not applicable as there were no COPCs identified for surface soil (undisturbed scenario)
S = surface and subsurface soil
S-IA = surface and subsurface soil to indoor air
(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.
(2) "Yes" means the cumulative risk was equal to or greater than 10^{-6} and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.
(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

As indicated in the table above, only the commercial worker receptors had a cumulative HI above 1 for Commercial Area 3. For segregated hazards, a cumulative HI was observed for effects on the central nervous system (manganese in soil and mercury in soil and groundwater).

Commercial Area 4

Area	*Exposure*	*Risk ≥ 10^{-4}* (1)	*Risk ≥ 10^{-6}* (2)	*Hazard > 1* (3)	*Table Reference*
Trespasser	Undisturbed	No	Yes Arsenic (SS)	No	I.11.33.RME
	Disturbed	No	Yes Arsenic (S) Total PCBs (S)	No	I.11.33.RME
Recreational User	Undisturbed	No	Yes Arsenic (SS)	No	I.11.34.RME
	Disturbed	No	Yes Arsenic (S) Total PCBs (S)	Yes No Individual COPCs	I.11.34.RME
Commercial Worker	Undisturbed	No	Yes Arsenic (SS) Benzene (S-IA) Tetrachloroethene (S-IA)	Yes No Individual COPCs	I.11.35.RME
	Disturbed	No	Yes Arsenic (S) Total PCBs (S) Benzene (S-IA) Tetrachloroethene (S-IA)	Yes No Individual COPCs	I.11.35.RME
Utility Worker	Disturbed	No	Yes Arsenic (S)	No	I.11.36.RME
Construction Worker	Disturbed	No	No	Yes No Individual COPCs	I.11.37.RME

Notes:
SS = surface soil
S = surface and subsurface soil
S-IA = surface and subsurface soil to indoor air
(1) "Yes" means the cumulative risk was equal to or greater than 10^{-4} and "No" means that the cumulative risk was less than 10^{-4}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-4}.
(2) "Yes" means the cumulative risk was equal to or greater than 10^{-6} and "No" means that the cumulative risk was less than 10^{-6}. Contributing COPCs are presented if they have a calculated risk equal to or greater than 10^{-6}.
(3) "Yes" means the cumulative hazard was greater than 1 and "No" means that the cumulative hazard was less than 1. The COPCs are presented if they have a calculated hazard greater than 1.

As indicated in the above table, recreational user, commercial worker, and construction worker receptors had cumulative HIs above 1 for Commercial Area 4. However, there were no segregated hazards above 1.

It should be noted that many of the COPCs that contributed the most to cumulative risk/hazard were metals in soil, primarily arsenic, cobalt, copper, manganese, mercury, and thallium. Based on comparison to the MDEQ Statewide Background Levels, a significant number of the soil samples collected at the Site had metal concentrations below the background levels, and therefore only a small portion of the soils at the Site may actually result in risks/hazards greater than acceptable levels and above risks/hazards that can be attributed to background.

10.1.4 ECOLOGICAL RISK ASSESSMENT

The SLERA identified a number of constituents as COPECs for all 11 redevelopment areas. A constituent was identified as a COPEC if:

1. The maximum concentration exceeded its ESV.
2. The maximum concentration was below its ESV, it is a BCOC, and the ESV does not consider bioaccumulation.
3. The constituent was detected but does not have an ESV.
4. The constituent was not detected but greater than 80 percent of the samples had LODs greater their ESVs.

Residential Area 1

Twenty-one constituents or constituent groups (e.g., PAHs, PCBs) were identified as COPECs. One SVOC (bis(2-ethylhexyl)phthalate), HMW PAHs, total PCBs, and nine metals (cadmium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) were identified as COPECs based on SQs greater than unity. One VOC (isopropylbenzene) and two SVOCs (carbazole and dibenzofuran) were identified as COPECs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and four SVOCs (2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation.

Habitat for ecological receptors is currently present in this redevelopment area. Under the current redevelopment plan, a portion of the existing habitat is likely to remain, particularly the area adjacent to the Kalamazoo River. The Step 3a refinement process will address those areas most likely to provide habitat for ecological receptors.

Residential Area 2

Sixteen constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. HMW PAHs, total PCBs, and seven metals (copper, iron, lead,

manganese, selenium, vanadium, and zinc) were identified as COPECs based on SQs greater than unity. One VOC (1,2-dibromo-3-chloropropane and four SVOCs (2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Mercury and nickel were identified as COPECs because they are BCOCs and their ESVs do not consider bioaccumulation.

Habitat for ecological receptors is currently present in this redevelopment area. Under the current redevelopment plan, a portion of the existing habitat is likely to remain, particularly the area adjacent to the Kalamazoo River. The Step 3a refinement process will address those areas most likely to provide habitat for ecological receptors.

Residential Area 3

Twenty-one constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. HMW PAHs, total PCBs, and 11 metals (antimony, arsenic, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) were identified as COPECs based on SQs greater than unity. Two SVOCs (carbazole and dibenzofuran) were identified as COEPCs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and four SVOCs (2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation.

Habitat for ecological receptors is currently present in this redevelopment area. Under the current redevelopment plan, a portion of the existing habitat is likely to remain, particularly the area adjacent to the Kalamazoo River. The Step 3a refinement process will address those areas most likely to provide habitat for ecological receptors.

Residential Area 4

Thirty-one constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. One VOC (acetone), four BTEX constituents (benzene, toluene, o-xylene, and m&p-xylene), HMW PAHs, total PCBs, 12 metals (antimony,

arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) and cyanide were identified as COPECs based on SQs greater than unity. One VOC (isopropylbenzene) and two SVOCs (carbazole and dibenzofuran) were identified as COPECs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and six SVOCs (2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation.

Habitat for ecological receptors is currently present in this redevelopment area. Under the current redevelopment plan, a portion of the existing habitat is likely to remain, particularly the area adjacent to the Kalamazoo River. The Step 3a refinement process will address those areas most likely to provide habitat for ecological receptors.

Waterfront Plaza

Iron was identified as COPEC based on a SQ greater than unity. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation. The evaluation for this area is based on a single sample. Habitat for ecological receptors is currently present in this redevelopment area. Due to complete redevelopment of this area, the Step 3a refinement process will not address this redevelopment area.

Mixed Residential/Commercial Area 1

Nineteen constituents or constituent groups (e.g., PAHs) were identified as COEPCs. HMW PAHs and 10 metals (arsenic, cadmium, cobalt, iron, lead, manganese, mercury, selenium, vanadium, and zinc) were identified as COPECs based on SQs greater than unity. One SVOC (carbazole) was identified as a COEPC because it was detected, but does not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and five SVOCs (2,4-dimethylphenol, 2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation.

The majority of this redevelopment area is currently covered by buildings and parking lots. Those areas of vegetative cover that are present are small and isolated with limited value as habitat for ecological receptors. Due to complete redevelopment of this area, the Step 3a refinement process will not address this redevelopment area.

Mixed Residential/Commercial Area 2

Forty constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. One VOC (acetone), four BTEX constituents (benzene, toluene, o-xylene, and m&p-xylene), LMW PAHs, HMW PAHs, total PCBs, 15 metals (antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, vanadium, and zinc) and cyanide were identified as COPECs based on SQs greater than unity. Eight VOCs (1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 2-phenylbutane, cymene, isopropylbenzene, n-butybenzene, n-propylbenzene, and tetrahydrofuran,) and two SVOCs (carbazole and dibenzofuran) were identified as COPECs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and five SVOCs (2,4-dimethylphenol, 2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs.

Habitat for ecological receptors is currently present in this redevelopment area. Under the current redevelopment plan, a portion of the existing habitat is likely to remain, particularly the area adjacent to the Kalamazoo River. The Step 3a refinement process will address those areas most likely to provide habitat for ecological receptors.

Commercial Area 1

Nineteen constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. HMW PAHs, total PCBs, and eight metals (copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) were identified as COPECs based on SQs greater than unity. Two SVOCs (carbazole and dibenzofuran) was identified as COEPCs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and five SVOCs (2,4-dimethylphenol, 2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and

hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation.

Habitat for ecological receptors is currently present in this redevelopment area. This redevelopment area does not abut the Kalamazoo River. Under the current redevelopment plan, a portion of the existing habitat is likely to remain. The Step 3a refinement process will address those areas most likely to provide habitat for ecological receptors.

Commercial Area 2

Nineteen constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. HMW PAHs, total PCBs, and nine metals (arsenic, cadmium, iron, lead, manganese, mercury, selenium, vanadium, and zinc), and cyanide were identified as COPECs based on SQs greater than unity. One VOC (1,2-dibromo-3-chloropropane) and five SVOCs (2,4-dimethylphenol, 4,6-dinitro-2-methylphenol, 2-chlorophenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation.

Habitat for ecological receptors is currently present in this redevelopment area. This redevelopment area does not abut the Kalamazoo River. Under the current redevelopment plan, a small portion of the existing habitat is likely to remain. The Step 3a refinement process will address those areas most likely to provide habitat for ecological receptors.

Commercial Area 3

Nineteen constituents or constituent groups (e.g., PAHs) were identified as COEPCs. HMW PAHs, and nine metals (antimony, cadmium, iron, lead, manganese, mercury, selenium, vanadium, and zinc), and cyanide were identified as COPECs based on SQs greater than unity. One VOC (isopropylbenzene) and one SVOC (dibenzofuran) were identified as COPECs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and four SVOCs (2-chlorophenol,

4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation.

The majority of this redevelopment area is currently covered by buildings and parking lots. Those areas of vegetative cover that are present are small and isolated with limited value as habitat for ecological receptors. Due to complete redevelopment of this area, the Step 3a refinement process will not address this redevelopment area.

Commercial Area 4

Twenty-seven constituents or constituent groups (e.g., PAHs, PCBs) were identified as COEPCs. One BTEX constituent (benzene), HMW PAHs, total PCBs, 13 metals (antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, vanadium, and zinc) and cyanide were identified as COPECs based on SQs greater than unity. One VOC (isopropylbenzene) and two SVOCs (carbazole and dibenzofuran) were identified as COPECs because they were detected, but do not have an ESV. One VOC (1,2-dibromo-3-chloropropane) and five SVOCs (2,4-dimethylphenol, 2-chlorophenol, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and hexachlorobutadiene) were identified as COPECs because they were not detected, but the LODs for less than 20 percent of the samples exceed their ESVs. Nickel was identified as a COPEC because it is a BCOC and the ESV does not consider bioaccumulation.

Habitat for ecological receptors is currently present in this redevelopment area. Under the current redevelopment plan, the portion of the existing habitat adjacent to the Kalamazoo River and mill run will likely remain relatively undisturbed. The Step 3a refinement process will address those areas most likely to provide habitat for ecological receptors.

In Step 3a of the U.S. EPA 8-step process the constituents identified as COPECs will be further evaluated and refined based on several site-specific factors, including RME concentrations rather than maximum concentrations, alternative ecological benchmarks for specific receptor groups (soil invertebrates, terrestrial plants, birds, and mammals), and historical use and generation. For metals, background concentrations will also be considered. For BCOCs, food chain

models will be used to evaluate the potential for risk to upper trophic level receptors.

10.2 CONCLUSIONS

10.2.1 SOIL

Residential Area 1

VOCs, SVOCs, metals and cyanide (total) were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and/or DCC in Residential Area 1.

The HHRA target risk and hazard level exceedances for Residential Area 1 soil are summarized as follows:

- The calculated cancer risks and hazards for the trespasser, recreational user, resident, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic and pentachlorophenol were the major contributors), and below the target hazard of 1.

Residential Area 2

VOCs, SVOCs, and metals were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and/or DCC in Residential Area 2.

The HHRA target risk and hazard level exceedances for Residential Area 2 soil are summarized as follows:

- The calculated cancer risks and hazards for the recreational user, resident, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard of 1.

- The calculated cancer risk and hazard for the resident inhalation of indoor air (from soil) was above the target risk levels of 1×10^{-4} and 1×10^{-6}, and above the target hazard of 1, with benzene the major contributor to cumulative risk and hazard.
- The calculated cancer risk and hazard for the commercial worker inhalation of indoor air (from soil) was below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (benzene was the major contributor), and below the target hazard of 1.

Residential Area 3

VOCs, SVOCs, metals, and cyanide (total) were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and/or DCC in Residential Area 3.

The HHRA target risk and hazard level exceedances for Residential Area 3 soil are summarized as follows:

- The calculated cancer risks and hazards for the trespasser, recreational user, resident, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard of 1.

Residential Area 4

VOCs, SVOCs, PCBs, metals, cyanide (total), and phosphorus were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, DCC, and/or SVIAC in Residential Area 4.

The HHRA target risk and hazard level exceedances for Residential Area 4 soil are summarized as follows:

- The calculated cancer risks for the trespasser, recreational user, resident, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4} and at or above the target risk level of 1×10^{-6} (benzo(a)pyrene, dibenz(a,h)anthracene, arsenic, and total PCBs were the major contributors). In addition, the calculated hazard for the recreational

user and resident direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil was above the target hazard of 1, with total PCBs the major contributor to cumulative hazard.

- The calculated cancer risk and hazard for the resident inhalation of indoor air (from soil) was above the target risk levels of 1×10^{-4} (benzene was the major contributor) and 1×10^{-6} (benzene and ethylbenzene were the major contributors), and above the target hazard of 1 (benzene, xylene, mercury were the major contributors).
- The calculated cancer risk and hazard for the commercial worker inhalation of indoor air (from soil) was below the target risk levels of 1×10^{-4} (benzene was the major contributor), at or above the target risk level of 1×10^{-6} (benzene and ethylbenzene were the major contributors), and above the target hazard of 1 (mercury was the major contributor).

Waterfront Plaza

Metals were detected in the soil sample in exceedance of the Part 201 Residential and/or Non-Residential DWPC and/or GSIPC in Waterfront Plaza.

The HHRA target risk and hazard level exceedances for Waterfront Plaza soil are summarized as follows:

- The calculated cancer risks and hazards for the trespasser, recreational user, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard of 1.

Mixed Residential/Commercial Area 1

VOCs, metals and cyanide (total) were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, PSIC, and/or DCC in Mixed Residential/Commercial Area 1.

The HHRA target risk and hazard level exceedances for Mixed Residential/Commercial Area 1 soil are summarized as follows:

- The calculated cancer risks and hazards for the recreational user, resident, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard of 1.
- The calculated cancer risk and hazard for the resident inhalation of indoor air (from soil) was below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (tetrachloroethene was the major contributor), and below the target hazard of 1.

Mixed Residential/Commercial Area 2

VOCs, SVOCs, metals, cyanide (total), nitrate, and phosphorus were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, PSIC, and/or DCC in Mixed Residential/Commercial Area 2.

The HHRA target risk and hazard level exceedances for Mixed Residential/Commercial Area 2 soil are summarized as follows:

- The calculated cancer risks and hazards for the trespasser, recreational user, resident, commercial worker, utility worker, and construction worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were above the target risk level of 1×10^{-4} (resident only; arsenic was the major contributor), at or above the target risk level of 1×10^{-6} (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and arsenic were the major contributors), and above the target hazard level of 1 (resident only; arsenic and thallium were the major contributors).
- The calculated cancer risk and hazard for the resident inhalation of indoor air (from soil) was below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (benzene, ethylbenzene, and tetrachloroethene were the major contributors), and above the target hazard of 1 (mercury was the major contributor).
- The calculated cancer risk and hazard for the commercial worker inhalation of indoor air (from soil) was below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (benzene and ethylbenzene were the major contributors), and below the target hazard of 1.

Commercial Area 1

VOCs and metals were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, PSIC, and/or DCC in Commercial Area 1.

The HHRA target risk and hazard level exceedances for Commercial Area 1 soil are summarized as follows:

- The calculated cancer risks for the commercial worker and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard level of 1.

Commercial Area 2

VOCs, metals and cyanide (total) were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and/or DCC in Commercial Area 2.

The HHRA target risk and hazard level exceedances for Commercial Area 2 soil are summarized as follows:

- The calculated cancer risks for the trespasser, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard level of 1.

Commercial Area 3

VOCs, metals and cyanide (total) were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, and/or DCC in Commercial Area 3.

The HHRA target risk and hazard level exceedances for Commercial Area 3 soil are summarized as follows:

- The calculated cancer risks and hazards for the commercial worker and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic was the major contributor), and below the target hazard level of 1.
- The calculated cancer risk and hazard for the commercial worker inhalation of indoor air (from soil) was below the target risk levels of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (benzene was the major contributor), and above the target hazard of 1 (mercury was the major contributor).

Commercial Area 4

VOCs, SVOCs, PCBs (total), metals, cyanide (total), nitrate, and phosphorus were detected in soil samples in exceedance of the Part 201 Residential and/or Non-Residential DWPC, GSIPC, PSIC, and/or DCC in Commercial Area 4.

The HHRA target risk and hazard level exceedances for Commercial Area 4 soil are summarized as follows:

- The calculated cancer risks and hazards for the trespasser, recreational user, commercial worker, and utility worker direct contact (incidental ingestion, dermal contact, and ambient air inhalation) with soil were below the target risk level of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (arsenic and total PCBs were the major contributors), and below the target hazard level of 1.
- The calculated cancer risk and hazard for the commercial worker inhalation of indoor air (from soil) was below the target risk levels of 1×10^{-4}, at or above the target risk level of 1×10^{-6} (benzene and tetrachloroethene were the major contributors), and below the target hazard of 1.

10.2.2 GROUNDWATER

Metals are present at various locations across the Site in exceedance of the Part 201 Residential and/or Non-Residential DWC and GSIC. Additionally, bis(2-ethylhexyl)phthalate was detected in a VAS water sample at a concentration above the Part 201 Residential and/or Non-Residential DWC. It should be noted that benzo(g,h,i)perylene was detected in a water sample at a concentration above the water solubility criteria; however, this sample was

collected in 1997 and subsequent samples in the area did not identify the presence of this constituent above criteria.

Residential Area 1

Metals are present in Residential Area 1 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC. Additionally, bis(2-ethylhexyl)phthalate was detected in a VAS water sample at a concentration above the Part 201 Residential and/or Non-Residential DWC in Residential Area 1.

The HHRA target risk and hazard level exceedances for Residential Area 1 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} and 1×10^{-6} (arsenic and hexavalent chromium were the major contributors), and above the target hazard level of 1 (arsenic, iron, and manganese were the major contributors).

Residential Area 2

Metals are present in Residential Area 2 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

The HHRA target risk and hazard level exceedances for Residential Area 2 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} and 1×10^{-6} (arsenic and hexavalent chromium were the major contributors), and above the target hazard level of 1 (arsenic, iron, and manganese were the major contributors).

Residential Area 3

Metals are present in Residential Area 3 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

The HHRA target risk and hazard level exceedances for Residential Area 3 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} and 1×10^{-6} (arsenic and hexavalent chromium were the major contributors), and above the target hazard level of 1 (arsenic, iron, and manganese were the major contributors).

Residential Area 4

Metals are present in Residential Area 4 in exceedance of the Part 201 Residential and/or Non-Residential DWC and GSIC.

The HHRA target risk and hazard level exceedances for Residential Area 4 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} and 1×10^{-6} (arsenic was the major contributor), and above the target hazard level of 1 (arsenic and manganese were the major contributors).

Waterfront Plaza

Metals are present in Waterfront Plaza in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

Following the HHRA, there were no target risk and hazard level exceedances for Waterfront Plaza groundwater.

Mixed Residential/Commercial Area 1

Metals are present in Mixed Residential/Commercial Area 1 in exceedance of the Part 201 GSIC.

The HHRA target risk and hazard level exceedances for Mixed Residential/Commercial Area 1 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} and 1×10^{-6} (arsenic was the major contributor), and above the target hazard level of 1 (arsenic and manganese were the major contributors).

Mixed Residential/Commercial Area 2

Metals are present in Mixed Residential/Commercial Area 2 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

The HHRA target risk and hazard level exceedances for Mixed Residential/Commercial Area 2 groundwater are summarized as follows:

- The calculated cancer risks and hazards for the resident potable groundwater exposure were above the target risk levels of 1×10^{-4} (arsenic was the major contributor) and 1×10^{-6} (arsenic and hexavalent chromium were the major contributors), and above the target hazard level of 1 (antimony, arsenic, cadmium, iron, and manganese were the major contributors).

Commercial Area 1

Metals are present in Commercial Area 1 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

Following the HHRA, there were no target risk and hazard level exceedances for Commercial Area 1 groundwater.

Commercial Area 2

No constituents are present in exceedance of the Part 201 Residential and/or Non-Residential Cleanup Criteria in Commercial Area 2.

Following the HHRA, there were no target risk and hazard level exceedances for Commercial Area 2 groundwater.

Commercial Area 3

Metals are present in Commercial Area 3 in exceedance of the Part 201 GSIC.

Following the HHRA, there were no target risk and hazard level exceedances for Commercial Area 3 groundwater.

Commercial Area 4

Metals are present in Commercial Area 4 in exceedance of the Part 201 Residential and/or Non-Residential DWC and/or GSIC.

Following the HHRA, there were no target risk and hazard level exceedances for Commercial Area 4 groundwater.

10.3 RECOMMENDATIONS

10.3.1 RECOMMENDATIONS FOR ADDITIONAL SOIL AND GROUNDWATER ASSESSMENT

Based on the information reviewed and presented in this RI Report, the only area of additional assessment identified during the RI phase of work is the continued collection of static water levels and staff gauge readings on a quarterly basis to evaluate seasonal fluctuations (i.e., wet versus dry).

10.3.2 ECOLOGICAL RISK ASSESSMENT

Further evaluation and refinement of the constituents identified as COPECs during the Steps 1 and 2 is recommended based on several Site-specific factors, including RME concentrations rather than maximum concentrations, alternative ecological benchmarks for specific receptor groups (soil invertebrates, terrestrial plants, birds, and mammals), and historical use and generation as Step 3a of the U.S. EPA 8-step process. For metals, background concentrations may also be considered. For BCOCs, food chain models will be used to evaluate the potential for risk to upper trophic level receptors. The Step 3a refinement report will be submitted as a separate, stand-alone document.

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February 4, 2013 Reference No. 056394-06

Ms. Sheila Desai
Remedial Project Manager
United States Environmental Protection Agency – Region 5
77 West Jackson Boulevard (SR – 6J)
Chicago, Illinois 60604 – 3590

Dear Ms. Desai:

Re: Responses to U.S. EPA Comments
Remedial Investigation Report, Revision 2
Former Plainwell, Inc. Mill Property Operable Unit No. 7
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Allegan and Kalamazoo County

Conestoga-Rovers & Associates (CRA) has prepared this letter, on behalf of the Weyerhaeuser Company (Weyerhaeuser), in response to the January 3, 2013 United States Environmental Protection Agency's (U.S. EPA's) comments on the Remedial Investigation (RI) Report, Revision 2 for the former Plainwell, Inc. Mill Property (Site), which was submitted to the U.S. EPA on October 19, 2012.

The revised RI Report (Revision 2) was submitted in accordance with the RI/Feasibility Study (FS) Work Plan dated July 2009, the Multi-Area Quality Assurance Project Plan (QAPP) dated September 23, 2009, the Multi-Area Field Sampling Plan (FSP) dated November 2009, the Phase II RI Work Plan dated November 2009, the Statement of Work (SOW) for the RI/FS, and the terms of the Consent Decree for the Design and Implementation of Certain Response Actions at Operable Unit #4 and the Plainwell, Inc Mill Property of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Consent Decree), which became effective February 22, 2005.

The following presents responses to the U.S. EPA's comments consistent with the revisions to the RI Report (Revision 2) dated October 19, 2012.

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GENERAL REPORT COMMENTS

U.S. EPA Comment #1

The executive summary does not discuss PCBs in soil in the MW-16 area and does not mention the underground tanks encountered at the sludge dewatering building. In addition, the executive summary and Section 5 of the report should discuss the product encountered in the AST delivery line during redevelopment activities.

Response

The Executive Summary of the report has been revised to include references to the PCBs identified in soil in the area around MW-16.

The Executive Summary and Section 5 of the report have been revised to include a discussion of the below grade structures encountered beneath the area to the west of the former Sludge Dewatering Building and the oil observed within the former No. 6 fuel oil aboveground storage tank (AST) piping during decommissioning and demolition activities that were conducted in this area.

U.S. EPA Report Comment #2

Section 5.2.4, Page 84, Paragraph 2: The text should refer to the actual figure numbers for the figures used to compare pre- and post-sewer line installation groundwater flow patterns. In addition, Figure 5.1.2 says "proposed storm sewer" in the legend and the figure should show the actual as-built locations, if available.

Response

The text of Section 5.2.4 has been modified to include a reference to the groundwater contour maps utilized during the comparison to pre- and post-sewer line installation activities.

Figure 5.12 has been modified to show the "approximate storm sewer" lines based on drawings showing the proposed sewer locations and locations observed in the field. Drawings provided by the Michigan Department of Transportation (MDOT) are included in Appendix E to the revised RI Report. Final as-built drawings were not available for inclusion in the report.

U.S. EPA Report Comment #3

Section 5.4.8, Page 177, Paragraph 3: The text discusses the fuel oil observed in the coal tunnel. The previous section (Section 5.4.7) states that fuel oil releases to the Number 6 Fuel Oil AST Area "have been documented historically". The text should also include a discussion of the fuel oil encountered in the AST delivery line during the August 2012 redevelopment activities and show the location of the delivery line on a figure. In particular, the text should discuss whether fuel oil releases are isolated or whether a larger area of impacts exists extending from the AST to the coal tunnel and along the delivery line to the former Plainwell Mill building.

Response

Sections 5.4.7 and 5.4.8 have been modified to include a discussion of the observations and actions taken related to the presence of product in the below grade fuel oil delivery system piping during the 2012 redevelopment activities. The approximate locations of the below grade product delivery system lines are shown on Figure 5.7 and on a historical figure presented in Appendix E of the revised RI Report.

HUMAN HEALTH RISK ASSESSMENT COMMENTS

U.S. EPA Comment #1

The response to EPA HHRA General Comment #4, states that Section 8.1.5.4 has been revised to "summarize the segregated hazards as appropriate ...". Section 8.1.5.4 has been revised to discuss the basic hazard segregation process and to identify for each exposure area those toxicity endpoints (target organs) associated with cumulative hazard indices (HI) >1 and the associated chemicals of potential concern (COPC). However, the numeric value of each cumulative HI is not identified, nor is the maximum cumulative HI identified. This information is presented in the associated "Risk Assessment Guidance for Superfund" (RAGS) Part D tables in Appendix I and should be presented also in the text. (Note: the incomplete discussion/presentation of segregated hazard results also impacts Section 10.1.3 with regard to EPA HHRA Specific Comment #15 and the executive summary with regard to EPA HHRA General Comment #1).

Response

Sections 8.1.5.4 and 10.1.3 have been modified to include the requested information. The Executive Summary presents conclusions identified for each redevelopment area by individual media type (i.e., soil and groundwater) and not for combined media; therefore, the segregated hazards (based on a combination of soil and groundwater cumulative HI) have not been included in this section.

U.S. EPA Comment #2

The executive summary, Section 8.0 (Baseline Human Health Risk Assessment), and Section 10.0 (including Section 10.1.3 [Human Health Risk Assessment]) do not identify or discuss the impacts of the Michigan Department of Transportation (MDOT) and Michigan Gas Utilities (MGU) utility line installations completed in 2012. Section 5.2.4 of the Revised (Revision 2) RI report has been revised to discuss these installations. However, this section-specific discussion should be summarized or at least referenced elsewhere in the RI, including the HHRA.

Response

The Executive Summary, Section 8.0 and Section 10.0 have been modified to include references to the MDOT and Michigan Gas Utilities utility line installations conducted in 2012.

U.S. EPA Comment #3

Based on a spot check of the transfer of the RAGS D exposure area - and receptor-specific risk and hazard calculations to the text, a single error was identified. Specifically, in Section 8.1.5.6.2, in the in-text table for the future resident - "disturbed" soil exposure scenario, the cumulative hazard quotient (HQ) for iron in groundwater is presented as "2.0E+01". However, the correct value is "2.0E+00" as presented in the referenced RAGS D Table 1.2.46.RME. This single error indicates that there may be other errors, albeit likely a small number, within HHRA results not addressed in the limited spot-check. Section 8.0, in particular Section 8.1.5.6, should be closely reviewed and the current results verified or corrected as needed.

Response

The cumulative hazard quotient (HQ) for iron in groundwater has been corrected to be 2.0E+00, consistent with Table 1.2.46.RME. A review and comparison of the values presented in Appendix I have been made to the tables within Section 8.0. Revisions have been made to Section 8.0, as necessary.

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT COMMENTS

U.S. EPA Comment #1

Section 9.0, Page 315, Paragraph 2: The text states Section 9.4 summarizes the constituents identified as chemicals of potential ecological concern (COPEC) - it should reference Section 9.3, and it should also state that Section 9.4 summarizes the uncertainties associated with the SLERA.

Response

The text of Section 9.0 has been revised as noted in the comment.

U.S. EPA Comment #2

Section 9.2.2.7, Page 340, Paragraph 2: This paragraph identifies all COPECs with a screening quotient (SQ) greater than 1 and states the SQ for chromium is 1.1, while Table J6 and the previous paragraph identified the SQ for chromium as 0.5. The reference to chromium should be removed from this paragraph.

Response

The text of Section 9.2.2.7 has been revised as noted in the comment.

U.S. EPA Comment #3

Section 9.2.2.8, Page 342, Paragraph 5: The text identifies an SQ for chromium as 2.5, while Table J6 identifies the SQ as 3.3; the text must be revised to be consistent with the table.

Response

The text of Section 9.2.2.8 has been revised as noted in the comment.

U.S. EPA Comment #4

Section 9.2.2.9, Page 344, Paragraph 5: The text identifies the SQs for copper as 71 and iron as 129, while Table J6 identifies the SQs for copper as 1.1 and iron as 71; the text must be revised to be consistent with the table.

Response

The text of Section 9.2.2.9 has been revised as noted in the comment.

U.S. EPA Comment #5

Section 9.2.2.10, Page 346, Paragraph 4: This paragraph identifies all COPECs with a SQ greater than 1 and states the SQ for chromium is 1.1, while Table J6 and the previous paragraph identified the SQ for chromium as 0.54. The reference to chromium should be removed from this paragraph.

Response

The text of Section 9.2.2.10 has been revised as noted in the comment.

U.S. EPA Comment #6

Section 9.2.2.11, Page 348, Paragraph 5: This paragraph identifies all COPECs with a SQ greater than 1 and states the SQ for arsenic is 1.1, while Table J6 identified the SQ as 1.0. The reference to arsenic should be removed from this paragraph and discussed in the previous paragraph.

Response

The text of Section 9.2.2.11 has been revised as noted in the comment.

U.S. EPA Comment #7

Section 9.2.2.12, Page 351, Paragraph 3: To be consistent with the presentations within this section, this paragraph should have the heading "Ecological Considerations" inserted at the beginning.

Response

The heading within Section 9.2.2.12 has been revised as noted in the comment.

U.S. EPA Comment #8

Section 10.1.4, Page 374, Paragraph 2: The text identities eight volatile organic compounds as COPECs, and "al,3,5-trimethylbenzene," should be "1,3,5-trimethylbenzene."

Response

The text of Section 10.1.4 has been revised as noted in the comment.

Should you have any questions with regard to this letter, please do not hesitate to contact the undersigned.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Gregory A. Carli, P. E.

JQ/ejh/25/Pwl.
Encl.

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