AUGUSTA BROWNFIELDS REDEVELOPMENT PROJECT
SECOND GRANT

EPA COOPERATIVE AGREEMENT #BF 97493603-0

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PHASE II ENVIRONMENTAL SITE ASSESSMENT
AND SITE REUSE FEASIBILITY STUDY
AUGUSTA BROWNFIELDS STUDY AREA
AUGUSTA, GEORGIA

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PREPARED FOR:
AUGUSTA ENGINEERING DEPARTMENT
AUGUSTA, GEORGIA

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EXECUTIVE SUMMARY

Gannett Fleming, Inc. (GF) was retained by the Augusta Engineering Department to conduct a Phase II environmental site assessment and feasibility study of the Augusta Brownfields Study Area. The Brownfields Study Area consists of four target areas: the former Goldberg Brothers scrap yard, a portion of the Hyde Park neighborhood off Dan Bowles Road and Gordon Highway in south Augusta, the Fabrister Ranch property (currently an active recycling center operating under the name Campbell Recycling), and the Richmond Recycling property (an abandoned metal scrap yard). The Campbell Recycling facility and Richmond Recycling property are located adjacent to Hyde Park and across Dan Bowles Road from the former Goldberg Brothers Recycling facility.

The primary purpose of this project was to determine the estimated extent of contamination at the target brownfield area, and if contamination may have migrated off the metal scrap yards (including the former Goldberg Brothers site) into the neighborhood or from the former Goldberg Brothers site onto the two metal scrap yards. The work of this project was funded by the United States Environmental Protection Agency (US EPA) under EPA Cooperative Agreement #BF97493603-0.

Between March 27 and April 10, 2006, GF mobilized to the Augusta brownfields study area and collected 55 soil samples from 49 distinct locations across the study area. The soil samples were submitted to Analytical Environmental Services, Inc. (AES) in Atlanta for laboratory analysis. On August 8–10, 2006, GF remobilized to the site to collect additional soil samples based on the results of the initial sampling effort and to fill some of the data gaps observed between sample locations. Thirty-six additional borings were drilled to 1-foot below grade using a hand auger in the Hyde Park neighborhood. In addition, five of the original borings were re-drilled in order to collect deeper samples (1.5 to 2 feet) and determine the vertical extent of impacted soil. The sample locations are shown on Figure 1, at the back of this report.

In order to assess groundwater conditions, GF sampled the 13 existing monitoring wells located on the former Goldberg Brothers and Richmond Recycling properties and installed and sampled 9 additional monitoring wells. GF also collected water level readings from the wells in April and August 2006. The well locations are also shown on Figure 1.

The environmental assessment revealed the following conclusions:

Soil:

- Pockets of contaminated soil exceeding the Georgia Environmental Protection Division (EPD) Type 1 (residential) Risk Reduction Standard (RRS) are located throughout the study area, including the residential Hyde Park community.
- A large area of soil on the Fabrister Ranch and Richmond Recycling properties exceeds the Type 3 (non-residential) RRS. A few smaller areas of soil were detected within the Hyde Park neighborhood that also exceeded the Type 3 RRS.
- Primary contaminants in soil include cadmium, copper, lead, mercury, zinc, and PCBs.
- Soil impacts appear to be limited to surficial soil and ditch sediment in most areas, and are likely the result of surface deposition from storm water runoff and flooding.
- The former Goldberg Brothers and Richmond Recycling sites are known sources of soil contamination in the Hyde Park area based on the results of this and past studies. The Fabrister Ranch and Augusta Steel and Metal Company sites are also potential sources of contamination based on the results of sampling along Dan Bowles Road. However, further study is required to determine if these areas are actually sources of contamination or if the contamination along Dan Bowles Road is from other known sources. Automobile repair work appears common on many of the residential properties in the neighborhood and also can not be ruled out as a potential source of some of the contamination observed in Hyde Park.
- Based on the disposition of contaminants found in Hyde Park, it is very likely that metal contaminants from the nearby scrap yards have been transported to the Hyde

Park neighborhood due to storm water runoff and flooding that have occurred over time.

- GF investigated several remedial alternatives to address the soil contamination including in-situ solidification/stabilization, ex-situ solidification/stabilization, and excavation and off-site disposal. The approximate cost to remediate soil using these technologies are summarized below:
  - To clean up all areas to the Type 1 RRS:
    - In-situ Solidification/Stabilization: $20,300,000
    - Ex-situ Solidification/Stabilization: $19,300,000
    - Excavation and Off-Site Disposal: $34,000,000
  - To clean up Hyde Park to the Type 1 RRS and the scrap yards to the Type 3 RRS:
    - In-situ Solidification/Stabilization: $15,000,000
    - Ex-situ Solidification/Stabilization: $13,900,000
    - Excavation and Off-Site Disposal: $30,000,000
  - To clean up all areas to the Type 3 RRS:
    - In-situ Solidification/Stabilization: $5,200,000
    - Ex-situ Solidification/Stabilization: $4,600,000
    - Excavation and Off-Site Disposal: $11,700,000

- The cost of the two solidification/stabilization technologies are essentially the same within the accuracy of the estimates. Excavation and off-site disposal is significantly more expensive than the other two options.

Groundwater

- Groundwater impacts appear to be limited to a relatively small area around MW-12 and MW-13 located on the former Goldberg Brothers scrap yard. MW-13 is the only well where a regulated constituent (lead) was detected above the applicable RRS during this sampling event. No groundwater contaminants were detected above the Type 1/3 RRS in samples collected from the newly installed wells in the Hyde Park neighborhood.
- Several feet of dense, non-aqueous phase liquid (DNAPL) was observed in well MW-13 during the August 2006 water level event. Although, no constituents exceed the RRS at MW-12, approximately 0.4 inches of light, non-aqueous phase liquid (LNAPL) was observed in the well while collecting water level data in August.

Samples for organic constituents other than polychlorinated biphenyls (PCBs) were not collected during this investigation, because past investigations did not detect significant levels of organic contaminants.

- Since no groundwater impacts have been detected beyond the former Goldberg Brothers scrap yard, there is no off-site groundwater that requires remediation. Remediation alternatives for groundwater at the former Goldberg Brothers site have already been evaluated and are discussed in the previous Phase II report for that site (Gannett Fleming, Inc., April 20, 2004). Approximate current costs to remediate groundwater at the former Goldberg Brothers property range from $300,000 to $400,000.
- Additional investigations are required to determine the impact of the free phase products discovered at the former Goldberg Brothers site.

Based on the findings of this investigation GF recommends the following:

- Due to the recent discovery of LNAPL and DNAPL in wells MW-12 and MW-13, respectively, GF recommends that a round of groundwater samples be collected from the monitoring well network and analyzed for organic constituents. In addition, GF recommends that samples of the free phase liquids in these wells be collected and analyzed to determine their composition. Additional soil borings and monitoring wells should be installed in the vicinity of MW-12 and MW-13 to determine the extent of the free phase liquids.
- Prior to any remedial efforts, additional investigation should be conducted to better define the horizontal and vertical limits of impacted soil across the study area. Soil samples should also be collected for TCLP analysis to determine the extent of material that would be hazardous and require treatment prior to disposal.
- Soil should be remediated to meet applicable standards for current or future land uses as appropriate.
- Potential developers should investigate Georgia's Brownfields Program for potential remedial options that may reduce the cleanup costs and provide future liability protection.

1.0 INTRODUCTION

1.1 Purpose

Gannett Fleming, Inc. (GF) was retained by the Augusta Engineering Department to conduct a Phase II environmental site assessment and feasibility study of the Augusta Brownfields Study Area. The Brownfields Study Area consists of four target areas: the former Goldberg Brothers scrap yard, a portion of the Hyde Park neighborhood off Dan Bowles Road and Gordon Highway in south Augusta, the Fabrister Ranch property (currently an active recycling center operating under the name Campbell Recycling), and the Richmond Recycling property (an abandoned metal scrap yard). The Campbell Recycling facility and Richmond Recycling property are located adjacent to Hyde Park and across Dan Bowles Road from the former Goldberg Brothers Recycling facility. A previous U.S. Environmental Protection Agency (EPA) Brownfields grant (Cooperative Agreement #BP984866-99-0) was used primarily to assess soil and groundwater contamination at the former Goldberg Brothers site; contaminants associated with the property included heavy metals (primarily lead) and polychlorinated biphenyls (PCBs) in soils and low concentrations of metals in shallow groundwater based on the most recent data. Small pockets of petroleum contamination were also observed at the site.

The primary purpose of this project is to determine the estimated extent of contamination in the target brownfield area, and if contamination may have migrated off the metal scrap yards (including the former Goldberg Brothers site) into the neighborhood or from the former Goldberg Brothers site onto the two metal scrap yards. It is hoped that information derived from this report will be used by City and community leaders to make decisions about future use of the area.

This report satisfies the final deliverable for the Augusta Brownfields Redevelopment Project under EPA Cooperative Agreement #BF 97493603-0.

1.2 Site Location and Description

The study area is located off Dan Bowles Road in south Augusta and generally comprises the former Goldberg Brothers scarp yard, the Campbell Recycling facility, an abandoned scrap yard at the Richmond Recycling property, and the residential streets of Willow, Walnut, Goldenrod, and Leonia and Aragon Drive in the Hyde Park neighborhood.

The former Goldberg Brothers property is located at 241 Dan Bowles Road, Augusta-Richmond County, Georgia. The property was once owned by Goldberg Brothers, Inc. of Augusta, Georgia, but has been under the control of a U.S. Bankruptcy Court since 1998. The approximately 10.8-acre property is a former metal recycling facility and scrap yard. The property is bounded to the west by a Norfolk Southern Railroad right-of-way and tracks, to the north by U.S. Highway 278 (Gordon Highway), to the northeast by a drainage ditch and Aragon Drive, to the east by the Hyde Park neighborhood, and to the south by Dan Bowles Road.

The Richmond Recycling site located at 240 Dan Bowles Road (Parcel No. 087-2-122-00-0) comprises 3.3 acres and is an abandoned scrap yard with a dilapidated concrete block building. The wooden roof of the building has collapsed, and various types of inert debris is scattered around the structure. Piles of debris are scattered across the property comprised primarily of tires, metal wire, scrap metal, rubber hoses, building materials, and small electronic equipment (TVs, microwaves, etc.). The property is bounded to the west by a Norfolk Southern Railroad right-of-way and tracks, to the north by the Fabrister Ranch property, to the east by Dan Bowles Road and Hyde Park neighborhood, and to the south by a 3.5-acre automobile sales, repair and junk yard (Tim's Budget Auto Sales and Used Parts). The majority of the property consists of bare ground with stands of small bushes, sparse trees, and overgrown vegetative areas. There are concrete slabs and piles of wooden building materials scattered around the property, indicating the previous existence of several other buildings. Storm water generally flows toward the east and into the drainage ditch along Dan Bowles Road. The property is fenced along the western and southern boundaries, but the fence is in poor condition and there are several areas where the fence has collapsed or no longer exists. Several empty quart-size oil cans and plastic jugs of antifreeze and a small empty plastic drum were observed along the southern edge of the property

near the adjacent auto repair and junk yard. No significant soil staining was observed with the exception of occasional petroleum-type dark staining in certain areas. Due to the flat topography ponded water is observed to exist for extended periods of time after a rain event.

The 2.6-acre Fabrister Ranch property is currently leased to Campbell Recycling, a metal recycling facility, which includes an approximately 25,000 square-foot metal building with concrete slab and a 6-foot high white metal fence surrounding the eastern portion of the property. The area within the fence is undeveloped, cleared bare soil. Storm water at this site appears to flow east toward drainage ditches along Dan Bowles Road. The owner of this property would not permit GF or the City access to the site to collect environmental samples.

The fourth study area is the Hyde Park neighborhood; the community extends approximately from Dan Bowles Road to Florida Road to the east and Horton Drive to the north; however, the focus of the environmental studies has been primarily the areas closest to the former scrap yards, including Walnut, Willow, Goldenrod, and Leonia Streets and Aragon Drive.

A concrete-lined drainage swale extends from Dan Bowles Road near the southeastern corner of the former Goldberg Brothers property and meanders southeast through the neighborhood to approximately Leonia Street, where it transitions into a storm culvert and drainage ditch that extends to the Norfolk Southern Railroad tracks near Doug Bernard Parkway. Stormwater runoff from the adjacent scrap yards, including Richmond Recycling and Fabrister properties flows into this swale. Because the area is relatively flat and has poor drainage, there are numerous reports by residents of area flooding during significant storm events. Automobile repair work on the properties appears to be common among some of the residents, and several property owners report the presence of old drinking water wells on their properties.

1.3 Geology and Hydrogeology

1.3.1 Regional Geology and Hydrogeology

The Atlantic Coastal Plain physiographic province of southern Georgia is comprised predominantly of unconsolidated sediments (Early Cretaceous to Holocene in age). Cretaceous

age sediments unconformably overlie the igneous and metamorphic crystalline complex of the southern Appalachian Piedmont province, as well as Triassic redbeds and intrusives, Paleozoic sedimentary rocks, and variably aged felsic to mafic volcanic and metavolcanic materials. The Cretaceous sediments are often unconformably overlain by Tertiary age sediments (Vincent, 1982).

Clark and Zisa (1976) show Richmond County lying within the Washington Slope District, the Fall Line Hills District, and the Vidalia Upland District of the Atlantic Coastal Plain. The study site is located on the western edge of the Augusta East U.S. Geological Survey, 7.5 Minute Series topographic map in the Fall Line Hills District. In this area, land surface elevations generally decrease in an easterly direction toward the Savannah River, thus producing a general pattern of progressively older exposed sediments onlapping the Piedmont to the east due to the erosion of the younger sediments by the Savannah River. The net affect of increasing age to the east, is the onlap of fluvial (Upper Cretaceous) kaolinitic sands and clays near the Savannah River (Hetrick, 1992). A rather flat, featureless plain, generally more than two miles wide, at an elevation below 140 feet, borders the Savannah River from Augusta southward (LeGrand and Furcron, 1956). This flood plain is overlain by Quaternary Alluvial sediments (Hetrick, 1992).

The contact between the basement and the Coastal Plain sedimentary rocks shows a general northeast-southwest strike with a southeast dip. In the northeastern and east-central portions of Richmond County, near the Savannah River, the dip is reported as approximately 40 feet per mile while further west at Warrenton, Georgia, the dip is approximately 15 feet per mile. These differences in the slope of the basement interface could be due to regional differences in tectonic activity, the amount of paleo-erosion, or irregularities in paleo-shorelines (Hetrick, 1992).

The igneous and metamorphic basement north of Augusta yields water from fractures in quantities of about 10 to 20 gallons per minute (LeGrand and Furcron, 1956). This is considerably less than the yield of the Coastal Plain sediments in Richmond County.

The outcrop area of the Cretaceous sediments in Richmond County contains porous sands which receive and store large quantities of water. In the southern portion of Richmond County

abundant supplies of water can be obtained from the Cretaceous sediments, where the thickness of the sediments may exceed 500 feet. Near the Fall Line, the Cretaceous age deposits are less than 100 feet thick and too high on the stream divides to yield large amounts of water (LeGrand and Furcron, 1956).

1.3.2 Local Geology and Hydrogeology

The topography in the vicinity of the Augusta brownfields study area is generally flat with only a slight slope southeast toward Phinizy Swamp. The specific topography across the site may have locally been altered during previous site development and excavation, backfilling, and grading activities at the former Goldberg Brothers site.

The lithology at the Goldberg Brothers site, as determined from sediments recovered during the installation of monitoring well MW-7D, consists of a soft, brown, fine, moist, sandy clay from the land surface to a depth of 1.5 feet below land surface (bls). This upper unit is underlain by a soft, moist, gray clay to a depth of 4 feet bls. Underlying the gray clay, to a depth of 6.5 feet bls, is a dense, dry, gray, coarse to medium sandy clay. The sandy clay is underlain by a soft, moist, gray-brown clay that extends to a depth of 10.5 feet bls. In turn, the gray-brown clay is underlain, by a dense, dry, gray to dark gray clay to a depth of 12.5 feet bls. Underlying the dark gray clay, to a depth of 18.5 feet bls, is a soft, moist, dark brown to black clay containing wood chunks. Underlying the dark brown to black clay is dense, moist, gray clay, to a depth of 21 feet bls. The gray clay is underlain, to a depth of 23.5 feet bls, by a soft, wet gray clay. From 23.5 feet bls to 25.5 feet bls is a wet, golden brown, very coarse to coarse sand with some granules. The above unit is underlain, to a depth of 37 feet bls, by a wet, gray-brown to golden brown, very coarse to coarse sand with granules, and stringers of orange, medium sand. This type of short interval sequencing is commonly seen in alluvial flood plain overbank deposits, and would be expected in the Quaternary Alluvial deposits in this area as described by Hetrick (1992).

The dense, dry, gray clay noted at the Goldberg Brothers site in the depth interval from 18.5 to 21 feet bls may act as an aquitard or aquiclude, as it appears that the unit overlying it containing the wood chunks may have once been a wetland area that was buried by its overlying overbank

deposits. The dense, gray clay would have aided in maintaining the necessary water content for the wetland to have survived.

The lithology of the former Richmond Recycling site, as determined from sediment cuttings recovered during the installation of monitoring well MW-16, consisted of soft, brown, fine, moist silty clay from the ground surface to a depth of 1.5 feet bls. This upper unit is underlain by soft, moist, light gray silty clay to a depth of 4 feet bls. Underlying the gray silty clay unit is dark gray soft, moist, silty clay. This unit was logged to where drilling was terminated at 20 feet bls.

Bore holes MW-18A and MW-20 depicted two different lithology sequences for the Hyde Park residential area. At location MW-18, the surface soil sediment cuttings consisted of soft, light gray, dry silty clay from to 0 to 3 feet bls. This unit was underlain by a soft light gray, moist silty clay from 4 to 9 feet bls. This unit is underlain by soft light gray, moist, gravel clay. This unit was logged to where drilling was terminated at 20 feet bls. The lithology for bore hole MW-20 located in the residential area next to the drainage ditch and south of the Goldberg Brothers site, as determined from sediment cuttings recovered during the installation of monitoring well MW-20, consisted of a dark gray, soft, fine grain, moist silty clay from the land surface to a depth of 20 feet bls. This unit was logged to where drilling was terminated at 20 feet bls.

The groundwater potentiometric surface varies from 2.55 to 7.91 feet bls in the shallow wells, and is at 5.45 feet bls in the deep well MW-7D. All of the monitoring wells installed during this and the previous investigations, except MW-7D, are screened to monitor the uppermost groundwater quality. Monitoring well MW-7D was screened to monitor the groundwater quality in the next deeper zone of groundwater, beneath the surficial zone. Groundwater, in the surficial zone, flows to the south-southwest.

1.4 Site History

The study area and surrounding vicinity is generally developed and occupies an older section of southern Augusta, with industrial development in the area beginning prior to the 1940's and

residential development beginning in the late 1940's and early1950's. Prior to this time the area was farmland or undeveloped swamplands.

The Richmond Recycling property was at one time connected with the former Goldberg Brothers Recycling operation, which was a former metal recycling center and scrap yard. It was also reportedly occupied by Hallmark Homes, a pre-fabricated manufactured homes facility, before becoming a junk yard.

The 2.6-acre Fabrister Ranch property was also at one time connected with the former Goldberg Brothers Recycling operation directly across Dan Bowles Road. Campbell Recycling has been operating at the present location for the last few years.

The properties in the Hyde Park community are a mixture of vacant or abandoned lots and small residential homes, many of which were constructed in the mid 1940's and 1950's. Some of the homes sit vacant with dilapidated structures and overgrown yards. Most of the parcels contain residential structures with storage sheds in some of the back yards; however, some properties are undeveloped or have a concrete slab where a house once sat. There are a few commercial or church establishments in the Hyde Park community, although the greater majority is residential.

The Goldberg Brothers site was reportedly an active scrap yard from 1952 until 1998, when Mr. Phillip Goldberg filed for bankruptcy. Historic aerial photographs show that the site and surrounding area was primarily undeveloped or farmland in 1941. The photographs show that by the 1960's, there was an active salvage operation in place at the property. Various environmental investigations have been conducted at the site since the early 1990's. In 1999 the City of Augusta received a grant from the EPA to conduct environmental assessments and a feasibility study under the EPA's Brownfields Assessment Demonstration Pilot Program. In September 2000, the City of Augusta contracted with GF to provide environmental assessment services to meet the grant's objectives. In August 2000, the Georgia Department of Natural Resources (DNR), Environmental Protection Division (EPD) mobilized a contractor to the site to mitigate primary health threats to the community by removing surface debris and remediating shallow soils. The site soils were remediated to meet the State's non-residential standards according to

interviews with the State contractor. A detailed history of these investigations and corresponding corrective actions are described in the April 20, 2004 Gannett Fleming report entitled "Phase II Environmental Site Assessment and Site Reuse Feasibility Study, former Goldberg Brothers, Inc. Site, 241 Dan Bowles Road, Augusta, Georgia."

In June 2003, the city received a second EPA Brownfields Grant to investigate the area around the former Goldberg Brothers Site. This report presents the results of that investigation and satisfies the final deliverable for the Augusta Brownfields Redevelopment Project under EPA Cooperative Agreement #BF 97493603-0.

1.5 Previous Findings

Contaminants associated with the former Goldberg Brothers site include heavy metals, primarily lead, and PCBs in soils and low concentrations of metals in shallow groundwater based on the most recent data. Small pockets of petroleum contamination have also been observed at the site.

As previously indicated, a Georgia EPD contractor has completed soil remediation at the former Goldberg Brothers site to meet non-residential cleanup standards; however, GF has not verified through sampling that soil meets non-residential standards at the former scrap yard.

Former environmental studies conducted at the Goldberg Brothers and Richmond Recycling properties have found that groundwater impacts are limited primarily to a small area around wells MW-6, MW-12, and MW-13 on the Goldberg Brothers site. Benzo(a)pyrene, methylene chloride, lead, PCBs, and benzene have been detected in one or more of these wells at concentrations exceeding the EPD's Risk Reduction Standards (RRS). In 2004, cadmium was detected in groundwater at well MW-11 on the former Richmond Recycling property at concentrations exceeding the RRS. Antimony was also detected in groundwater at concentrations exceeding the RRS in several wells in 2004; however, subsequent testing using alternative analytical methods could not verify this result and since that time antimony has not been detected in groundwater exceeding the RRS.

1.6 Phase I Environmental Site Assessment Overview

GF was retained by the Augusta Engineering Department to complete a Phase I Environmental Site Assessment (ESA) for the study area and prepare a report of findings. The full text of that report can be found in the document entitled: "Phase I Environmental Site Assessment Report, Augusta Brownfields Redevelopment Project, Augusta, Georgia" (GF May 2006). The Phase I assessment revealed the following conclusions:

- According to property deed records, historical information, and interviews with area residents both the Fabrister Ranch and Richmond Recycling properties were at one time part of the former Goldberg Brothers recycling scrap yard operation. Numerous piles of scrap metal, wire, rubber and plastic hoses, tires, building materials, and other debris were observed at the Richmond Recycling site. Similar piles of junk were once stored at the former Goldberg Brothers site, which has demonstrated concentrations of heavy metals (primarily lead) and PCBs in soil and heavy metals in groundwater above State standards for residential and non-residential use. Phase II soil and groundwater sampling and analysis in 2002 revealed the presence of zinc in two soil samples above Georgia residential standards and cadmium above residential standards in groundwater on the Richmond Recycling property. It is likely that similar contaminants exist in subsurface soil and groundwater across the Phase I study area based on prior use of the former scrap yard properties and the proximity of the former Goldberg Brothers site to the study area.
- Historical environmental studies and a removal action in Hyde Park indicate the potential for contaminants to still be present in the community:
    - In 1995, sediment sampling along the Hyde Park drainage swale revealed the presence of chromium, cadmium, selenium, lead, and mercury above Georgia residential standards. A surface water sample from that sampling event also indicated elevated levels of lead.
    - In 1997 soil sampling along Walnut Street properties revealed elevated levels of polycyclic aromatic hydrocarbons (PAHs), PCBs, and lead.

- In 1998 a soil removal action was undertaken by EPA on three properties on Walnut Street that abut the former Goldberg Brothers scrap yard.

- Hyde Park residents report existing drinking water wells on their properties, many of which could still be in use; however, it is unlikely these wells are currently being used for drinking water purposes because the homes are connected to Augusta water and sewer services. Groundwater sampling and analysis is planned for the Phase II ESA from newly installed monitoring wells in Hyde Park. Depending on the results of this sampling, it may be advisable to have existing private wells abandoned.
- Several empty quart-size oil containers and antifreeze jugs were observed on the Richmond Recycling site along the southern property line.
- Limited petroleum staining was observed on soils at the Richmond Recycling property and at some of the residential properties in Hyde Park.
- Interviews with Hyde Park residents indicate floating oily sheens have been observed in area ditches, especially after heavy rains or flooding.
- The former Goldberg Brothers recycling scrap yard, a Georgia EPD superfund site, is situated adjacent to Hyde Park and the Fabrister Ranch and Richmond Recycling properties. Phase II environmental sampling and analysis in 2002 and 2004 indicated the presence of heavy metals (primarily lead) and PCBs in soil and heavy metals in groundwater above State standards. Surface runoff and area flooding may have resulted in contaminant impacts to Hyde Park, Fabrister Ranch, and Richmond Recycling properties.
- There are several offsite concerns that have the potential to impact the Phase I study area, including six Leaking Underground Storage Tank (LUST) sites that are within ½-mile and upgradient of the Phase I study area. The Circle K #2705349 located at 1500 Gordon Highway, a LUST site, is the closest to the subject properties and has the most potential to impact the area. However, Phase II environmental sampling and analysis did not reveal the presence of LUST contaminants on the former Goldberg Brothers site in 2002 and 2004.

Information obtained from the Phase I environmental site assessment was used to focus the Phase II investigation.

2.0 SOIL INVESTIGATION

2.1 Procedures

On March 27, 2006, GF mobilized to the Augusta brownfields study area off Dan Bowles Road to conduct a Phase II ESA as part of the Augusta Brownfields Redevelopment Project under a grant from the United States EPA.

GF collected 55 soil samples from 49 distinct locations across the study area. The sample locations are shown on Figure 1. Soil boring numbers began with SB-22 because the initial brownfields assessments in 2002 and 2004 ended with 21 soil borings. Twenty-nine soil samples (SB-22 through SB-44, and SB-48 through SB-53) were collected from 1-foot deep borings located on various properties and in the right-of-ways throughout the Hyde Park Neighborhood. Special care was taken to ensure that soil samples were collected from the native soil on these properties and not from topsoil. Five sediment samples (SB-45, SB-46, SB-47, SB-54, and SB-55) were collected from various locations in the concrete lined storm water ditch that runs through the Hyde Park neighborhood. Six soil samples were collected from three borings (SB-62, SB-63, and SB-64) drilled to 3 feet below ground surface along the south side of Dan Bowles Road adjacent to the Fabrister Ranch Property. Two sediment samples (SB-58 and SB-59) were collected from the earthen storm water ditch located just east of the Fabrister Ranch property on the west side of Dan Bowles Road, and two soil samples were collected from the east side of Dan Bowles Road (SB-56 and SB-57) across from the Fabrister Ranch Property. Nine soil samples were collected from 6 borings (SB-65 through SB-70) installed on the Richmond Recycling property. Two soil samples (SB-60 and SB-61) were collected in the drainage ditches on the south and north sides of Dan Bowles Road, respectively. These samples are topographically upgradient of the former Goldberg Brothers, Fabrister Ranch, and Richmond Recycling properties and were collected to assess the potential for offsite impacts to the study area.

All soil samples were submitted to Analytical Environmental Services, Inc. (AES) in Atlanta for laboratory analysis of Total Petroleum Hydrocarbons, Diesel Range Organics (TPH-DRO) by USEPA SW-846 method 8015B, polychlorinated biphenyls (PCBs) by USEPA SW-846 method

8082, and the following 15 metals: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, vanadium, and zinc. Mercury was analyzed using USEPA SW-846 method 7471A; the remaining metals were analyzed utilizing USEPA method 6010B. The analytes were selected based on the results of the previous assessments conducted on the former Goldberg Brothers and Richmond Recycling properties. All sampling protocols, procedures, and analytical testing were conducted in accordance with the EPA-approved Quality Assurance Project Plan (QAPP), with the following two exceptions:

- Some of the soil borings on the Richmond Recycling property that were intended to be cored to 3 feet deep using a hand auger could only be advanced to one foot due to the presence of buried debris (brick, wire, and other hard materials). As a result only one sample was able to be collected from some of these borings instead of two as planned.
- Due to an oversight by the field technician when filling out one of the laboratory chain of custody forms, 12 of the soil samples were not analyzed for TPH-DRO by the laboratory until after the mistake was realized and the holding times had expired. However, the impact of this error had little effect on the overall results since TPH-DRO concentrations in other soil samples that were analyzed within the proper holding times were relatively low with the exception of 5 soil samples which had concentrations above 100 milligrams per kilogram (mg/Kg).

Soil cuttings generated by the sampling were placed back in the boreholes.

On August 8–10, 2006, GF remobilized to the site to collect additional samples based on the results of the sampling effort described above and to fill some of the data gaps observed between sample locations. Thirty four additional borings (SB-72 to SB-105) were drilled to 1-foot below grade using a hand auger in the Hyde Park neighborhood. The samples were submitted for laboratory analysis of cadmium, copper, lead, mercury, and zinc. These metals were selected for analysis because they represented the primary metals observed in the initial sampling event. It was also determined that the two upgradient samples (SB-60 and SB-61) collected during the initial sampling event may not have been sufficiently upgradient from the study area to be

representative. Therefore, two additional upgradient samples were collected (SB-71 and SB-106) and analyzed for cadmium, copper, lead, mercury, and zinc.

Five borings were drilled to 3 feet at borings SB-23, SB-26, SB-41, SB-48, and SB-51 in order to determine approximate vertical extent of these five metals in select borings where metals were detected at the surface (6-inches to 1-foot deep) in the Hyde Park community.

In addition, five borings from the initial scope of work above (SB-23, SB-26, SB-60, SB-68, and SB-69) were selected for re-sampling and analysis of semivolatile organic compounds (SVOCs) by USEPA SW-846 Method 8270 based on elevated TPH-DRO results. Finally, three of the 12 TPH samples that were not analyzed within the appropriate holding time (SB-45, SB49, and SB-51) were re-sampled and re-analyzed to determine the effect on the reported results.

2.2 Results

The complete soil results are summarized in Tables 1, 2, and 3.

2.2.1 Results of Initial Sampling

Of the 15 metals initially analyzed in soil, five metals (barium, beryllium, cobalt, selenium, and vanadium) were not detected at levels exceeding the Georgia EPD Type 1 (residential standards) Risk Reduction Standard (RRS) throughout the study area. The remaining ten metals were detected at concentrations above the Type 1 RRS in one or more soil samples as indicated in the table below:

Metal (listed alphabetically)	Number of Detections Exceeding the Type 1 RRS Across the Study Area (out of a total of 55 samples)	Percentage of Detections Exceeding the Type 1 RRS Across the Study Area
Antimony	2	4%
Arsenic	1	2%
Cadmium	7	13%
Chromium	1	2%
Copper	11	20%
Lead	21	38%
Mercury	4	7%

Metal (listed alphabetically)	Number of Detections Exceeding the Type 1 RRS Across the Study Area (out of a total of 55 samples)	Percentage of Detections Exceeding the Type 1 RRS Across the Study Area
Nickel	1	2%
Silver	1	2%
Zinc	24	44%

Lead and zinc were detected the most often, and several samples collected on or adjacent to residential properties exhibited concentrations of one or both of these metals above the Type 1 RRS. Copper and cadmium were the next most prevalent metals observed at elevated levels and were also detected in one or more residential samples above the Type 1 RRS. Concentrations of copper, lead, mercury, and zinc exceeding the Type 1 RRS were also detected in several of the sediment samples collected from the concrete lined storm water ditch in Hyde Park. Antimony, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc were detected on the Richmond Recycling property at concentrations exceeding the Type 1 RRS. In addition, concentrations of antimony, copper, lead, and zinc exceeded the Type 3 (non-residential) RRS in samples collected on this property. The highest concentrations of these metals were observed on the Richmond Recycling property, although the second highest observed lead concentration in soil was observed on residential property adjacent to the former Goldberg Brothers Recycling site.

PCBs were detected in two soil samples at concentrations exceeding the Type 1 and Type 3 RRS, SB-68 and SB-69 both on the Richmond Recycling property. These samples were collected from 0 to 1 foot below grade. Metal and other debris prevented the collection of a sample at the 2- to 3-foot depth at either location. At boring SB-69, Aroclors 1248, 1254, and 1260 were all detected significantly above the Type 1 RRS of 1,550 micrograms per kilogram (µg/Kg). At boring SB-68 the total combined concentration of Aroclors 1248 and 1260 exceed the RRS, but not the individual Aroclors. The Type 3 RRS for these compounds is the same as the Type 1. Low levels of PCBs were detected in several other samples; however, none of the samples exceeded the Type 1 RRS.

Cadmium, copper, lead, and zinc were detected at concentrations above the Type 1 RRS in soil samples SB-60 and SB-61. These samples are located on either side of Dan Bowles Road upgradient of the subject properties. After review of other historical information, it was discovered that extensive flooding in the area has occurred. Past floods have been known to cover the entire area between each of the railroad tracks (See Figure 1). Therefore these samples may not truly represent upgradient conditions.

In borings SB-62, SB-63, SB-64, SB-65, SB-66, and SB-70, samples were collected from both 0 to 1 feet and 2 to 3 feet below grade. None of the analyzed constituents were detected above the Type 1 RRS in any of the 2- to 3-foot deep samples.

There is no standard for TPH-DRO in Georgia and it is difficult to assess the risk posed by TPH because the analysis detects a very wide range of compounds. Therefore TPH is generally used as a screening tool to determine if regulated compounds may be present in sufficient quantities to warrant additional investigation. Some states publish standards for TPH-DRO; however, these standards vary widely from state to state. For instance, Oklahoma publishes a residential cleanup level of 50 mg/Kg while Maryland uses 230 mg/Kg. Only samples SB-68 and SB-69, collected on the Richmond Recycling property, exceed the Maryland standard. A general rule of thumb is that samples with TPH-DRO concentrations over 100 mg/Kg may warrant additional investigation to determine if other constituents are present. Of the 55 total samples collected only five samples exhibited concentrations above 100 mg/Kg (SB-23, SB-26, SB-60, SB-68, and SB-69).

2.2.2 Results of Additional Sampling

After the initial sampling in late March and early April 2006, GF determined that data gaps existed primarily in the Hyde Park Neighborhood. In order to conduct the additional assessment in the most cost effective manner samples were analyzed only for those constituents consistently detected above the Type 1 RRS: cadmium, copper, lead, mercury, and zinc (see table above).

Cadmium was detected in nine of the 36 additional soil samples with 4 of these detections exceeding the Type 1 RRS (borings SB-71, SB-76, SB-78, and SB-80). None of the samples exceeded the Type 3 RRS. Copper was detected in all 36 samples; however, only 5 samples exceeded the Type 1 RRS (SB-71, SB-76, SB-78, SB-79, and SB-80). In addition, the copper concentration at boring SB-79 also exceeded the Type 3 RRS. Lead, mercury, and zinc were also detected in all 36 soil samples. Lead concentrations exceeded the Type 1 RRS in 14 of the borings (SB-71, SB-74, SB-76, SB-78, SB-80, SB-81, SB-84 through SB-87, SB-95, SB-96, SB-98, and SB-106). Soil samples from three of these borings also exceeded the Type 3 RRS for lead (SB-71, SB-74, and SB-78). Mercury was detected in three soil samples at concentrations exceeding the Type 1 RRS (SB-71, SB-74, and SB-76); none of these exceeded the Type 3 RRS. Zinc exceeded the Type 1 RRS in twelve of the soil samples (SB-71, SB-74, SB-76, SB-78 through SB-81, SB-85, SB-91, SB-93, SB-104, and SB-106); one of these (SB-80) also exceeded the Type 3 RRS. Figure 2 shows the samples with concentrations exceeding the Type 1 and 3 RRSs.

Two of these samples (SB-71 and SB-106) were located in the Dan Bowles Road right-of-way west of the railroad tracks to obtain information from an area upgradient of the subject area. These locations were selected since historical information indicated that flooding did not extend into this area. Cadmium, copper, lead, mercury, and zinc were all detected above the Type 1 RRS in boring SB-71, with lead concentrations exceeding the Type 3 RRS as well. Lead and zinc were detected in soil at boring SB-106 at concentrations exceeding the Type 1 RRS. SB-71 is adjacent to another active recycling facility (Augusta Steel and Metal Company). The results indicate that this facility may be another possible source of metal contaminants. SB-106 is located across the street from the recycling center, adjacent to the Thermal Ceramics facility. GF has not been able to obtain an upgradient soil sample in the area that is free from metals contamination.

Five borings (SB-23, SB-26, SB-41, SB-48, and SB-51) were selected for re-sampling at the depth interval of 1.5 to 2 feet to determine the vertical extent of these five metals in soil in the Hyde Park area. Lead and zinc were detected at concentrations exceeding the Type 1 RRS in the deeper samples collected at SB-23 and SB-26. These borings are located along the Goldberg

Brothers property line and therefore, it can be expected that contamination at these locations would have migrated deeper than at other areas. None of the other constituents exceeded the Type 1 RRS in any of the deeper samples. Therefore, it appears that the impact in the Hyde Park neighborhood is primarily limited to surficial soils with the exception of areas immediately adjacent to the former Goldberg Brothers site.

Five soil borings (SB-23, SB-26, SB-60, SB-68, and SB-69) were re-sampled and analyzed for SVOCs due to the detection of TPH-DRO exceeding 100 mg/Kg. Several organic constituents were detected in these samples, however, none exceeded the Type 1 RRS.

Three samples were re-analyzed for TPH (SB-45, SB-49, and SB-51) to determine if the results were biased due to the samples being run outside of the specified holding times. The table below summarizes the results:

Sample ID	TPH Concentration (mg/Kg)		Relative Percent Difference	Change Factor (August/April)
	April 2006	August 2006		
SB-45	28 JH	130	129%	4.64
SB-49	7.9 JH	46	141%	5.82
SB-51	11 JH	29	90%	2.63

This table indicates that the original samples are biased low. On average, the concentrations increased by 4.4 times over the initial samples. If this factor is applied to the other 9 samples, then the TPH-DRO concentration at borings SB-45, SB-50, and SB-54 may also exceed 100 mg/Kg. However, since no regulated compounds were detected above the Type 1 RRS for SVOCs in the samples collected at the other five elevated TPH-DRO sample locations, it is unlikely that regulated substances are present at these locations at concentrations that exceed the Type 1 RRS.

2.2.3 Summary of Soil Investigation Results

Figures 3 through 8 show the results for cadmium, copper, lead, mercury, zinc, and total PCBs, respectively, across the study area. The results indicate that there are pockets of impacted soil located throughout the area. The impacts appear to be limited to surficial soil and ditch sediment in most areas, and are likely the result of surface deposition from storm water runoff and flooding.

The former Goldberg Brothers and Richmond Recycling sites are known sources of soil contamination in the Hyde Park area, based on the results of this and past studies. The Fabrister Ranch and Augusta Steel and Metal Company sites are also potential sources, based on the results of sampling along Dan Bowles Road. Automobile repair work appears common on many of the residential properties in the neighborhood and also can not be ruled out as a potential source of some of the contamination. However, further study is required to determine if these areas are actually sources of contamination or if the contamination along Dan Bowles Road is from other known sources. Based on the disposition of contaminants found in Hyde Park, it is very likely that metal contaminants from the nearby scrap yards have been transported to the Hyde Park neighborhood due to storm water runoff and flooding that has occurred over time.

The laboratory analytical reports are presented in Appendix A. Laboratory results were validated by MAKuehl Company and deemed usable. The validator's report is included in Appendix B.

3.0 GROUNDWATER INVESTIGATION

3.1 Procedures

In order to assess groundwater conditions, GF sampled the 13 existing monitoring wells located on the former Goldberg Brothers and Richmond Recycling properties and installed 9 additional monitoring wells (MW-14 through MW-22). The well locations are shown on Figure 1. One well (MW-14) was installed on the west side of Dan Bowles Road, just east of the Fabrister Ranch property. Two wells were installed on the Richmond Recycling Property (MW-15 and MW-16) and the remaining six wells (MW-17 through MW-22) were installed in the Hyde Park neighborhood.

The nine new wells were installed utilizing a Geoprobe ^{TM} 6610 DT track-mounted drilling rig and four-inch diameter hollow stem augers. The wells were installed to intersect the shallow water table and constructed with 10 feet of 2-inch diameter Schedule 40 PVC 0.010-inch continuous slotted pipe screen and completed with solid PVC risers. Well construction logs are found in Appendix C and the well construction information is summarized on Table 4.

The wells were developed by pumping, and samples were collected from the wells for laboratory analysis of PCBs, and the following 15 metals: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, vanadium, and zinc. Samples for organic constituents other than PCBs were not collected during this investigation, because past investigations did not detect significant levels of organic parameters. All sampling protocols, procedures, and analytical testing were conducted in accordance with the EPA-approved Quality Assurance Project Plan (QAPP). Groundwater sampling was performed using the EPA-approved low flow purge method to minimize turbidity. GF also collected water level readings in April and August 2006.

Soil cuttings, development water, and purge water from the investigation were collected in 55-gallon drums. The drums were stored inside the fence and on a concrete pad at the former Goldberg Brothers site while they were being characterized for disposal. Based on the lack of contamination in groundwater, the development and purge water was discharged to the ground

and the drums transported to a scrap yard for recycling. A total of nine drums of investigation-derived liquids from well development and sample purging were discharged to the ground. Composite soil samples were collected from the remaining drums containing soil cuttings and submitted for laboratory analysis using the toxicity characteristic leaching procedure (TCLP) for the eight Resource, Conservation, and Recovery Act (RCRA) metals. The soil was determined to be non-hazardous and transported to the Richmond County Landfill for disposal by HEPACO, Inc. A total of six, 55-gallon drums of soil cuttings were disposed of at the landfill. Waste disposal manifests are included in Appendix E.

3.2 Results

Table 4 summarizes the analytical results for groundwater. Lead was detected in well MW-13 at 50.7 micrograms per liter (µg/L), exceeding the Type 1 RRS of 15 µg/L. The Type 1 and 3 RRS for lead are the same. In addition, an oily sheen was reported on the sampling equipment when it was removed from the well. GF attempted to determine if a light non-aqueous phase liquid (LNAPL) was present in this well using an oil/water interface probe. However, no measurable LNAPL was observed in this well. No other constituents were detected in groundwater at concentrations above the Type 1 RRS. No constituents were detected in groundwater above the Type 1 RRS in any of the monitoring wells in the Hyde Park neighborhood.

While collecting groundwater levels in August 2006, GF again attempted to measure product in monitoring wells MW-12 and MW-13. GF utilized an oil/water interface probe to look for the presence of an LNAPL or DNAPL (dense non-aqueous phase liquid) in wells MW-12 and MW-13. Approximately 0.03 feet of LNAPL was discovered in well MW-12. However, when well MW-13 was gauged a DNAPL was discovered; water was measured in this well from 4.73 to 5.45 feet below surface, while DNAPL was encountered from 5.45 feet to the bottom of the well (14.55 feet below ground).

Water level measurements were obtained from the wells to determine groundwater flow direction. Groundwater was observed to flow generally to the southeast based on the April and August 2006 water level information. Figures 9 and 10 show the April 2006 and August 2006 groundwater contours, respectively.

The laboratory analytical reports are presented in Appendix A. Laboratory results were validated by MAKuehl Company and deemed usable. The validator's report is included in Appendix B. Field groundwater sampling logs are presented in Appendix D.

4.0 RISK ASSESSMENT

4.1 Soil

The Type 1 and 3 RRSs for the regulated substances found at the site are generic tabulated values for residential and non-residential (or "industrial") sites, respectively which are based on the Georgia Hazardous Site Response Act (HSRA) and the EPD's *Guidance on Target Soil Concentrations for Type 1 and Type 3 Risk Reduction Standards*, March 1995.

The calculation of Type 2 or 4 RRSs (site specific, risk-based residential and industrial standards, respectively) is not warranted at this time. Based on the current level of data available at the site, the slight increase in cleanup standards obtained by calculating site specific standards would have negligible impact on the remediation cost estimates; however, as more data is collected at the site and a site specific redevelopment plan is developed, the calculation of these standards may become warranted.

With the exception of the former Goldberg Brothers site, the potential exists for exposure to site contaminants through ingestion, dermal contact, or inhalation across the study area because of people living in the impacted area and the relatively shallow nature of the contamination. However, the primary soil contaminants at the site, metals and PCBs, are not volatile; therefore inhalation is not a likely exposure pathway. Surface soils at the Goldberg Brothers property have been reportedly remediated to meet the Type 3 RRSs; therefore, ingestion, dermal contact, and inhalation are not complete pathways at the former Goldberg Brothers scrap yard site.

4.2 Groundwater

The Type 1 and 3 RRSs for groundwater are the same for all HSRA regulated substances. Groundwater Type 1/3 RRSs are also lookup values. Groundwater ingestion and dermal contact risks are considered unlikely but possible because the site is located in an area with public water supply. While there are no private wells in use within one mile according to available information; there are reportedly several private, potable water wells located at residences along Willow and Goldenrod streets. However, the houses are reportedly connected to the public water system and the wells are no longer in use. Irrigation systems requiring groundwater use to

supply water for agriculture are not needed since the immediate area is zoned as industrial or residential. As previously discussed, metals are not volatile. Therefore, inhalation of the primary groundwater contaminants is not feasible. Furthermore, groundwater impacts appear to be limited to two wells on the former Goldberg Brothers site.

5.0 FEASIBILITY STUDY

5.1 Potential Land Re-Use and Redevelopment Options

At the time this report was prepared, GF was not aware of specific plans for site redevelopment of the Hyde Park, Goldberg Brothers, Richmond Recycling, or Fabrister Ranch properties. However, the community has at one time expressed an interest to provide development-ready land to support a non-manufacturing business and technology park with professional office space. There is also the possibility of creating a greenspace with small community parks that will include wildlife habitat areas, walking/jogging trails, a community education/training center, and a non-profit community recreational facility to integrate the new buildings/offices into the adjacent Hyde Park community.

Specific areas designated for greenspace or parks are not known at this time. Therefore, the remediation alternatives presented herein are based on cleaning the area for future use as one of three possible scenarios:

1. All residential,
2. Cleaning up the former metal scrap yards to non-residential ("industrial") standards and all other areas to residential standards, and
3. All to non-residential standards (would require re-zoning).

Once a redevelopment plan has been determined, actual remedial strategies should be reviewed and incorporated into the plan for a cost-effective solution.

5.2 Estimated Extent of Contamination

Site data collected during the Phase II assessment were reviewed and compared to the RRSs to identify the estimated extent of regulated substances across the study area.

5.2.1 Soil

Figures 3 through 8 show the estimated extent of cadmium, copper, lead, mercury, zinc, and total PCBs, respectively, in surficial soil across the study area. The results indicate pockets of impacted soil located throughout the area. The impacts appear to be limited to surficial soil and ditch sediment in most areas and are likely the result of surface deposition from storm water runoff and flooding. The major areas of impacted soil are the Campbell Recycling and former Richmond Recycling scrap yard properties, the sediments in the concrete lined drainage ditch in Hyde Park, several of the residential properties west of Walnut Street (especially those immediately adjacent to the former Goldberg Brothers site), and much of the area north of the concrete lined ditch between Walnut and Willow streets. Figure 11 shows the approximate areas where soil exceeds the Type 1 and 3 RRSs.

5.2.2 Groundwater

Groundwater impacts appear to be limited to a relatively small area around MW-12 and MW-13. MW-13 is the only well where a regulated constituent (lead) was detected above the applicable RRS during this sampling event. Several feet of DNAPL was also observed in this well during the August 2006 water level event. Although, no constituents exceed the RRS at MW-12, approximately 0.4 inches of LNAPL was observed in the well while collecting water level data in August. Samples for organic constituents other than PCBs were not collected during this investigation, because past investigations did not detect significant levels of organic constituents.

In addition to PCBs, benzene was previously detected in groundwater at MW-13 at a concentration of 5.67 µg/L in January 2004. This value slightly exceeds the Type 1 RRS of 5 µg/L. Lead was also detected in groundwater exceeding the Type 1 RRS (15 µg/L) at MW-12 at a concentration of 20 µg/L in 2004 (the April 2006 result is 10.4 µg/L).

5.3 Remedial Alternatives

5.3.1 Soil

As mentioned in Section 5.1, no redevelopment plan currently exists for the study area. Therefore, remedial cost estimates have been developed assuming one of three possible

combinations of non-residential ("industrial") or residential cleanup scenarios: (1) clean up entire area to Type 1 (residential) RRS; (2) clean up of current residential areas to Type 1 RRS and clean up of industrial areas (scrap yard sites) to Type 3 (non-residential) RRS; and (3) clean up of entire area to meet Type 3 RRS. The costs presented below do not include property acquisition or demolition costs and assume all structures are removed from areas prior to remediation (whether they are residential or not). Potential alternatives to remediate soil are presented below:

- In-situ Solidification/Stabilization, Excavation, and Offsite Disposal
- Excavation, Ex-situ Solidification/Stabilization, and Offsite Disposal
- Excavation and Offsite Disposal

All three technologies are considered technically feasible and are nearly equally effective in protecting human health and the environment. GF also investigated the possible application of phytoremediation at the site. This remedial alternative involves cultivating plants that have an affinity to preferentially uptake contaminants such as metals from the soil into the plant matter. The plants remove the metals from the soil by uptake through the roots along with other nutrients and depositing them in the biomass (primarily leafs) of the plant. The leaves are then harvested and disposed of in a licensed facility. However, after further review it was determined that this technology is not technically feasible for the specific site conditions and contaminants (particularly lead).

5.3.2 Groundwater

Lead was the only constituent detected in any of the wells exceeding the RRS. However, LNAPL and DNAPL were observed in two of the wells on the Goldberg Brothers site. Remediation of these free phase liquids should remove the source of groundwater impact (soil in the area has already been remediated to Type 3 RRS).

Since no groundwater impacts have been detected beyond the former Goldberg Brothers scrap yard, there is no off-site groundwater that requires remediation. Remediation alternatives for

groundwater at the former Goldberg Brothers site have already been evaluated and are discussed in the previous Phase II report for that site (Gannett Fleming, Inc., April 20, 2004). Additional investigations are required to determine the impact of the free phase products discovered at the former Goldberg Brothers site. GF estimates approximately $300,000 to $400,000 to investigate and mitigate the site impacted with free phase product.

5.4 Evaluation of Remedial Alternatives

This evaluation of remedial alternatives identifies advantages and disadvantages for each alternative and compares present worth cost estimates. The cost estimates are based on currently known site conditions and are subject to change as additional data is gathered during the design and remediation phase. The list of remedial alternatives is not exhaustive, but the selected alternatives were considered the most applicable technologies given the current site conditions. For the purposes of comparing costs between alternatives, it is also assumed that all soil exceeding the Type 3 RRS and 25% of the soil exceeding the Type 1 RRS is considered a RCRA characteristic hazardous waste (i.e. it fails TCLP for one or more constituents). All other soil is considered non-hazardous.

In order to calculate the volume of soil to be remediated, GF assumed a depth of impact for the various contaminated areas. Based on the previous remedial efforts at the former Goldberg Brothers site and the data collected as part of this investigation, it is assumed that the impacted soil with concentrations above the Type 3 RRS extend to an average depth of 4 feet on the Fabrister Ranch and former Richmond Recycling scrap yards and the residential area immediately adjacent to the former Goldberg Brothers site. Soils exceeding the Type 1 RRS in these areas are assumed to extend an average of 3 feet below grade. The small pockets of impacted soil east of Goldenrod Street are assumed to extend to an average depth of 1.5 feet; while the remaining residential areas are assumed to extend to approximately 2 feet below grade for both Type 1 and Type 3 RRSs.

Also, in order to calculate the weight of soil to remediate, GF assumed a soil density of 1.4 tons per cubic yard. The calculated soil volumes also include a 20% safety factor to account for over excavation, and a 15 percent contingency was added to the costs.

Based on the areas shown on Figure 11 and the assumed depths outlined above, approximately 27,000 tons of soil will require remediation to meet the Type 3 RRS and approximately 124,000 additional tons of soil will require remediation to meet the Type 1 RRS for a total of 151,000 tons of soil. Approximately 44,000 tons of soil that exceeds the Type 1 RRS is on the Campbell Recycling and former Richmond Recycling scrap yards (zoned for industrial use); therefore, cleaning this area up to only meet the Type 3 RRS reduces the amount of soil to be remediated by 44,000 tons.

In-situ Solidification/Stabilization followed by Excavation and Offsite Disposal –
This remedial alternative involves the application of a chemical reagent to the hazardous soil, such as MEACTITE ^{TM} or Portland cement, in order to solidify or stabilize constituents and render the material non-hazardous. Application of the reagent to the contaminated soil reacts with the metals in the soil to render them less mobile, but does not reduce the mass of the contaminated material. The treated soil and all other soil above Type 1 RRS that is non-hazardous can then be excavated and disposed of offsite in a Subtitle D landfill, such as the Deans Bridge Road Landfill in Augusta (pending approval of the disposal facility). This method has the advantage of not generating any hazardous waste.

The reagent is mixed with water and applied directly to the soil prior to excavation. The material is given time to percolate into the soil and then mixed in-situ using a backhoe or other mechanical device. Quality control sampling and analyses is performed to verify that the soil has been successfully treated to non-hazardous conditions before excavation. After the soil is excavated and disposed of offsite, the excavation is backfilled with clean offsite material, compacted, graded, and re-seeded to restore the disturbed area.

Based on current soil data and the assumptions stated above, it is estimated that approximately 58,000 tons of hazardous soil would have to be treated prior to being removed from the site to remediate the entire area to Type 1 Standards. If the former metal scrap yards are cleaned up to Type 3 standards and the other areas remediated to Type 1, then only 47,000 tons of hazardous soil would be treated, and if the entire area were remediated to meet the Type 3 RRS, only

27,000 tons of soil would need to be treated. A total of 151,000 tons of soil would have to be excavated and removed from the site (including the treated soil) to remediate the area to the Type 1 RRS. Approximately 107,000 tons would be removed if the former metal scrap yards are remediated to the Type 3 RRS and the remaining areas to the Type 1 RRS. Approximately 27,000 tons would require treatment and removal if the entire area were remediated to the Type 3 RRS.

The estimated capital cost to remediate the entire area to residential standards using this technology is approximately $20,300,000. The estimated cost to remediate the Campbell Recycling and former Richmond Recycling scrap yards to non-residential standards and the remaining areas to residential standards using this technology is $15,000,000. The cost to remediate the entire area to industrial standards only is approximately 5,200,000. These costs include additional studies and design fees that accompany this particular technology.

Excavation, Ex-situ Chemical Treatment and Offsite Disposal - This remedial alternative involves excavating the impacted soil, testing the excavated soil to determine if it is a hazardous waste utilizing TCLP analysis, then treating the soils that fail TCLP by application of a chemical reagent such as MEACTITE ^{TM} or Portland cement to solidify or stabilize constituents and render the material non-hazardous. Application of the reagent to the contaminated soil reacts with the metals in the soil to render them less mobile, but does not reduce the mass of the contaminated material. The excavated soil can then be disposed of offsite in a Subtitle D landfill, such as the Deans Bridge Road Landfill in Augusta (pending approval of the disposal facility).

The soil would be excavated and stockpiled for treatment. The chemical reagent is then mixed with water, applied to soil, and mixed above grade using a backhoe or other mechanical device. Quality control sampling and analyses is performed to verify that the soil has been successfully treated before transportation off site. After the soil is excavated and disposed of offsite, the excavation is backfilled with clean offsite material, compacted, graded, and re-seeded to restore the disturbed area.

Soil volumes requiring treatment and disposal for this option are the same as the in-situ treatment option. However, because the material is excavated prior to treatment, the soil becomes a hazardous waste and the site will become a hazardous waste generation and/or treatment facility. This will require the agency remediating the site to obtain a hazardous waste generator ID number.

The estimated capital cost to remediate the entire area to residential standards using this technology is approximately $19,300,000. The estimated cost to remediate the Campbell Recycling and former Richmond Recycling scrap yards to non-residential standards and the remaining areas to residential standards using this technology is $13,900,000. The cost to remediate the entire area to industrial standards only is approximately 4,600,000. These costs include additional studies and design fees that accompany this particular technology.

Excavation and Offsite Disposal - This remedial alternative involves excavation of soil with concentrations exceeding the Type 1 RRS and offsite disposal in a Subtitle D landfill if the excavated material is non-hazardous (passes the TCLP for metals and PCBs) or in a Subtitle C landfill, such as Waste Management's Emelle, Alabama facility, if the material is hazardous. The excavation would be backfilled with clean offsite material, then compacted, graded, and re-seeded to restore the disturbed area.

The soil volumes are similar to the options above, except that instead of treating the hazardous soil, it would be transported to a hazardous waste landfill. This option also requires the agency remediating the site to obtain a hazardous waste generator ID number.

The estimated capital cost to remediate the entire area to residential standards using this technology is approximately $34,000,000. The estimated cost to remediate the Campbell Recycling and former Richmond Recycling scrap yards to non-residential standards and the remaining areas to residential standards using this technology is $30,000,000. The cost to remediate the entire area to industrial standards only is approximately 11,700,000. These costs include additional studies and design fees that accompany this particular technology.

Remedial alternatives were evaluated on the basis of general advantages, disadvantages, and capital cost. A summary of the remedial alternative evaluation for soil is presented in Table 7.

Summary - The cost of the two solidification/stabilization technologies are essentially the same within the accuracy of these estimates. Excavation and off-site disposal is significantly more expensive than the other two options. The in-situ and ex-situ solidification/stabilization technologies as well as excavation and off-site disposal are equally as effective in reaching the remedial objectives.

5.5 Georgia State Brownfields Program

Under a relatively new program within Georgia EPD, a prospective site developer may enter into an agreement with EPD to conduct necessary soil remediation in exchange for environmental liability protection for contamination stemming from former use of the site and not having to clean up groundwater. This program is gaining popularity across the state and should be considered as another alternative to assist in site remediation and redevelopment. Potential cleanup alternatives using this approach could cost considerably less if the State would be amenable to higher risk-based cleanup standards other than the RRSs. In addition, options to couple the cleanup remedy with site redevelopment could also reduce cleanup costs. For example, with the exception of a few "hot spots", soil exceeding the Type 1 and 3 RRSs could potentially be left onsite and buried under parking lots or building foundations to minimize the potential for contaminant exposure. This option would require various land use restrictions and have to be approved by Georgia EPD. Hot spot areas could be cleaned up by one of the remedial alternatives presented above. This approach has been used successfully in other states.

6.0 CONCLUSIONS

GF was retained by the Augusta Engineering Department to conduct a Phase II environmental site assessment and feasibility study of the Augusta Brownfields Study Area. The assessment revealed the following:

Soil:

- Pockets of contaminated soil exceeding the Georgia Environmental Protection Division (EPD) Type 1 (residential) Risk Reduction Standard (RRS) are located throughout the study area, including the residential Hyde Park community.
- A large area of soil on the Fabrister Ranch and Richmond Recycling properties exceeds the Type 3 (non-residential) RRS. A few smaller areas of soil were detected within the Hyde Park neighborhood that also exceeded the Type 3 RRS.
- Primary contaminants in soil include cadmium, copper, lead, mercury, zinc, and PCBs.
- Soil impacts appear to be limited to surficial soil and ditch sediment in most areas, and are likely the result of surface deposition from storm water runoff and flooding.
- The former Goldberg Brothers and Richmond Recycling sites are known sources of soil contamination in the Hyde Park area based on the results of this and past studies. The Fabrister Ranch and Augusta Steel and Metal Company sites are also potential sources of contamination based on the results of sampling along Dan Bowles Road. However, further study is required to determine if these areas are actually sources of contamination or if the contamination along Dan Bowles Road is from other known sources. Automobile repair work appears common on many of the residential properties in the neighborhood and also can not be ruled out as a potential source of some of the contamination observed in Hyde Park.
- Based on the disposition of contaminants found in Hyde Park, it is very likely that metal contaminants from the nearby scrap yards have been transported to the Hyde Park neighborhood due to storm water runoff and flooding that have occurred over time.
- GF investigated several remedial alternatives to address the soil contamination including in-situ solidification/stabilization, ex-situ solidification/stabilization, and excavation and off-site disposal.

- Refer to Table 7 for a summary of estimated cleanup costs. The cost of the two solidification/stabilization technologies is essentially the same within the accuracy of the estimates. Excavation and off-site disposal is significantly more expensive than the other options.

Groundwater

- Groundwater impacts appear to be limited to a relatively small area around MW-12 and MW-13 located on the former Goldberg Brothers scrap yard. MW-13 is the only well where a regulated constituent (lead) was detected above the applicable RRS during this sampling event. No groundwater contaminants were detected above the Type 1/3 RRS in samples collected from the newly installed wells in the Hyde Park neighborhood.
- Several feet of DNAPL was observed in well MW-13 during the August 2006 water level event. Although, no constituents exceed the RRS at MW-12, approximately 0.4 inches of LNAPL was observed in the well while collecting water level data in August. Samples for organic constituents other than PCBs were not collected during this investigation, because past investigations did not detect significant levels of organic contaminants.
- Since no groundwater impacts have been detected beyond the former Goldberg Brothers scrap yard, there is no off-site groundwater that requires remediation. Remediation alternatives for groundwater at the former Goldberg Brothers site have already been evaluated and are discussed in the previous Phase II report for that site (Gannett Fleming, Inc., April 20, 2004). Approximate current costs to remediate groundwater at the former Goldberg Brothers property range from $300,000 to $400,000.
- Additional investigations are required to determine the impact of the free phase products discovered at the former Goldberg Brothers site.

7.0 RECOMMENDATIONS

Based on the findings of this investigation GF recommends the following:

- Due to the recent discovery of LNAPL and DNAPL in wells MW-12 and MW-13, respectively, GF recommends that a round of groundwater samples be collected from the monitoring well network and analyzed for organic constituents. In addition, GF recommends that samples of the free phase liquids in these wells be collected and analyzed to determine their composition. Additional soil borings and monitoring wells should be installed in the vicinity of MW-12 and MW-13 to determine the extent of the free phase liquids.

- Prior to any remedial efforts, additional investigation should be conducted to better define the horizontal and vertical limits of impacted soil across the study area. Soil samples should also be collected for TCLP analysis to determine the extent of material that would be hazardous and require treatment prior to disposal.

- Soil should be remediated to meet applicable standards for current or future land uses as appropriate.

- Potential developers should investigate Georgia's Brownfields Program for potential remedial options that may reduce the cleanup costs and provide future liability protection.

8.0 REFERENCES

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