ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES

U.S. EPA Brownfield
Revolving Loan Fund (RLF) Assistance Amendment (AA)# BF-00E48101-7
Indiana Brownfields Program
for the
Former Carpenter Bus Manufacturing Site
1100 Industries Road
Richmond, Indiana
March 2015

This Analysis of Brownfield Cleanup Alternatives (ABCA) was cooperatively prepared by the Indiana Brownfields Program (Program), the City of Richmond, and Weaver Consultants Group (WCG, formerly known as Weaver Boos Consultants) as a requirement for utilizing United States Environmental Protection Agency (U.S. EPA) Revolving Loan Fund (RLF) monies to remediate a brownfield. The Former Carpenter Bus Manufacturing facility (Program site #4020031) located at 1100 Industries Road in Richmond, Indiana (Site) is currently an underutilized, light-industrial and commercial facility occupied by multiple tenants engaged in a variety of operations. The historical presence of multiple aboveground storage tanks (ASTs) and underground storage tanks (USTs) previously used in school bus manufacturing operations is believed to be the source of petroleum impact to soil and groundwater contamination beneath the Site. Elevated concentrations of petroleum hydrocarbons were also discovered intruding a sanitary sewer line that serves the Site. A thin, shallow, confined sand aquifer is also impacted. This ABCA presents remedial alternatives considered to mitigate potential exposure to contaminated soil, petroleum-derived free product, groundwater, and hydrocarbon vapors associated with the historical release. Site redevelopment is expected to include an expansion of the existing facility, light manufacturing, and warehousing.

<u>Site Details</u>

Site Name:	Former Carpenter Bus Manufacturing Site 1100 Industries Road Richmond, Indiana
Property Owner:	MRJ3, LLC c/o: Richard E. Jeffers 3501 Geraldine Lane Richmond, IN 47374
Site Representative:	Mr. Tony Foster II Executive Director, City of Richmond Department of Metropolitan Development 50 North 5th Street Richmond, IN 47374

Summary of Remedial Alternatives

1. Alternative 1 – Emplacement of oxygen release compounds (ORC) at the source and to form a reactive barrier against contaminated migration to the sanitary sewer.
2. Alternative 2 – In-situ air sparging and soil vapor extraction (AS/SVE) at the source and further downgradient to remove the contaminants.
3. Alternative 3 – High-vacuum dual-phase extraction (HVDPE) at the source and further downgradient to remove the contaminants.

Summary of Previous Site Activities

Site History

Historical environmental assessments indicate that the Site was used for agricultural purposes prior to its development by the Wayne Corporation as a bus manufacturing facility in 1967. The Carnegie Pension Fund owned the Site from 1967 until 1993. The Site was occupied during this period by the Wayne Corporation who rented it or leased it out for the manufacturing of bus bodies. The City of Richmond purchased the Site in 1993 and leased it to Carpenter Manufacturing, who also manufactured school buses there until going out of business in October 2000. The City of Richmond subsequently sold the Property to MRJ3, LLC who leases portions of the facility to several light industrial and transportation-related tenants, including a school for over-the-road truck drivers.

Previous Environmental Assessments/Environmental Investigations

Environmental conditions at the Site were assessed several times between 1991 and 2013. The Site was enrolled into Indiana's Voluntary Remediation Program (VRP) in 1994, but was eventually withdrawn without obtaining a certificate of completion or covenant not to sue. As described in the Phase II Investigation Report by Hull & Associates, Inc. (Hull) dated October 24, 1996, historical environmental assessments of the Site included the following:

1. Environ Corporation, 1991, Phase I Environmental Site Assessment.
2. Hull & Associates, Inc., 1992, Phase II Environmental Site Assessment (1st Sampling Event).
3. Hull & Associates, Inc., 1993, Phase II Environmental Site Assessment (2nd Sampling Event).
4. Hull & Associates, Inc., Phase II Environmental Site Assessment (3rd Sampling Event).
5. Hull & Associates, Inc., Phase II Environmental Site Assessment (4th Sampling Event).

The assessment process continued at the Site when Clayton Environmental (Clayton) prepared a Remediation Work Plan dated February 2004. Clayton conducted soil and groundwater investigations and implemented bioattenuation remedial activities. Clayton has since performed quarterly groundwater monitoring at the Site to assess the effectiveness of the bioattenuation in impacted wells. The areas of the continued environmental due diligence and remedial activities are focused within and on the north side of the on-site building in connection with a release of hazardous substances (mainly organic solvents) that is separate from and unrelated to the petroleum release considered in this ABCA.

In early 2011, a nearby property owner's complaint prompted the Richmond Sanitary District to investigate and consequently identify two sanitary sewer manholes on the Site as being contaminated with petroleum products (benzene, toluene, ethylbenzene, or xylene). The Richmond Sanitary District then met with WCG, who completed a multi-phase Site Investigation from 2011-2013. The investigation culminated in a Site Investigation/ Remediation Work Plan for the petroleum impacts that forms the basis of proposed and alternative remedial activities discussed in this ABCA.

Historical Results (1991 – 1996)

Information reported by Hull and reviewed by WCG includes results obtained from 61 soil borings and 42 monitoring wells. Hull's investigations focused on four areas of the Site:

1. Area A: The north ASTs and associated piping storing naphtha and "Wayne 50/50".
2. Area B: The west ASTs and associated piping storing butyl acetate and lacquer thinner.
3. Area C: USTs storing gasoline and diesel fuel directly east of the front office.
4. Area D: USTs storing gasoline and diesel fuel south of the front office, just south of what is now Enterprise Avenue.

Chlorinated aliphatic hydrocarbons such as 1,1,1-trichloroethane and trichloroethene were found in Area A along with lesser concentrations of aromatic hydrocarbons such as benzene. Aromatic hydrocarbons were the primary contaminants detected in Areas B and C; in Area C, Hull detected benzene concentrations as high as 1.29 mg/kg in subsurface soil and 3,800 µg/L in shallow groundwater. Only trace concentrations of aromatic hydrocarbons were detected in Area D. Hull further reported that all potential sources (ASTs, USTs, and piping) were emptied and secured against future use, and concluded that all source areas were eliminated and future increase(s) in groundwater contaminant concentrations were unlikely. Preliminary remedial alternatives proffered by Hull focused primarily on contaminant fate and transport modeling and establishment of institutional controls to mitigate future exposure.

Recent Site Investigations (2011 – 2013)

Additional Site Investigations were undertaken during 2011 in response to a nearby complaint, and from 2011 through 2013 to fill data gaps in the Site characterization in support of remedial action planning related to petroleum hydrocarbon intrusion into the sanitary sewer system.

Early 2011

According to the Program, a nearby property owner's complaint prompted the Richmond Sanitary District to investigate and consequently identify two manholes on the Site as being contaminated with petroleum products. The Sanitary District sampled Manholes #2, #3, #4, #5, #6, #7, #8, #9, and #046 located on the periphery of the Site's central building for benzene, toluene, ethylbenzene, total xylenes (BTEX), and methyl-tert-butyl ether (MTBE) between February 24 and March 3, 2011. Only #8 and #046, which are connected to lines draining the Site, were found to be impacted with petroleum hydrocarbons. An apparent seep in #8 was identified as a potential point of intrusion into the sewer line.

2011 WCG Site Investigation Activities

WCG met with representatives of the Richmond Sanitary District and the Program and began work at the Site in 2011, continuing until 2013. Field sampling and analytical protocol for the Site Investigation were conducted as specified in the approved 2011 Quality Assurance Project Plan (QAPP) and updated 2013 QAPP, respectively. WCG's Site Investigation activities are summarized as follows:

1. Historical reports and information, including sampling data collected by the Richmond Sanitary District, were reviewed in an attempt to infer potential source(s) for the aromatic hydrocarbons detected in Manholes #8 and #046.
2. An electromagnetic geophysical survey was performed over selected parts of the Site on June 9, 2011. The survey was implemented using a Geonics EM-61 Time Domain Electromagnetic (TDEM) detector in an attempt to identify buried ferrous metal objects such as USTs. Cultural interference from other structures such as fire protection water lines, hydrants, electrical wiring, etc. generally limited the utility of the survey.
3. On July 6, 2011, EnviroCore, Ltd., advanced direct-push soil probes P-1 through P-8 under the supervision of a WCG geologist in areas north and northeast of sanitary Manhole #8. WCG observed, classified, field screened the soil cores using a photoionization detection (PID) and logged the holes. One soil sample from probe P-3 was collected for laboratory analysis based on an elevated PID reading and the presence of an odor.
4. Temporary groundwater monitoring wells were installed in each of the soil probes. Groundwater samples were collected from all eight of the wells on July 7, 2011 for laboratory analysis of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and total petroleum hydrocarbons (TPH) gasoline range organics (GRO) and diesel range organics (DRO). The temporary monitoring well locations were subsequently surveyed.

2012 WCG Site Investigation Activities

1. On August 15, 2012, EnviroCore, Ltd., advanced direct-push soil probes P-9 through P-19 under the supervision of a WCG geologist to explore the former UST cavity identified as Area C, which was believed to represent a potential source of petroleum hydrocarbons.

2. Soil probe P-10 exhibited apparent shallow soil contamination due to elevated PID results. In consultation with the Program Project Manager, eight additional shallow soil probes were advanced in proximity to P-10 in an attempt to delineate of the area of potential contamination. These additional probes were designated P-12 through P-19 and extended to 8 feet (ft) below ground surface (bgs).
3. Ten (10) soil samples plus QA/QC samples were selected from the probes based on PID readings and submitted for VOCs, SVOCs, and TPH-GRO/DRO.
4. Temporary groundwater monitoring wells were installed in soil probes P-9, P-10, and P-11 and sampled for VOCs, SVOCs, and TPH-GRO/DRO.

2013 WCG Site Investigation Activities

Site investigation activities were conducted in two phases during 2013, the first of which included additional soil probes and temporary monitoring wells. The second phase was to install longer-term semi-permanent 2-inch groundwater monitoring wells to facilitate periodic performance monitoring during remediation of apparent gasoline impact identified beneath the main office building located along the south side of the facility.

1. On March 27, 2013, EnviroCore, Ltd. advanced direct-push soil probes P-22 through P-30 under the supervision of a WCG scientist to explore for petroleum hydrocarbons previously detected in temporary well P-6, along a line from Area C towards Manhole #8, and along the south side of Enterprise Avenue to further assess Area D as a potential source.
2. Soil samples were collected from depth intervals representing the shallow aquifer sand and gravel at probes P-22 through P-29 and submitted for VOC analysis.
3. Temporary groundwater monitoring wells were installed in soil probes P-22, P-24, P-25, P-26, P-28, P-29, and P-30 and sampled for VOCs on March 28, 2013. Additionally, the flow at the bottom of Manhole #8 was also sampled for VOCs.
4. On June 4 and 5, 2013, EnviroCore, Ltd. advanced direct-push soil probes WB-1 through WB-9 under the supervision of a WCG scientist to explore the nature and extent of petroleum hydrocarbons prominently detected in temporary monitoring well P-22, P-25, P-26, P-29, and P-30 during the March 2013 field mobilization.
5. The direct-push probes WB-1 through WB-9 were each completed as 2-inch diameter semi-permanent groundwater monitoring wells with 10 feet of screen set to intersect the uppermost shallow aquifer layer encountered at each location. The wells were developed by bailing, and subsequently purged and sampled on June 6, 2013 for VOCs.
6. The long-term groundwater monitoring wells were surveyed and checked for free product using an interface probe on June 19, 2013. Monitoring well WB-8 showed particular evidence of free product when the bailer was found coated with LNAPL resembling weathered petroleum as it was developed on June 6, 2013.

Summary of Site Characterization

The following summary of results and conclusions is supported by historical and recent Site Investigations:

1. The Site is located at the interchange of Interstate 70 and U.S. Hwy 35 as shown on Figure 1. The property includes approximately 93 acres bounded on the north by Interstate 70, on the west by U.S. Hwy 35, on the south by Industries Road, and on the east by private property. An approximately 500,000 ft^2 manufacturing building is located near the center of the Site.
2. The Site is located in an upland area between the Nolands and East Forks of the Whitewater River which flows generally southerly. The area is underlain by the Wayne-Henry Aquifer System, which is an intra-till system characterized by thin sand and gravel aquifer zones contained within silty clay sequences of variable thickness. The system is thicker than 75 feet beneath the Site as indicated by Hull's deepest soil borings. The productive zones in this aquifer system are usually less than 10 feet thick and generally adequate for domestic supply purposes.
3. The Site is located about equidistant between two creek or stream tributaries. The inferred direction of subsurface groundwater flow is radial from the Site towards the southwest, south, and southeast. The drainage through the sewer system also appears to be southerly, consistent with the slope of the land.
4. Potable water for the City of Richmond is obtained mainly from groundwater wells located along the Middle and East Forks of the Whitewater River, several miles southeast and east, respectively from the Site. According to the City Planner and another member of the City staff, the Site is not located within a regulated wellhead protection area. WCG also identified fifty-one (51) low-capacity water wells appearing to be located within approximately 1.0 mile from the Site. Seventeen (17) high-capacity wells were identified within a 2.0-mile radius of the Site. Based upon WGC's review of their locations, none of these nearby water wells is believed likely to be affected by the petroleum hydrocarbons identified in the shallow subsurface beneath the Site.
5. Groundwater flow is south-southeasterly from the Site's former front office building towards Enterprise Avenue. The soil types encountered during drilling included primarily silty clay till with one or sometimes two thin layers of medium to coarse sand and fine gravel. Due to the low permeability of the clay till, groundwater flows preferentially through the sand and gravel layers. The horizontal groundwater flow velocity beneath the Site through these hydraulically-conductive layers is estimated using Darcy's law as approximately 0.4 ft/day.
6. The recent Site Investigation and historical environmental assessments indicate that groundwater and the subsurface soil are affected by elevated concentrations of aromatic hydrocarbons (benzene, toluene, ethylbenzene, xylenes, and others) and polycyclic aromatic hydrocarbons (naphthalene). Additionally, 3.15 feet of light non-aqueous phase liquid (LNAPL) with an appearance and odor of weathered gasoline also accumulated in monitoring well WB-8. Insomuch as none of the current light industrial tenants occupying the Site are known to store or dispense motor fuel, and

whereas Carpenter and its predecessors formerly did so, the petroleum hydrocarbons are attributed to historical activities at the Site.

7. The hydrocarbon-impacted groundwater flows through the sand and gravel layers towards the south-southeast where it appears to be intercepted (at least in part) by a relatively deep sanitary sewer line trench located beneath Enterprise Avenue, 200 ft to 300 ft downgradient from where the highest concentrations of petroleum hydrocarbons were detected in monitoring wells WB-1, WB-8, and P-22. After the contaminated groundwater enters the sewer line backfill, which is presumed to include hydraulically conductive backfill, it appears to flow west-southwesterly to sanitary sewer Manhole #8 where it has been observed to enter the manhole through an opening in its barrel. After the petroleum hydrocarbons enter the sanitary sewer at or near Manhole #8, they are conveyed southerly by a collector through Manhole #046 and beyond. The inferred extent of petroleum hydrocarbon impact is shown on Figure 2.

Remedial Action Objectives

Environmental conditions at the Site and current land use suggest that the following human exposure routes represent potential risks for the indicated media and potentially exposed populations:

1. Inhalation of petroleum hydrocarbon vapors related to potential intrusion of vapors into on-Site or off-Site buildings;
2. Direct contact with impacted subsurface soil, groundwater, or free product by on-site workers or future construction workers performing maintenance or excavation;
3. Ingestion of groundwater by future users of water wells that might be drilled at the Site; and,
4. Direct contact with impacted sewer water by sanitation or water treatment workers.

Three aspects of the Site are identified as needing corrective action based on the results of historical and recent Site investigations. The Indiana Department of Environmental Management (IDEM)'s Remediation Closure Guide (RCG) provides numeric remedial action objectives in the form of screening levels (SLs) for the relevant exposure routes and land uses. Land use at the Site is currently commercial/industrial, and is expected to remain so for the foreseeable future. Soil or groundwater media exceeding applicable SLs or exhibiting the presence of free product include the following:

1. Subsurface Soil Media to variable depths that exceed one or more Direct Contact Soil SLs for commercial/industrial or excavation worker exposure, or migration to groundwater SLs over an approximately 2.0-acre portion of the Site.
2. Free product, resembling weathered gasoline, floating atop the water table in at least one well within the 2.0-acre area.
3. Groundwater beneath an approximately 2.0-acre portion of the Site and water found inside the sanitary sewer lines draining the Site that exceeds one or more Residential Tap Water and Commercial/Industrial Vapor Exposure SLs.

Analysis of Remedial Alternatives

The remedial action alternatives considered were evaluated using the following criteria:

(1) Effectiveness

a. The degree to which the toxicity, mobility and volume of the contamination is expected to be reduced.

b. The degree to which a remedial action option, if implemented, will protect public health, safety and welfare and the environment over time.

c. Taking into account any adverse impacts on public health, safety and welfare and the environment that may be posed during the construction and implementation period until case closure.

(2) Implementability

a. The technical feasibility of constructing and implementing the remedial action option at the site or facility.

b. The availability of materials, equipment, technologies and services needed to conduct the remedial action option.

c. The administrative feasibility of the remedial action option, including activities and time needed to obtain any necessary licenses, permits or approvals; the presence of any federal or state, threatened or endangered species; and the technical feasibility of recycling, treatment, engineering controls, disposal or naturally occurring biodegradation; and the expected time frame needed to achieve the necessary restoration.

(3) Cost

a. The following types of costs are generally associated with the remedial alternatives:

- Capital costs, including both direct and indirect costs; Initial costs, including design and testing costs.
- Annual operation and maintenance costs.

Remedial Alternatives

1. *Alternative 1 – Oxygen release compound (ORC):* The first remedial technology considered is the injection of an ORC near and downgradient from the source area(s). Implementation would involve the injection of the ORC in the form of a lateral barrier directly upgradient from the sanitary sewer trench along the centerline of Enterprise Avenue. Several applications would likely be necessary over a period of months or years. This would promote natural biological degradation of the petroleum hydrocarbons in the ground. Apparent advantages to this approach included include no need for treatment or discharge of water and no air emissions requiring control. The costs would be approximately $320,000-$460,000, which is reasonable for three years of implementation. Potential disadvantages include the large mass of petroleum hydrocarbons as evidenced by high concentrations and free product

perched atop the water table. Treatment might need to be repeated for later years if the ORC is depleted without causing the oxidation of the majority of the contaminants.

   a. **Effectiveness** – Low to medium, with high variability.
   b. **Implementability** – Medium: Implementation would be labor-intensive in initial and subsequent applications, but requires no maintenance in between.
   c. **Cost** – Low to high: depending on how quickly the ORC can oxidize the petroleum hydrocarbons in the ground. Repeat applications past the three-year quotation listed above would commensurately increase the cost.

2. *Alternative 2 – Air Sparging/Soil Vapor Extraction (AS/SVE)*: The second remedial alternative considered is in-situ AS/SVE. Implementation would involve the installation of numerous air injection wells near and further downgradient from the source area(s). SVE trenches or wells would be positioned above and around the AS outlets. Such a system could be implemented for $380,000-$550,000. Potential advantages of this technology include the fact that no aqueous discharge would require treatment and the technology should have relatively quick and permanent effect. Potential disadvantages include the presence of free product and potential for driving vapor intrusion to the Site's former front office building overlaying the affected part of the Site. Additionally, the affected shallow aquifer is quite thin (2 to 3.5 ft), and so the disruptive installation of numerous sparging wells and extensive vapor extraction facilities would be necessary. Because the vapor emissions from the SVE system will be particularly concentrated at start up and likely to remain for a considerable period thereafter, emissions controls are recommended.
   a. **Effectiveness** – High: This method has been used by WCG with considerable success under more appropriate site conditions.
   b. **Implementability** – Low: The presence of AS/SVE stations throughout the Site would interfere with routine operations, and there is a significant risk of inducing vapor intrusion in the central building.
   c. **Cost** – Medium.
3. *Alternative 3 – High-Vacuum Dual-Phase Extraction (HVDPE)*: The third remedial technology considered was HVDPE, which holds the potential to significantly and rapidly reduce the concentrations of benzene and related hydrocarbons in the thin aquifer layer. Implementation would involve the installation of several dual-phase extraction wells near and further downgradient from the source area(s). The probable cost for implementing this technology range from $415,000-$530,000. Apparent advantages of this technology include relatively quick and permanent effect with no risk of inducing vapor intrusion. System O&M is estimated to extend for approximately two years using this technology. Potential disadvantages include the need to control and treat a continuous aqueous discharge and continuous vapor emission. Because the vapor emissions from the HVDPE system will be particularly concentrated at start up and likely for a considerable period thereafter, emissions controls are recommended. The annual quarterly monitoring cost is a little higher because regular monitoring of the aqueous discharge will be required.

a. **Effectiveness –** High: This method has been used by WCG with considerable success under conditions similar to those present at the Site.

b. **Implementability** – Medium to high: Aside from the labor-intensive start-up, the system is expected to run for approximately two years before completing the remedial objectives. Furthermore, the wells would be relatively non-intrusive and there is no risk of driving vapor in the office building.

c. **Cost** – Medium to high.

Remedial Alternatives with Respect to Climate Change Conditions

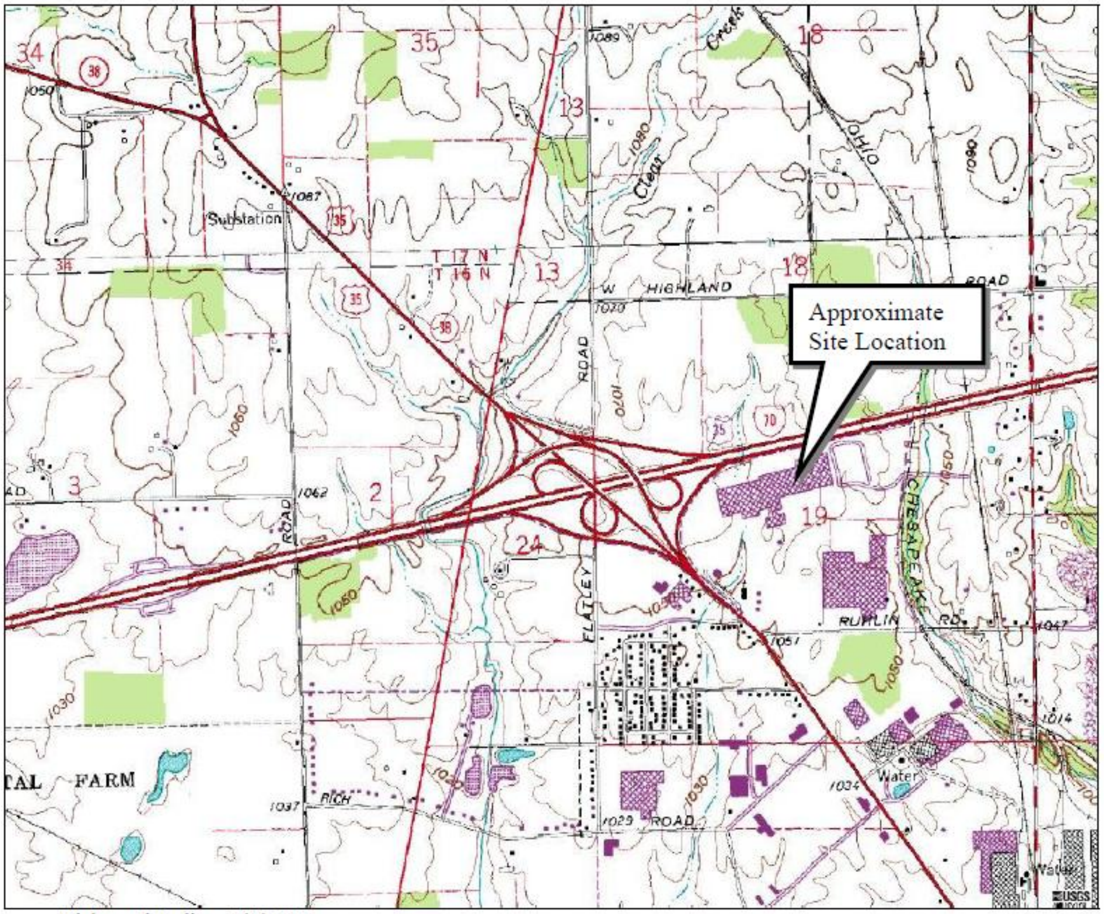
WCG has considered trends in climate change as directed by the U.S. EPA's *Checklist: How to Address Changing Climate Concerns in an ABCA*. We have concluded that several climate change consequences (e.g., rising sea level, increased risk of wildfires, increased salt water intrusion) will not materially affect the Site given its location in inland Indiana. Other factors that may significantly affect the Site are unlikely to manifest within the time period (approximately three years) in which the remediation system is expected to operate. Data provided by the National Oceanographic and Atmospheric Administration (NOAA) shows that atmospheric carbon dioxide concentrations measured at the Mauna Loa Observatory are increasing at approximately 1.5 ppm per year since 1960, as shown in Figure 3. From the time that remediation is implemented to the time that the system is expected to be decommissioned, average atmospheric CO_2 is expected to rise by a small margin (4.5 ppm) relative to natural fluctuations (5-6 ppm from peak to trough in any given year), as shown in Figure 4. Finally, WCG notes that if extreme climate changes do arise, all remedial alternatives are likely to be impacted by the same extent – either changing the conditions under which Alternative 1 (the ORC) was designed to operate, or impeding access to Alternatives 2 and 3 (the AS/SVE and HVDPE, respectively) for routine maintenance and sampling.

Recommendation for Site Remedy

Alternative 1 (ORC) may be an effective alternative with medium implementability and low-to-medium cost owing to the lack of maintenance required if the ORC fulfills its intended purpose. However, its effectiveness is in question; WCG notes that Clayton Environmental attempted to implement an ORC system and did not succeed in remediating an unrelated part of the Site. This technology is therefore only recommended as a low-cost stop-gap measure because its beneficial effect is unlikely to be permanent. Alternative 2 (AS/SVE) is an effective alternative with low implementability and medium cost. However, the operation of the system is expected to be disruptive to commercial operations at the Site, and there is a potential for driving vapor into the office building. Given these drawbacks, this technology is not recommended. Alternative 3 (HVDPE) is an effective alternative that is implementable at a medium or high cost. Although it is likely the most costly of the alternatives, it is expected to complete remedial objectives in the shortest timeframe and is minimally intrusive to the current tenants of the Site and is therefore recommended for implementation.

Decision Document

A decision document will be issued at the close of the public comment period with additional details on the selected alternative for site remedy. The decision document will serve as a notice to proceed with federally funded remediation activities and will be available in the local information repository for public review, along with this Site ABCA and other Site-related documents.



Richmond, Indiana 7/1/1984

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Site Location Map

Former Carpenter Manufacturing
1100 Industries Road
Richmond, Indiana

N

Drawn by: SMS	Not to Scale	Date: 2/26/13	Project No.: 2339-353-03-02	Figure 1

FIGURE 1

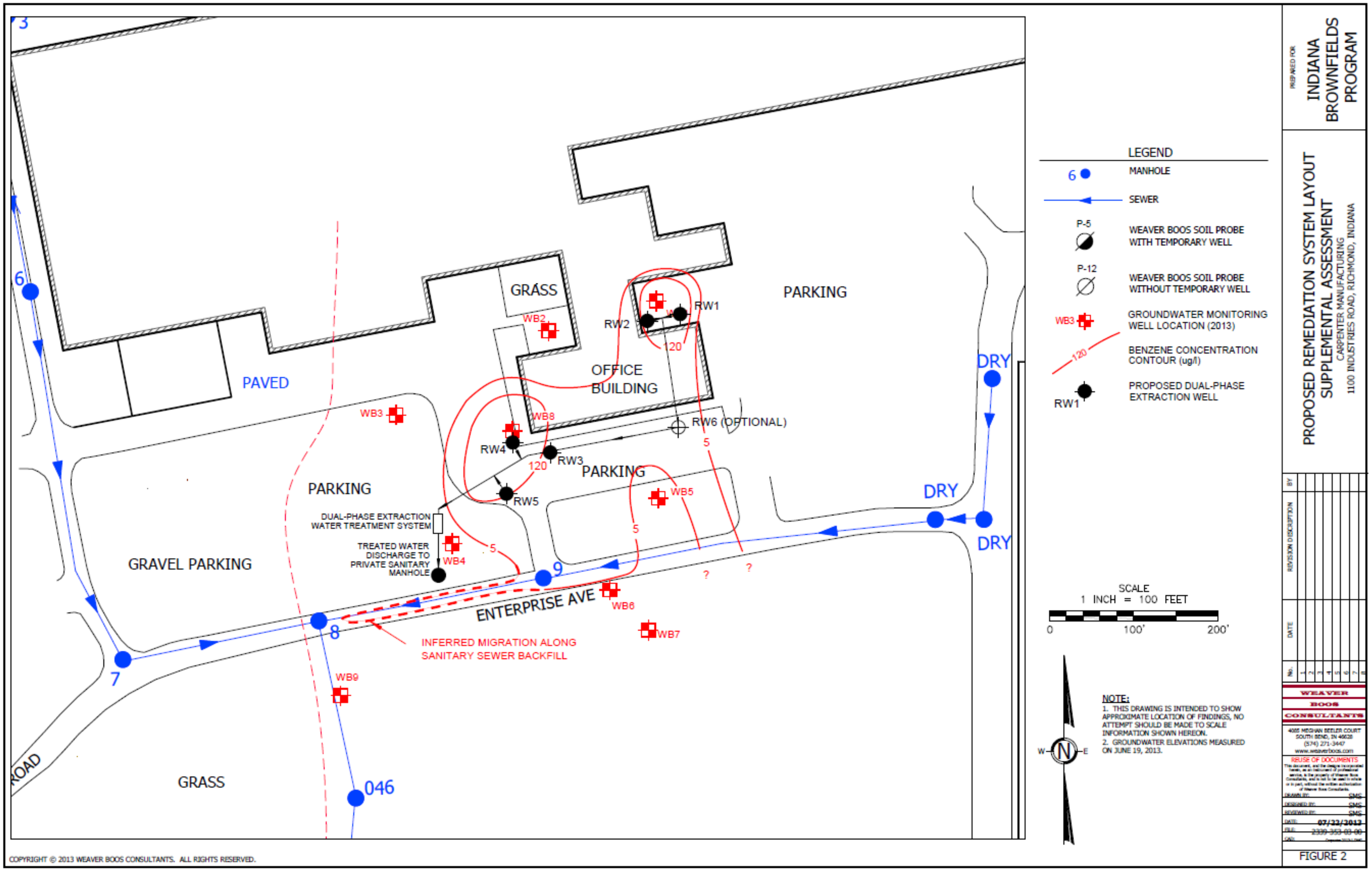
PAVED
GRASS
PARKING
OFFICE BUILDING
RW1
RW2
RW3
RW4
RW5
RW6 (OPTIONAL)
WB2
WB3
WB4
WB5
WB6
WB7
WB8
WB9
DRY
GRAVEL PARKING
DUAL-PHASE EXTRACTION WATER TREATMENT SYSTEM
TREATED WATER DISCHARGE TO PRIVATE SANITARY MANHOLE
ENTERPRISE AVE
INFERRED MIGRATION ALONG SANITARY SEWER BACKFILL
046
LEGEND
MANHOLE
SEWER
WEAVER BOOS SOIL PROBE WITH TEMPORARY WELL
WEAVER BOOS SOIL PROBE WITHOUT TEMPORARY WELL
GROUNDWATER MONITORING WELL LOCATION (2013)
BENZENE CONCENTRATION CONTOUR (ug/l)
PROPOSED DUAL-PHASE EXTRACTION WELL
SCALE
1 INCH = 100 FEET
NOTE:
1. THIS DRAWING IS INTENDED TO SHOW APPROXIMATE LOCATION OF FINDINGS, NO ATTEMPT SHOULD BE MADE TO SCALE INFORMATION SHOWN HEREON.
2. GROUNDWATER ELEVATIONS MEASURED ON JUNE 19, 2013.
INDIANA BROWNFIELDS PROGRAM
PROPOSED REMEDIATION SYSTEM LAYOUT
SUPPLEMENTAL ASSESSMENT
CARPENTER MANUFACTURING
1100 INDUSTRIES ROAD, RICHMOND, INDIANA
WEAVER BOOS CONSULTANTS
FIGURE 2
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FIGURE 2

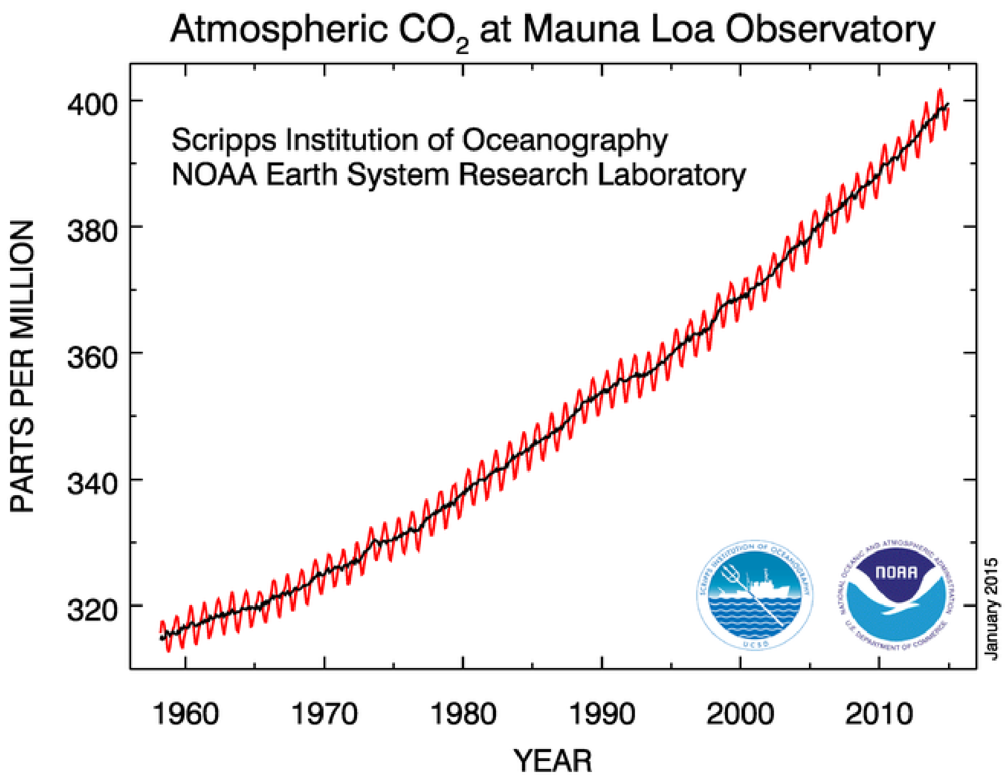
Atmospheric CO2 at Mauna Loa Observatory
Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
PARTS PER MILLION
400
380
360
340
320
1960
1970
1980
1990
2000
2010
YEAR
January 2015

FIGURE 3

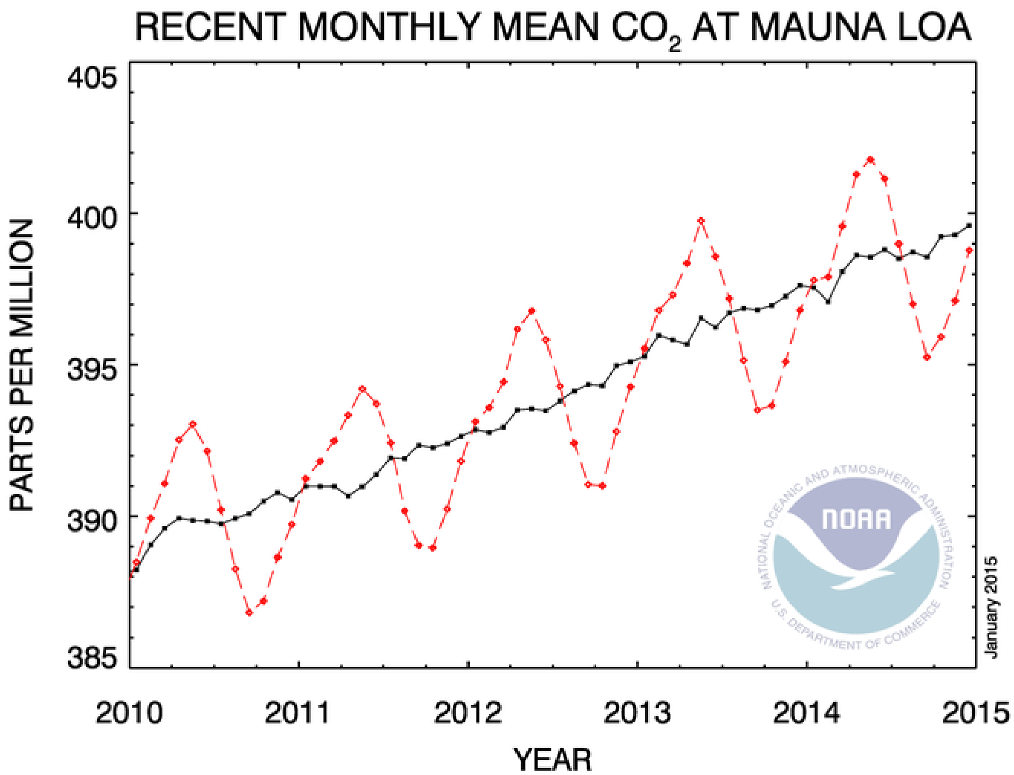
RECENT MONTHLY MEAN CO_2 AT MAUNA LOA
PARTS PER MILLION
405
400
395
390
385
2010
2011
2012
2013
2014
2015
YEAR
January 2015
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

FIGURE 4