SITE ASSESSMENT REPORT ADDENDUM
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

Prepared by:

HSA Engineers & Scientists
4019 East Fowler Avenue
Tampa, Florida 33617

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1.0 INTRODUCTION

HSA is pleased to submit this Site Assessment Report Addendum (SARA) that details additional assessment activities at the Countryside Executive Golf Course (Site) located in Clearwater, Florida (Figure 1). The golf course is currently not being utilized and is intended to be converted to a residential land use. As is the case at all golf courses, herbicides and/or pesticides were routinely applied on-site. 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 known accidental spills were reported. These products commonly contain arsenic. Furthermore, select chlorinated herbicides/pesticides commonly approved for use, have been used at other golf courses in the past. These herbicides/pesticides can result in impacts above default residential land use cleanup criteria for soils, and may result in limited impacts to groundwater.

HSA previously submitted a Site Assessment Report and Remedial Action Plan (dated December 2005), a Response to Comments Letter (dated July 10, 2006), an Interim Source Removal Plan and Groundwater Monitoring Plan (dated July 2006), and an Interim Report (dated November 15, 2006). At the request of the Department, additional assessment activities were conducted in order to satisfy the requirements for a complete Site Assessment in accordance with Chapter 62-780, Florida Administrative Code (FAC).

The additional assessment activities included:

1. Soil sampling at alternating tees and greens throughout the subject golf course;
2. Delineation soil sampling at the property boundary;
3. Additional soil sampling for the presence of arsenic, herbicides, and pesticides in the vicinity of monitoring well MW-2, and near previous soil sampling locations CSS-7, CSS-33, and CSS-40;
4. Review of available literature regarding site geological setting and boring log descriptions.
5. Monitoring well installation and groundwater sampling at selected monitoring wells.

2.0 SUMMARY OF HISTORICAL ASSESSMENT ACTIVITIES AND REMEDIAL APPROACH

Initially, between August 2004 and September 2005, assessment activities were conducted at the Site. The results of the assessment identified arsenic in soil and groundwater at concentrations that exceed Department cleanup criteria 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. An isolated area of groundwater impact was also detected in the vicinity of monitoring well MW-2, located in the southeastern portion of the Site. 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 and monitoring well MW-2. With regard to arsenic soil impacts located throughout the remainder of the site, these impacts appear to be the result of lawful routine application of herbicides/pesticides. The owner wishes to voluntarily agree to manage the impacted soil and groundwater at this Site through implementation of institutional and engineering controls as set forth in Chapter 62-780, FAC.

HSA has previously presented a remedial approach for the Site, one that will facilitate site redevelopment and valuable use of the property. The plan includes the use of engineering/institutional controls to prevent exposure to arsenic. HSA has also proposed the completion of Interim Source Removal activities near the maintenance facility in order to remediate arsenic impacted soils that were likely associated with former routine facility maintenance activities, and that may represent a continuing source of arsenic impact to groundwater. Following source removal activities, a groundwater monitoring plan is recommended for the area of the maintenance facility.

3.0 ON-SITE PRODUCTION WELL EVALUATION

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 Groundwater Cleanup Target Level (GCTL) established in Chapter 62-777, FAC of 10 micrograms per liter (µg/L). Public supply well numbers 56 and 63 are located on-site and well number 58 is located northwest and hydraulically upgradient of the subject 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 subject 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 order to determine whether the shallow and deeper groundwater located on the subject site is interconnected, HSA reviewed and evaluated available groundwater quality data and soil boring lithologic information.

HSA previously evaluated site-specific stratigraphy by reviewing available stratigraphic information gathered during a previous geotechnical investigation conducted at the subject Site. Copies of the cross-sections developed from this review are included as **Appendix A.** With the exception of the on-site lake, the site has an approximate elevation of 75 feet (ft) National Geodetic Vertical Datum (NGVD). 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 ft below land surface (ft bls) underlain by brown to gray-brown variegated fine sand from land surface to depths ranging from 14 to 23 ft 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 ft 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 ft 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 ft 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 is included as **Figure 2** and a geologic cross-section developed from the two on-site potable well logs is included as **Figure 3**. Both borings were completed to a depth of approximately 297 ft bls. Both borings encountered sand to a depth of approximately 35 ft bls. At both locations, the sand was underlain by sandy clay to a depth of approximately 70 ft bls. This clay unit was also encountered at approximately 35 ft 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 ft and both wells exhibited depth to water measurements of approximately 60 ft bls, further evidence of a confined aquifer. The lithology below this confining unit beginning at approximately 70 ft bls, can be described as limerock of varying hardness down to the total depth of each boring.

In addition to the presence of the confining unit between 35 and 70 ft bls, HSA also conducted groundwater sampling at an intermediate depth monitoring well (DW-1) located in the immediate vicinity of monitoring well TW-5 that has historically exhibited the highest concentration of arsenic in any on-site monitoring wells. Monitoring well DW-1 is screened from a depth of 25 to 30 ft bls. The current arsenic concentration at this well is 9.9 µg/L, below the GCTL of 10 µg/L. Based upon the results of the lithology and analytical data review, it appears that the production zone of the two on-site potable wells is isolated from surficial groundwater by a clay aquitard. This aquitard likely precludes vertical migration of herbicides and/or pesticides and associated contaminants, beneath the site.

4.0 ADDITIONAL ASSESSMENT ACTIVITIES

4.1 Tee and Green Soil Sampling

Tee and green soil sampling activities were conducted on October 27, 2006. Soil sampling began at the tee of Hole No. 1 and continued to alternate tees and greens throughout the Site. A site plan depicting the locations of the samples is included as **Figure 4**. 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 ft bls, 2 to 4 ft bls, and 4 to 6 ft bls. It should be noted that refusal was encountered at 4 ft bls at the soil boring advanced at the tee on Hole No. 11, therefore, a sample was not collected below this depth. Soil samples were collected in laboratory-supplied containers and delivered to the laboratory for arsenic analysis by EPA Method 6010. Completed soil sampling data sheets are included as **Appendix B**.

A summary of the results of the soil sampling analysis is included in **Table 1**. The highest concentration of arsenic detected in any of the soil samples was 9.2 milligrams per kilogram (mg/kg) at soil-13 from the shallow sample depth. In general, arsenic soil concentrations were highest in the shallow soils and decreased with depth at each of the locations sampled. In fact, the highest concentrations in each of the intervals sampled were 9.2, 4.6, 3.2, and 0.9 mg/kg from the 0 to 6-inch bls, 6-inch to 2 ft bls, 2 to 4 ft bls, and 4 to 6 ft bls samples, respectively. These recent sampling results confirm previous results that indicate a decreasing concentration trend with increased depth in soil. Furthermore, the results do not indicate excessively higher concentrations of arsenic on the tees and greens when compared to soil analytical results from the remainder of the Site. Complete soil laboratory analytical results are included as **Appendix C**.

4.2 Property Boundary Soil Sampling

Property boundary soil sampling activities were conducted on November 8 and 9, 2006. Thirty soil sampling locations were selected for property boundary sampling. A site plan depicting the locations of the samples is included as **Figure 5**. All soil samples were gathered with a decontaminated stainless steel hand auger in accordance with the FDEP SOP for soil sampling (FS3000). At each location, soil samples were collected from land surface to 6-inches bls, 6-inches to 2 ft bls, and 2 to 4 ft bls. The samples from land surface to 6-inches bls and 6-inches to 2 ft 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. Soil samples were collected in laboratory-supplied containers and delivered to the laboratory for arsenic analysis by EPA Method 6010. Completed soil sampling data sheets are included as **Appendix B**.

A summary of the property boundary soil sampling results is included as **Table 2**. For the shallow soil samples (land surface to 6-inches bls), concentrations ranged from below detectable levels to 27 mg/kg. In general, the concentrations of arsenic decrease with depth. The highest concentrations of arsenic were detected at soil sample locations SS-20 and SS-22 located along the eastern portion of the site. Complete soil laboratory analytical results are included as **Appendix C**.

4.3 Additional Soil Sampling at Selected Locations

At the request of the Department, additional soil sampling was conducted in the vicinity of monitoring well MW-2 to further determine whether a specific source of arsenic and/or herbicides/pesticides exists near the monitoring well. Four soil borings were advanced near monitoring well MW-2 to the north, south, east, and west. Soil samples were gathered from land surface to 6-inches bls, 6-inches bls to 2 ft bls, 2 to 4 ft bls, and 4 to 6 ft bls at each location. Each sample was analyzed for the presence of arsenic by EPA Method 6010. Completed soil sampling data sheets are included as **Appendix B**. In addition, each shallow sample was analyzed for the presence of herbicides (by EPA Method 8141) and pesticides (by EPA Method 8081). The results of the analysis did not identify the presence of any herbicides or pesticides above laboratory reporting limits at any of the locations sampled, and as such, deeper samples were not analyzed. Arsenic was detected at each location sampled at the top three depths. In the deepest sample (4 to 6 ft bls), arsenic was not detected above the residential exposure SCTL of 2.1 mg/kg. At the soil location north of monitoring well MW-2, arsenic was detected in the shallow sample (0 to 6-inches bls) at a concentration of 36 mg/kg. A summary of soil analytical data at selected site-wide locations is included as **Table 3**. Complete laboratory soil analytical results are included in **Appendix C**.

Additional soil sampling was conducted at historical soil sampling locations CSS-33, CSS-7, and CSS-40 as requested by the Department (**Figure 6**). At each location, soil samples were gathered from land surface to 6-inches bls, 6-inches bls to 2 ft bls, 2 to 4 ft bls, and 4 to 6 ft bls. The samples were analyzed sequentially, and each of the shallow samples was analyzed for the presence of herbicides and pesticides by EPA Methods 8141 and 8081, respectively. The results of the subsequent analysis identified the presence of low-levels of dieldrin at CSS-7 and CSS-40 and aldrin and a-chlordane at CSS-7. The concentrations of pesticides exceeded the residential exposure SCTL, at soil sample location CSS-7 (0 to 6 inches bls), and the leachability-based SCTL was slightly exceeded at CSS-40 and CSS-7. A summary of soil analytical data at selected site-wide locations is included as **Table 3**. Complete laboratory soil analytical results are included as **Appendix C**.

4.4 Groundwater Sampling

Between November 28 and December 1, 2006, and on December 21, 2006, additional groundwater sampling was conducted at the Site. Existing monitoring wells MW-1, MW-2, MW-3, MW-4, DW-1, TW-1, TW-2, TW-3, TW-4, TW-5, TW-6, TW-7, TW-11, TW-12, TW-13, TW-14, TW-15, and TW-16 were sampled. Groundwater sampling was also conducted at newly installed monitoring wells TW-17, TW-18, TW-19, and TW-20.

4.4.1 Monitoring Well Installation

Monitoring wells TW-17, TW-18, and TW-19 were installed on November 28, 2006 and monitoring well TW-20 was installed on December 20, 2006. The monitoring wells were

installed to total depths of 12 ft bls and were installed using a stainless steel hand auger. The wells were constructed with 10-ft of 2-inch diameter 0.010-slot well screen and casing blank. The annular area of each well was backfilled with 20/30 silica sand to 1-foot above the screen and each well was sealed with 30/65 sand. Following installation, the wells were purged with a peristaltic pump until the purge water was sediment free. Monitoring well completion reports are included as **Appendix D**. A summary of monitoring well construction details is included as **Table 4**.

4.4.2 Groundwater Elevation Data

Groundwater elevation data was gathered on October 12 and December 1, 2006. Groundwater elevation data was obtained by measuring depth to water at each well location with an electronic water level tape accurate to ±0.01 ft. Once obtained, the depth to water measurements were subtracted from the top of casing elevations to determine groundwater elevation values at each point. The groundwater elevation values are reference to an assumed on-site datum. A summary of depth to water measurements and groundwater elevation results is included as **Table 5**. Groundwater elevation contour maps are included for the October and December sampling events in **Figures 7** and **8**, respectively. The groundwater flow is generally to the southeast toward Tampa Bay. The groundwater throughout the site is also influenced by the series of stormwater detention ponds and stormwater ditches that are located at the perimeter of the site. The groundwater flow directions were generally consistent between the October and December sampling events.

4.4.3 Groundwater Sampling Procedures

All of the groundwater monitoring wells were sampled in general accordance with the FDEP SOP for groundwater sampling FS2200. Groundwater samples were delivered to a fixed laboratory for analysis for the presence of arsenic by EPA Method 6010. Completed groundwater sampling data sheets are included as **Appendix E**.

4.4.4 Groundwater Sampling Results

A summary of the groundwater arsenic analytical results is included as **Table 6**. **Figures 9, 9A,** and **9B** depict arsenic concentrations site-wide, near the maintenance facility, and near monitoring well MW-2, respectively.

4.4.4.1 Site-Wide Evaluations

With respect to site-wide arsenic groundwater quality, slightly elevated levels of arsenic were reported at shallow water table monitoring wells TW-6 (11.2 µg/L) and TW-7 (12.4 µg/L). The remaining monitoring wells MW-1, MW-3, MW-4, and TW-16 did not exhibit arsenic levels

above the GCTL. Because historical arsenic data at monitoring wells TW-6 and TW-7 exhibited arsenic levels below its GCTL, the current levels appear to be associated with seasonal fluctuations of the groundwater table rather than a discernable trend of increasing arsenic impacts.

4.4.4.2 Maintenance Area

Groundwater sampling results for the maintenance area are consistent with historical observations. The highest concentration of arsenic was detected at monitoring well TW-5 (661 µg/L). Upgradient (TW-18 and TW-19) and downgradient (TW-11 and TW-12) monitoring wells exhibited concentrations of arsenic below its GCTL. Additionally, deep monitoring well DW-1 also reported an arsenic concentration below its GCTL suggesting that the impacts are attributable to and delineated near, the maintenance facility.

4.4.4.3 Monitoring Well MW-2 Area

Groundwater sampling results for the vicinity of monitoring well MW-2 exhibited slightly elevated levels of arsenic at monitoring well MW-2 and monitoring well TW-14. These low-level impacts are delineated by monitoring wells TW-15, TW-17, and TW-20. Complete groundwater laboratory analytical results are included in Appendix F.

5.0 CONCLUSION

HSA has completed site assessment activities at the Countryside Executive Golf Course in Clearwater, Florida. The results of the assessment identified arsenic in soil and groundwater at concentrations that exceeded FDEP cleanup criteria 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. Based upon the relative magnitude of the soil and groundwater impacts and the proximity of these impacts to locations historically utilized for the handling and storage of herbicides/pesticides, it appears that surface discharges of arsenic occurred in the past in this area. With regard to arsenic in soil throughout the remainder of the site, these impacts appear to be the result of lawful routine application of herbicides/pesticides. The owner wishes to voluntarily manage impacted soil and groundwater at this site through implementation of institutional and engineering controls as set forth in Chapter 62-780 FAC.

In order to remediate arsenic impacts that were the result of the management activities of the golf course in the vicinity of the maintenance facility, HSA proposes excavation and off-site disposal of arsenic-impacted soil from this area. Following soil removal activities, associated groundwater impacts are expected to attenuate with time as a result of the cessation of arsenic mass flux from the unsaturated zone.

Following completion of soil removal activities in the vicinity of the maintenance facility, HSA will prepare a Source Removal Report. The report will include a summary of soil removal activities along with the results of site-wide soil and surface water testing. The Source Removal

Report will also specify the types of engineering/institutional controls that will be required to limit future exposure to on-site residents.

In order to manage site-wide arsenic soil impacts that are a result of lawful routine herbicide/pesticide application, HSA recommends the use of engineering/institutional controls to limit exposure of such soil to future on-site residents. Specifically, 2 ft of clean fill will be placed in all areas that will be exposed following site redevelopment, and a restriction will be placed on the use of on-site shallow groundwater.

6.0 RECOMMENDATIONS

Based upon the results of additional testing, arsenic is present in soils throughout portions of the subject site at similar concentrations, even in the vicinity of the property boundaries. The presence of arsenic in soils near the property line is not unexpected given the lawful routine application of herbicides/pesticides associated with golf course maintenance. In fact, the use of similar herbicides/pesticides at off-site and neighboring properties is also likely. HSA proposes to mitigate any future exposure to such impacts through the use of on-site engineering and institutional controls. HSA believes that the amount of sampling completed to date meets the level of assessment necessary to define the extent of soil impacts at the subject site and facilitate approval of the soil assessment activities.

Arsenic impacts to groundwater have been identified in the vicinity of the maintenance facility and near monitoring well MW-2. As previously discussed, the presence of arsenic at monitoring well MW-2 and at monitoring wells TW-6 and TW-7 appears to be the result of intermittent low-level leaching of arsenic from shallow soils, which have been impacted as a result of routine golf course maintenance operations. The majority of the shallow monitoring wells (including monitoring wells TW-6 and TW-7) were installed within the top several feet of water column beneath the Site. As such, the presence periodic low-level exceedances of the GCTL is not unexpected given the presence of arsenic in shallow soils. Nevertheless, the flux of arsenic to groundwater appears to be limited in nature, and likely only occurs during periods of elevated groundwater levels. Furthermore, the mass flux does not appear to overcome the attenuation capacity of the underlying aquifer as is confirmed by the data gathered at DW-1. The groundwater arsenic concentrations are likely to fluctuate over time, and in certain instances, exist at concentrations that slightly exceed its GCTL. Nevertheless, proposed institutional controls will prevent exposure to future on-site residents. With regard to arsenic groundwater impacts in the vicinity of the maintenance facility, HSA recommends soil excavation with off-site disposal and a subsequent groundwater monitoring period to monitor natural attenuation of arsenic groundwater impacts. HSA believes that the amount of sampling completed to date meets the level of assessment necessary to define the extent of groundwater impacts at the subject site and facilitate approval of the groundwater assessment activities.