DRAFT ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES

For

Ackley Garage
3098 and 3012 Route 47
Block 222, Lot 25
Township of Maurice River
Cumberland County, New Jersey
NJDEP Case No. 02-01-16-0159-32

1.0 INTRODUCTION AND BACKGROUND

This report presents an Analysis of Brownfields Cleanup Alternatives (ABCA) for the former Ackley Garage (site) located in the Township of Maurice River, Cumberland County, New Jersey. The purpose of this ABCA is to identify and evaluate cleanup alternatives that will mitigate risks to human health and the environment for contaminated areas identified at the site based on the findings of assessments and investigations conducted to date. Woodard & Curran prepared this ABCA in support of Maurice River Township's 2014 United States Environmental Protection Agency (USEPA) Brownfield Cleanup Grant Proposal for the site.

This ABCA Report provides an overview of current site conditions, historical, current, and anticipated site uses, and an evaluation of the effectiveness, implementability, and costs associated with potential remedial actions. Analysis of this data provides a means to synthesize a plan for the most suitable remedial alternative based on the results of assessments and investigations conducted at the site to date as well as potential available funding.

This ABCA report was prepared using information obtained from a draft Site Investigation Report prepared by Woodard & Curran dated December 2013.

1.1 Site Location and Description

The site is located at the northwest corner of the intersection of Route 47 and Yawpshore Road in Maurice River Township, Cumberland County, New Jersey. The site is designated as Block 222, Lot 25 by the Township of Maurice River and the site is approximately three (3) acres in size. The Township of Maurice River acquired the site in 2004 as a result of tax foreclosure. Prior to acquisition of the site by the Township, the site was utilized as an automobile service station, general store and residence.

Figure 1 presents the approximate location of the site as shown on the United States Geologic Survey (USGS) 7.5-minute topographic map Port Elizabeth, New Jersey quadrangle. Figure 2 displays the approximate location of the site on the Township of Maurice River tax map overlain on an aerial photograph.

The site is currently vacant. The following four abandoned buildings are located on the site:

- Store Building – located in the southeastern corner of the site and fronts on Route 47. This building formerly housed an office and store associated with former gasoline service station operations.
- Service Garage – adjacent to the southwestern corner of the Store Building. This is a single-bay building with a former hydraulic lift. The Service Garage fronts on Yawpshore Road.
- Residence – abandoned two-story single-family house with a basement located northwest of the Store Building.
- Residential Garage – Wood-frame free-standing two-car garage and storage shed located southwest of the Residence.

All four (4) of these buildings are dilapidated. Remnants of a collapsed storage shed are located to the south of the Residential Garage.

1.2 Previous Investigations

Schoor DePalma conducted a Preliminary Assessment (PA) of the site on behalf of the Township of Maurice River. The PA findings were summarized in a PA report dated January 2004. Site Investigation (SI) activities were conducted by Schoor DePalma and CMX between November 2003 and January 2010. These prior assessment and investigation activities were funded by a New Jersey Economic Development Authority (NJEDA)/New Jersey Department of Environmental Protection (NJDEP) Hazardous Discharge Site Remediation Fund (HDSRF) Preliminary Assessment/Site Investigation Grant. Additional SI activities conducted by Woodard & Curran between January and November 2013 were funded by a USEPA Brownfield Community Wide Petroleum Assessment Grant awarded to Maurice River Township on September 19, 2011. Woodard & Curran's draft Site Investigation Report dated December 2013 documented the findings of prior assessment and investigations as well as the recent investigations.

The following areas of concern (AOCs) were identified in connection with the site based on the findings of these investigations.

Ackley Garage AOCs				
AOC	**Description**	**Location**	**SI Conducted?**	**Additional Investigation/ Action Recommended**
AOC-1	Aboveground Storage Tank	East of Service Garage	YES	YES
AOC-2A/2B/2C	Gasoline UST System	North of Store Building	YES	YES
AOC-2D	550-Gallon UST	East of Service Garage	YES	YES
AOC-2E	550-Gallon Heating Oil UST	North of House	YES	NO
AOC-2F/2G	1,000-Gallon Gasoline UST	East of Store Building	YES	YES
AOC-3	Hydraulic Lift	Service Garage	YES	NO
AOC-4A/4B	Septic Systems	Northwest of Store Building	YES	YES
AOC-5	Potable Well	Unknown	NO	NO
AOC-6	Maintenance Pit Area	East of Service Garage	YES	YES
AOC-7	Suspected Dumping	Wetlands on west end of site	YES	YES
AOC-8	Discarded Drums	West of the Service Garage	YES	YES
AOC-9	Lubrication Oil Drum	Store Building	NO	YES
AOC-10	Ground Water	-	YES	YES

No further investigation of AOC-2E, AOC-3, and AOC-5 was recommended based on the findings of the assessment and investigations conducted to date. Information regarding AOCs for which additional investigation was recommended is provided below.

AOC-1: 550-Gallon AST

During the PA, CMX reported a 550-gallon aboveground storage tank (AST) containing a dark liquid at the southeast exterior of the store building (AOC-1). The AST was located on an unpaved surface.

One surface soil sample (AOC-1-1) was collected directly beneath the AST during the SI in June 2006. The sample was analyzed for total petroleum hydrocarbons (TPHC), volatile organic compounds (VOC), base neutral and acid extractable compounds (BNA), with a library search of up to 40 tentatively identified compounds (TIC), pesticides, PCBs, metals, and total phenols. Analytical results indicate that chlordane and lead were present at concentrations exceeding current NJDEP Direct Contact Soil Remediation Standards (SRS). In addition, chlordane, lead, cadmium and mercury concentrations exceeded the default impact to groundwater (IGW) soil screening levels (SSL).

AOC-2A/2B/2C – Gasoline UST System

Initial Investigation

A UST system comprised of three USTs was located to the north of the Store Building. The UST system also included piping to two dispensers on the eastern side of the Store Building and remote vent pipes located southwest of the UST field. AOC-2A and AOC-2B stored unleaded gasoline and AOC-2C leaded gasoline.

A geophysical survey was conducted in May 2006, which confirmed the location of the three USTs and associated piping. The USTs were estimated to be approximately 6.4 feet in diameter and 21.5 feet in length corresponding to an estimated capacity of 5,000 gallons each. The tank field measured roughly 25 by 25 feet. The underground piping runs southeast to the dispensers and southwest to the vents were each roughly 40 to 50 feet long.

Ten soil borings were advanced in this area in June 2006. Eight of the soil borings, designated SB-AOC-2-1 through SB-AOC-2-8, were located around the perimeter of the tank field. Two of the soil borings, designated SB-AOC-2-9 and SB-AOC-2-10, were located along the underground piping to the dispensers, southeast of the tank field.

Soil borings were logged and field screened with a photo-ionization detector (PID) for the presence of organic vapor. Odors were reported from 3.5 to 4.0 feet below grade in soil boring SB-AOC-2-4. Black staining and "oily" odors were reported from 5.4 to 5.8 feet below grade in soil boring SB-AOC-2-5. Elevated PID readings were reported at the bottom of borings SB-AOC-2-4 and SB-AOC-2-5. No field evidence of contamination was reported in the remaining eight borings completed in this AOC.

One soil sample was collected from each soil boring. The soil samples were collected at depths biased toward field evidence of contamination. If no evidence of contamination was detected the sample was collected from the six-inch interval just above the water table. The samples were analyzed for Priority Pollutant Volatile Organic Compounds with a library search of 10 Tentatively Identified Compounds (VOC+10) and lead. Analytical results indicate that no VOCs were detected and lead was detected at levels below the SRS and IGWSSL.

UST Closure and Removal

The UST system including appurtenant piping was closed and removed in January 2013. No PID readings, stained soil, or odors were observed along the sidewalls of the tank field following removal of the USTs. No product, sheen or other evidence of impacted ground water was observed in the tank field excavation following removal of the USTs. A weathered gasoline-like odor was noted during removal of the piping runs to the former dispensers. PID readings were measured between 5 and 150 parts per million (ppm) along the length of the piping trench, with the highest readings observed closest to the tank field.

Upon inspection, dime-sized corrosion holes were noted in the top of the eastern ends of USTs 2A and 2B. Several dime-sized corrosion holes were noted in the bottom of the west end of UST-2A. A break in a 90 degree joint prior to piping entering Dispenser 2 was noted. No PID readings above background were observed in this area of the piping break. No stained or obviously impacted soil was noted in this area. Ground water was encountered in the excavation.

Post-Closure Soil Sampling

Post-closure soil samples were collected to assess subsurface soil conditions immediately after closure and removal of the USTs, piping and dispensers. Because ground water was encountered in the excavation, post-closure soil samples were collected at the six-inch interval above the observed ground water table at the perimeter of the excavation as prescribed in Section 5.2.1.2 of the NJDEP's April 12, 2012 guidance document entitled "Technical Guidance for Investigation of Underground Storage Tank Systems" (UST Guidance).

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Ten soil samples were collected along the sidewalls of the UST excavation from the six-inch interval 5.5 to 6.0 feet bgs. No elevated PID readings were observed during screening of the sidewalls of the tank field. Six soil samples were collected from soils beneath the former piping invert at a depth of 2.0 to 2.5 feet bgs. Two soil samples were collected from soil immediately below the two dispensers at depths between 1.0 and 1.5 feet bgs.

All soil samples collected to assess AOCs 2A through 2C were analyzed in accordance with the analytical requirements outlined in Table 2-1 of N.J.A.C. 7:26E for both leaded and unleaded gasoline. Analyses included TCL VO+TICs (including 1,2-dibromoethane and 1,2-dichloroethane), tertiary butyl alcohol (TBA), and lead. Analytical results indicate that all constituents were either not detected or reported at concentrations below the SRS and IGWSSL with the exception of the following soil samples:

- Benzene was reported at a concentration exceeding the IGWSSL for sidewall sample 2C1;
- Benzene was reported at a concentration exceeding the IGWSSL for piping samples2ABCP1 and 2ABCP4;
- Lead was reported at a concentration exceeding the IGWSSL for piping sample ABCP3;
- Benzene was reported at a concentration exceeding the RDCSRS and IGWSSL for dispenser sample DISP1. MTBE, toluene, and lead were reported at concentrations exceeding the IGWSSL for dispenser sample DISP1; and
- Lead was reported at a concentration exceeding the IGWSSL for dispenser sample DISP2.

AOC-2D: 550-Gallon UST

Initial Investigation

During the PA, Schoor DePalma reported a fill port and vent pipe indicative of a potential UST at the south exterior of the Store Building (AOC-2D). A geophysical survey was conducted in this area in May 2006, which located the UST.

Four soil borings (SB-AOC-2D-1 to SB-AOC-2D-4) were completed around the perimeter of the tank in June 2006. Soil borings were logged and field screened with a PID for the presence of organic vapor. Gasoline-like odors were reported in the soil borings and from within the UST. Elevated PID readings were detected in the four soil borings. Elevated PID readings extended to the bottom of borings SB-AOC-2D-1, SB-AOC-2D-2 and SB-AOC-2D-4. Staining was reported in SB-AOC-2D-3 from 5.4 to 5.8 feet below grade.

One soil sample was collected from each soil boring. The soil samples were collected at depths biased toward field evidence of contamination. Soil samples were analyzed for Priority Pollutant List of Parameters (PP+40) and total petroleum hydrocarbons (TPHC). Analytical results indicate that naphthalene exceeded the SRS in two samples (AOC-2D-1 and AOC-2D-2). Beryllium and 2-methylnaphthalene exceeded the IGWSSL in these two samples. No VOCs were detected.

UST Closure and Removal

The UST and appurtenant piping was closed and removed in January 2013. No holes, pitting, or corrosion were noted.

Post-Closure Soil Sampling

Post-closure soil samples were collected to assess subsurface soil conditions immediately after closure and removal of the UST and piping. Two soil samples (2D1 and 2D2) were collected from the centerline of the tank grave from the six-inch interval 5.5 to 6.0 feet bgs. A laboratory-blind duplicate sample was collected at location 2D2 designated soil sample 2D2D. No stained soils, elevated PID readings, or other evidence of a release were observed during screening.

Because the contents of AOC-2D were unknown, the soil samples were analyzed in accordance with the analytical

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requirements outlined in Table 2-1 of N.J.A.C. 7:26E for waste oil/unknown petroleum hydrocarbons. Soil samples were analyzed for EPH Category 2 with contingency Target Compound List plus 30 non-targeted organic compounds/Target Analyte List (TCL/TAL+30) analysis.

Analytical results indicate that all constituents were either not detected or reported at concentrations below the SRS and IGWSSL with the exception of the following soil samples:

- Antimony and thallium were reported at concentrations exceeding the IGWSSL for sample 2D2D; and
- Benzo(a)pyrene was reported at a concentration exceeding the RDCSRS and IGWSSL for sample 2D2D.

AOC-2F/2G: 1,000-Gallon Gasoline UST

In January 2013, a previously unidentified UST (AOC-2G) was observed beneath the piping run associated with AOC-2A/2B/2C.

UST Closure and Removal

On November 13, 2013, the gasoline UST and appurtenant piping were removed. It was determined that the vent pipes located at the west exterior of the Store Building (AOC-2F) were connected to this previously unidentified UST. Upon uncovering, the gasoline tank measured 4.0 feet in diameter by 10.0 feet in length, with an estimated volume of 1,000-gallons. No evidence of corrosion, holes, or releases was observed. No elevated PID readings, odors, or soil staining were observed in the excavation. Elevated PID readings were observed beneath the piping run, with the highest reading measured at 1475 ppm.

Post-Closure Soil Sampling

Post-closure soil samples were collected to assess subsurface soil conditions immediately after closure and removal of the UST and piping.

Two soil samples (2G1 and 2G2) and one duplicate sample (2G3) were collected from the base of the excavation along the centerline of the former UST from the six-inch interval 5.5 to 6.0 feet bgs. Soil sample 2GP1 was collected from immediately beneath the pipe at the location with the highest PID reading from the six-inch interval 2.5 to 3.0 feet bgs. Samples were analyzed for EPH Category 1, TCL VO+TICs, TBA, naphthalene, 2-methylnaphthalene, and lead.

Analytical results indicate that all constituents were either not detected or reported at concentrations below the SRS and IGWSSL with the exception of the following soil samples:

- Benzene was reported at a concentration exceeding the IGWSSL for samples 2G1 and 2G3; and
- Benzene and naphthalene were reported at concentrations exceeding the RDCSRS and IGWSSL for sample 2GP1. Ethylbenzene, toluene, xylene, 2-methylnaphthalene, and lead were reported at concentrations exceeding the IGWSSL for sample 2GP1.

AOC-4A and 4B: Septic Systems

Two septic systems were identified on the west side of the Store Building (AOC-4A and AOC-4B). Based on the site's history as a garage/service station and because former owners were not available to provide certification that the septic system received only sanitary waste, CMX recommended further investigation of this AOC.

A geophysical survey was conducted in this area in May 2006, which identified approximately 30 feet of suspected underground piping extending from the Store Building to the northern septic system. A further roughly 80 linear feet of suspected underground piping was identified extending westward from the septic system. This appeared to be a

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discharge pipe; however, due to the presence of large trees and heavy vegetation, the outlet could not be located. The geophysical survey did not identify underground lines associated with the southern septic system. In addition, the geophysical survey did not identify drain fields associated with either septic system. It is noted that access was limited due to heavy vegetation in this area.

On June 1, 2006, both of the septic systems were inspected. The circular cement covers were removed and the interiors observed for contents and construction. Both systems appeared to be circular structures constructed of concrete block. It appears that both septic systems were constructed as cesspools.

The northern septic system (AOC-4A) contained approximately 0.5 feet of liquid and no sludge. The southern septic system (AOC-4B) contained no liquid. A liquid sample, identified as AOC-4A, was collected from the northern septic system and analyzed for PP+40. Benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, indeno(1,2,3-cd)pyrene, arsenic, cadmium, lead and thallium were reported for this sample at concentrations exceeding the NJDEP Ground Water Quality Standards (GWQS).

On January 2, 2013, the contents of the cesspools were removed using a vacuum truck. The cesspools were then properly abandoned by filling with clean fill material in accordance with Standards for Individual Subsurface Sewage Disposal Systems (N.J.A.C. 7:9A).

On February 6, 2013, one soil boring was advanced at locations suspected to be approximately five feet downgradient of each abandoned cesspool to assess soils in the vicinity of AOC-4A/4B. Soil boring CESS4A was advanced adjacent to the west of AOC 4A, and soil boring CESS4B was advanced adjacent to the west of AOC 4B. Both soil borings were advanced to a depth of 15.0 feet bgs.

Soil borings were logged and field screened with a PID for the presence of organic vapor. The following bulleted items provide a summary of pertinent conditions observed

- CESS4A: A slight petroleum-like odor was observed between 10.0 to 12.0 feet bgs. PID readings ranged from approximately 10 ppm at 1.0 foot bgs, to a maximum of 18 ppm at 6.5 feet bgs.
- CESS4B: PID readings ranged from approximately 8.0 ppm at the surface, to a maximum of 32 ppm at 11.0 feet bgs. PID readings were 10.3 ppm at the termination of the boring at 15.0 feet bgs.

Based on the presence of saturated soils beginning at approximately 2.5 feet bgs, soil sample CESS4A was collected at the 2.0 to 2.5 foot interval bgs from boring CESS4A. Based on the presence of what was assumed to be a drainage layer for the cesspool at 2.5 to 3.0 feet bgs, soil sample CESS4B was collected at the six inch interval below this layer. A laboratory blind duplicate sample designated CESS4C was collected in this location as well. The samples were analyzed for EPH Category 2, full TCL/TAL+30, and hexavalent chromium.

Antimony was detected at concentrations exceeding the IGWSSL in samples CESS4A and CESS4C. Thallium was detected with an estimated concentration exceeding the IGWSSL in sample CESS4A. Methylene chloride was detected at a concentration exceeding the IGWSSL in sample CESS4C; however, methylene chloride was detected in the method blank for soil sample CESS4B, and is a suspected laboratory contaminant.

AOC-6: Maintenance Pit Area

A former sub-grade pit previously used for vehicle maintenance was identified during the PA site inspection (AOC-6). The pit is located east of the service garage building. The pit appeared to have been backfilled with sand, preventing visual evaluation of potential impact.

On May 3, 2006, CMX conducted a test pit investigation of the maintenance pit. Small trees and shrubs were observed growing near the center of the pit. Sandy soil was excavated from the maintenance pit. The pit extended

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to a depth of 6.0 feet below grade and was constructed of concrete block walls and a solid concrete bottom. Staining and odors were encountered at the bottom of the pit towards the southwest end. One soil sample (AOC-6A) was collected from soil at the bottom of the pit in this area and analyzed for PP+40 and TPHC. PCBs were detected at a concentration exceeding the RDCSRS and IGWSSL.

AOC-7: Suspected Dumping Area/ Disturbed Area

During the PA site inspection, a Maurice River Township Committee member identified an area where waste oil filters from vehicle maintenance activities were reportedly dumped in the past. This area corresponded to an observed disturbance area noted in a 1951 aerial photograph of the site. During the PA site inspection in 2003, the specific area identified in the 1951 aerial photograph was overgrown with vegetation and no visual observation could be made. However, miscellaneous debris, consisting of paint cans, oil filters, bottles, and oil cans were observed on the ground surface in nearby areas on the site.

During the supplemental Site Reconnaissance on November 9, 2005, CMX observed a bermed area to the east of the suspected Dumping Area/Disturbed Area. The bermed area measured approximately two feet higher in elevation than the surrounding ground surface.

Two test pits designated AOC-7A and AOC-7B were excavated in this area during the SI field investigation on May 3, 2006. The test pits were roughly four feet deep. Approximately one foot of debris was identified at the surface in this area. Debris encountered consisted of empty paint cans, waste automobile oil filters, glass bottles, metal cans, car batteries, and other miscellaneous debris. No staining or other indication of impact was observed below the surficial debris. Surface soil samples AOC-7A and AOC-7B were collected from the perimeter of the test pits and analyzed for PP+40. Lead was detected at a concentration exceeding the IGWSSL in AOC-7A.

Due to heavy vegetation, AOC-7 was not fully inspected or delineated. The area will require clearing before investigation of this AOC can be completed. In addition, a portion of AOC-7 appears to extend into an adjacent wetland. Because this AOC extends into an adjacent wetland and/or associated transition area, a Freshwater Wetland General Permit 4 (Hazardous Site Investigation and Clean Up) must be obtained from NJDEP before clearing, investigation and/or remediation can proceed for this AOC. HDSRF grant funds were recently disbursed to the Township for activities associated with preparation of the required General Permit 4 with work expected to proceed in the first quarter of 2014.

Based on visual observations during the January 5, 2010 site reconnaissance, CMX estimated that the suspected dumping area/disturbed area measures roughly 45 by 65 feet or approximately 3,000 square feet. The final dimensions of the suspected dumping area/disturbed area will be determined following site clearing.

AOC-8: Discarded Drums

During the PA, several unlabeled rusty drums were observed in the wooded area west of the Store Building (AOC-8). Heavy vegetation in this area inhibited inspection of the ground surface beneath the drums.

On May 3, 2006, as part of the SI, test pits AOC-8A and AOC-08B were excavated adjacent to two drums identified in the wooded area southwest of the Service Garage. No staining, odors, or other field evidence of contamination were observed in the test pits. One of the drums was sealed and appeared to be partially full of an unknown liquid. The drum was rusted, but intact, and no evidence of leaks was reported. Soil samples (AOC-8A and AOC-8B) were collected from the ground surface beneath each of the two drums and forwarded analyzed for PP+40. Lead was detected in both samples at concentrations exceeding the IGWSSL.

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AOC-9: Lubrication Oil Drum

During the supplemental Site Reconnaissance on November 9, 2005 CMX observed a lubrication oil drum and dispenser within a shop area in the rear exterior of the Store Building. This drum was not noted during the PA inspection in 2003 because the interior portion of the building had not been accessible at that time. The drum exhibited evidence of leaks and oil staining was noted on the floor beneath and around the drum. The floor of this area of the building appeared to be of wood construction; however, due to its poor condition, it was unclear if oil leakage may have impacted soil beneath the floor. Based on safety concerns associated with the building condition, CMX was unable to access the sub-floor beneath this drum to assess the potential for soil impact or to collect soil samples.

AOC-10: Ground Water

Woodard & Curran conducted ground water investigation activities at the site between February and November 2013. Three (3) permanent ground water monitoring wells, designated MW-1 through MW-3, were installed at the site on February 6, 2013, by a New Jersey licensed well driller. Monitoring wells were installed at the following locations.

- MW-1 - Northwest corner of the former UST field associated with AOC-2A/2B/2C;
- MW-2 – Adjacent to and to the west of AOC 4A; and
- MW-3 – Former UST AOC-2D.

Monitoring Wells were constructed in accordance with the August 2005 Field Sampling Procedures Manual and N.J.A.C. 7:9D. Wells were developed until purge water was clear. Drill cuttings and development water were containerized in 55-gallon drums, which were disposed off-site.

On February 25, 2013, ground water samples were collected from all three monitoring wells utilizing low-flow/low-stress purging and sampling techniques. A duplicate sample (DUP) was also collected from ground water monitoring well MW-1. Ground water samples were analyzed for TCL VO+TICs, TCL SVO+TICs, and TAL metals. The analytical results are summarized as follows:

- Benzene was reported at a concentration of 1.2 ug/L for MW-3, slightly exceeding the GWQS of 1 ug/L;
- Aluminum was reported at concentrations exceeding the GWQS of 200 ug/L for MW-1 (245 ug/L), DUP(MW-1) (294 ug/L) and MW-3 (290 ug/L);
- Arsenic was reported at a concentration of 6.6 ug/L for MW-2, slightly exceeding the GWQS of 3 ug/L;
- Cadmium was reported at a concentration of 7.1 ug/L MW-3, slightly exceeding the GQWS of 4 ug/L;
- Iron was reported at concentrations exceeding the GWQS of 300 ug/L for MW-2 (24,300 ug/L) and MW-3 (6,210 ug/L);
- Manganese was reported at concentrations exceeding the GWQS of 50 ug/L for MW-2 (887.5 ug/L) and MW-3 (460.5 ug/L); and
- Sodium was reported at a concentration of 65,600 ug/L for MW-2, exceeding the GWQS of 50,000 ug/L.

On April 2, 2013, a second round of ground water samples were collected from all three monitoring wells utilizing low-flow/low-stress purging and sampling techniques. A duplicate sample (DUP) was also collected from ground water monitoring well MW-1. Ground water samples were analyzed for TCL VO+TICs, TCL SVO+TICs, and TAL metals. The analytical results are summarized as follows:

- Benzene was reported at a concentration of 2.3 ug/L for MW-3, slightly exceeding the GWQS of 1 ug/L;
- Arsenic was reported at a concentration of 6.096 ug/L for MW-2, slightly exceeding the GWQS of 3 ug/L;
- Iron was reported at concentrations exceeding the GWQS of 300 ug/L for MW-1 (890 ug/L), DUP(MW-1) (876 ug/L), MW-2 (27,600 ug/L) and MW-3 (13,600 ug/L);

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- Manganese was reported at concentrations exceeding the GWQS of 50 ug/L for MW-1 (85.92 ug/L), DUP(MW-1) (83.14 ug/L), MW-2 (1,083 ug/L) and MW-3 (902.2 ug/L); and
- Sodium was reported at a concentration of 66,200 ug/L for MW-2, exceeding the GWQS of 50,000 ug/L.

On November 25, 2013, a temporary well point investigation was conducted to characterize ground water in the vicinity of AOC-2G and to characterize the extent of benzene ground water contamination identified based on the findings of investigations conducted to date. Four soil borings were advanced to 15 feet. Soil borings were field screened with a PID for the presence of organic vapors. Temporary well points were installed at each boring location (TWP-1 through TWP-4). Water table was observed to be at approximately 4 feet below grade.

Ground water samples were collected from each temporary well point. In addition, a duplicate sample (TWP-5) was collected from temporary well TWP-4. In accordance with the analytical protocols for investigation of gasoline, kerosene and diesel fuel discharges specified Table 2-1 of N.J.A.C. 7:26E, ground water samples were forwarded to a New Jersey certified laboratory for analysis of TCL VO+TICs and TCL SVO+TICs.

The results indicate that all targeted constituents are below the GWQC. TWP-2 had an estimated concentration of total VOC TICs of 810 ug/L and an estimate concentration of total SVOC TICs of 960 ug/L, each exceeding the 500 ug/L Interim Generic Criteria for synthetic organic chemicals.

2.0 SUMMARY OF PRIORITY CLEANUP AREAS OF CONCERN

An evaluation of site data indicates that remedial cleanup actions are warranted to address the direct contact and/or impact to ground water pathways for the following priority cleanup AOCs.

- AOC-1 – Aboveground Storage Tank;
- AOC-2A/2B/2C – Gasoline UST System;
- AOC-2D – 550-Gallon UST;
- AOC-2F/2G – 1,000-Gallon UST;
- AOC-4A – Septic System;
- AOC-6 – Maintenance Pit Area;
- AOC-8 – Discarded Drums; and
- AOC-10 – Ground Water.

3.0 APPLICABLE REGULATIONS AND CLEANUP STANDARDS

Laws and regulations applicable to this cleanup include:

- New Jersey Technical Requirements for Site Remediation (N.J.A.C. 7:26E);
- New Jersey Remediation Standards (N.J.A.C. 7:26D);
- New Jersey Administrative Requirements for the Remediation of Contaminated Sites (N.J.A.C. 7:26C);
- Resource Conservation and Recovery Act (40 CFR Part 260 et seq);
- Occupational Health and Safety Administration - Construction Standard (40 CFR Part 1926); and
- Occupational Health and Safety Administration - HAZWOPER (40 CFR Part 1910.120);

Determination of waste as hazardous or non-hazardous will be conducted in accordance with the regulations set forth in 40 CFR Part 261 et seq. Work on site will be conducted in accordance with the health and safety requirements outlined in the OSHA construction standard (40 CFR Part 1926) and HAZWOPER regulations (40 CFR Part 1910.120). In addition, all appropriate permits (e.g., notify before you dig, soil transport/disposal manifests) will be obtained prior to the work commencing.

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4.0 EVALUATION OF CLEANUP ALTERNATIVES

The following sections provide a summary of cleanup alternatives evaluated for priority cleanup areas described in Section 2.0.

4.1 Cleanup Areas

A brief summary of the cleanup areas and the contaminants of concern are provided below.

Area of Concern	Contaminants Exceeding RDCSRS	Contaminants Exceeding IGWSSL
AOC-1: 550-Gallon AST	Chlordane, lead	Chlordane, lead, cadmium, mercury
AOC-2A/2B/2C: UST, Piping, Dispensers	Benzene	Benzene, toluene, MTBE, lead
AOC-2D: 550-Gallon UST	Naphthalene	Naphthalene, 2-methylnaphthalene, beryllium
AOC-2G: 1,000-Gallon Gasoline UST	None	Benzene
AOC-2G: Piping only	Benzene, naphthalene	BTEX, lead, 2-methylnaphthalene
AOC-4A: Septic System	None	Antimony, thallium
AOC-6: Maintenance Pit Area	PCBs	PCBs
AOC-7: Suspected Dumping Area	None	Lead
AOC-8: Discarded Drums	None	Lead

4.2 Cleanup Alternatives

Cleanup alternatives included in this evaluation are (1) no action, (2A) removal of contaminated soil to the RDCSRS and off-site disposal, (3A) removal of contaminated soil to the RDCSRS and IGWSSL and off-site disposal, and (2B/3B) ground water monitored natural attenuation. The following sections provide an analysis of cleanup alternatives including a discussion of the effectiveness, implementability, and cost for each alternative.

4.2.1 Alternative 1: No Action

Effectiveness: No action alternative will not be effective in controlling or preventing the exposure of receptors to contamination at the site. There would be a potential for direct contact exposure and potential for impacts to ground water. There are several potable wells in the surrounding area. With the no action alternative, there would be a potential for impacts to human receptors via the drinking water supply. In addition, the surficial debris located at AOC-7 would remain in place and could potentially impact sensitive ecological receptors.

Implementability: Easy to implement since no action would be required.

Cost: There are no costs associated with Alternative 1.

4.2.2 Alternative 2A: Removal and Off-site Disposal – Soil exceeding RDCSRS

This alternative consists of excavation and off-site disposal of soil exceeding the RDCSRS. This also includes the removal and disposal of drums located in AOC-8.

Effectiveness: Excavation and off-site disposal of soil exceeding the RDCSRS will be effective at preventing exposure for the direct contact pathway, but will not be effective to prevent potential impacts to ground water. In addition, the surficial debris located at AOC-7 would remain in place and could potentially impact sensitive ecological receptors.

Implementability: Moderately difficult to implement. Soil would be removed using an excavator direct loading to a triaxle dump truck. The work will involve coordination during cleanup activities, dust monitoring and prevention, and

trucks entering and leaving the site for soil disposal and clean backfill delivery. Some of the excavation areas may extend below the water table requiring excavation dewatering and later disposal of the water. This work would be completed in an estimated 4 to 5 days, including excavation work and site restoration.

Cost: This alternative is estimated to cost roughly $51,000, as detailed below. If the estimated cost for monitored natural attenuation ground water is included in this alternative, the total estimated cost would be $134,000 ($51,000 + $83,000).

The estimated volume of contaminated soil exceeding the RDCSRS is summarized in the following table:

AOC	Estimated Area (SF)	Estimated Depth (ft)	Estimated Volume (CY)	Estimated Weight (tons)
AOC-1: 550-Gallon AST	100	3	11	17
AOC-2A/2B/2C: Dispenser 1 only	25	3	3	4
AOC-2D: 550-Gallon UST	90	6	20	30
AOC-2G: Piping only	100	4	15	22
AOC-6: Maintenance Pit Area	45	6	10	15
TOTAL:			**59**	**88 (~5 trucks)**

Disposal of contaminated soil from the above listed AOCs would most likely include re-use at a landfill as daily cover.

The estimated cost for cleanup alternative 2A is summarized in the following table:

Removal and Off-Site Disposal Cost Estimate – Cleanup to RDCSRS	
Description	**Estimate**
Consulting – Labor & Equipment	$ 7,500
Contractor – Labor & Equipment (Excavator and Dump Truck)	$ 21,500
Waste Classification	$ 3,000
Post-Excavation Lab Costs	$ 8,000
Soil Disposal (Non-haz - $50/ton)	$ 5,000
Clean Fill ($30/ton)	$ 3,000
Restoration	$ 3,000
ESTIMATED TOTAL:	**$ 51,000**

The above outlined cost estimate was developed using the following assumptions:

- Excavation dewatering will not be required;
- The work will be completed in 5 days;
- Contractor costs include heavy equipment (e.g. excavator, dump truck), operators, laborers, and mobilization/ demobilization;
- Soils requiring disposal will be classified as non-hazardous; and
- The volume of soil to be excavated was estimated based on available sampling results. This volume may increase or decrease based on the results of additional investigations or based on field observations at the time the soils are excavated.

4.2.3 Alternative 3A: Removal and Off-site Disposal – Soil exceeding RDCSRS & IGWSSL

This alternative consists of excavation and off-site disposal of soil exceeding the RDCSRS and IGWSSL. This alternative also includes the removal of surficial debris located at AOC-7, as well as the removal and disposal of drums located in AOC-8.

Effectiveness: Excavation and off-site disposal of soil exceeding the RDCSRS and IGWSSL will be effective at preventing exposure for the direct contact pathway as well as the impact to ground water pathway. In addition, this alternative would address the surficial debris located at AOC-7, eliminating the impact to sensitive ecological receptors.

Implementability: Moderately difficult to implement. This alternative is essentially the same as Alternative 2, with additional volume of soil excavated to remove soil with contaminant concentrations exceeding the IGWSSL. Soil would be removed using an excavator direct loading to a triaxle dump truck. The work will involve coordination during cleanup activities, dust monitoring and prevention, and trucks entering and leaving the site for soil disposal and clean backfill delivery. A General Permit GP-4 is required to complete the excavation work in wetlands located at AOC-7. This work would be completed in an estimated 8 to 10 days, including excavation work and site restoration.

Cost: This alternative is estimated to cost roughly $113,000, as detailed below. If the estimated cost for monitored natural attenuation ground water is included in this alternative, the total cost would be $196,000 ($113,000 + $83,000).

The estimated volume of contaminated soil exceeding the RDCSRS and IGWSSL is summarized in the following table:

AOC	Estimated Area (SF)	Estimated Depth (ft)	Estimated Volume (CY)	Estimated Weight (tons)
AOC-1: 550-Gallon AST	100	3	11	17
AOC-2A/2B/2C: UST	100	4.5	17	25
AOC-2A/2B/2C: Piping, Dispensers	250	3	28	42
AOC-2D: 550-Gallon UST	90	6	20	30
AOC-2G: 1,000-Gallon Gasoline UST	Included as part of AOC-2A			
AOC-2G: Piping only	90	4	13	20
AOC-4A: Septic System	45	2.5	4	6
AOC-6: Maintenance Pit Area	45	6	10	15
AOC-7: Suspected Dumping Area	3,000	1	111	167
AOC-8: Discarded Drums	100	2	8	12
TOTAL			**222**	**334 (~17 trucks)**

Contaminated materials in AOC-7 include debris, such as empty paint cans, waste automobile oil filters, glass bottles, metal cans, car batteries, and other miscellaneous debris. This material will most likely be disposed of at an approved landfill. Contaminated soil from the remaining AOCs would most likely be suitable for re-use at a landfill as daily cover.

The estimated cost for cleanup alternative 3A is summarized in the following table:

Removal and Off-Site Disposal Cost Estimate – Cleanup to RDCSRS & IGWSSL	
Description	**Estimate**
Consulting – Labor & Equipment	$ 15,000
Subcontractor – Labor & Equipment (Excavator and Dump Truck)	$ 42,000
Waste Classification	$ 3,000
Post-Excavation Lab Costs	$ 12,000
Soil Disposal (Non-haz - $50/ton)	$ 9,000
Soil Disposal (AOC-7 debris - $100/ton)	$ 18,000
Clean Fill ($30/ton)	$ 11,000
Restoration	$ 3,000
ESTIMATED TOTAL:	**$ 113,000**

The above outlined cost estimate was developed using the following assumptions:

- Excavation dewatering will not be required;
- The work will be completed in 10 days;
- Contractor costs include heavy equipment (e.g. excavator, dump truck), operators, laborers, and mobilization/ demobilization;
- Soils requiring disposal will be classified as non-hazardous;
- Debris will be disposed as non-hazardous solid waste in a solid waste landfill; and
- The volume of soil and/or solid waste to be excavated was estimated based on available sampling results and field observations. This volume may increase or decrease based on the results of additional investigations or based on field observations at the time the soils are excavated.

4.2.4 Alternative 2B/3B: Ground Water Monitored Natural Attenuation

Ground water contaminants identified on the site exceeding the NJ GWQS include benzene, VOC TICs, SVOC TICs, aluminum, arsenic, cadmium, iron, manganese, and sodium. A Classification Exception Area (CEA) will be established at the site as a method of public notification and to restrict ground water use in the affected area. A Remedial Action Permit Application for Ground Water will be submitted to NJDEP. Long-term monitoring, maintenance, and evaluation will be required as part of the CEA maintenance.

Effectiveness: Monitored natural attenuation with a Classification Exception Area (CEA) would be an effective remedial measure to restrict ground water use in the affected area and provide for monitored natural attenuation of contaminants. In addition, source removal by soil excavation as part of Alternatives 2 and 3 is expected to improve ground water quality.

Implementability: This alternative would be relatively easy to implement. It involves establishing a CEA, obtaining a Remedial Action Permit from NJDEP, installation and periodic sampling of monitoring wells (including upgradient, down-gradient, sentinel, and intermediate wells), periodic inspections, and submittal of biennial certifications.

For the purposes of this analysis, the duration of the CEA is assumed to be 10 years. An initial eight rounds of sampling will be conducted including four consecutive quarterly sampling events. Seven rounds of sampling will be conducted throughout the duration of the CEA. This includes sampling annually for the first 4 years, biennially for the following 6 years. This work would include an estimated 15 days of field work.

Cost: This alternative is estimated to cost roughly $83,000, as detailed below.

Ground Water Monitored Natural Attenuation	
Description	**Estimate**
Consulting – Labor (Initial reporting)	$ 5,000
Consulting – Labor (Biennial certifications – 10 years)	$ 16,000
Well sampling - Lab Costs (8 initial rounds + 7 rounds)	$ 18,000
Consulting – Field Labor and equipment (15 field days)	$ 44,000
TOTAL:	**$ 83,000**

The above outlined cost estimate was developed using the following assumptions:

- Eight ground water monitoring wells installed during the Remedial Investigation (RI) phase would be sampled during each ground water sampling event; and
- Ground water samples will be collected and analyzed for benzene and/or metals.

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5.0 CONCLUSION

Woodard & Curran prepared this ABCA for the Ackley Garage property to support Maurice River Township's 2014 USEPA Brownfield Cleanup Grant Proposal for the site.

This ABCA included an evaluation of three (3) cleanup alternatives for the cleanup of priority cleanup AOCs identified based on the findings of assessments and investigations conducted at the Site to date. The three (3) cleanup alternatives evaluated included (1) no action, (2A) removal and off-site disposal of soil exceeding the RDCSRS, (3A) removal and off-site disposal of soil exceeding the RDCSRS and IGWSSL, and (2B/3B) ground water monitored natural attenuation. The following bulleted items provide a summary of the cleanup alternatives evaluated.

- Alternative 1: A no action alternative is not recommended, since the potential for direct contact and impact to ground water would remain if this alternative were implemented.
- Alternative 2A: Removal and off-site disposal of soils exceeding the RDCSRS only is not recommended, since potential for impact to ground water would remain if this alternative were implemented.
- Alternative 3A: Removal and off-site disposal of soils exceeding the RDCSRS and IGWSSL would eliminate the potential for both direct contact and impact to groundwater. This alternative would also eliminate the impact to sensitive ecological receptors.
- Alternative 2B/3B: Monitored natural attenuation with a Classification Exception Area (CEA) would be an effective remedial measure to restrict ground water use in the affected area and provide for monitored natural attenuation of contaminants.

The estimated cost for each alternative developed using the assumptions identified herein is summarized below:

Alternative	Description	Estimated Cost (Soil)	Estimated Cost (Ground Water)	Total Cost
1	No Action	$ 0	$ 0	**$ 0**
2A/2B	Removal and Off-Site Disposal– Cleanup to RDCSRS and Ground Water Monitored Natural Attenuation	$ 51,000	$ 83,000	**$ 134,000**
3A/3B	Removal and Off-Site Disposal– Cleanup to RDCSRS & IGWSSL and Ground Water Monitored Natural Attenuation	$ 113,000	$ 83,000	**$ 196,000**

Based on the above, Woodard & Curran currently recommends that Alternative 3A/3B be implemented at the site. The remedial alternatives may be further evaluated after completing a RI as a RI will better define the limits of the contaminated areas. In addition, site-specific IGWSRS will potentially be established, which could result in a significant reduction of soil volume to be excavated for off-site disposal and potentially reduce the cost for Alternative 3A.

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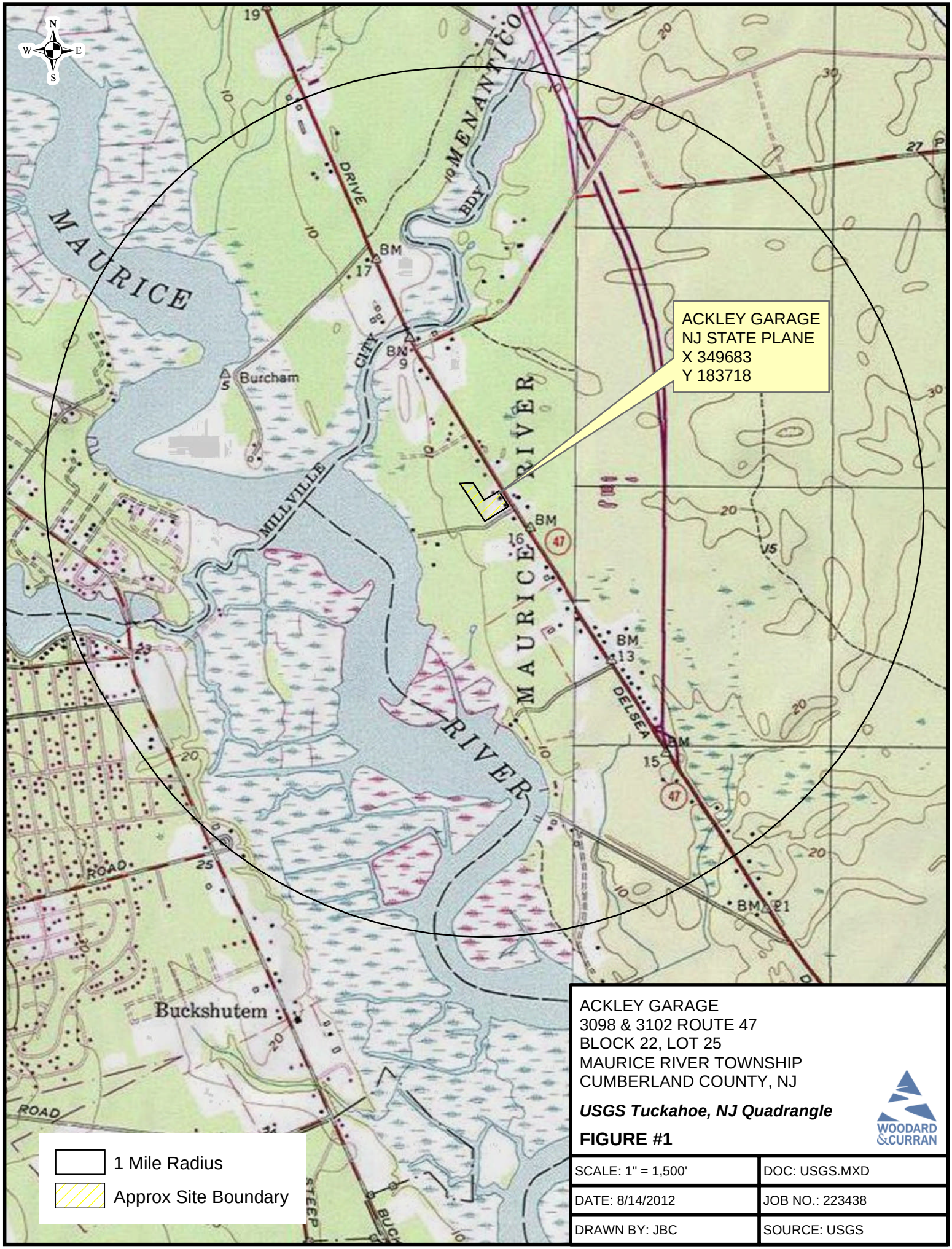


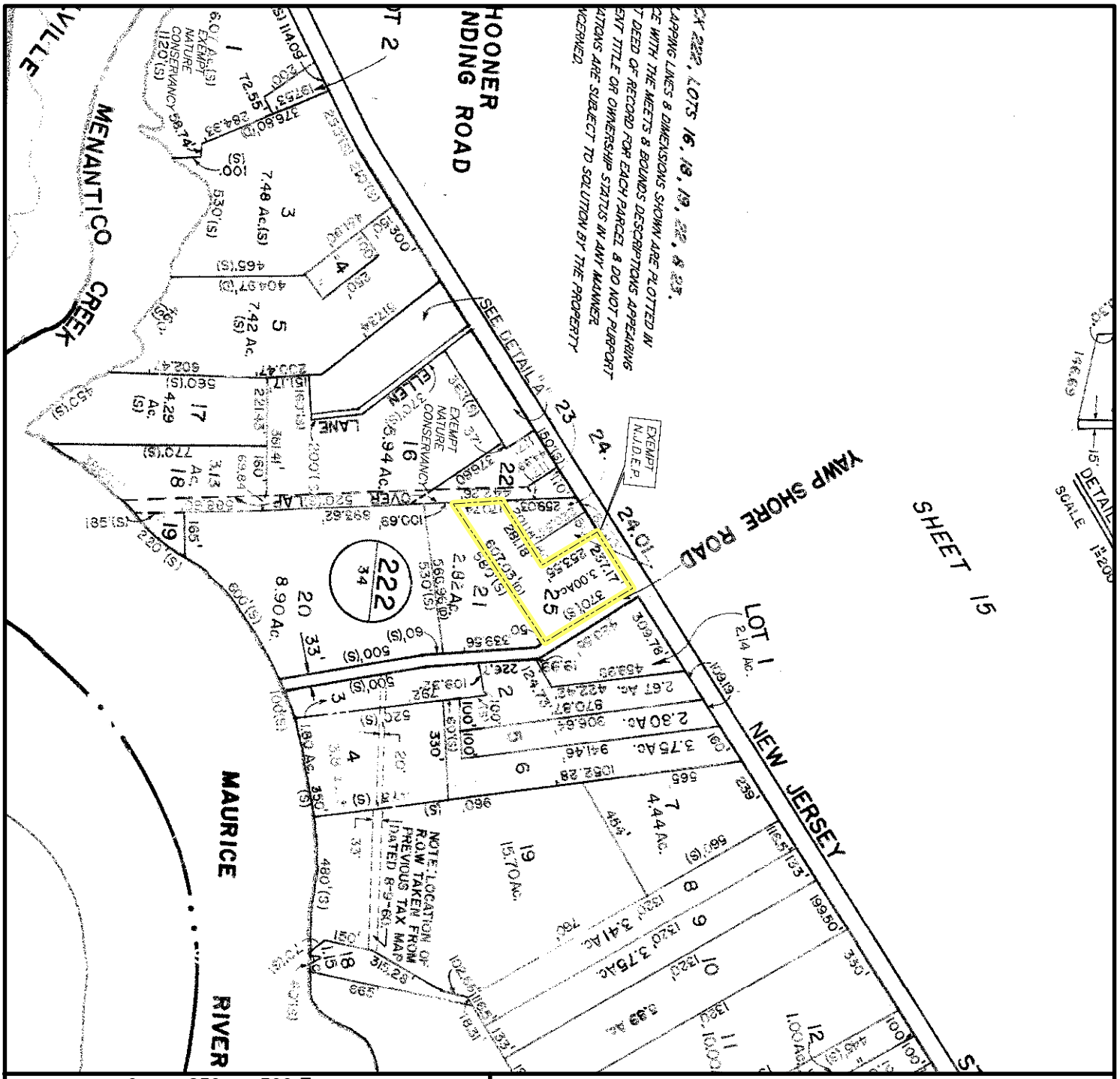
ACKLEY GARAGE
3098 & 3102 ROUTE 47
BLOCK 22, LOT 25
MAURICE RIVER TOWNSHIP
CUMBERLAND COUNTY, NJ

USGS Tuckahoe, NJ Quadrangle

FIGURE #1

WOODARD &CURRAN

SCALE: 1" = 1,500'	DOC: USGS.MXD
DATE: 8/14/2012	JOB NO.: 223438
DRAWN BY: JBC	SOURCE: USGS



0 250 500 Feet

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This map is based on the Maurice River Township Tax Map of Cumberland County, New Jersey, prepared by Gordon M. Ludwig, P.L.S., dated 2/18/1991.

SITE LOCATION

FIGURE 2
TAX MAP

ACKLEY GARAGE
3098 AND 3102 ROUTE 47
MAURICE RIVER TOWNSHIP
CUMBERLAND COUNTY
NEW JERSEY
NJDEP CASE NO. 02-01-16-0159-32

CMX
1101 LAUREL OAK ROAD, SUITE 160
VOORHEES, NJ 08043
TEL (856) 783-1900 FAX (856) 783-2100

SCALE	DATE	DRAWN BY	DES. BY	FILE NO.	CHECKED BY
1" = 500'	1/21/2010	JC	NJ	020054403	---