SITE ASSESSMENT ADDENDUM AND INTERIM SOURCE REMOVAL REPORT
Countryside Executive Golf Course
2506 Countryside Boulevard
Clearwater, Pinellas County, Florida

Prepared for:

Florida Department of Environmental Protection
Southwest District
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

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1.0 INTRODUCTION

HSA Engineers & Scientists (HSA) has prepared this Site Assessment Addendum and Interim Source Removal Report for the Countryside Executive Golf Course located at 2506 Countryside Boulevard, Clearwater, Pinellas County, Florida (the "Site") for submittal to the Florida Department of Environmental Protection (FDEP, Department). A Site location map is presented as **Figure 1**.

Additional assessment and interim remedial activities were conducted in order to satisfy the requirements for Site Assessment in accordance with Chapter 62-780, Florida Administrative Code (FAC) and to address FDEP correspondence dated January 20, 2008.

The additional assessment and interim remedial activities included:

1. Off-site soil sampling for the purpose of delineating to the residential direct exposure Soil Cleanup Target Level (SCTL) of 2.1 milligrams per kilogram (mg/kg) for arsenic;
2. Site wide soil assessment for chlorinated pesticides and herbicides;
3. Synthetic Precipitate Leaching Procedure (SPLP) testing for the purpose of establishing an alternative SCTL for Groundwater Criteria for arsenic at the Site;
4. Implementation of Interim Source Removal activities;
5. Monitor well installation and groundwater sampling for the purpose of delineating to the Groundwater Cleanup Target Level (GCTL) of 10 micrograms per liter (µg/L) for arsenic; and
6. Evaluation of background water quality for the purpose of establishing an alternative GCTL for arsenic at the Site.

This Site Assessment Addendum and Interim Source Removal Report presents the Site characterization data currently available, along with recommendations for a course of action, to meet overall Site cleanup objectives.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site and Vicinity Description

The former golf course is currently vacant and is intended to be developed for future residential use. As is the case at all golf courses, herbicides and/or pesticides were routinely applied on-site in the past. Based on available information, the application of herbicides and/or pesticides at the Countryside Executive Golf Course was consistent with the labeling protocols, and no releases

were reported. However, these herbicides/pesticides approved for use, commonly contained arsenic. Consequently, these herbicides/pesticides can result in impacts above default residential land use cleanup criteria for soils, and can result in limited impacts to groundwater.

Land use surrounding the subject property includes residential development to the west, southwest, south, and southeast. Commercial businesses including CVS Pharmacy, Psychic Reader, and the North Belcher Professional Center are located northwest of the subject Site. The Florida Auto Exchange, St. Michael Catholic Church, and Casa Miguel are located north of the Site. Various commercial businesses are located east of the Site. The Countryside Professional Center and Woodgate Park are located southeast of the Site. City of Clearwater sewer lift stations are located to the east and south of the subject Site.

2.2 Topography and Drainage

Topographic and drainage characteristics were determined from the USGS 7.5 Minute Series Oldsmar, Florida Quadrangle (1995) topographic map (**Figure 2**). The Site is located in Sections 30 and 31, Township 28 South, and Range 16 East at an elevation of approximately 75 feet National Geodetic Vertical Datum (NGVD) or approximately 72 feet National Atlantic Vertical Datum (NAVD). The general latitude/longitude coordinates of the Site are 28°00'55.81" N and 82°44'32.02" W. The Site is relatively flat, but a slight topographic gradient in the surrounding vicinity is evident toward the west-northwest. Two surface water bodies currently exist at the Site. The nearest off-site surface water body is a pond in the Village on the Green residential development located approximately 200 feet west of the subject Site. Lake Chautauqua, located approximately a mile southeast of the Site, is the largest surface water body in the immediate vicinity, and has a slightly higher elevation (83 feet). Curlew Creek is located approximately a mile north of the Site, and has a southeast to northwest gradient.

2.3 Water Supply Wells

Two potable water supply wells operated by the City of Clearwater exist at the subject Site. Additionally, two irrigation wells are located on the east side of the Maintenance Facility and southwest of the clubhouse near the first green. The wells were historically utilized for on-site irrigation activities. A well location map and summary table of on-site and off-site wells within one-half mile of the subject Site is included in **Appendix A**.

HSA previously submitted results of available groundwater quality data for three City of Clearwater potable wells located within proximity of the subject Site. Public supply well numbers 56, 58, and 63 were reportedly sampled in January 2006 with arsenic results of 14, 13, and 21 µg/L, exceeding the default GCTL of 10 micrograms per liter (µg/L). Public supply well numbers 56 (general latitude/longitude coordinates 28°00'37.82" N and 82° 44'30.76" W) and 63 (general latitude/longitude coordinates 28°01'01.91" N and 82° 44'32.68" W) are located on-site and well number 58 is located northwest of the Site. The arsenic identified in these public

supply wells suggests that low-level arsenic groundwater impacts may be widespread, and indicative of the local background groundwater quality. Additionally, the production wells located in the vicinity of the Site are known to produce from the Floridan Aquifer, which is typically present below a confining unit that is known to exist throughout the Clearwater area at varying depths. In previous reports, HSA reviewed and evaluated available groundwater quality data and soil boring lithologic information and determined the shallow and deeper groundwater located on the subject Site is not interconnected.

2.4 Previous Investigations

Previous assessment activities consisting of soil and groundwater sampling were conducted at the subject property by Land Assessment Services, Inc. (LAS) and HSA from 2004 to the present. According to a Site Assessment Report and Remedial Action Plan (SAR/RAP) prepared by HSA in December 2005, Site wide arsenic soil impacts were identified in shallow soils, and groundwater arsenic impacts were identified in the immediate vicinity of the Maintenance Facility. The SAR/RAP recommended soil excavation in the vicinity of the Maintenance Facility and implementing engineering/institutional controls on Site.

Several additional soil and groundwater samples were collected and reported in a Site Assessment Report Addendum (SARA) – Response to Comments dated July 10, 2006. The purpose of the report was to address comments from the FDEP on the SAR/RAP and further delineate the arsenic and/or pesticide/herbicide impacts near the Maintenance Facility and the area near MW-2 (also referred to as the Clubhouse Dogwater Café Area). Soil samples taken near the maintenance area in May 2006 (SB-1 to SB-4) were analyzed for the presence of chlorinated pesticides/herbicides using EPA Methods 8081 and 8151, respectfully. No elevated levels of pesticides/herbicides were detected in the samples collected. A sediment sample and two surface water samples were taken from the pond just south of the maintenance area. The sediment sample had a slight exceedance of the residential direct exposure SCTL for arsenic, and the pesticides/herbicides did not exceed the laboratory method detection limit. The first surface water sample taken in May 2006 exhibited arsenic at a concentration of 152 mg/L, exceeding the Fresh Surface Water Criteria (FSWC) level of 50 mg/L; however, an additional sample taken in June 2006 (49 mg/L) did not exceed the FSWC. Soil samples taken in the vicinity of the Monitor Well MW-2 Area exhibited arsenic at a concentration above the Residential direct exposure SCTL and groundwater samples exhibited arsenic at levels exceeding the GCTL, indicating that this area may have been used as a temporary Maintenance Facility in the past.

Additional assessment activities were conducted and reported in an Interim Report dated November 2006. The additional assessment was intended to evaluate soil quality on the tees and greens and compare the results to the remainder of the Site. Soil sampling began at the tee of Hole No. 1 and continued to alternate tees and greens throughout the Site. Eighteen locations (Soil-1 through Soil-18) were sampled at depths of land surface to 6 inches below land surface (bls), 6 inches to 2 feet bls, 2 to 4 feet bls, and 4 to 6 feet bls. In general, arsenic soil

concentrations were highest in the shallow soils and decreased with depth at each of the locations sampled. The conclusions of the Interim Report stated that no greater impacts were located on the tees and greens area than throughout the rest of the Site. A recommendation for additional sampling to further delineate potential arsenic impacts was included in the report.

A SARA was completed in January 2007 at the request of the FDEP in order to further delineate arsenic impacts in soil at the Site's property boundaries, install additional monitor wells, determine lithology of the deeper aquifer using acquired boring logs from the two on-site potable wells, and take additional soil and groundwater samples near the Maintenance Facility and Monitor Well MW-2 Area. Soil samples (PLS-1 to PLS-30) were taken around the property boundary of the Site and analyzed for arsenic using EPA Method 6010. At each location, soil samples were collected from land surface to 6-inches bls, 6-inches to 2 feet bls, and 2 to 4 feet bls. The samples from land surface to 6-inches bls, and 6-inches to 2 feet bls were initially analyzed and the deeper samples were placed on hold. Because the sample results were consistent with Site-wide results (elevated levels shallow and decreasing concentrations with increased depth), additional deeper analysis was not performed. For the shallow soil samples (land surface to 6-inches bls), arsenic concentrations ranged from below the laboratory method detection limits to 27 mg/kg.

A SARA was submitted on September 19, 2008 to report on the additional soil testing activities that were intended to determine the extent of impact. Since additional off-site access agreements have been recently obtained and additional off-site soil testing has been conducted, these results have been presented in their entirety in this report.

At the request of the Department, additional assessment activities were conducted in order to satisfy the requirements of a Site Assessment in accordance with Chapter 62-780, Florida Administrative Code (FAC). This Site Assessment Addendum and Interim Source Removal report addresses these additional assessment activities and recent source removal activities.

In summary, assessment activities have been ongoing at this Site since August 2004. The results of the assessments have identified arsenic in soil and groundwater at concentrations that exceed the default SCTL and GCTL per Chapter 62-777 Florida Administrative Code (FAC) in portions of the Site. The highest soil and groundwater arsenic concentrations were identified in the vicinity of the Maintenance Facility located in the east-central portion of the Site and another localized area near monitoring well MW-2. Based upon the relative magnitude of the soil and groundwater impacts in these areas and the proximity of these impacts to locations historically utilized for the handling and storage of herbicides/pesticides, it appears that discharges of these products resulting from routine mixing and handling, may have occurred in the past near the Maintenance Facility. With regard to arsenic soil impacts located throughout the remainder of the Site, these impacts appeared to be the result of lawful routine application of herbicides/pesticides.

3.0 GEOLOGY AND HYDROGEOLOGY

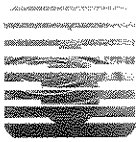
3.1 Site Geology

HSA previously evaluated site-specific stratigraphy by reviewing available stratigraphic information gathered during a previous geotechnical investigation conducted at the Site. Copies of the cross-sections developed from this review are included as **Appendix B.** With the exception of the on-site surface water features, the Site has an approximate elevation of 75 feet National Geodetic Vertical Datum (NGVD) or approximately 72 feet National Atlantic Vertical Datum (NAVD). The geology and lithology that underlies the Site, inferred from cross-sections A-A' and B-B', generally consists of brown to gray-brown fine sand with roots (including top soil) to a maximum depth of approximately 5.0 feet bls underlain by brown to gray-brown variegated fine sand from land surface to depths ranging from 14 to 23 feet bls. The sand is sporadically interlaminated with organic silty to silty fine sand. Gray-brown limestone underlies most of the sand; however, in the northern and some southern parts of the Site, the limestone is missing and replaced by green-brown to gray-brown silty fine sand to a depth of approximately 28 feet bls. The limestone and silty fine sand are underlain by green clayey silt or green brown dolomitic silty sand. The distribution of lithologies at depths greater than 31 feet bls is generally inferred with respect to the lithologies observed at soil borings B-13 and B-14, which were advanced to a depth of approximately 35 feet bls.

At the request of the Department, HSA acquired boring logs for the two on-site potable wells to determine lithology of the deeper aquifer. A Site plan depicting the locations of the on-site potable wells and a geologic cross-section developed from the two on-site potable well logs is included in **Appendix B**. Both borings were completed to a depth of approximately 297 feet bls. Both borings encountered sand to a depth of approximately 35 feet bls. At both locations, the sand was underlain by sandy clay to a depth of approximately 70 feet bls. This clay unit was also encountered at approximately 35 feet bls at previously completed geotechnical borings B-13 and B-14. This clay unit appears to be acting as a confining unit that is underlain by the Floridan Aquifer. Production well Numbers 56 and 63 are cased to at least 75 feet and both wells exhibited depth to water measurements of approximately 60 feet bls, exhibiting further evidence of the presence of a competent confining unit. The lithology below this confining unit beginning at approximately 70 feet bls can be described as limerock of varying hardness down to the total depth of each boring.

3.2 Hydrogeology

Groundwater in Pinellas County occurs under both non-artesian and artesian conditions. Non artesian conditions occur in the surficial aquifer. The surficial aquifer primarily consists of permeable units within deposits of Pliocene to Recent age. The lithologic units consist of unconsolidated layers of fine-to medium-grained sand with varying degrees of silt and shell that grade downward into sandy clay or marl with interbedded clay. Surficial aquifer sediments



below the Pinellas Ridge area of Pinellas County extend to a depth of less than 10 to 50 feet below grade. The top of the water saturated zone reflects a subdued replica of the surface topography, ranging from near sea level along the coast to approximately 80 feet above sea level in the central portion of the Pinellas Ridge area. The depth to water in the hilly uplands area is encountered from 3 to 10 feet below grade. The direction of groundwater flow in the area of the Site is to the northeast except near streams where water flows laterally to these features. Fluctuations in the water table generally are lowest in the dry spring months up through June and recover in the wet summer months to the annual high in September and October. This fluctuation usually varies within a 2-foot range.

Underlying the sands of the surficial aquifer are sandy clays and marls of the Hawthorne Group of middle to early Miocene age. These sandy clays and marls comprise the upper confining unit of the Florida aquifer system. In some areas in northern Pinellas County, the sediments of this confining layer are absent and the Floridan system is under water table conditions. Throughout the remainder of the County, these sediments, which range in thickness from less than 25 feet in the northern areas to greater than 150 feet in the southern areas, effectively restrict vertical movement of water between the surficial sands and the underlying Floridan system.

Below this confining unit is a thick sequence of carbonates and evaporites. The upper 1,000 to 2,000 feet comprise the principle potable water bearing aquifer in this region and is known as the Upper Floridan aquifer (UFA). The UFA is composed of a thick, stratified sequence of limestone and dolomite and include, in descending order, hydrologically connected permeable beds of the lower Hawthorn Group, Ocala, Avon Park, and Lake City Limestones. Thickness of the UFA sediments is approximately 1,200 feet and is encountered at an approximate depth of 40 to 90 feet below grade in the Pinellas Ridge area. Underlying the Floridan aquifer is the lower confining bed that generally occurs in the Lake City Limestone where persistent intergranular anhydrite and gypsum occur, thus restricting the porosity.

The potentiometric surface is relatively flat throughout Pinellas County, and is about 10 feet above sea level in the northeastern and southern parts of the county and about five feet above sea level in the central areas. The potentiometric surface is slightly higher at points in the north-central, west-central, and extreme southern parts of the county. Water moves radially from these high points to the natural discharge areas of Tampa Bay and the Gulf of Mexico. The average depth to water measured throughout the subject Site during this investigation was approximately 3 feet bls.

3.3 Site Groundwater Flow Data

On October 16, 2008, HSA subcontracted the services of Florida Design Consultants, Inc. to survey the top-of-casing (TOC) elevations of the newly installed monitor wells and staff gauges. Florida Design Consultant's surveyed monitor wells MW-3 through MW-13 and staff gauges 1 through 3 installed within the two surface water bodies and an on-site ditch. HSA personnel surveyed the TOC of the monitoring wells MW-14 through MW-23 on December 17, 2008. A summary of monitor well construction details and top of casing elevation measurements are provided in **Table 1** and **2**, respectively. The groundwater monitor well locations are illustrated on **Figure 3**.

A set of groundwater depths was measured on November 7, 2008 (see **Table 2**). Depth to water measurements on that date ranged from 6.78 to 13.08 feet below top of casing (feet btoc), with an average depth to water of 8.66 feet btoc.

Water-level measurements were converted to groundwater elevations and subsequently plotted and contoured with Surfer (Version 8.0) to produce groundwater flow maps. The average elevation on November 7, 2008 was 67.88 feet NAVD. The groundwater flow map indicates that groundwater generally flows to the northwest, **(Figure 4)** with a calculated horizontal hydraulic gradient of 0.0025 feet/foot.

With the installation of an additional ten monitor wells, a set of groundwater elevation measurements were measured on December 17, 2008. Groundwater elevation measurements on that date ranged from 66.22 to 71.54 feet NAVD, with an average elevation of 67.72 feet NAVD. In addition, two of the staff gauges, SG-1 located in the north pond, and SG-3 located in the south pond, were noted as being dry. The groundwater flow map indicates a groundwater flow generally to the northwest (**Figure 5**), consistent with the November sampling event. From November 7 to December 17, 2008, the average depth to groundwater decreased 0.16 feet, but the groundwater flow direction remained relatively unchanged.

3.4 Site Hydraulic Characteristics

Publicly available site assessment documents for other nearby sites were reviewed and revealed the following local hydrogeological information.

A *Remedial Action Plan* for a petroleum facility (FDEP Facility ID No. 528515358), identified as Gas World #11, located at 2200 Main Street, Dunedin, Florida (approximately 1000 feet northeast of the Site), dated January 2000, prepared by Custom Solutions, Inc., described the following:

- Lithology reported primarily as fine grain quartz sand with varying silt content to approximately 16 feet bls, underlain by medium grain silty quartz sand and shell fragments to 36 feet bls. A soft to very firm clay was encountered at approximately 36 feet and was determined to be approximately 14 feet thick.
- Groundwater flow direction to the northwest, with an average water table fluctuation of 1.5 feet attributed to seasonal fluctuations,
- A hydraulic gradient of 0.017 feet/foot, hydraulic conductivity of 11 feet/day, and aquifer porosity of 0.43.
- Depth to water averaged 6 feet bls.

A *Template Site Assessment Report* for a former petroleum facility (FDEP Facility ID No. 528515626), identified as the Countryside Store, located at 26998 US Highway 19 North, Clearwater, Florida (approximately 1 mile northwest of the Site), dated November 28, 2001, prepared by Jones-Ayres Joint Venture described the following:

- The lithology of the subsurface soil consist primarily of well-sorted fine-grained sand with varying amounts of silt to a depth of 35 feet bls. A low permeability clay layer was reported at a depth of approximately 35 feet bls.
- The average depth to groundwater was 5.41 feet bls.
- Groundwater flow direction was reported to be to the northwest.
- Slug test data results indicated an average hydraulic conductivity of 7.0 feet/day to 9.0 feet/day in the shallow saturated sediments. Based on an estimated hydraulic gradient of 0.002 feet/foot, and an assumed effective porosity of 20 percent, the rate of groundwater flow velocity was estimated to range from approximately 25 to 33 feet/year.

Based on the publicly available site assessment documents for the nearby sites described above, which had similar site geology and hydrogeology to the subject Site, assuming an average hydraulic conductivity, a groundwater velocity may be calculated. The calculated hydraulic conductivities were reported at 11 feet/day (Custom Solutions, 2000), and 7 and 9 feet/day (Jones-Ayres Joint Venture, 2001), and the average of these hydraulic conductivities calculate to 9 feet/day.

From Darcy's Law $v = Ki/n$, where v = average groundwater velocity, K = hydraulic conductivity, I = hydraulic gradient, and n = effective porosity, the groundwater "seepage" velocity can be calculated. Using an average hydraulic conductivity of 9 feet/day, a hydraulic gradient of 0.0025 feet/foot, and estimated effective porosity of 0.25, the hydraulic seepage velocity calculates to 0.09 feet/day or 32 feet/year.

4.0 SITE CHARACTERIZATION

The Site assessment consisted of soil and groundwater sampling to assess the horizontal and vertical extent of the arsenic-impacted soils. Additionally, ISR activities were conducted, as discussed in **Section 5.0**.

4.1 Soil Assessment

Since the submittal of the SARA in January 2007, HSA has conducted additional soil assessment activities consisting of the following:

- Advanced soil borings on adjacent off-site properties for arsenic analysis,
- Submitted soil samples for pesticide analysis,
- Submitted samples for Synthetic Precipitation Leaching Procedure (SPLP) testing to establish an alternative arsenic SCTL for Groundwater Criteria, and
- Conducted post excavation soil sampling at the former maintenance area and Monitor Well MW-2 Area (included in **Section 5.0**).

Included below are a summary of recent arsenic soil sampling (off-site), a summary of on-site pesticide sampling, and a summary of arsenic SPLP testing. Historical data is also included in summary tables.

4.1.1 Off-Site Arsenic Soil Sampling

Off-site soil sampling activities were conducted from May 28, 2008 through July 1, 2008. Soil sampling began at the northwest section of the off-site property and continued in a general counterclockwise fashion along the perimeter of the Site. Soil sampling was conducted at locations that were adjacent to on-site locations that exhibited elevated levels of arsenic identified during previous assessment activities. A Site plan depicting the locations of these samples is included as **Figure 6**. All soil samples were gathered with a decontaminated stainless steel hand auger in accordance with the FDEP Standard Operating Procedure (SOP) for soil sampling (FS3000). At each location, soil samples were collected from land surface to 6-inches bls, 6-inches to 2 feet bls, and 2 to 4 feet bls. Soil samples were collected in laboratory-supplied containers and delivered to a State-certified laboratory for arsenic analysis by EPA Method 6010.

Initially, shallow soil samples were analyzed from each location and only selected deeper samples were analyzed for the purpose of delineating to the default residential direct exposure SCTL of 2.1 mg/kg. Based on the results of the adjoining perimeter off-site samples, additional soil samples locations were collected laterally until the soil arsenic concentrations were defined to the SCTL.

A summary of the results of the Site wide and off-site soil sampling data is included in **Tables 3** and **4**, respectively. In general, arsenic soil concentrations were highest in the shallow soils, from land surface to 6 inches bls, and decreased with depth at each of the locations sampled, as illustrated in **Figures 7** through **9**. **Figure 7** illustrates the soil sampling results from depths less than 6-inches bls. **Figure 8** illustrates the soil sampling results at the 6-inches to 2 feet bls interval and **Figure 9** illustrates the soil sampling results at the 2 to 4 feet bls interval. These figures also include the soil sample results from the tees and greens (Soil-1 through Soil-18), which were sampled and analyzed in October 2006, the on-site property boundary soil sample locations (PLS-1 through PLS-30), which were sampled and analyzed in November 2006, and the soil samples collected for SPLP characterization (SB-1 through SB-15), which were sampled and analyzed in December 2008.

The highest concentration of arsenic detected in any of the off-site soil samples was 8.9 mg/kg at ROW-31 from a shallow sample depth. As illustrated on **Figure 7,** this soil sample is located in the right of way of Countryside Boulevard, southeast of the Clubhouse Dogwater Café. The next highest concentration of arsenic was 7.57 mg/kg at VOG-38 from a shallow sample depth. This sample is located within a residential area in the northwest portion of the study area, approximately 200 feet south of the Site property boundary. In fact, four sample locations were collected laterally from this area based on an on-site boundary sample location PLS-2 that exhibited an arsenic concentration of 4.8 mg/kg. Soil samples were collected at increasing distances off-site and concentrations were generally consistent with values of 2.75 mg/kg (VOG-1), to 2.97 mg/kg (VOG-2), to 2.65 mg/kg (VOG-22) and then increased at approximately 200 feet from the property boundary to 7.57 mg/kg (VOG-38). Similar increasing concentration trends were observed in the same general area at soil sample VOG-39 that exhibited a soil arsenic concentration of 5.9 mg/kg, also located nearly 200 feet from the Site property boundary. It was generally observed within this residential area (located in the northwest portion of the study area near Belcher Road) that concentrations of arsenic increased with samples collected laterally away from the Site property boundary. These data suggest that the application of arsenical herbicide/pesticides occurred on the neighboring residential properties for routine grass maintenance. Since these off-site arsenic concentrations, collected nearly 200 feet from the Site property boundary, are clearly not associated with the impacts observed on the subject property, no additional lateral soil assessment was conducted in this area.

At the soil sample interval from 6-inches to 2 feet bls (**Figure 8**), only three off-site locations exhibited exceedances of the SCTL, including VOG-23, VOG-3 and ROW-31. At the soil sample interval from 2 to 4 feet bls, there were no off-site locations that exhibited exceedances of the SCTL. These results strongly support the conceptual model that indicates the lawful routine application of herbicides/pesticides. Soil laboratory analytical results were included in the SARA (HSA, 2008) and the newly obtained data is included in **Appendix C**.

4.1.2 On-Site Pesticide Soil Sampling

Although previous pesticide sampling at the Site did not indicate the widespread presence of pesticides at elevated levels on-site, the Department requested that additional pesticide testing be completed. Additional pesticide sampling was conducted at locations that previously exhibited elevated levels of arsenic to rule out pesticides as a site-wide contaminant of interest. Soil sampling activities for the purpose of pesticide assessment was conducted on September 9, 2008 from select soil boring locations on the Tee and Green Area (two locations) and On-site Property Boundary samples (three locations). Historical pesticide analysis of soils present in the Maintenance Facility Area (seven locations) and Monitor Well MW-2 Area (four locations) were conducted between May and November 2006 and reported in the SARA (HSA, January 2007).

Two soil samples, Soil-5 and Soil-13, were collected from the Tee and Green Area and analyzed for the presence of chlorinated pesticides and herbicides by EPA Method 8081 and EPA Method 8151, respectively. Soil sample Soil-5, located in the southern portion of the Site, exhibited a arsenic concentration of 7.9 mg/kg at an interval depth from land surface to 6 inches bls. Soil-13, located in the northern portion of the Site, had a historical concentration of 9.2 mg/kg at an interval depth from land surface to 6 inches bls.

Three soil samples, PLS-7, PLS-20 and PLS-22, which were collected on the property boundary, were also analyzed for the presence of chlorinated pesticide and herbicides by EPA Method 8081 and 8151, respectively. These soil samples exhibited arsenic concentrations ranging from 9.2 to 27 mg/kg at an interval depth from land surface to 6 inches bls.

These five soil samples reported chlorinated pesticide and herbicide parameter concentrations below the applicable default residential direct exposure SCTL. Low-level concentrations of the constituent's dieldrin and DDT were reported in soil sample PLS-20; however, at concentrations below the respective laboratory practical quantitation limit. No chlorinated herbicide compounds were detected above the laboratory method detection limit. These results are summarized in **Table 3.** Historical pesticide soil sampling in the maintenance area did identify concentrations of chlorinated pesticides exceeding their default SCTLs. These exceedances, however, were addressed as part of the ISR and confirmatory soil sampling confirmed clean endpoints (see **Section 5.0**, below).

4.1.3 SPLP Arsenic Testing

Soil sampling activities were conducted on December 5, 2008 for the purpose of an alternative SCTL for Groundwater Criteria for arsenic by utilizing the SPLP extraction method in accordance with FDEP guidance dated May 2008. In order to develop a range of total arsenic concentrations, soil samples were collected from various locations on Site, including the tees and greens, on-site property boundary, Maintenance Facility, and the Monitor Well MW-2 area. A Site plan depicting the location of these samples (SB-1 through SB-15) is included on **Figure 6.**

All soil samples were gathered with a decontaminated stainless steel auger in accordance with FDEP SOP for soil sampling (FS3000). At each location, soil samples were collected from land surface to 6-inches and 6-inches to 2 feet bls. Soil samples were collected in laboratory-supplied containers and delivered to the laboratory for arsenic analysis by EPA Method 6010.

A summary of the results of the soil sampling analysis is included in **Table 3** and illustrated on **Figures 7** through **9**. The highest concentration of arsenic detected in any of the soil samples was 21 mg/kg at SB-11 from a shallow sample depth.

Soil samples ranging in total arsenic concentration from 1.3 mg/kg to 21 mg/kg were selected for SPLP extraction by EPA Method 1312, followed by analysis of the leachate for arsenic by EPA Method 6010. A summary of the soil sample results and the corresponding leachate analysis results are included in **Table 5**. In accordance with the Guidance for Determining Leachability by Analysis of SPLP Results (FDEP, 2008), a graph was constructed comparing results for total soil arsenic concentration versus SPLP for each sampling location. As illustrated on the chart included with **Table 5**, the estimated leachability threshold for soil sampling data is approximately 5.0 mg/kg when considering the default GCTL of 10 micrograms per liter (µg/L). Given the alternative GCTL of 100 µg/L for groundwater of poor quality, the estimated leachability threshold for soil sampling data is 46.2 mg/kg.

4.2 Groundwater Assessment

During the past two years, property maintenance contractors inadvertently destroyed the majority of the existing monitoring well network. As such, the recent groundwater quality study at the Site required the installation of a replacement network of monitor wells. Existing monitor well MW-3 and newly installed monitor wells MW-5 through MW-23 were installed and sampled to determine groundwater quality conditions beneath the Site.

4.2.1 Monitor Well Installation

Following an evaluation of the soil analytical and historical groundwater results, a network of monitor wells was installed to more accurately determine the location and extent of any groundwater arsenic impacts. It should be noted that the current groundwater quality study focused on the presence of arsenic only. Historical groundwater analytical data successfully demonstrated the absence of other target compounds. The monitor well locations were generally chosen at areas where soil arsenic contamination was documented at the 0.5 to 2 feet bls interval, at areas where groundwater arsenic contamination was previously documented, or at areas where recent soil excavations were conducted. Additionally, four monitor wells were installed off-site, including hydraulically upgradient locations (MW-16 and MW-17), downgradient (MW-14) and side gradient (MW-15). The monitor well locations are illustrated on **Figure 3**.

A network of nine monitor wells (MW-5 through MW-13) were installed on October 28 and 29, 2008. These wells were installed by National Environmental Technology, Inc. under the supervision of HSA personnel. An additional 10 monitor wells (MW-14 through MW-23), were installed between December 4, 2008 through December 12, 2008. Four monitor wells, MW-14 through MW-17, were installed off-site, within the Right of Way of Belcher Road, Enterprise Drive, and Countryside Boulevard. These ten monitor wells were installed by Mortensen Engineering, Inc. under the supervision of HSA personnel. The monitor well construction details are presented in **Table 1** and illustrated in **Appendix D**. **Appendix D** also provides a copy of the monitor well completion reports.

The shallow monitor wells were installed to approximate depths of 13 feet bls. Monitor wells MW-5, MW-6, MW-7, MW-10 and MW-12 were installed by direct-push methods and constructed with 1.0-inch diameter, Schedule 40 PVC casing and screen. The direct-push wells were constructed with a ten-foot 0.01-slot, pre-packed screen with 20/30-grade silica sand serving as the filter pack. A one-foot fine-sand seal, consisting of 30/65-grade silica sand was emplaced approximately one foot above the filter pack. A Portland cement grout seal was emplaced from the fine sand seal to approximately 1 feet bls. The monitor wells were completed within a 3.0 feet aluminum riser and set in a 2 feet by 2 feet concrete pad. The wells were equipped with water tight expansion caps.

The remaining newly installed monitor wells were installed by hollow stem auger and constructed with 2.0 diameter Schedule 40 PVC casing and screen. The permanent monitor wells were constructed with a ten-foot, 0.01-slot screen with 20/30 grade silica sand serving as the filter pack. A one-foot fine-sand seal, consisting of 30/65-grade silica sand was emplaced approximately one foot above the filter pack. A Portland cement grout seal was emplaced from the fine sand seal to approximately 1 feet bls. The on-site monitor wells were completed with 3.0 feet aluminum riser and set in a 2 feet by 2 feet concrete pad. The four off-site monitor wells, MW-14 through MW-17, were completed to grade. The wells were equipped with locking expansion caps.

After installation of the monitor wells, the wells were developed with a submersible pump until the discharge water was relatively sediment free. Any soil cuttings and purged waters generated during the installation of the monitor wells were temporarily stored on-site in Florida Department of Transportation (FDOT)-approved 55-gallon drums as investigation-derived waste (IDW). Documentation of proper IDW disposal will be provided to FDEP under separate cover.

4.2.2 Monitor Well Survey and Water Level Measurements

HSA subcontracted the services of Florida Design Consultants, Inc., to survey the top-of casing elevations of the existing monitor well network on October 16, 2008. The elevations were surveyed to +/- 0.01 feet and referenced to the NAVD of 1988 based on a benchmark established by the registered land surveyor. On December 17, 2008, HSA personnel surveyed the top of casing of the newly installed monitor wells (monitor well MW-14 through MW-23). On November 29, 2006, December 13, 2008, and again on December 17, 2008, HSA personnel measured and recorded a complete set of depth-to-water measurements from the monitor wells. (**Table 2**) Contoured water-elevation data are presented in **Figures 4** and **5,** and a discussion of interpreted results was presented above in **Section 3.3**.

4.2.3 Groundwater Sampling Methodology

The newly installed monitor wells were sampled between October 30, 2008 through December 15, 2008. Prior to collecting groundwater samples, the monitor wells were purged to ensure that representative formation water was subsequently sampled. HSA employed low-flow purging to reduce turbidity and turbulence that could potentially alter groundwater chemistry. This procedure is in accordance with the 2004 FDEP Standard Operating Procedures (DEP-SOP001/01) for groundwater sampling (Section FS 2200). Field parameter measurements were collected approximately two to three minutes apart, until the parameters stabilized or sufficient purging had been conducted. The parameters had stabilized when they were within the following limits: Temperature +/- 0.2 C; pH +/-0.2 Standard Units (SU); specific conductance +/- 5.0% of reading; dissolved oxygen (DO) is not greater than to 20% of saturation (at field-measured temperature); and turbidity is not greater than 20 Nephelometric Turbidity Units (NTUs). Copies of the groundwater sampling logs are included in **Appendix E**.

The groundwater samples were collect in laboratory supplied containers and immediately preserved on ice and transported to PEL Laboratories or SunLabs for analysis of arsenic by EPA Method 6010. Select monitor wells were also analyzed for secondary water quality parameters, pH, total dissolved solids (TDS), chloride, aluminum, iron, manganese, and color. The groundwater purged from the monitor wells was temporarily stored in labeled 55-gallon FDOT-approved drums as IDW. Documentation of proper IDW disposal will be provided to FDEP under separate cover.

4.2.4 Groundwater Quality Field Parameters

The groundwater field parameters are presented in **Table 6**. The pH measurements for the groundwater ranged between 4.68 and 6.23 standard units (SU), with an average of 5.64 SU. Specific conductance for the groundwater ranged from 232 to 5,200 microSiemens per centimeter (µS/cm), with an average of 1,524 µS/cm. Eight monitor wells had conductivites greater than 1500 µS/cm, including MW-3, MW-5, MW-6, MW-7, MW-11, MW-15, MW-19 and MW-21. Four of these wells are located in the northern portion of the Site, the others are located within the central portion of the Site (MW-9 and MW-11), near the Maintenance Facility (MW-19 and MW-21) and off-site (MW-15). Average temperatures were 19.3 degrees Celsius for the groundwater. Shallow zone DO ranged from 0.03 to 1.58 mg/L, with an average of 0.51 mg/L. Only five wells (MW-10, MW-19, MW-20, MW-21 and MW-22) exhibited a DO reading greater than 1.0 mg/L. Three of these monitor wells, MW-20, MW-21 and MW-22, are located within the vicinity of the recent source removal activities and these activities may have attributed to the elevated DO readings. Groundwater oxidation-reduction potential, or ORP, ranged from -306 milliVolts (mV) to 143 mV, with an average of -111 mV. Turbidities ranged from 0.57 to 15.9 NTUs, which are all below the SOP threshold of 20 NTUs.

4.2.5 Groundwater Analytical Results

A summary of the groundwater arsenic analytical results is included as **Table 7**. **Figure 10** depicts current Site-wide groundwater arsenic concentrations. Of the 19 newly installed wells, arsenic concentrations in excess of the default GCTL were limited to location MW-3 (47 µg/L) and MW-13 (73 µg/L). These arsenic concentrations are below the corresponding default Natural Attenuation Default Source Concentrations (NADSC) of 100 µg/L as established in Chapter 62-777, FAC.

Monitor well MW-3 is located along the northeastern portion of the property and MW-13 is located in the southern portion of the property. Because historical arsenic data at monitor well MW-3 exhibited arsenic levels below the GCTL, the current levels appear to be associated with seasonal fluctuations of the groundwater table rather than a discernable trend of increasing arsenic impacts.

All four off-site wells, MW-14 through MW-17, exhibited groundwater arsenic concentrations below the laboratory method detection limit of 4.9 µg/L.

As reported previously, a groundwater sample collected from a deep well DW-1, screened from 25 to 30 feet bls, reported an arsenic concentration below the default GCTL. This well was formerly located in the immediate vicinity of monitor well TW-5 at the maintenance area that exhibited the highest concentration of arsenic in any on-site monitoring wells. This suggests that

impacts are delineated vertically and are located within the shallow surficial aquifer. Any Floridan aquifer arsenic impacts are therefore, not related to shallow arsenic impacts. Groundwater laboratory analytical results are included in **Appendix F**.

An off-site irrigation well located east of the subject Site exhibited an arsenic concentration of 14.3 µg/L, which exceeds the GCTL of 10 µg/L. This well is completed in the Floridan Aquifer, with a total depth of 300 feet bls and a static water level of 65 feet bls. The arsenic concentrations identified in the on-site public supply wells and this irrigation well completed with the same aquifer suggests that low-level arsenic groundwater impacts may be widespread, and indicative of the local background groundwater quality.

4.2.6 Background Groundwater Quality Analysis

The background groundwater quality at the Site was evaluated by sampling and analyzing groundwater for parameters including pH, total dissolved solids (TDS), chloride, aluminum, iron, manganese, and color, which exhibit Secondary Drinking Water Standard as defined in Chapter 62-550, FAC. These constituents are not considered a component of the use of arsenical pesticides or herbicides and are considered representative of groundwater quality exclusive of the presence of arsenic.

The background groundwater quality analytical results are summarized in **Table 8**. Samples were collected from a hydraulically upgradient and off-site locations (MW-16 and MW-17), upgradient on-site well locations (MW-10, MW-13, MW-22, and MW-23), centrally located and side-gradient locations (MW-8, MW-15, MW-18 and MW-21), downgradient on-site wells (MW-3, MW-5 and MW-6) and from off-site, downgradient locations (MW-14) to determine spatial groundwater quality with respect to these parameters.

The pH values ranged from a low of 4.88 SU to a high of 6.35 SU, which are all below the Secondary Drinking Water Standard limits that range from 6.5 to 8.5 SU.

Total dissolved solids ranged from 190 mg/L (MW-16, upgradient off-site location) to 2,330 mg/L (MW-6, downgradient location). The concentrations at MW-3, MW-5, MW-6, MW-15, MW-18, MW-21 and MW-23 were greater than the Secondary Drinking Water Standard of 500 mg/L.

Aluminum concentrations ranged from 150 to 2,400 mg/L, and averaged 804 mg/L. Aluminum concentrations were greater than the Secondary Drinking Water Standard of 200 mg/L in all samples collected, with the exception of monitor wells MW-18, MW-21 and MW-23.

Iron concentrations were reported between 279 and 8,000 mg/L. Iron concentrations were above the Secondary Drinking Water Standard of 300 mg/L in all samples collected, with the exception of monitor well MW-17.

Similarly, the parameter color was reported at values between 20 and 17,000 color units, which are above the Secondary Drinking Water Standard of 15 color units. The highest value for color was reported at monitor well MW-14, which is an off-site monitor well, hydraulically downgradient of the Site.

In general, the conditions summarized above demonstrate that surficial groundwater is of poor quality as defined in Chapter 62-780 FAC. In all cases, the parameters pH and color were reported for all groundwater samples at concentrations outside or above their respective Secondary Drinking Water Standard. Additionally, the parameters aluminum and iron were reported at concentrations above their respective Secondary Drinking Water Standard for the majority of the groundwater samples.

5.0 INTERIM SOURCE REMOVAL ACTIVITIES

In order to resolve the arsenic impacts identified beneath and in the vicinity of the Maintenance Facility and Monitor Well MW-2 area that appeared to be the result of a historical discharge, HSA conducted ISR activities on October 6 through 8, 2008, and November 13, 17, and 18, 2008. These interim source removal activities included soil and groundwater removal and off-site disposal.

A total of 1,626.81 tons of contaminated soil were removed from the Maintenance Facility and the Monitor Well MW-2 area and transported by Soil Tech for disposal at Waste Management Okeechobee Landfill, located at 10800 NE 128th Avenue in Okeechobee, Florida. The areas of excavation and excavation depths for the Maintenance Facility and MW-2 Area are shown on **Figures 11** and **12,** respectively. The waste disposal manifest numbers and weight for each load of contaminated soil are summarized in **Table 9**. Copies of the manifests and weight tickets are provided in **Appendix G**.

On November 13, 2008, HSA contracted the services of Aqua Clean Environmental to remove impacted groundwater from the excavation areas. Approximately 6,500 gallons of impacted groundwater was pumped from the excavation area at the Maintenance Facility and 3,500 gallons from the Monitor Well MW-2 Area. A total of 10,000 gallons of impacted groundwater was transported by Aqua Clean to their facility at 3210 Whitten Road in Lakeland, Florida for treatment and disposal. Copies of the manifests are provided in **Appendix G**.

5.1 Maintenance Facility ISR Activities

Based upon soil and groundwater analytical data gathered from the vicinity of the Maintenance Facility, the majority of the impacts appeared to be located to the east and northeast of the existing structure. As such, an area approximately 50 by 80 feet was excavated, as illustrated on **Figure 11**. Soil excavation was generally conducted vertically to a depth approximately two feet below the water table, which was encountered at a depth of approximately four feet bls. A City of Clearwater water main was present in the area of excavation, which limited the excavation depth to 2.5 feet in a small portion of the excavation, as shown on **Figure 11**.

The arsenic and pesticide impacted soil was excavated using a backhoe excavator and either stockpiled on-site or direct loaded into truck for off-site disposal. Soil that was stockpiled was placed on visqueen and any stockpiled soils that remained overnight was covered with visqueen and secured.

At the completion of the excavation activities, four (4) confirmation soil samples were collected for laboratory analysis to confirm the impacted soils were removed. Confirmation soil samples (CSS-1/CS-Pit-1North, CSS-2/CS-Pit-1East, CSS-3/CS-Pit-1South, and CSS-4/CS-Pit-1West) were collected from the sidewalls at the intervals from land surface to 6 inches bls, 6 inches to 2 feet bls, and 2 to 4 feet bls. The soil samples collected in the vicinity of the Maintenance Facility were analyzed for the presence of arsenic and chlorinated pesticides by EPA Method 6010 and 8081, respectively, by PEL Laboratories. The samples (CS-Pit-1North, CS-Pit-1-East, CS-Pit-1South, and CS-Pit-1East) collected from 2 to 4 feet bls were analyzed for arsenic only. A summary of the analytes detected in the confirmation soil samples is presented in **Table 3**. Confirmation soil samples were not collected from the base of the excavation because the depths of the excavations were below the soil/water table interface. The location of these samples are illustrated on **Figure 11**; and for clarity purposes, the samples results from CSS-1, CSS-2, CSS-3 and CSS-4 are shown.

The constituents arsenic, dieldrin, and toxaphene were detected in three of the four sidewall samples above the corresponding residential direct exposure SCTL. As a result, a second excavation of this area was conducted on November 17 and 18, 2008, along the northern, western and southern boundaries. Final confirmation soil samples (CSS-1R, CSS-3R and CSS-4R) were collected at various interval depths from the sidewalls to confirm that the previously elevated concentrations were effectively removed. The results of the confirmation soil samples analysis identified only arsenic at concentrations above the applicable residential direct exposure SCTL. Because it has been concluded that arsenic-impacted soils exist in the shallow soils throughout the subject Site because of routine legal herbicide/pesticide application, additional excavation of arsenic impacted soil was not recommended at this time.

Replacement monitor wells were installed to the northwest of the excavation and on the south side of the excavation. As reported in **Section 4.2.5**, all groundwater arsenic results were reported below the default GCTL.

In accordance with Chapter 62-780.600(5)(l)3., FAC, post remedial groundwater monitoring will be conducted in this area. Once the excavation is backfilled, an additional monitor well will be installed within the center of the former excavation area. Post remedial groundwater samples will be collected from MW-20 and MW-21 for arsenic analysis by EPA Method 6010 and from the newly installed well for arsenic and chlorinated pesticides by EPA Method 6010 and 8081, respectively. Groundwater sampling will continue until two consecutive quarterly sampling events demonstrate that the contaminants of concern are less than the applicable GCTL.

5.2 Monitor Well MW-2 ISR Activities

An area approximately 45 feet by 45 feet was excavated in the area of monitor well MW-2, as illustrated on **Figure 12**. Soil excavation was generally conducted vertically to a depth of ten feet bls. This was approximately two feet below the water table, which was encountered at a depth of approximately eight feet bls. The excavation depth was approximately two to four feet bls in the area near the ditch.

The arsenic impacted soil was excavated using a backhoe excavator and either stockpiled on-site or direct loaded into truck for off-site disposal. Soil that was stockpiled was placed on visqueen and any stockpiled soils that remained overnight were covered with visqueen and secured.

At the completion of the excavation activities, four (4) confirmation soil samples were collected for laboratory analysis to confirm the impacted soils were removed. Confirmation soil samples (CS-Pit-2North, CS-Pit-2East, CS-Pit-2South, and CS-Pit-2West) were collected from the sidewalls at the intervals from land surface to 6 inches bls, 6 inches to 2 feet bls, and 2 to 4 feet bls. Because no pesticides were historically detected in this area, the confirmation soil samples were analyzed for the presence of arsenic by EPA Method 6010. A summary of the analytes detected in the confirmation soil samples are presented in **Table 3**. Confirmation soil samples were not collected from the base of the excavation because the depths of the excavations were below the soil/water table interface.

Arsenic was detected at a concentration above the residential direct exposure SCTL in the confirmation soil sample, CS-Pit-2West, collected from shallow intervals, land surface to 6-inches and 6-inches to 2 feet. Because arsenic-impacted soils exist in the shallow soils throughout the subject Site as a result of routine legal herbicide/pesticide application, additional excavation of arsenic impacted soil was not recommended at this time.

A post excavation monitor well was installed on the southern side of the excavation area. As reported in **Section 4.2.5**, groundwater arsenic results from monitor well MW-22 was reported below the GCTL.

In accordance with Chapter 62-780.600(5)(l)3., FAC, post remedial groundwater monitoring will be conducted in this area. Once the excavation is backfilled, an additional monitor well will be installed within the center of the former excavation area. Post remedial groundwater samples will be collected from MW-22 and from the newly installed well and analyzed for the presence of arsenic by EPA Method 6010. Groundwater sampling will continue until two consecutive quarterly sampling events demonstrate that the contaminants of concern are less than the applicable GCTL.

6.0 QUALITY ASSURANCE/QUALITY CONTROL LABORATORY REVIEW

All project related data were reviewed for completeness and accuracy. Quality control parameters were reviewed against the FDEP program and the method specific criteria. A case narrative accompanied the soil and groundwater laboratory reports and is included in **Appendices C** and **F**, respectively.

6.1 Soil Data

Soil samples were collected in September, October, November and December of 2008 and submitted to PEL a Division of Spectrum Analytical, Inc. (PEL) and/or SunLabs, Inc. (SunLabs) for analysis. Batch Quality Control (QC) samples: method blank (MB), laboratory control sample (LCS)/LCSD duplicate were analyzed daily. Data values reported between the Method Detection Limit (MDL) and the Reporting Limit (RL) were qualified as "I/Estimated." Case narratives accompanied each laboratory report. Complete soil laboratory analytical results are included in **Appendix C**.

September 11, 2008
Soil samples collected on September 11, 2008 were submitted to PEL (Tampa, FL). Soil samples analyzed for chlorinated pesticides using EPA Method 8081 and chlorinated herbicides using EPA Method 8151 were all analyzed within the hold time criteria. LCS recoveries for the following analytes were outside of the laboratory established control limits and associated data values were FDEP qualified as "J/Estimated": aldrin, alpha-BHC, gamma-BHC, 2,4,5-T, heptachlor, dalapon, and heptachlor. All other precision and accuracy measured by the LCS/LCSD pairs were acceptable. Surrogate recoveries for the following analytes were outside of the laboratory established control limits and were qualified as "J/Estimated: DCAA.

October 7, 2008
Soil samples collected on October 7, 2008 were submitted to PEL (Tampa, FL). Soil samples analyzed for arsenic using EPA Method 6010 and chlorinated pesticides using EPA Method 8081 were all analyzed within hold time criteria. Arsenic analysis was subcontracted to lab certification No. 87600/E87936. LCS recoveries were within the laboratory established control limits. Surrogate recoveries were within the laboratory established control limits.

October 14, 2008
Soil samples collected on October 14, 2008 were submitted to PEL (Tampa, FL). Soil samples analyzed for arsenic using EPA Method 6010 and were all analyzed within hold time criteria. LCS and surrogate recoveries were within the laboratory established control limits.

November 17, 2008
Soil samples collected on November 17, 2008 were submitted to PEL (Tampa, FL). Soil samples analyzed for arsenic using EPA Method 6010 and chlorinated pesticides using EPA Method 8081 were all analyzed within hold time criteria. LCS and surrogate recoveries were within the laboratory established control limits.

December 5, 2008
Soil samples collected on December 5, 2008 were submitted to SunLabs (Tampa, FL). Soil samples analyzed for arsenic using EPA Method 6010 and SPLP by EPA Method 1312 were all analyzed within hold time criteria. LCS and surrogate recoveries were within the laboratory established control limits.

6.2 Groundwater Data

Groundwater samples were collected in September, October, November, and December of 2008 and submitted to PEL and/or SunLabs for analysis. Batch QC samples: MB, LCS/LCSD were analyzed daily. Data values reported between the MDL and the Reporting Limit (RL) were qualified as "I/Estimated." Case narratives accompanied each laboratory report. Complete groundwater analytical data is included as **Appendix F**.

September 30, 2008
Groundwater samples collected on September 30, 2008 were submitted to PEL (Tampa, FL). A duplicate groundwater sample and an equipment blank sample were included on the chain of custody for laboratory analysis. Groundwater samples analyzed for arsenic using EPA Method 6010 were all analyzed within hold time criteria. LCS and surrogate recoveries were within the laboratory established control limits. The duplicate sample (DUP-A) required a 1:20 dilution and the sample MW-6 required a 1:100 dilution, reportedly due to arsenic interference.

November 7, 2008
Groundwater samples collected on November 7, 2008 were submitted to PEL (Tampa, FL). Groundwater samples analyzed for arsenic, aluminum, iron, and manganese using EPA Method 6010, pH using EPA Method 150.1, TDS using EPA Method 160.1, chloride using EPA Method 3001, and color using EPA Method SM2120B, were all analyzed within hold time criteria. The analytes, color and TDS were subcontract to AEL, lab certification No. 87600/E87936. LCS and surrogate recoveries were within the laboratory established control limits. Several samples required dilution, reportedly due to high concentrations of color, TDS, chloride and arsenic. Several analytes were detected below the RL in the blanks; however, since all hits were below the RL, no action was taken.

November 7, 2008
Groundwater samples collected on November 7, 2008 (reported on November 25, 2008) were submitted to PEL (Tampa, FL). Groundwater samples, previously analyzed for arsenic using EPA Method 6010, were re-analyzed for arsenic using EPA Method 7060A. All samples were analyzed within hold time criteria. LCS and surrogate recoveries were within the laboratory established control limits.

December 8, 2008
Groundwater samples collected on December 8, 2008 were submitted to SunLabs (Tampa, FL). Groundwater samples analyzed for arsenic using EPA Method 6010 were all analyzed within hold time criteria. LCS and surrogate recoveries were within the laboratory established control limits.

December 10, 2008
A groundwater sample collected on December 10, 2008 was submitted to PEL (Tampa, FL). The groundwater sample analyzed for arsenic, aluminum, iron, and manganese using EPA Method 6010, pH using EPA Method 150.1, TDS using EPA Method 160.1, chloride using EPA Method 3001, and color using EPA Method SM2120B, were all analyzed within hold time criteria. The analytes, color and TDS, were subcontract to AEL, lab certification No. 87600/E87936. LCS and surrogate recoveries were within the laboratory established control limits. The sample required dilution, reportedly due to high concentrations of color. Several analytes were detected below the RL in the blanks; since all hits were below the RL, no action was taken.

December 10, 2008
A groundwater samples collected on December 10, 2008 was submitted to SunLabs (Tampa, FL). The groundwater sample analyzed for arsenic using EPA Method 6010 was analyzed within hold time criteria. LCS and surrogate recoveries were within the laboratory established control limits.

December 15, 2008
Groundwater samples collected on December 15, 2008 were submitted to SunLabs (Tampa, FL). Groundwater samples analyzed for arsenic using EPA Method 6010 were all analyzed within hold time criteria. LCS and surrogate recoveries were within the laboratory established control limits.

December 8, 2008
A groundwater sample collected on December 8, 2008 was submitted to PEL (Tampa, FL). The groundwater sample analyzed for arsenic, aluminum, iron, and manganese using EPA Method 6010, pH using EPA Method 150.1, TDS using EPA Method 160.1, chloride using EPA Method 3001, and color using EPA Method SM2120B, were all analyzed within hold time criteria. The analytes, color and TDS, were subcontract to AEL, lab certification No. 87600/E87936. LCS and surrogate recoveries were within the laboratory established control limits. The sample required dilution, reportedly due to high concentrations of color.

December 12, 2008
A groundwater sample collected on December 12, 2008 was submitted to SunLabs (Tampa, FL). The groundwater sample analyzed for arsenic, aluminum, iron, and manganese using EPA Method 6010, pH using EPA Method 9040, TDS using EPA Method SM2540C, chloride using EPA Method 300, and color using EPA Method 110.2, were all analyzed within hold time criteria. The parameter TDS was performed by Benchmark EnviroAnalytical, Inc., certification number E84167. The spike were not within acceptable control limits for iron; however, the LCS data was within acceptable control limits. Therefore the poor spike results were attributed to matrix interference. LCS recoveries were within the laboratory established control limits. The sample required dilution, reportedly due to high concentrations of chloride and iron.

December 15, 2008
Groundwater samples collected on December 15, 2008 were submitted to PEL (Tampa, FL). The groundwater samples analyzed for arsenic, aluminum, iron, and manganese using EPA Method 6010, pH using EPA Method 150.1, TDS using EPA Method 160.1, and color using EPA Method SM2120B, were all analyzed within hold time criteria. Chloride, using EPA Method 300.1, was analyzed out of hold time. The analytes, color and TDS, were subcontract to AEL, lab certification No. 87600/E87936. LCS and surrogate recoveries were within the laboratory established control limits. The sample required dilution, reportedly due to high concentrations of color. Several analytes were detected below the RL in the blanks; since all hits were below the RL, no action was taken.

7.0 CONCLUSIONS

HSA has completed Site assessment activities at the Countryside Excecutive Golf Course in Clearwater, Florida. The results of this assessment are summarized below.

The arsenic residential direct exposure SCTL was exceeded for the majority of the golf course for the sample interval between land surface and 6-inches bls. Off-site assessment within this interval identified limited impacts at several locations surrounding the Site. A significant area of impact was also revealed in a residential neighborhood located immediately south of the northwest portion of the Site. The arsenic soil impacts in this area appear to be the result of an off-site source.

Although widespread shallow soil arsenic impacts were noted, only limited impacts were identified in the deeper intervals between 6-inches and 2 feet bls and 2 to 4 feet bls. These results support HSA's conceptual model of lawful routine surface application of herbicides/pesticides.

Soil leachability testing using SPLP extraction identified an estimated leachability threshold of 5.0 mg/kg to be protective of the arsenic GCTL of 10 µg/L. Considering an alternative GCTL of 100 µg/L, the soil concentration increases to 46 mg/kg. These results suggest that leaching may be occurring from shallow soils, but at deeper intervals, additional soil sorptive capacity exists.

The inferred direction of groundwater flow in the shallow aquifer was generally to the northwest. The dissolved groundwater plume includes two isolated areas of arsenic impacts, at MW-3 and MW-13 that exceed their respective default GCTLs. These shallow monitor wells were installed within the top several feet of the water column beneath the Site. The periodic low-level exceedances of the GCTL are not unexpected given the presence of arsenic in shallow soils. Nonetheless, there were no groundwater exceedances of the respective default NADSC, and the groundwater assessment is complete.

An evaluation of background groundwater quality conditions at the Site suggests that area-wide groundwater is of poor quality as defined in Chapter 62-780, FAC. The widespread Secondary Drinking Water Standard exceedances of pH, aluminum, iron and color support this conclusion. Given that poor groundwater quality exists, Chapter 62-780, FAC allows for an alternative GCTL that is equal to 10 times the default GCTL, or 100 µg/L for arsenic.

A total of 1,626.81 tons of contaminated soil were removed from the Maintenance Facility and the Monitor Well MW-2 area and transported to the Waste Management Okeechobee Landfill in Okeechobee, Florida. In addition, approximately 10,000 gallons of impacted groundwater were pumped from the excavation areas and disposed of by Aqua Clean. The post excavation soil sampling results demonstrate the removal of highly impacted arsenic and pesticide impacted soils. The post excavation groundwater analysis demonstrates the groundwater results are below the default GCTLs.

8.0 RECOMMENDATIONS

Based on the most recent soil analytical data, HSA recommends corrective action utilizing a combination of limited soil removal (to mitigate off-site shallow soil impacts) and the use of engineering/institutional controls to manage direct exposure risks associated with on-site shallow arsenic impacts after Site redevelopment. Specifically, arsenic impacted soils will be placed beneath a suitable engineering controls such as buildings and/or impervious cover, or green areas that will be maintained with 2 feet of clean cover.

With regard to recent ISR activities, HSA recommends Post Active Remedial Monitoring (PARM) near the maintenance area (monitoring wells MW-19, MW-20, and MW-21), and near the monitoring well MW-2 area (monitoring wells MW-10 and MW-22). Groundwater sampling is recommended on a quarterly basis for arsenic of a one-year period to demonstrate stable groundwater quality conditions.

HSA also recommends corrective action for groundwater by a designation of poor quality for the shallow groundwater located beneath the subject Site, with protection of exposure via the use of an institutional control. Historical groundwater analytical data have not indicated the presence arsenic in groundwater at concentrations exceeding the proposed alternative GCTL of 100 µg/L at any wells located outside the immediate vicinity of the maintenance area, and current arsenic groundwater concentrations in the maintenance area are currently well below this value, following ISR activities.

Upon the Department's approval of the SAR, quarterly groundwater monitoring will be initiated. A Soil Management Plan will also be prepared for use during Site redevelopment activities. Following Site redevelopment and suitable engineering/institutional control development in accordance with FDEP guidance, a No Further Action Proposal will be presented in pursuit of a Site Rehabilitation Completion Order consistent with Risk Management Option Level II.

9.0 REFERENCES

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