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WDNR-Kewaunee Marsh Treatability Project

Final Report

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Executive Summary

Approximately 15 acres of the Kewaunee Marsh Besadny Wildlife Area, in Kewaunee, Wisconsin, are contaminated with arsenic. The source of the arsenic is likely a spill from the adjacent railroad that occurred in the 1940s. An interim action was completed in 1996 to limit the threat of direct contact to the arsenic; approximately 4 acres of the marsh were capped, and the 15 acres were enclosed in a fence. In 2002, STS Consultants completed a Phase II Site Investigation (SI), and found that the arsenic contamination is limited to the shallow groundwater and the upper 2 feet of the marsh sediment (soil), and that arsenic is entering the Kewaunee River through two surface water sloughs. On the basis of the results of the SI, site-specific cleanup standards of 19 mg/kg for soil and 148 μg/L for groundwater/surface water were established for the site.

RMT, Inc., was retained by the Wisconsin Department of Natural Resources (WDNR) to perform treatability studies for selected remedial options, and prepare cost estimates for a set of remedial alternatives for the site.

During the site investigation, as part of the treatability study, RMT identified a source area for arsenic near the railroad tracks. The arsenic in the source area is predominately in the dissolved phase and is slowly transported from the source area with groundwater flow, or during high water elevation events. The arsenic throughout the rest of the marsh is primarily associated with the organic matter in the marsh soil and was found not to leach; rather, the arsenic is slowly released into the pore water of the marsh as the organic matter decomposes over time. The transport of arsenic in the marsh is primarily attributed to surface water flow mixing with the pore water. The concentration of arsenic in the marsh has decreased over time. Based on the results of RMT's laboratory studies and analysis of the site, this decrease can be attributed to volatilization of arsenic to arsine gas under reducing conditions in the marsh.

RMT evaluated remediation of the source area, marsh soil, and slough water to meet the cleanup objectives for the site. Treatability studies were completed to evaluate treatment of the groundwater in the source area, *in situ* stabilization and bioreduction of the marsh soil, and implementation of a Permeable Reactive Barrier (PRB) or treatment for the slough water. *In situ* stabilization and the PRB alternatives were eliminated from the remedial options analysis based on the results of the treatability studies. The alternatives that were evaluated and for which cost estimates were prepared are as follows:

- Source area: (1) Pump and dispose contaminated water off-site, (2) pump and treat contaminated water on-site, or (3) treat contaminated water in situ.
- Marsh soil: (1) Excavate marsh soil that exceeds the cleanup criteria, or (2) bioremediate the marsh soil that exceeds the cleanup criteria that is outside the capped area.
- Slough water: (1) Install an impermeable barrier to contain the surface runoff, or (2) construct an outfall structure around the two sloughs and pump and treat the surface runoff water on-site.

The costs for each alternative are summarized in Table 20. Based on the results of the treatability studies and cost estimates, RMT recommends the following:

- The source area be remediated either through pump and disposal of contaminated groundwater off-site, or *in situ* treatment.
- The marsh soil be remediated using a bioreduction approach, with field trials being conducted prior to any full-scale implementation.
- The slough water be remediated with the construction of an impermeable barrier.

Section 1
Introduction

1.1 Background

Approximately 15 acres of the Kewaunee Marsh Besadny Wildlife Area, in Kewaunee, Wisconsin, are contaminated with arsenic. The marsh is located approximately 1 mile from the mouth of the Kewaunee River, as it flows into Lake Michigan (Figure 1). The source of the arsenic is likely from a spill from the adjacent railroad that occurred in the 1940s. In the mid-1990s, stressed vegetation was observed at the site, which led to soil contamination investigations. The investigations showed high levels of arsenic in the stressed vegetation area, with lower, but still elevated, arsenic levels in much of the surrounding marsh. A map of the site is shown on Figure 1, including the soil concentrations measured during the mid-1990s.

Following identification and confirmation of the impacts, an interim action was completed in 1996 to limit the threat of direct contact to the arsenic. Specifically, the most highly impacted area (approximately 4 acres) was capped, and the 15 acres known to contain arsenic impacts were enclosed within a fence. Following the interim action, a Phase II Site Investigation (SI) was conducted in 2002 in which more soil samples were collected and several groundwater monitoring wells were installed (STS Consultants, 2004, 2006). The soil arsenic concentrations measured in 2002 are shown on Figure 2, and the average arsenic concentrations in the shallow groundwater are shown on Figure 3.

In general, the previous investigations concluded that the arsenic contamination is generally limited to the shallow groundwater and the upper 2 feet of the marsh sediment (soil). The arsenic concentrations in the soil are highest under the capped area and immediately adjacent to the cap, especially to the east and south. The arsenic in the groundwater is in the dissolved state, and occurs predominantly as arsenite or arsenate. Groundwater concentrations are particularly elevated in the well immediately adjacent to the railroad tracks (MW04-10), where the concentrations exceed 1,000,000 μg/L. Concentrations in the groundwater monitoring wells to the east of the cap are in the low to 1,000 part per billion (μg/L) range, while the concentrations in the remaining wells are generally in the hundreds of parts per billion or lower. Concentrations to the west of the tracks or outside the fenced area are at background levels (except for MW02-7, east of the cap).

As part of previous studies, water samples from two sloughs (Figure 3) draining the site to the Kewaunee River were sampled (STS Consultants, 2006). Flow rates and arsenic levels in the slough water vary with the seasons. Arsenic concentrations in the slough water are in the 1,000 part per billion range.

On the basis of the results of the SI, a no further action alternative was evaluated to be unacceptable for the site, and site-specific cleanup standards (19 mg/kg for soil and 148 µg/L for groundwater/surface water) were developed for the site. Based on the clean-up standards, the Wisconsin Department of Natural Resources (WDNR) identified three potential remedial options for the site: *in situ* solidification or stabilization, construction of a permeable reactive barrier (PRB), and mechanical removal of "hot spot" contamination. RMT, Inc. (RMT) was retained by the WDNR to evaluate these remedial options through treatability work and feasibility assessments.

1.2 Purpose and Scope

The project initially had the following objectives:

- To evaluate the effectiveness of various stabilizing agents and the feasibility of implementing *in situ* stabilization/solidification
- To evaluate the effectiveness of various adsorption agents and the feasibility of constructing a permeable reactive barrier (PRB)
- To evaluate dewatering options and the feasibility of mechanical source area excavation
- To evaluate the cost for the implementation of each remedial option or combination thereof

Following RMT's initial evaluation of possible treatment approaches and based on the results of the initial screening of the soil and groundwater in the marsh, the scope of the project was modified with concurrence from the WDNR. The modified scope, and that presented within this report, includes the following:

- Define the source area and prepare a conceptual fate and transport model for the site.
- Evaluate the effectiveness of various stabilizing agents for *in situ* stabilization/solidification of the marsh soil.
- Evaluate bioremediation of the marsh soil.
- Evaluate groundwater treatment options for the source area.
- Evaluate water treatment options for the slough water.
- Develop feasible conceptual remedial options for the source area, marsh soil, and slough water; and estimate the cost for each alternative.

Section 2
Site Evaluation

RMT completed several rounds of sampling and a general evaluation of the fate and transport of arsenic in the marsh, which are described below.

2.1 Hydrogeologic Setting

The spill occurred along a railroad grade constructed through a marsh that is adjacent to the Kewaunee River, shown on Figure 1. The water table occurs at a depth of approximately 0 to 2 feet below ground surface (bgs) in a black organic peat that is 7 to 10 feet thick. The hydraulic conductivity of this unit ranges from 10^{-3} to 10^{-4} cm/s. Below the black organic peat is a unit of very dark-gray organic silt that has generally lower hydraulic conductivities ranging from 10^{-3} to 10^{-7} cm/s.

This portion of the marsh is located on the inside bend of an oxbow of the Kewaunee River, approximately 1 mile upstream from its mouth, where the river discharges to Lake Michigan. As a result, the water table is very flat and is controlled by the elevation of the Kewaunee River, which borders the marsh on three sides. Therefore, the groundwater flow velocity in the shallow peat is correspondingly low with an estimated range of 0.5 to 5 feet per year.

The marsh level is controlled, in part, by the level of Lake Michigan. The U.S. Army Corps of Engineers maintains monthly lake levels for the Great Lakes. Monthly data from their Web site (www.lre.usace.mil) and a hydrograph of the average lake level between 1945 and 2006 is presented in Appendix A. The surface elevation of Lake Michigan has varied by about 6 feet since the late 1940s when the spill is thought to have occurred. The average lake level was at about 579.5 feet above mean sea level between 1945 and 1950, going up to 581.5 feet in the early 1950s, and then back down to 580 feet in the late 1950s. The level has fluctuated since that time, and is currently at 577.5 feet. The variation in water levels means that mobile arsenic spilled in the marsh will have been spread out or moved into the river by the fluctuating water levels.

The annual precipitation at Kewaunee is 30.30 inches (www.idcide.com/weather/wi/kewaunee.htm). Open water evaporation for northern Wisconsin is about 28 inches per year (Linsley and Franzini, 1979; http://wi.water.usgs.gov/pubs/FS-068-00/, 2007). Transpiration (loss of water due to evaporation from plants) may increase the water loss from the marsh to the point where there should be no net loss of water from the marsh except due to high flow events

(Mitsch and Gosslink, 2000). During the summer, the groundwater levels indicate an inward flow of water from the river to the marsh, reflecting the loss due to evapotranspiration.

2.2 November 2005 Soil Sampling

2.2.1 Sample Collection and Compositional Analysis

A sampling plan was prepared and approved by both the WDNR and the USEPA for the collection of grab samples for use in the treatability studies. Sampling was conducted by RMT in November 2005, and the locations are shown on Figure 4. Sixteen samples were collected by hand from the top foot of material and placed in plastic buckets. Two samples were taken from underneath the cap by digging through the cap and taking a sample from the top 1 to 2 feet of material below the cap.

The samples were stored at 4°C until analysis. The workplan was approved in March 2006, at which time each sample was homogenized, and subsamples were sent to PACE Laboratories for compositional analysis. The laboratory reports are in Appendix B, and the results of the composition analysis are given in Table 1. The quality control checks for samples conducted by PACE Laboratories have been reviewed by RMT and are acceptable.

On the basis of the compositional analysis, two samples were prepared for use in the bench-scale treatability studies. One sample was of highly contaminated material (arsenic >1,000 mg/kg) and consisted of sample T-1. The second sample, the moderately contaminated material, was a composite of all samples with compositional arsenic values ranging from 200 mg/kg to 1,000 mg/kg, and consisted of equal weights (wet weight) of samples T-3, T-5, T-6, T-9, T-10, T-10A, T-10B, T-11, T-12, T-16, and T-17.

2.2.2 Leaching Analysis

Each of the samples collected in November 2005 was subjected to three leaching tests: a screening Toxicity Characteristic Leaching Procedure (TCLP), a screening Synthetic Precipitation Leaching Procedure (SPLP) using simulated eastern acid rain, and a screening SPLP using site groundwater. The groundwater was collected on June 16, 2006, from MW-20. Screening tests were used rather than the standard regulatory tests to facilitate analysis of a large number of options and to reduce the amount of solids and site groundwater needed for the testing.

The screening tests follow the standard USEPA protocols (TCLP-SW 846 Method 1311 and SPLP-SW 846 Method 1312), with the exceptions that the leaching solution is analyzed directly after acidification, and smaller quantities of solid and leaching solution are used, while still maintaining the 1:20 solid to solution ratio. Test procedures are given in Appendix C. Previous tests have shown that the screening tests correlate well with standard leaching test results. The results of the leaching tests and pore water analyses are given in Table 2.

The correlation between compositional arsenic and screening TCLP for arsenic is shown on Figure 5. With the exception of the highest concentration point, there is almost no relationship between compositional and leachable arsenic. The same is true for the SPLP-east and SPLP-site-specific leaching test results, as well (Figure 6).

The pore water concentrations show a better correlation ($R^2 = 0.6$) with the SPLP concentration, especially the site-specific groundwater SPLP (Figure 7). The slope on the linear regression is 0.05, *i.e.*, the SPLP arsenic concentration is about one-twentieth of the pore water concentration, which is the same as the one-to-twenty dilution used in the SPLP test. This trend suggests that the dissolved arsenic present in the leachate from the leaching test is primarily diluted pore-water arsenic, and is not leaching from the solid material.

Another indication that the arsenic in the leaching tests comes primarily from the dissolved arsenic in the pore water comes from a series of tests using an SPLP (east) test protocol, with varying solid-liquid ratios, ranging from 1:1 to 1:80, and using the moderately contaminated composite sample as the solid material. Results of the tests using different solid-liquid ratios are shown on Figure 8. The linear relationship between the amount of solid used in the leaching test and the resultant arsenic concentration in the leachate supports the idea that there is a soluble fraction of arsenic in the marsh material, which controls the concentration in the leaching test. Only 5 percent of the arsenic present in the leachate can be attributed to leaching; therefore, 95 percent of the arsenic in the sample is not leachable in the SPLP test, and may not be modeled in the treatability studies.

If so, this has important implications for the treatment of the marsh. If the bulk of the arsenic is tied up in an insoluble form that is permanently bound, then treatment of just the pore water is sufficient. However, if the arsenic is bound in the organic matter in the marsh material, and if this arsenic is released over time as the organic matter is decomposed, then treatment of the arsenic in the pore water will not result in long-term site stabilization. During the bioreduction studies discussed in Subsection 3.1.3, up to 40 percent reduction in the total arsenic in the marsh material was observed. This is much greater than the amount of arsenic present in the pore water (roughly 1 percent of the total arsenic over most of the contaminated area), indicating that the solid-bound arsenic is being solubilized and then lost from the sample. Treatment of the arsenic dissolved in the pore water will not provide long-term site stabilization because the arsenic in the organic matter is released when the organic matter decomposes.

If arsenic stabilization were to be used, then a target concentration for the leaching tests is needed for evaluating successful treatment. Since the target arsenic concentration for groundwater is 148 µg/L, and the leaching tests essentially dilute the sample pore water by a factor of 20, the target arsenic concentration for successful treatment is in an SPLP (east or site groundwater) is 7.4 µg/L.

2.3 June 2006 Soil Sampling (Cap Area)

The highest arsenic concentration observed during the November 2005 sampling event was 2,500 mg/kg in sample T-1. This is considerably below the concentration detected in the same area during the 1994 sampling event (10,700 mg/kg), and in general, the arsenic concentrations in the samples collected in November 2005 were lower than samples collected previously at the same approximate locations. Whether these lower numbers reflect simple soil heterogeneity or a real decrease in arsenic concentrations could not be determined without collecting and analyzing additional samples. In addition, only 1.7 mg/L arsenic leached from sample T-1 in the screening TCLP test, which is nonhazardous (<5,000 µg/L). Since part of the treatability study was aimed at evaluating methods to render marsh material that leached arsenic to nonhazardous levels, additional sampling of the marsh soil with high arsenic concentrations was warranted to confirm the current arsenic concentrations at the site.

Additional soil samples were collected in June 2006 from under the cap area. These samples were taken from locations under the cap that had been previously sampled in order to compare the trends in the concentration of arsenic over time in the marsh (Figure 9). The samples were collected using a Geoprobe, and the borehole abandonment forms are included in Appendix D. The laboratory reports from Pace Laboratories are given in Appendix B, the compositional analysis results of the June 16, 2006, sampling are given in Table 3. The results show that the concentration of arsenic has generally decreased by a factor of 3 to 4 under the cap between 1994 and 2005/2006.

2.4 April 2007 Groundwater Sampling (Source Area)

The high, and relatively isolated, arsenic concentration in the groundwater at MW04-10 suggested that MW04-10 was located in, or close to, the source area for arsenic. Previously, STS collected two soil samples from the area immediately under the railroad tracks (SB02-17 and SB02-18). SB02-18, immediately west of MW04-10, had arsenic concentrations between 1,800 and 6,520 mg/kg, which are similar to the concentrations observed in the most contaminated area under the cap. SB02-17 had very low arsenic concentrations. These results further indicated that there may be an area of high arsenic concentrations in the area under the railroad tracks in the vicinity of MW04-10. The arsenic concentrations in the groundwater at MW04-10, in the 1,000,000 to 2,000,000 µg/L range, are sufficiently elevated so as to suggest that this arsenic is a residual of the original spill, and has remained in the dissolved state for the decades since the spill. Based on the available data, it was hypothesized that the dissolved-phase material is acting as the ongoing source area for arsenic at the site.

In order to confirm the hypothesis discussed above, and to delineate the extent of the proposed source area, groundwater samples were collected from the area near MW04-10 on April 3, 2007. A Geoprobe® was used to install 22 borings, and groundwater was collected from 21 of these borings using temporary well points. The locations of the borings are shown on Figure 10 and the borehole abandonment forms are included in Appendix D. Groundwater profiling was completed in 3-foot intervals in the top 24 feet of the saturated zone in boring T2-0, and one groundwater sample was collected from the upper 5 feet of the aquifer in the remaining borings.

The arsenic concentrations measured in the groundwater are summarized in Table 4 and are shown on Figure 10. The results show that there is an area of high arsenic levels (>100,000 µg/L) in the groundwater under the railroad tracks, near MW04-10, which is the source area for the site. The source area (>100,000 µg/L) encompasses the entire 20-foot width of the railroad bed and extends approximately 30 feet east from the railroad bed, while the lateral extent is approximately 70 feet long and centered on MW04-10. The persistence of such high arsenic concentrations in the source area since the presumed spill indicates that the groundwater flows at extremely slow rates from this location. It is likely that a low-permeability soil layer surrounds the railroad ballast, resulting in low flow under normal conditions. Surges of arsenic may be allowed to overflow the low-permeability layer and enter the marsh under high water conditions.

Several cation concentrations (calcium, iron, magnesium, and sodium) were also measured in the groundwater, to determine if the arsenic is associated with a counter ion. The concentrations are summarized in Table 4, and plotted versus arsenic concentrations on Figure 11. Arsenic and calcium/magnesium are linearly related, whereas the other cations (especially sodium) have no correlation with the arsenic concentrations. When plotted according to the charge contributed to the water (as mequivalents/L), arsenic is related in a 1:1 relationship with the sum of calcium and magnesium (Figure 12). This suggests that the original spill was of calcium/magnesium arsenate or arsenite (both were used as pesticides). In all likelihood, the original material was a neutral calcium/magnesium arsenate, since the arsenic at the site is predominantly arsenate, and it is highly unlikely that arsenite would have oxidized to arsenate in reducing conditions at the marsh.

2.5 Conceptual Model of Advective Transport

As described in the Site Assessment and Remedial Alternatives Report (STS, 2004), groundwater flow, alone, does not explain the transport of arsenic from the likely spill area to a distance of over 1,000 feet to the east. Therefore, RMT developed a conceptual model to describe the fate and transport of the arsenic at the site. This model assumes that infiltration and overland surface flow of dissolved phase arsenic are the primary transport mechanisms at the site. The original spill of arsenate was likely as a solid. This solid remained on the ground surface of the railroad embankment until it was dissolved by rain or melting snow. A portion of the arsenate solution infiltrated into the groundwater in the railroad ballast beneath the spill, which accounts for the residual source area of dissolved-phased arsenic described in Subsection 2.4. The rest of the dissolved-phase arsenic was carried across the marsh via overland flow, which accounts for the historical area of distressed vegetation. Once spread across the marsh, the impacted surface water seeped into the shallow water table and was incorporated into the marsh solids and vegetation. In the groundwater, arsenic transport has been limited to slow groundwater migration and to events (i.e., spring snow melt with high river elevation) where overland surface flow would mix with impacted groundwater and organic material and leave the site through a surface water pathway (e.g., the sloughs).

The arsenic in the groundwater and surface water at the site persists likely as a result of the residual source area, the low groundwater flow rate, and the fact that a large portion of the arsenic that was spread across the marsh is now associated with the organic matter in the soil retained in an aerobic layer at the surface of the marsh (described in Subsection 2.2.2).

Section 3
Treatability Studies

3.1 Marsh Soil Treatability Studies

The residual arsenic in the upper 2 feet of soil at the marsh requires remediation in order to achieve the cleanup criterion for the site. The following three potential alternatives were considered for the marsh soil:

1. Excavation and disposal
2. *In situ* stabilization
3. Bioremediation

Laboratory-based treatability studies were completed in order to better evaluate *in situ* treatment and the bioremediation as remedial options. These studies are discussed below following a brief discussion on arsenic environmental chemistry.

3.1.1 Arsenic Environmental Chemistry

Treating the arsenic-contaminated marsh materials involves converting the arsenic to a form that is stable (i.e., nonleachable) in the environment, or reducing the concentration of arsenic to levels that do not pose a threat to human health or the environment. Such treatment involves manipulating the form of the arsenic and the leaching environment to which the arsenic is exposed in order to minimize the leaching potential for the contaminant. An understanding of the environmental chemistry of arsenic is crucial for developing successful treatment approaches. The discussion below is a very brief summary of the applicable portions of the geochemistry of arsenic relevant to the marsh environment.

Arsenic exists in four oxidation states in the environment: -III (arsine), 0 (element), +III (arsenite), and +V (arsenate). Of these, the +III and +V states are by far the most prevalent. The -III oxidation state is found only under very reducing conditions. If the redox potential is in the range where sulfate is reduced to sulfide, or organic matter converted to methane, arsenic can be reduced to the arsine form. This is generally present as H_3As, a gas. Under oxic conditions (where oxygen or air is present), arsenate is the stable form, while under mildly reducing conditions, arsenite is stable. Microorganisms are capable of methylating arsenic to form the methylated arsenates or arsenites. Figure 13 shows the transformations of arsenic in the soil environment.

Arsenate is chemically similar to phosphate, and occurs in a variety of protonation states – H_3AsO_4, $H_2AsO_4^-$, $HAsO_4^{2-}$, and AsO_4^{3-}. In the pH range common in the marsh environment (from slightly acidic to slightly basic), $H_2AsO_4^-$ and $HAsO_4^{2-}$ are the predominant forms. Arsenate forms very insoluble compounds with several common cations, most notably iron. Arsenate is also very strongly adsorbed on iron oxides or hydroxides, and on several other common metal oxides or hydroxides (e.g., MnO_2, $Al(OH)_3$). Such adsorption is pH dependent, with the strongest adsorption in the mildly acidic pH range (3 to 6).

Arsenite, which is found under mildly reducing conditions, occurs in either the acid form (H_3AsO_3) or as the monoanion ($H_2AsO_3^-$). The conversion from the acid to the anion occurs at a pH of around 9, which means that in neutral to slightly acidic conditions such as are common in a marsh, arsenite occurs in the uncharged acid form. Arsenite is often considered to be more mobile in the environment than arsenate, since the common understanding is that it is less strongly adsorbed on iron hydroxide than arsenate. However, the pH dependence of arsenite adsorption is quite different from that of arsenate, with the maximum adsorption for arsenite occurring at around the pK_a of 9.2 (pH at which the acid form is half dissociated). At more acidic and more basic pH values, arsenite adsorption goes down. At slightly acidic pH values (<7), arsenate is much more strongly adsorbed than arsenite. In contrast, at slightly basic pH values (8-10), arsenite is the more strongly adsorbed species. However, under the slightly reducing conditions at which arsenite is stable, ferric iron is reduced to ferrous iron. Since ferric hydroxides are major adsorbents for arsenic species, arsenic is more mobile under slightly reducing conditions than under oxidizing conditions. The release of arsenic under mildly reducing conditions (under which arsenite is the stable form) as ferric hydroxides are reduced may give rise to the popular impression that arsenite is the more mobile form.

3.1.2 Stabilization

The purpose of the stabilization studies was to evaluate different additives that could be used to chemically or physically stabilize arsenic in the marsh material, and consequently reduce the soluble arsenic concentration (and presumably bioavailability). The bench-scale studies evaluated different additives and different doses of the additives, and the effects these had on stabilizing the arsenic in the high arsenic and moderate arsenic composite samples collected in November 2005. Treatment effectiveness was evaluated using the screening leaching tests, including the TCLP and two SPLP tests using simulated eastern rainfall and site groundwater, as described in Subsection 2.2.2. The following additives were tested:

- $Al(OH)_3$
- Fe_2O_3
- $Al_2 (SO_4)_3$
- $Al_2 (SO_4)_3 + CaCO_3$
- Metallic iron (Fe)
- Iron foundry byproducts
- $Fe_2 (SO_4)_3$
- $Fe_2 (SO_4)_3 + CaCO_3$
- Pyrite (FeS_2)
- Cement
- Arsenic adsorbent (Anderson)

The tests were run by introducing a specific amount of additive to the sample, allowing the sample to react for several hours (approximately 4), then running the three leaching tests on the treated sample. For cement-treated samples, the treated samples were allowed to set for 1 week prior to testing. The cemented material was broken into pieces (approximately ¾ inches in diameter, according to the leaching test protocol) before leaching analysis. Also, some additives (Fe, pyrite) were tested at both 4 hours and after 1 week reaction time to monitor the effect of time on treatment effectiveness. In addition, five replicates of each untreated composite were analyzed throughout the testing, and the mean value from the tests was used for comparison.

The results of the testing are summarized in Table 5. The results from the test using SPLP site-specific groundwater are presented graphically on Figures 14 and 15, for the high and moderate arsenic samples, respectively. The additives can be grouped based on their effectiveness (i.e., reduction in SPLP leachable arsenic), as follows:

- Little or no effectiveness (arsenic reduction of less than 20%) – $Al(OH)_3$, pyrite
- Moderate effectiveness (arsenic reduction of 50 to 80%) - $Al_2 (SO_4)_3$, $Fe_2 (SO_4)_3$, Fe_2O_3, foundry byproducts, Anderson arsenic adsorbent
- Good effectiveness (arsenic reduction of >90%) – $Fe_2(SO_4)_3 + CaCO_3$, Fe, cement

$Al(OH)_3$ and pyrite had little consistent reduction on leachable arsenic in the SPLP, suggesting that sorption on the aluminum hydroxide or pyrite surface was not strong enough to lower arsenic concentrations. It should be noted that, originally, sodium sulfide (Na_2S) was also going to be tested. However, strong hydrogen sulfide (H_2S) odors were encountered during sample preparation. Because H_2S is highly toxic, further testing was not conducted because of the health and safety concerns associated with the use of the material in the field.

Several of the additives reduce arsenic by between 50 and 80 percent at one or more of the doses tested, including $Al_2 (SO_4)_3$, $Fe_2 (SO_4)_3$, and Fe_2O_3. The reduction indicates that the chemistries are moderately effective, but are not as effective as the last set.

The third group of additives reduced arsenic concentrations in the tests by greater than 90 percent. These include metallic iron, ferric sulfate plus calcium carbonate, and cement.

Metallic iron may work via one (or more) of several mechanisms. Iron is a strong reducing agent and could reduce arsenic to arsenic metal or arsenic gas. Both are relatively insoluble and would not leach (arsenic gas would be lost from the test). Iron will also reduce sulfur species to sulfide, which could precipitate arsenic as an arsenic sulfide. Iron addition reduced arsenic concentrations to relatively low values (in some cases <6 μg/L), although there is some scatter in the data. Iron is commonly used in reactive barrier walls to remove chlorinated solvents. An added advantage is that metallic iron works in an anaerobic environment, and so would be effective in the marsh subsurface. It would not be effective in a reactive barrier wall that is exposed to air or oxygenated water since the iron would quickly oxidize and lose its treatment effectiveness.

The combination of ferris sulfate and calcium carbonate was also effective in lowering arsenic concentrations and was more effective in the TCLP or SPLP-East tests than in the SPLP-Site tests. Ferric sulfate acts as both a precipitant and as an adsorbant; the calcium carbonate (limestone) serves to neutralize the acid generated from the iron hydrolysis. It is well known that arsenate and arsenite are strongly adsorbed on iron hydroxide (Pierce and Moore, 1982; Sun and Doner, 1996; and Jain et al., 1999). Forming the iron hydroxide *in situ* provides a very high surface area solid on which the adsorption can occur.

Under certain conditions, iron hydroxide will be reduced to ferrous iron, which releases any arsenic associated with the solid. Thus, ferric sulfate treatment will be effective only as long as the sample remains oxic (at the surface of the marsh or in the aerated section of a reactive barrier wall).

Cement was also effective in reducing arsenic concentrations. Cement physically traps arsenic in the cement matrix and prevents contact between the marsh water and the solids. The high calcium content of cement may also precipitate arsenic as calcium arsenate. Cement treatment should be relatively permanent as long as the cement remains intact. Normally, cement is used to form a large monolith. However, the cement marsh material mixture can also be formed into smaller pieces that can still reduce arsenic leaching. The smaller pieces would have two advantages over a large block. They would have less effect on the local groundwater flow, and the pieces would tend to sink over time, removing the material from contact with the surface water.

As discussed in Subsection 2.2.2, the majority of arsenic in the marsh is insoluble and non-leachable. Therefore, although some stabilization additives have been evaluated as effective, they are likely only controlling the soluble arsenic and will have little effect on solid-bound arsenic at the site. Given the low mineral content of the marsh material, the arsenic is likely tied up in an organic form which is slowly released to a soluable form as the organics decompose. If *in situ* stabilization was selected as a remedial option at the site, it would require that a stabilization agent be continuously applied to the marsh for decades as the arsenic is slowly released from the organic matter. On the basis of this interpretation from the results of the leaching test and the stabilization treatability tests, *in situ* stabilization, although effective, is not a feasible approach to remediating the marsh, and further evaluation of *in situ* stabilization is therefore not recommended. Consequently, further consideration of this alternative and a cost for this option was not prepared for this report.

3.1.3 Bioreductants

Arsenic can be converted to a volatile form (either arsine or methyl arsines) under very reducing conditions. Such conditions are found in marshes. If this natural process could be enhanced, it might be possible to eliminate arsenic from the marsh by converting arsenic to a gaseous form that would volatilize from the marsh.

Marshes are known to be major producers of methane, and arsines can be generated under the highly reducing conditions required for methane generation. One laboratory study showed that methane-generating bacteria can convert arsenate and arsenite to arsine gas from arsenic-contaminated soil, although in their study, only a small fraction of the arsenic in the soil was volatilized (Bachofen, *et al.* 1995).

The confinement of the arsenic to the top 2 feet of the marsh raises the question as to why the arsenic is not more uniformly distributed throughout the marsh, particularly into the deeper sediment. Arsenic would be expected to move throughout the site with the groundwater and infiltrate into the deep soil over time. The confinement of the arsenic to the top 2 feet of the marsh suggests a chemical, biological, or physical process is controlling the arsenic distribution at the site.

3.1.3.1 *Site Arsenic Concentrations Over Time*

Samples have been taken of the marsh material during three different time periods (1994-1996, 2002, 2004-2006) and appear to show a general decrease in arsenic concentration through time. However, there is considerable heterogeneity in the arsenic distribution in the marsh, such that two samples taken in the same area may have different arsenic concentrations. In order to evaluate whether there has been an overall decrease in the arsenic concentration in the marsh, all of the sampling points for which samples have been taken in the different time intervals were combined and the total arsenic mass represented by those samples was compared. The change in arsenic concentrations in the marsh material between the different sampling dates was made by estimating the concentration in the area around each sampling location on the different sampling periods. This approach assumes that the local heterogeneity effects are eliminated by using a larger number of sample locations. This approach does not estimate the total mass of arsenic in the marsh, but rather the mass of arsenic in the sample areas. The mass estimates represent only a fraction of the total arsenic in the marsh and were only used to compare the relative change in mass during the period between 1995 and 2006.

The mass of arsenic in the sampled area of the marsh, outside of the cap, was estimated for the soil samples collected in 1995, 2002, and 2005/6. The results are presented on Figures 16 and 17. The calculations indicated that there was a 56 percent decrease in arsenic mass between 1995 and 2002, and a further 4 percent between 2002 and 2004/5, for a total decrease of 60 percent between 1995 and 2005, or approximately 5,000 kg. This compares well with the measured decrease in concentrations of the marsh material under the cap of 61 percent, and summarized in Table 3. This analysis shows that there has been a significant decrease in the mass of arsenic in the marsh over the period of study (1995-2006), but it cannot be used to estimate the overall rate of decay since the presumed spill, or the total mass of arsenic in the marsh historically or currently. It is also unclear whether the decrease is linear or exponential with time.

STS had also estimated that between 1 and 5 pounds (0.5 to 2.5 kg) of arsenic are lost per year (for the year analyzed – 2005). STS attributed this loss to flow through the sloughs (STS Addendum, 2006). However, the amount lost from the marsh used in the mass lost estimation for 1995-2002 was 5,000 kg, whereas only 25 kg of arsenic could be accounted for by loss through the slough flow. Although both numbers are subject to large uncertainties, the magnitude of the difference in the mass loss as calculated by RMT and by STS indicates that there has been a major loss of arsenic from the marsh through a route other than flow to the river. Since groundwater movement is negligible, the most likely other route of loss is volatilization.

3.1.3.2 Laboratory Bioreduction Studies

To evaluate the volatilization of arsenic at the site, RMT completed two bench-scale bioreductant experiments. Strong bioreductants were added to the marsh material to stimulate and enhance methane formation and arsine generation in both experiments.

Bioreductant Test 1 - The first experiment tested the concept of creating very reducing conditions in the marsh material to enhance arsine production and loss using a known methane-generating material as the bioreductant, cow manure. Samples of the moderate arsenic composite sample were mixed with different amounts of a bioreductant (5, 10, and 25 percent on a wet-weight basis) placed in anaerobic gas generation vessels, and the gas generation was monitored over time. Samples of the material were taken after 2 weeks and 6 weeks reaction time for analysis of both compositional and leachable arsenic.

The sample generated considerable amounts of gas (presumably methane) over the duration of the experiment, with the amount of gas proportional to the amount of manure added (Figure 18). This indicates that under the proper conditions, the marsh material–bioreductant mix can generate methane.

The results of the compositional and leaching analysis on the original material and after two months biodegradation are summarized in Table 6. Compositional arsenic was reduced from 803 mg/kg to 453 mg/kg in the 25 percent bioreductant sample, or a reduction of 25 percent after accounting for dilution due to the bioreductant. Pore water arsenic concentrations actually increased with increasing bioreductant use, indicating that the loss was from the solid-bound arsenic and not due simply to loss from pore water.

Bioreductant Test 2 - A second bioreductant experiment was conducted using a variety of bioreductants, as follows:

- Cow manure (25%)
- Whey wastewater from cheese manufacturing(1) (25%)
- Wastewater treatment sludge from cheese manufacturing(1) (25%)
- Lactate (2,500 mg/L)
- Sugar (2,500 mg/L)
- Ethanol (2,500 mg/L)

In each case, 50 mL of solution or 50 g of slurry were added to 200 g of the moderately contaminated sample of marsh material, to give the same final volume in the test. The experiment was run for 75 days.

Gas generation results are shown on Figure 19 and summarized in Table 7. Gas generation was considerably more variable than in the first experiment, and achieved much lower gas generation rates. For the sugar-treated sample, the gas volumes fluctuated during the experiment—first increasing, then decreasing—indicating that the sample was re-adsorbing the gas it had previously generated. The ethanol-treated sample required 50 days before gas generation started. The variability in gas generation rates and lag times may reflect the sensitivity of the methane-generating bacteria to the precise conditions in the experiment.

Arsenic concentrations were significantly reduced in the test samples. Arsenic concentrations were reduced by between 20 and 40 percent of the original value. Cow manure and sugar were the most effective additives at reducing arsenic concentrations, and the cheese manufacturing wastewater solids were the least effective; however, even the untreated sample lost 20 percent of the original arsenic when placed under anaerobic conditions. The results show clearly that, under anaerobic conditions, arsenic is lost from the marsh, and that the addition of bioreductants can enhance this loss. The variability of the results, both in gas generation and in arsenic loss, makes it difficult to reliably rank the bioreductants as to effectiveness. The choice of bioreductant to be used (if any) depends on ease of application, availability, price, public

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(1) Cheese manufacturing waste products were supplied by Trega Foods, Luxemburg, Wisconsin. Their cooperation was greatly appreciated.

perception, and the results of field-scale studies that are discussed in the cost section of this report.

These results are consistent with the field observations of the decrease in arsenic concentrations over time, and the relative persistence of arsenic in the upper foot of the marsh. Cattails will transfer oxygen to the roots and create an aerobic zone around the roots (Mitsch and Gosselink, 2000). Under the aerobic conditions, arsenic will not be reduced to arsine gas and remains in the marsh material. In order to create the reducing conditions required for arsine generation in the upper foot of the marsh, the influx of oxygen into the root zone needs to be disrupted by removing the cattails during the duration of the marsh treatment until arsenic is reduced to acceptable levels.

One concern about bioreduction is that the arsenic is converted to a highly toxic form—arsine gas—which is being released into the environment. (The air quality standard [TLV®-TWA] for arsine is 0.050 ppm-V.) However, the rate of arsine generation through bioreduction at the marsh is relatively slow, resulting in a low concentration. Given the remote nature of the site, the mixing ratios of the generated gas and air would be expected to be more than sufficient in the marsh setting, to lower the concentrations of arsine gas at the site to well below the TLV.

3.2 Source Area Treatability Study

The April 2007, sampling under the railroad tracks identified the residual source area of arsenic contamination in the marsh, as described in Subsection 2.4. The arsenic in the source area is primarily dissolved in the groundwater, and the source area groundwater must be remediated in order to meet the cleanup criterion for the marsh. The following three alternatives were considered for the source area remediation:

1. Pump and treat the contaminated groundwater on-site.
2. Treat the source area groundwater *in situ*.
3. Pump and dispose of the contaminated groundwater off-site.

A laboratory treatability study was performed to evaluate treatment options that could be applied to Alternatives 1 or 2. The main objective of the study was to develop a treatment approach that would reduce the arsenic concentrations to below the cleanup criterion, and render any solids generated in the treatment process as nonhazardous. The procedure and the results of the groundwater treatment study are discussed below.

3.2.1 Testing Procedure and Results

An unpreserved sample of groundwater from MW04-10, collected by Ms. Annette Weissbach of the WDNR, was provided to RMT for the treatment study. There are several approaches that could be used for treating the water, but with arsenic concentrations in the millions of microgram-per-liter range, precipitation is a reasonable approach. Arsenate forms precipitates with several common cations. Initial tests showed that the arsenic in the water from MW04-10 would form precipitates with ferrous and ferric iron, calcium, copper, and magnesium. Tests were run using both ferrous and ferric iron to remove arsenic, and the results are summarized in Table 8.

The addition of either ferrous or ferric iron precipitated arsenic (presumably ferrous and ferric arsenate, respectively). Ferric iron is clearly more effective at reducing arsenic concentrations. Ferric iron is commonly used to remove arsenate from solution (either through precipitation or sorption), and is readily available and inexpensive. Therefore, further tests were run using ferric iron (as ferric sulfate) to remove arsenic from the contaminated water from MW04-10.

Note that ferric iron is a moderately strong acid, and an alkaline material needs to be introduced to neutralize the acid that is generated. The next test involved higher doses of both ferrous and ferric iron, with pH adjustment to bring the pH back to the neutral range (pH 6-8). Arsenic concentrations were measured both before and after pH adjustment of the iron-treated solution.

Ferric iron is able to reduce arsenic concentrations to low levels. The next step is to determine the optimum pH for arsenic removal. This was done by forming the ferric arsenate, dividing the ferric arsenate into several aliquots, adjusting the pH to different values with a base (magnesium oxide), and measuring the dissolved arsenic concentration after filtration. The results are given in Table 10. Ferric iron can reduce arsenic to low levels even at acidic pH values. However, once the pH is above 5, the concentrations were not reduced with increasing pH values.

The next step was to try a two-step ferric iron addition, in an attempt to remove the bulk of arsenic as ferric arsenate, with the residual removed as adsorbed arsenate. In addition, the solids were removed and subjected to both compositional metals analysis and TCLP tests (Table 11).

The results show that treatment with ferric iron can reduce arsenic to low levels if done in a two-step process, and that the solids resulting from the first step are slightly above the hazardous criterion for arsenic. The next step is to see if a single addition of ferric iron at a higher dose can both reduce arsenic levels to low values and generate a nonhazardous sludge. Three different doses of ferric iron were added, along with sufficient magnesium ($Mg(OH)_2$) to neutralize the acid generated from the ferric iron precipitate. The results are presented in Table 12.

The results demonstrate that higher doses of ferric iron can reduce arsenic to low levels (~50 µg/L), while at the same time generating a nonhazardous sludge. The next step is to optimize the conditions by evaluating the influence of pH and iron dose on the final dissolved arsenic concentration.

A new sample of contaminated water from MW 04-10 was collected on April 3, 2007, and was used for the remaining testing. Five doses of ferric iron were added to the sample, the solids were allowed to form, and the slurries were then divided into several smaller aliquots. The pH values of the aliquots were adjusted to different values, the solids were allowed to equilibrate for several days, and the samples were then filtered, with the filtrate being analyzed for pH and arsenic concentration. The results are given in Table 13 and shown on Figure 20.

The results demonstrate that arsenic reduction depends, in part, on ferric iron dose and on pH. Iron doses of greater than 0.20 M reduce arsenic to low levels (low part per million range) over the neutral pH range. The results also demonstrate that calcium carbonate ($CaCO_3$) brings the pH to the mid-5s, but does not raise the pH to the higher values needed to reduce arsenic to below part per million levels.

TCLP tests were run on four of the solids generated from the iron dose experiments. The results, given in Table 14, demonstrate that the iron effectively immobilizes arsenic so that the solids are not hazardous.

The inability of the higher iron doses to reduce arsenic concentrations to below 1,000 µg/L suggests that some of the arsenic in the new sample may still be in the arsenite (As(III)) form. The next test evaluated whether adding hydrogen peroxide (H_2O_2), either in a single-step or dual step treatment, would improve treatment, and whether use of magnesium oxide (MgO) to raise the pH to higher values could improve treatment. The results are given in Table 15.

These results show that a single-step iron addition with initial peroxide treatment to convert any arsenite to arsenate can effectively lower arsenic to low levels (<130 µg/L). The next test was to evaluate the effect of different peroxide dosages on treatment effectiveness (Table 16). These results show that the lowest dosage of peroxide will oxidize the arsenite to the point where it is removed from solution.

3.2.2 Conclusions and Confirmation Testing

The results of the testing on the contaminated groundwater from MW04-10 have shown that arsenic can be removed from the groundwater to meet the cleanup criterion for the site using the following steps:

1. Add 2.5 mL 30% hydrogen peroxide per liter of water.
2. Add 0.30 M ferric iron and + 60 g/L $CaCO_3$.
3. Remove the solids from solution by settling or filtration.

A larger-scale test of the treatment process was run to confirm the results, and to generate samples for confirmatory laboratory analysis. One liter of the MW04-10 groundwater was mixed with the reagents given above. The sample was allowed to react overnight, and filtrate and solids were then analyzed for arsenic. In addition, the mass of solids generated and the toxicity of the solids (TCLP test for arsenic) were measured. The results are summarized in Table 17.

The treatment results in arsenic concentrations in the treated water of less than 11 μg/L and solids that are nonhazardous. However, it should be noted that the solids are a mixture of ferric arsenate and arsenate adsorbed on ferric hydroxide. Even though they are nonhazardous, they will still need to be disposed off-site in a manner that protects the environment.

Further lowering of arsenic concentrations can be done, if needed, by the addition of a second, smaller (0.05 M) dose of ferric iron, with additional $CaCO_3$ or MgO to bring the pH to neutral. This polishing step is recommended if the water is to be released outside of the treatment area in the marsh.

3.3 Slough Water Treatability Studies

The water draining from the marsh to the Kewaunee River through the two sloughs (north and south) has concentrations of arsenic over 1,000 μg/L. The WDNR has requested that remedial alternatives be evaluated to reduce the concentration of arsenic reaching the Kewaunee River. The following three approaches were considered for the slough water remediation:

1. Contain and treat the slough water on-site.
2. Construct a permeable reactive barrier (PRB).
3. Construct an impermeable barrier.

A laboratory-based treatability study was completed for the on-site treatment alternative, and a conceptual evaluation of the permeable reactive barrier was completed in order to better evaluate these remedial options. The results of the study and evaluation are summarized in the subsections that follow.

3.3.1 Slough Water Treatment

A common method to remove high levels of arsenic from water is to use adsorption on ferric hydroxide, similar to the concept used in the second iron addition discussed in Subsection 3.2.1. Therefore, experiments were conducted using ferric iron addition along with limestone for neutralization. Three doses of iron were added to a grab sample of south slough water collected on April 3, 2007. In addition, 0.5 g/L $CaCO_3$ was added for pH control. pH was measured after both iron and limestone addition, while arsenic was measured after the $CaCO_3$ addition step. The results are presented in Table 18.

The results show that arsenic concentrations can be lowered to low levels using ferric iron addition, with neutralization. Collected surface water could be treated using the following:

1. Addition of 0.002 M ferric iron and 0.5 g/L $CaCO_3$
2. Filtration of the resultant solids
3. Discharge of the treated water back to the marsh or river

3.3.2 Permeable Reactive Barrier Wall

One method for removing contaminants from groundwater is a permeable reactive barrier (PRB) wall, in which the contaminated groundwater moves through a wall of material that chemically removes the contaminants of concern from the groundwater. The concept has frequently been used for chlorinated solvents in groundwater, often using finely divided metallic iron as the reactive material. The concept has appeal for use in the marsh to remove arsenic from the slough water before it enters the river since PRBs are passive, simple in concept, and a number of additives are available, such as those additives identified as having “good effectiveness” in the stabilization treatability studies discussed in Subsection 3.1.2. However, a preliminary and conceptual valuation of the PRB option for the marsh indicated that the PRB is not a feasible option for the marsh, and further evaluation and treatability testing of the PRB was not completed. A justification for eliminating the PRB as a remedial alternative is presented below.

- **Varying redox conditions in the marsh**. In typical PRB applications, the groundwater has a consistent redox status over time. In contrast, the redox conditions in the marsh vary during the year between anaerobic and aerobic. Therefore, a treatment process would need to be designed for both anaerobic and aerobic conditions. During the *in situ* treatment testing, additives that would be effective under aerobic conditions (ferric sulfate plus calcium carbonate) and others that would be effective under anaerobic conditions (metallic iron) were identified. However, the additives intended to work under both sets of conditions (e.g., aluminum oxide) were not effective at reducing arsenic concentrations in the leaching tests. Therefore, finding a treatment additive that would be effective in a reactive barrier wall under both the aerobic and anaerobic conditions would be difficult.

- **Biological growth on barrier wall material.** The high biological activity in a marsh, as compared to a typical groundwater setting, would limit the effectiveness of the PRB over an extended period of time. The treatment solids may become covered with biological growth (bacteria, algae, plants) and lose reactivity.
- **Flow variation**. Groundwater flows are slow and relatively uniform, providing a relatively long contact time between the water and the reactants in the PRB. In contrast, much of the arsenic transport out of the marsh occurs during high flow events (storms or spring runoff), with the arsenic both in dissolved and particulate form. Designing a system that could trap the arsenic in the short residence time that the rapidly moving water would be in contact with the PRB would be difficult.

Section 4
Cost Estimates

Remedial action is required to address the arsenic contamination in the source area groundwater, marsh soil, and slough water entering the Kewaunee River, in order to meet the cleanup criterion for the site. The *in situ* stabilization alternative for the marsh soil and the PRB alternative for the slough water were eliminated as feasible options for the site based on the information provided in Section 3. Conceptual and feasible implementation approaches were developed for other remedial alternatives for each area of the marsh, and cost estimates were prepared for each option. The results of the treatability studies were used to develop the costs for those options that required treatability testing.

The estimated costs for each option, and the assumptions used to develop the costs, including long-term monitoring requirements, are summarized in Tables 19 and 20. In addition, the detailed cost-estimating spreadsheets are presented in Appendix E. The cost for each alternative is presented as a stand-alone cost; however, the selection of a combination of options that will treat the source area, marsh soil, and slough water is recommended to meet the cleanup objectives for the marsh. The costs presented in this report are based on preliminary concepts for comparative purposes only, and are not for budgetary purposes. The costs represent the best judgment of cost based on the conceptual approach described herein for each option; however, the range in cost may vary from -30 to +50 percent of the best judgment value. These costs are not intended to be used without the descriptions, assumptions, and uncertainties described in Table 19.

A general outline of each alternative is shown on Figure 21. The conceptual model, along with key constructability issues, for each alternative are presented below.

4.1 Source Area

In order to meet the clean-up criteria for the marsh, the on-going source of arsenic contamination to the marsh must be remediated. The arsenic in the source area is primarily in the dissolved phase and contained within the railroad ballast. Approximately 42,000 gallons of contaminated groundwater are assumed to comprise the source area based on the 50-foot by 70-foot area defined in Subsection 2.4, an estimated depth of 4 feet of saturated material, and a porosity of 40 percent. In order to eliminate the on-going source, the source area groundwater must be removed, or the arsenic in the groundwater must be immobilized. Three different source area remediation alternatives were evaluated.

1. **Pump and dispose off-site** - This alternative would accomplish direct removal of the soluble arsenic in the source area. A groundwater extraction well would be constructed in the source area, and groundwater pumped, and contained in batches on-site. The flow rate achieved from the extraction well has been assumed to be 0.5 gpm; however the specific flow rate and capture zone from the well would need to be based on in-field pump tests. Additional wells may be needed to capture the entire source area. The extracted groundwater would be contained in a 5,000-gallon holding tank housed inside the fence near the source area. When the holding tank is full, the pumping would be temporarily stopped until the groundwater could be pumped from the holding tank into a tanker truck and disposed off-site as a hazardous waste. Once the holding tank is emptied, pumping would resume. The process would be simple to control and power would be provided by a portable generator, and would continue until the highly contaminated water from the source area had been removed. RMT estimates that this would take up to 3 months to complete.
2. **Pump and treat on-site** - This alterative would immobilize the arsenic in the groundwater. A groundwater extraction well would be constructed in the source area, and groundwater would be pumped from the well and treated in batches on site based on the treatability results present in Subsection 3.2.2. The flow rate achieved from the extraction well has been assumed to be 0.5 gpm; however, the specific flow rate and capture zone from the well would need to be based on in-field pump tests. Additional wells may be needed to capture the entire source area. Because of the high doses of treatment chemicals required to treat the groundwater, the water would need to be treated in 1,000-gallon batches. The extracted groundwater would be stored in a 1,000-gallon equalization tank, and a small wastewater treatment process would be set up near the tank. The treatment process would require a person to be on-site to refill the treatment chemicals at the start of each 1,000-gallon batch. The groundwater extraction would be temporarily stopped, until the groundwater housed in the equalization tank was treated and discharged. The treated groundwater would be discharged to the surface, and the residual solids would be transported off-site for disposal as a nonhazardous waste. RMT assumes that a filter press would be used to dewater the solids, and that approximately 35 tons of solids would be generated from the wastewater treatment. The process would be controlled using a basic control panel, powered by a propane generator, and would continue until the 42,000 gallons of water from the source area were treated. It is estimated that this would take 3 to 4 months to complete.
3. ***In situ* remediation** - This alterative would immobilize the arsenic in the groundwater, and is based on the treatability study results presented in Subsection 3.2.2. The railroad ballast and any other overburden soil in the source area would be excavated and stockpiled on-site to expose the saturated zone. Treatment chemicals would be mechanically mixed into the saturated source area using a backhoe, and the treated material would be left in place. The treatment chemicals would be based on the treatability results presented in Subsection 3.2.2. The railroad ballast and overburden soil would be replaced following

treatment, and the site restored to existing conditions. It is estimated that this process would take approximately 2 weeks to complete.

4.2 Marsh Soil

The arsenic impacts in the marsh area are primarily associated with the pore water and the organic matter in the upper 2 feet of the marsh. The arsenic is slowly released to the pore water as the organic matter decomposes, and the arsenic appears to be volatilizing to arsine gas in the anaerobic portions of the marsh. In order to remediate the arsenic in the marsh area, the impacts can be removed through excavation, or the volatilization of arsenic can be enhanced through bioreduction. The cap currently eliminates a direct contact threat and reduces impacts to the surface water runoff; however, capping was not considered for the entire area since capping would require a significant time to achieve the clean-up criteria for the site.

Because the cap is effectively addressing the impacts in a portion of the marsh, leaving the cap in place was considered for two of the remedial alternatives described below. If the cap and material under the cap are left in place, then remedial action to address the uncapped marsh material and slough water impacts must be considered, since a source to the surface water impacts will remain on the site until volatilization of the arsenic has effectively remediated the residual impacts. Another option would be to excavate the entire marsh area including the cap and impacted soil below the cap. If this alternative is considered, remedial action on the slough water would not be necessary.

1. **Excavation (large area)** - The top 2 feet of marsh sediment exceeding the soil cleanup criterion (including the marsh material under the cap) would be excavated and disposed off-site as nonhazardous waste. The large excavation area (approximately 10.8 acres) shown on Figure 21, is the basis for estimating the quantity of material that would be handled for this alternative; however, additional sampling would be conducted to define the specific area requiring excavation if this alternative was implemented. Stabilized hauling roads would need to be constructed up to and within the marsh to facilitate the excavation. Erosion control would be in place during the excavation, and dewatering of the solids would be required prior to hauling the material off-site. The cost of excavation does not include any backfilling or wetlands restoration, and these items would significantly increase the cost, if required. RMT assumes that the full-scale application would take 2 months to complete. Implementation of this alternative would eliminate the need for a separate remedial alterative for the slough water.
2. **Excavation (small area)** - The top 2 feet of marsh sediment exceeding the soil cleanup criterion outside the capped area would be excavated and disposed off-site as nonhazardous waste. The small excavation area shown on Figure 21, is the basis for estimating the quantity of material that would be handled for this alternative; however, additional sampling would be conducted to define the specific area requiring excavation if

this alternative was implemented. Stabilized hauling roads would need to be constructed up to and within the marsh to facilitate the excavation. Erosion control would be in place during the excavation, and dewatering of the solids would be required prior to hauling the material off-site. The cost of excavation does not include any backfilling or wetlands restoration, and these items would significantly increase the cost, if required. RMT assumes that the full-scale application would take 2 months to complete. Implementation of this alternative would require implementing a separate remedial alterative for the slough water.

3. **Bioreduction** – This alternative would be applied to the same area defined for the small excavation; however, this alternative would rely on enhanced volatilization based on the bioreduction treatability studies. The natural methane-generating potential of the marsh would be enhanced by adding a bioreductant to the water. Prior to full-scale implementation, field trials would be performed. Small test plots would be constructed outside the capped area to evaluate the performance of different bioreductants in reducing the arsenic concentrations in the field. These test plots would be evaluated over 6 months, and the results would be used to develop a workplan for implementing the full-scale bioreduction option in the field. The specific bioreductant and field application approach would be based on the results of the test plot study; however, for costing purposes, sodium lactate applied using a temporary irrigation system was assumed. The Kewanee River would serve as the water supply for the irrigation, and above-grade piping would connect the irrigation system to a pump in the river. A 21,000-gallon tank would be used to store and mix a stock solution of the lactate. After the tank is filled with the solution, a high head pump would run the irrigation system at as much as 600 gpm. Six sprinkler heads, each with an approximately 200-foot spray radius, would spray the solution on the site. The solution from the tank would be introduced to the irrigation system via a venturi chemical injection system. RMT assumes that the full-scale application would take 1 month to complete, and that only one application would be required. Implementation of this alternative would require implementing a separate remedial alterative for the slough water.

4.3 Slough Water

The arsenic impacts to the surface water entering the Kewaunee River through the two sloughs must be addressed until the source of the surface water impacts have been adequately remediated. In order to prevent impacted surface water from entering the Kewaunee River, the water from the slough can be captured and treated on-site or a barrier can be constructed to physically stop the flow to the river.

1. **Impermeable barrier -** An impermeable barrier would be constructed along the fence line at the site to prevent surface water runoff from reaching the Kewaunee River. The barrier would be constructed out of ¼-inch polyethylene material. RMT assumes that the barrier would be installed in the winter. The barrier would extend approximately 2 feet above

ground surface and 3 feet below grade. The current configuration of the barrier has it keying into the railroad bed on the northern and southern end of the project area in order to maximize capture of the surface water. However, the northern 900 feet of the barrier could be eliminated, and significant capture of the surface water could still be achieved. The hydrology and hydrogeology of the marsh would contain the water in the marsh, and additional management of the water would not be necessary. Given the very low groundwater flow, the low vertical gradients in the groundwater, and the balance between annual evapotranspiration and annual precipitation, there would be little net influx of water to or from the groundwater. During high water flow periods, there would be a hydraulic gradient driving the surface water into the deeper, anoxic zone of the groundwater. However, during the summer, evapotranspiration would reverse this gradient and the water would be brought back toward the surface. Blocking the flow of surface water from the marsh to the river would allow time for the bioreduction to eliminate arsenic from the marsh. It is not anticipated that the impermeable barrier would change the water level inside the barrier, since the water is hydraulically connected under the impermeable barrier.

2. **Collection and treatment on-site -** Surface water runoff would be collected from the two sloughs and pumped to an on-site treatment facility located near the railroad tracks. A dam/outfall structure would be constructed in each slough to capture the surface water. Because the surface flow is mainly limited to times when the temperature is above freezing, the plumbing connecting the sloughs to a treatment staging would be constructed above grade. The treatment facility would be constructed inside the fence near the existing access point for the site. To remain a feasible option, this alternative would only be sized to capture 10,000 gallons of water per run event. This equates to an average sustained flow rate of 0.7 gpm from the two sloughs for 10 days, or a 10-gpm surge in the two sloughs over 16 hours. If additional flow occurs, this water would be allowed to overflow and enter the Kewaunee River. The extracted groundwater would be sized in a 10,000-gallon equalization tank. A small wastewater treatment process would be set up near the tank. The treated groundwater would be discharged to the surface, and the residual solids would be transported off-site for disposal as a nonhazardous waste. RMT assumes that bag filters would be able to dewater the solids, and that approximately 2 tons of solids would be generated from the wastewater treatment each year. The process would be controlled using a basic control panel, powered by a propane generator, and would require approximately seven site visits per year to maintain operation of the system. RMT assumes that the system would operate for 5 years.

Section 5
Findings and Conclusions

5.1 Site Evaluation

- **2005/2006 Marsh soil sampling:** Samples were collected from the marsh in areas that previously had shown high arsenic levels, including under the cap. Arsenic concentrations were still elevated, although they were generally lower than the concentrations measured previously.
- **Source area delineation:** A source area for arsenic was identified beneath the railroad bed near MW04-10. The arsenic is predominately in the dissolved phase at concentrations greater than 100,000 µg/L. A conceptual model was developed for the source area, which posits that a low permeability soil layer surrounds the railroad ballasts, resulting in the low flow of arsenic from the source under normal conditions. During high water conditions the dissolved phase arsenic is able to flow from the source area into the marsh above this low permeable layer.
- **Leaching tests on marsh soil samples:** Leaching tests were conducted on the marsh soil, using both standard and site-specific leaching tests. Arsenic in the leachates from the leaching studies came predominantly from the arsenic already dissolved in the pore water, indicating that the majority of arsenic in the marsh is insoluble and nonleachable. The arsenic is likely tied up in an organic form, which is slowly released to a soluble form as the organics decompose. This indicates that the marsh soil contributes dissolved arsenic to the water in the marsh over an extended period of time.
- **Hydrogeology:** The site sits in the inside bend of a large oxbow of the Kewaunee River within a mile of the mouth of the river. Therefore, the groundwater table is very flat and is controlled by the elevation of the Kewaunee River. There is no major upward or downward gradient in the groundwater. The groundwater is estimated to flow at between 0.5 and 5 feet per year toward the river. This flow is insufficient to account for the distribution of arsenic at the site, indicating that surface runoff is the primary transport mechanism for arsenic.
- **Site arsenic concentrations over time:** A 60 percent decrease in the mass of arsenic at the site, both inside and outside the capped area, was calculated to occur between 1994 and 2006. The amount of arsenic lost from the site is much greater than can be accounted for by loss through surface water, suggesting that arsenic is being lost by volatilization as arsine gas from very reduced (e.g., methane-generating) environments in the marsh.

5.2 Marsh Soil Treatability Studies

- ***In situ* stabilization:** Eleven additives were tested for effectiveness in reducing arsenic concentrations in three leaching tests. Cement, ferric sulfate plus limestone and iron were found to be effective additives (90 percent or greater reduction in arsenic concentration). However, *in-situ* stabilization was eliminated as a feasible remedial option based on the results of the leaching tests for the marsh material. Stabilization is only effective at reducing soluble arsenic concentrations. Because the soluble arsenic represents only a minor fraction of the arsenic in the marsh, and arsenic may be released slowly as the organics decompose, stabilizing agents would need to be applied for decades to effectively treat the marsh material.
- **Bioreduction:** Bioreduction tests were conducted to evaluate whether arsine volatilization can be enhanced as a means to meet the cleanup criterion for arsenic. The results demonstrate that the introduction of some bioreductants enhanced methane formation and arsenic volatilization. Approximately a 40 percent loss of the total arsenic was found after 70 days reaction time. This indicates that bioreduction is a potential method for removing arsenic from the marsh with minimal long-term impact on the marsh environment. However, field studies are needed to evaluate the optimal bioreductant and application technique.

5.3 Source Area Treatability Studies

- **Groundwater treatment:** High levels of dissolved arsenic were found in the groundwater under and near the railroad bed near monitoring well MW04-10. This arsenic is presumably the residual from the original spill and acts as a continuing source of arsenic to the marsh. Treatment of this water to lower the dissolved arsenic concentration was evaluated. This could be done by removing the groundwater and disposing of it off-site, or by treating the groundwater to immobilize the arsenic so that it does not leach to the marsh. Laboratory testing was completed to develop an approach to treat the groundwater in the source area to lower the dissolved concentration and generate a nonhazardous solid in the process. It was found that adding a combination of hydrogen peroxide, ferric iron, and limestone removed arsenic from the groundwater to 11 µg/L, and resulted in a solid that leached low-level (<1.0 mg/L) arsenic in a TCLP test.

5.4 Slough Water Treatability Studies

- **Slough water treatment:** Laboratory testing was performed to develop an approach to reduce the concentration of arsenic in the slough water. The addition of ferric iron and limestone will reduce dissolved arsenic concentrations to <13 µg/L.
- **Permeable reactive barrier wall:** One of the remedial options to be evaluated in a treatability study in the original proposal was a PRB located between the river's edge and

the marsh. Arsenic in the water moving through the barrier would be removed using a treatment reagent. However, a treatability study on the PRB was not completed for the following reasons:

- Redox conditions in the marsh vary over time, such that it would be difficult for treatment to be effective under both the aerobic and anaerobic conditions expected during the year.
- The high biological activity in the marsh would inhibit effectiveness of the PRB.
- Much of the arsenic transport out of the marsh occurs during high flow events, and designing a system that could trap the arsenic in the short residence time that the rapidly moving water would be in contact with the PRB would be impractical.

5.5 Cost Estimates

Based on the results of the treatability studies and a feasibility assessment for the remedial alternatives at the site, conceptual approaches for several remedial options for the source area, marsh soil, and slough water were developed. These approaches include the following:

- Source Area: (1) Pump and dispose of contaminated water off site, (2) Pump and treat contaminated water on-site, or (3) treat contaminated water in-situ.
- Marsh Soil: (1) Excavate marsh soil that exceeds the clean-up criteria that is outside the capped area, or (2) perform bioremediation on the marsh soil that exceeds the clean-up criteria that is outside the capped area
- Slough Water: (1) Excavate all the soil that exceed the clean-up criteria, eliminating the source of the surface water impacts, (2) install an impermeable barrier to contain the surface runoff, or (3) construct an outfall structure around the two sloughs and pump and treat the surface runoff water on-site.

The conceptual approaches and costs are summarized in Table 19 and Table 20. The costs presented in this report are based on preliminary concepts for comparative purposes only, and are not for budgetary purposes. The costs represent the best judgment of cost based on the conceptual approach described herein for each option; however, the range in cost may vary from -30 to +50 percent of the best judgment value. These costs are not intended to be used without the descriptions, assumptions, and uncertainties described in Table 19.

Section 6
Recommendations

Based on the results of the treatability studies and remedial options/cost analysis, RMT recommends that the following steps be taken to remediate the marsh:

1. **Source area** – Eliminate the on-going source of dissolved-phase arsenic by either pumping the contaminated groundwater and disposing it off-site as a hazardous waste, or treating the groundwater *in situ.* The costs for these two options are similar such that selection of one option over the other can be based on the WDNR's preference for the remediation approach.
2. **Slough water** – Eliminate the source of arsenic to the Kewaunee River by constructing an impermeable barrier along the fence line at the site. The impermeable barrier would eliminate the migration of arsenic from the marsh to the river and allow time to address remediation of the marsh soil. Given the very low groundwater flow and the minimal net flow of water from the marsh to the river, isolating the contaminated area would have minimal impact on the environment of the area. The impermeable barrier is preferred over the capture and treat alternative based on cost and on effectiveness (the capture and on-site treat alternative is limited in the volume of water that it can treat).
3. **Marsh soil** – Reduce the concentration of arsenic in the marsh soil to meet the clean-up criteria using bioreduction. RMT strongly recommends that field trials be conducted before full-scale implementation of the approach in order to confirm the effectiveness of this option, and to determine the most cost-effective approach for bioreduction at a full-scale level.

Section 7
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Table 1
Compositional Analysis of Samples Collected in November 2005
Kewaunee Marsh, Kewaunee, Wisconsin

	SOLIDS		COMPOSITIONAL ANALYSIS (mg/kg) (DRY WEIGHT)				
SAMPLE	%	VOLATILE (%)	TOC	ARSENIC	CALCIUM	IRON	PHOSPHORUS
T-1	17.6	61.3	630,000	2,500	92,000	6,400	830
T-3	18.4	61.3	380,000	900	33,000	5,300	680
T-5	11.7	61.9	350,000	720	58,000	7,400	1,400
T-6	19.6	42.0	480,000	240	61,000	8,200	1,100
T-7	31.1	26.8	380,000	86	35,000	10,000	1,300
T-8	14.0	75.9	560,000	140	34,000	6,500	1,200
T-9	14.4	79.1	640,000	660	22,000	5,000	1,300
T-10	7.35	80.2	490,000	760	30,000	5,600	1,600
T-10A	8.64	83.1	510,000	590	26,000	4,600	2,100
T-10B	8.86	82.7	430,000	850	38,000	6,700	1,700
T-11	8.29	53.5	290,000	670	87,000	16,000	2,600
T-12	11.3	60.6	340,000	570	25,000	5,700	2,200
T-14	10.8	79.3	450,000	110	24,000	6,100	1,900
T-15	5.93	88.6	480,000	120	15,000	2,900	1,600
T-16	13.5	70.9	460,000	490	44,000	8,500	980
T-17	6.62	79.9	410,000	520	24,000	4,900	1,400

Table 2
Leaching and Compositional Arsenic Concentrations – November 2005

SAMPLE	COMPOSITIONAL As (mg/kg)	SCREENING LEACHING TEST RESULTS					
		TCLP		SPLP - East		SPLP - Site	
		pH	ARSENIC (µg/L)	pH	ARSENIC (µg/L)	pH	ARSENIC (µg/L)
Criteria			**5,000**		**148**		**148**
T-1	2,500	5.54	1,720	7.46	806	7.51	562
T-3	900	5.13	239	7.82	136	7.54	104
T-5	720	5.27	688	8.07	202	7.55	125
T-6	240	5.13	947	7.62	479	7.59	294
T-7	86	5.23	696	7.58	308	7.34	248
T-8	140	5.02	384	7.17	181	7.40	144
T-9	660	5.01	1,090	7.24	769	7.40	493
T-10	760	5.00	247	7.49	164	7.49	119
T-10A	590	4.99	374	7.48	204	7.59	233
T-10B	850	5.01	831	7.56	462	7.56	399
T-11	670	5.03	584	7.39	164	7.57	128
T-12	570	5.01	514	7.46	241	7.56	173
T-14	110	4.98	272	7.09	102	7.47	66.5
T-15	120	4.96	203	6.90	120	7.50	102
T-16	490	5.17	801	7.89	99.2	7.52	75.3
T-17	520	4.98	301	7.11	168	7.45	146
Mod		5.03	518	7.79	221	7.52	189
Site groundwater						7.66	12.1(1)

Notes:

Leachate arsenic concentrations shown in µg/L.

SPLP-Site = synthetic precipitation leaching procedure using site groundwater.

Footnote:

(1) Above Limit of Detection, but below Limit of Quantitation (absolute value uncertain).

Mod = moderately contaminated composite sample (T-3, -5, -6, -9, -10, -10A, -10B, -11, -12, -16, and -17).

Table 3
Comparison of Historical and Current Arsenic Concentrations

LOCATION	ARSENIC CONCENTRATION (mg/kg)		
	1994	NOVEMBER 2005	JUNE 2006
TS-18	2,030		340
TS-1/19	10,700	2,500	6,100
TS-20	4,600		910
TS-21	2,660		640
TS-22	5,480		1,800
TS-23	4,500		1,500
TS-24	1,880		1,100
Mean	**4,550**		**1,770**

Table 4
Source Area Groundwater Concentrations – April 3, 2007

LOCATION			CONCENTRATION				
TRANSECT	SITE		ARSENIC (µg/L)	CALCIUM (mg/L)	IRON (mg/L)	MAGNESIUM (mg/L)	SODIUM (mg/L)
T(-1)	20 NW		82,000	180	1.6	78	16
	0		44,000	170	1.1	97	14
	20 SE		118,000	290	0.77	100	33
T1	40 NW		1,140	130	0.46	50	11
	30 NW		100,000	140	0.43	62	11
	20 NW		122,000	140	0.28	59	8.3
	10 NW		640,000	220	0.77	140	12
	0 (MW04-10)		2,200,000*	470	0.072	240	15
	10 SE		46,000	130	0.54	57	8.5
	20 SE		22,000	340	8.8	80	95
	30 SE		14,800	110	0.21	50	13
T2	0	1-4′	5,400	110	<0.025	65	66
		6-9′	3,600	120	<0.025	66	64
		11-14′	5,600	120	<0.025	67	63
		16-19′	4,600	120	<0.025	67	60
		21-24′	5,200	120	<0.025	66	55
T4	40 NW		38	120	0.82	30	12
	30 NW		94,000	150	8.9	36	14
	10 NW		1,160,000	320	0.093	140	12
	0		1,300,000	310	0.28	150	14
	10 SE		660,000	190	0.11	90	17
	20 SE		340,000	180	0.091	69	13
	30 SE		78,000	120	<0.025	45	10
T5	20 NW		680,000	240	0.041	90	11
	0		560,000	220	0.076	84	10
	20 SE		86,000	120	<0.025	45	9.1
N. Slough			1,700	43	0.14	18	9.2

Notes:

1. Samples were collected using a Geoprobe®.
2. Arsenic analysis (except for MW04-10) was performed by Pace Laboratories; all other analyses were performed in the RMT Applied Chemistry Laboratory.

Table 5
Kewaunee Marsh Treatability Results

SAMPLE	SCREENING LEACH TEST RESULTS					
	TCLP		SPLP (EAST)		SPLP (SITE GROUNDWATER)	
	pH	ARSENIC (μg/L)	pH	ARSENIC (μg/L)	pH	ARSENIC (μg/L)
Untreated						
Untreated High Arsenic Composite (T-1)						
Replicate 1	5.54	1,720	7.46	806	7.51	562
Replicate 2	5.63	1,640	7.82	765	7.54	522
Replicate 3	5.83	1,430	8.42	753	7.53	563
Replicate 4	5.90	2,550	8.38	1,760	7.59	1,320
Replicate 5	5.94	2,060	8.26	1,170	7.78	715
Mean	**5.77**	**1,880**	**8.07**	**1,050**	**7.59**	**736**
Untreated Moderate Arsenic Composite						
Replicate 1	5.03	518	7.79	221	7.52	189
Replicate 2	5.08	497	7.56	303	7.52	215
Replicate 3	5.18	558	8.15	190	7.53	135
Replicate 4	5.10	767	7.82	339	7.54	330
Replicate 5	5.03	664	7.64	243	7.66	249
Mean	**5.10**	**600**	**7.79**	**259**	**7.55**	**224**
Aluminum Hydroxide ($Al(OH)_3$)						
High Arsenic Composite (T-1)						
Untreated	5.77	1,880	8.07	1,050	7.59	736
1% $Al(OH)_3$	5.65	2,000	8.21	980	7.37	753
2.5% $Al(OH)_3$	5.52	1,890	8.13	1,000	7.44	781
5% $Al(OH)_3$	5.87	1,630	8.22	913	7.42	680

Table 5 (continued)
Kewaunee Marsh Treatability Results

SAMPLE	SCREENING LEACH TEST RESULTS					
	TCLP		SPLP (EAST)		SPLP (SITE GROUNDWATER)	
	pH	ARSENIC (µg/L)	pH	ARSENIC (µg/L)	pH	ARSENIC (µg/L)
Aluminum Hydroxide (continued)						
Moderate Arsenic Composite						
Untreated	5.10	600	7.79	259	7.55	224
1% $Al(OH)_3$	5.09	610	7.84	298	7.42	248
2.5% $Al(OH)_3$	5.05	596	7.88	298	7.53	232
5% $Al(OH)_3$	5.07	615	7.96	266	7.48	227
Ferric Oxide (Fe_2O_3)						
High Arsenic Composite (T-1)						
Untreated	5.77	1,880	8.07	1,050	7.59	736
1% Fe_2O_3	5.56	1,340	8.27	519	7.44	368
2.5% Fe_2O_3	5.76	766	8.25	382	7.44	245
5% Fe_2O_3	5.52	645	8.36	262	7.46	183
Moderate Arsenic Composite						
Untreated	**5.10**	600	7.79	259	7.55	224
1% Fe_2O_3	5.10	473	8.04	217	7.38	119
2.5% Fe_2O_3	5.12	273	7.92	132	7.45	103
5% Fe_2O_3	5.10	229	7.88	77.5	7.39	57
Aluminum Sulfate ($Al_2(SO_4)_3$)						
High Arsenic Composite (T-1)						
Untreated	5.77	**1,880**	**8.07**	**1,050**	**7.59**	**736**
1% $Al_2(SO_4)_3$	5.49	988	7.54	232	7.15	267
2.5% $Al_2(SO_4)_3$	5.36	640	6.80	113	6.68	119
5% $Al_2(SO_4)_3$	5.01	597	5.34	539	6.05	127

Table 5 (continued)
Kewaunee Marsh Treatability Results

SAMPLE	SCREENING LEACH TEST RESULTS					
	TCLP		SPLP (EAST)		SPLP (SITE GROUNDWATER)	
	pH	ARSENIC (μg/L)	pH	ARSENIC (μg/L)	pH	ARSENIC (μg/L)
Moderate Arsenic Composite						
Untreated	5.10	600	7.79	259	7.55	224
1% $Al_2(SO_4)_3$	5.04	414	6.26	49.2	6.88	57.9
2.5% $Al_2(SO_4)_3$	4.93	210	4.66	139	6.07	21.5
5% $Al_2(SO_4)_3$	4.83	286	4.15	249	5.35	80.7
High Arsenic Composite (T-1)						
Untreated	5.77	1,880	8.07	1,050	7.59	736
1% $Al_2(SO_4)_3$	5.57	252	7.54	133	7.21	211
2.5% $Al_2(SO_4)_3$	5.47	146	5.59	43.4	6.92	88.9
5% $Al_2(SO_4)_3$	5.36	194	5.48	148	5.97	42.5
Moderate Arsenic Composite						
Untreated	5.10	600	7.79	259	7.55	224
1% $Al_2(SO_4)_3$	5.03	183	5.15	42.6	6.62	39.5
2.5% $Al_2(SO_4)_3$	5.04	163	5.11	31.3	5.72	30.8
5% $Al_2(SO_4)_3$	4.88	136	4.24	140	4.88	39.9
Aluminum Sulfate plus Calcium Carbonate						
High Arsenic Composite (T-1)						
Untreated	5.77	1,880	8.07	1,050	7.59	736
1% $Al_2(SO_4)_3$ + 1% $CaCO_3$	5.88	172	7.70	95.3	7.76	336
2.5% $Al_2(SO_4)_3$ + 2.5% $CaCO_3$	5.90	413	8.58	202	8.09	94.9
5% $Al_2(SO_4)_3$ + 5% $CaCO_3$	6.09	166	8.49	107	8.07	112

Table 5 (continued)
Kewaunee Marsh Treatability Results

SAMPLE	SCREENING LEACH TEST RESULTS					
	TCLP		SPLP (EAST)		SPLP (SITE GROUNDWATER)	
	pH	ARSENIC (µg/L)	pH	ARSENIC (µg/L)	pH	ARSENIC (µg/L)
Moderate Arsenic Composite						
Untreated	5.10	600	7.79	259	7.55	224
1% $Al_2(SO_4)_3$ + 1% $CaCO_3$	5.23	167	7.74	39.3	7.37	35.5
2.5% $Al_2(SO_4)_3$ + 2.5% $CaCO_3$	5.13	65.2	7.51	26.7	7.22	31.4
5% $Al_2(SO_4)_3$ + 5% $CaCO_3$	5.26	58.8	7.64	16.0	7.57	26.9
Metallic Iron (Fe)						
High Arsenic Composite (T-1)						
Untreated	5.77	1,880	8.07	1,050	7.59	736
1% Iron metal	6.45	45.8	8.20	271	7.55	98.9
2.5% Iron metal	6.74	33.7	8.46	221	7.59	18.1
5% Iron metal	6.90	54.1	7.93	60	7.96	14.4
Moderate Arsenic Composite						
Untreated	5.10	600	7.79	259	7.55	224
1% Iron metal	5.35	97	7.94	55.8	7.55	23.4
2.5% Iron metal	5.97	37.7	8.10	21.9	7.67	19.0
5% Iron metal	6.73	51.7	8.25	46.9	7.85	17.3
High Arsenic Composite (T-1)						
Untreated	5.77	1,880	8.07	1,050	7.59	736
0.5% Iron metal (immediate)	5.66	81.4	8.27	156	7.53	82.4
1% Iron metal (immediate, duplicate)	5.55	1150	8.32	418	7.54	170

Table 5 (continued)
Kewaunee Marsh Treatability Results

SAMPLE	SCREENING LEACH TEST RESULTS					
	TCLP		SPLP (EAST)		SPLP (SITE GROUNDWATER)	
	pH	ARSENIC (µg/L)	pH	ARSENIC (µg/L)	pH	ARSENIC (µg/L)
2.0% Iron metal (immediate)	5.74	82.9	8.39	53.8	7.92	10.5
2.5% Iron metal (immediate, duplicate)	6.44	48.4	8.52	32.8	7.82	10
Moderate Arsenic Composite						
Untreated	5.10	600	7.79	259	7.55	224
0.5% Iron metal (immediate)	5.28	48.7	8.19	42.9	7.53	21.9
1% Iron metal (immediate, duplicate)	5.27	76.3	8.26	11.7	7.61	17.6
2.0% Iron metal (immediate)	5.16	155	8.11	55	7.62	14.6
2.5% Iron metal (immediate, duplicate)	5.35	75.2	8.36	19.2	7.79	13.4
High Arsenic Composite (T-1)						
Untreated	5.77	1,880	8.07	1,050	7.59	736
0.5% Iron metal (1 week)	5.82	731	8.13	295	7.56	197
1% Iron metal (1 week)	5.61	405	8.26	258	7.59	92.8
2.0% Iron metal (1 week)	6.39	52.2	8.50	23.2	7.84	<6
2.5% Iron metal (1 week)	5.88	634	8.36	73.8	7.64	55.9

Table 5 (continued)
Kewaunee Marsh Treatability Results

SAMPLE	SCREENING LEACH TEST RESULTS					
	TCLP		SPLP (EAST)		SPLP (SITE GROUNDWATER)	
	pH	ARSENIC (µg/L)	pH	ARSENIC (µg/L)	pH	ARSENIC (µg/L)
Moderate Arsenic Composite						
Untreated	5.10	600	7.79	259	7.55	224
0.5% Iron metal (1 week)	5.19	65.5	7.73	20.2	7.60	21.9
1% Iron metal (1 week)	5.20	59	7.88	<6	7.72	<6
2.0% Iron metal (1 week)	5.18	40.7	7.63	36.6	7.70	<6
2.5% Iron metal (1 week)	5.40	53.4	7.70	9.2	7.56	<6
Foundry Waste Byproducts						
Moderate Arsenic Composite						
Untreated	5.16	340	7.94	140	7.72	170
5% Kohler Foundry byproducts	5.15	200	8.28	78	7.79	69
10% Kohler Foundry byproducts	5.08	35	8.21	84	7.74	65
25% Kohler Foundry byproducts	5.08	37	8.20	78	7.84	31
5% Manitowoc Foundry byproducts	5.16	290	8.04	130	7.75	83
5% Sharon Foundry byproducts	5.21	200	8.29	140	7.81	85

Table 5 (continued)
Kewaunee Marsh Treatability Results

SAMPLE	SCREENING LEACH TEST RESULTS					
	TCLP		SPLP (EAST)		SPLP (SITE GROUNDWATER)	
	pH	ARSENIC (μg/L)	pH	ARSENIC (μg/L)	pH	ARSENIC (μg/L)
5% Metals Technology Foundry byproducts	5.72	250	8.30	140	7.87	91
Anderson Arsenic Adsorbent						
Moderate Arsenic Composite						
10% Adsorbent	5.14	110	8.33	87	7.92	65

Table 6
Bioreductant Test 1 - Effect on Soil Arsenic Concentration

SAMPLE		SOLIDS	VOLATILE SOLIDS	ARSENIC	PORE WATER As ARSENIC	
TREATMENT	REP	%	%	mg/kg	pH	As (µg/L)
Untreated	A	10.2	75.8	830	7.66	120
	B			750		
	C			830		
	Avg			803		
5% Bioreductant	A	9.86	70.1	710	7.61	130
	B			760		
	C			770		
	Avg			745		
10% Bioreductant	A	12.6	76.6	590	7.61	170
	B			640		
	C			650		
	Avg			627		
25% Bioreductant	A	14.4	71.6	440	7.99	310
	B			450		
	C			470		
	Avg			453		

Table 7
Bioreductant Test 2 - Effect on Soil Arsenic Concentration

SAMPLE	GAS GENERATION, mL	ARSENIC CONCENTRATION, PORE WATER µg/L	SOLIDS	
			ARSENIC CONCENTRATION, mg/kg	% REDUCTION*
Original	-	770	645	-
Untreated	6	440	517	20.1
Cow manure	340	550	448	39.7
Whey wastewater	498	1,330	462	29.7
Cheese wastewater solids	16	720	422	28.8
Lactate	2	1,550	467	30.7
Sugar	304	330	546	36.8
Ethanol	326	480	532	30.7

Note:

* The % reduction was calculated from the arsenic concentration in the solids and solids concentration in the flask, and accounting for the dilution due to the bioreductant addition.

Table 8
Arsenic Concentrations in MW04-10 Water Treated With Ferrous II and Ferric III Iron

SAMPLE	OBSERVATION	pH	DISSOLVED ARSENIC (µg/L)
Untreated			2,300,000
4 mM Fe(II)	Olive-green solids	5.53	1,700,000
8 mM Fe(II)		4.12	1,400,000
16 mM Fe(II)		3.76	1,300,000
32 mM Fe(II)		3.65	1,100,000
8 mM Fe(III)	Cream-colored solids	3.64	1,400,000
16 mM Fe(III)		3.07	640,000
32 mM Fe(III)		2.90	3,900
40 mM Fe(III) + 40 mM HCO_3		3.50	460,000
40 mM Fe(III) + 80 mM HCO_3		6.01	390,000
40 mM Fe(III) + 120 mM HCO_3^-		6.39	400,000
40 mM Fe(III) + 160 mM HCO_3^-		6.61	360,000

Table 9
Effect on Dissolved Arsenic Concentration of Ferrous (I) and Ferric (III) Iron Doses With and Without pH Adjustment

SAMPLE		BEFORE pH ADJUSTMENT			AFTER pH Adjustment		
		LIQUID			LIQUID		
		pH	As (µg/L)	Fe (mg/L)	pH	As (µg/L)	Fe (mg/L)
Untreated		6.39	2,235,000	BD			
Fe(II)	0.024 M	4.14	1,429,000	379	7.00	798,000	157
	0.032 M	3.97	1,356,000	607	6.86	498,000	8.64
	0.040 M	3.85	1,308,000	868	6.72	184,000	27.2
	0.048 M	3.80	1,273,000	996	6.60	74,800	72
Fe(III)	0.048 M	1.87	375,000	46.5	7.03	266,000	0.37
	0.064 M	1.69	231,000	228	7.01	9,640	0.27
	0.080 M	1.63	336,000	580	6.63	630	0.58
	0.092 M	1.60	484,000	907	6.38	190	0.83

Table 10
Effect of pH Adjustment on Arsenic Concentrations in MW04-10 Water Treated With Ferric Iron

0.080 M Fe(III) AND MgO DOSE		SOLUTION CONCENTRATION	
		pH	ARSENIC, µg/L
Fe(III)	MgO Dose		
Untreated		6.39	2,200,000
0.080 M	0 MgO	1.46	465,000
	0.020 M MgO	1.84	96,600
	0.040 M MgO	2.36	10,200
	0.060 M MgO	5.15	230
	0.080 M MgO	8.10	1,680
	0.10 M MgO	8.95	2,000
	0.20 M MgO	9.53	2,880
	0.30 M MgO	9.87	1,860
	0.40 M MgO	10.13	1,000
	0.50 M MgO	10.15	420

Table 11
Effect of Two- Step Ferric Iron Addition on Arsenic Concentrations in MW04-10 Water and the Composition and TCLP Arsenic Concentrations of the Resultant Solids

SAMPLE	ANALYTICAL RESULTS	
SOLUTION		
	pH	ARSENIC (µg/L)
Untreated solution	6.39	2,200,000
First iron addition – 0.60 M Fe(III) + 2.5 g $Mg(OH)_2$/L	5.36	210
Second iron addition 0.0225 M Fe(III) + 0.2 g $Mg(OH)_2$/L	9.01	40
SOLIDS FROM STEP 1		
	ARSENIC	IRON
Composition (mg/kg)	210,000	220,000
	pH	ARSENIC (µg/L)
TCLP	5.17	5,200

Table 12
Effect of Ferric Iron Dose on Dissolved Arsenic Concentration in MW04-10 Water and TCLP Arsenic Concentrations on the Resultant Sludge

SAMPLE	SOLUTION		TCLP ON SOLIDS	
	pH	ARSENIC, µg/L	pH	ARSENIC, µg/L
Untreated	6.39	2,200,000		
+ 0.10 M Fe(III) & 5 g $Mg(OH)_2$/L	6.34	120	8.65	3,800
+ 0.15 M Fe(III) + 7.5 g $Mg(OH)_2$/L	5.13	66	8.80	1,700
+ 0.20 M Fe(III) + 10 g $Mg(OH)_2$/L	4.63	51	8.85	710

Table 13
Effect of Iron Dose of pH Adjustment on Arsenic Concentration in April 3, 2007, Sample of MW04-10 Groundwater

SAMPLE		SOLUTION	
FERRIC IRON DOSE	pH ADJUSTMENT AGENT	pH	ARSENIC, µg/L
Untreated		6.58	2,380,000
0.05 M	NaOH	2.0	820,000
		4.90	565,000
		5.25	519,000
		5.69	463,000
		6.63	316,000
		7.41	207,000
		8.94	178,000
0.10 M		1.95	1,119,000
		3.98	116,000
		4.58	66,700
		5.91	30,100
		6.95	16,200
		7.76	9,240
		11.47	660,000
0.20 M		1.81	1,937,000
		3.32	22,600
		4.32	7,540
		5.52	3,960
		8.39	2,150
		9.98	27,000
		11.30	264,000
0.30 M	0 g $CaCO_3$/L	1.64	1,763,000
	35	5.62	5,100
	40	5.49	5,080
	45	5.57	3,550
	50	5.58	3,490
	60	5.74	8,930
0.40 M	0	1.64	1,696,000
	50	5.74	1,710
	55	5.62	1,700
	60	5.67	1,360
	65	5.75	2,080
	70	5.68	2,490

Table 14
Effect of Iron and Limestone Dose on Arsenic Concentration in MW04-10 Groundwater and TCLP Arsenic Concentration of Resultant Solids

SAMPLE	GROUNDWATER		SOLIDS TCLP	
	pH	ARSENIC, µg/L	pH	ARSENIC, µg/L
0.30 M Fe(III) + 35 g/L $CaCO_3$	5.62	5,100	6.23	2,700
0.30 M Fe(III) + 60 g/L $CaCO_3$	5.74	8,930	6.33	2,400
0.40 M Fe(III) + 50 g/L $CaCO_3$	5.74	1,710	6.26	1,300
0.40 M Fe(III) + 70 g/L $CaCO_3$	5.638	2,490	6.29	1,400
Hazardous waste criterion				5,000

Table 15
Effect of Hydrogen Peroxide Addition on Arsenic Concentration in Ferric Iron and Limestone-treated MW04-10 Groundwater

SAMPLE	GROUNDWATER		SOLIDS	
	pH	ARSENIC, µg/L	WEIGHT	MOISTURE
NO PEROXIDE INITIALLY				
0.20 M Fe(III), no peroxide, 25 g $CaCO_3$/L	NA	410	138.8 g/L	58.6
+ peroxide & 0.05 M Fe(III), 5 g/L MgO	10.63	25		
+ 0.05 M Fe(III), 5 g/L MgO	10.59	25		
WITH PEROXIDE INITIALLY				
0.20 M Fe(III), 10 mL 30% H_2O_2/L, 25 g $CaCO_3$/L	6.06	<130	147.4 g/L	66.6
+ 0.05 M Fe(III), 5 g/L MgO	10.23	30		

Note:
NA = not analyzed.

Table 16
Effect of Different Hydrogen Peroxide Doses on Arsenic Concentration in MW04-10 Water Treated With Ferric Iron and Limestone

SAMPLE MW04-10 + 0.30 M Fe(III) + 50 g/L $CaCO_3$	ANALYTICAL RESULTS
	ARSENIC µg/L
+ 0 H_2O_2	1,000
+ 2.5 mL 30% H_2O_2	<130
+ 5.0 mL 30% H_2O_2	<130
+ 10 mL 30% H_2O_2	<130

Table 17
Results of Larger-Scale Test on Groundwater Treatment

PARAMETER	RESULTS
FILTRATE	
Dissolved arsenic concentration	11 μg/L
pH	4.9
SOLIDS	
Wet weight	327 g
Dry weight	107 g
Composition: – arsenic	22,000 mg/kg
– iron	170,000 mg/kg
TCLP ON SOLIDS	
Arsenic concentration	<1,000 μg/L

Note:
A 1L sample was treated with 2.5 mL 30% hydrogen peroxide, 0.3 M ferric iron, 60 g/L limestone.

Table 18

Treatment of the South Slough Water Using Ferric Iron and Limestone

SAMPLE	AMOUNT FERRIC IRON	AFTER IRON ADDITION	AFTER LIMESTONE ADDITION	
		pH	pH	ARSENIC µg/L
Untreated	0	6.8	6.89	1,400
	0.002 M Fe(III)	3.80	7.03	<13
	0.004 M Fe(III)	2.80	6.74	<13
	0.006 M Fe(III)	2.70	7.42	<13

Note:
0.5 gm/L limestone added.

Table 19
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Source Area	1	Pump and Dispose Off-Site	$280,000	A groundwater extraction well will be constructed in the source area, and groundwater will be pumped from the well and contained in batches on-site. The batches will be transported off-site for disposal as a hazardous waste. ▪ This scenario assumes that pumping of 42,000 gallons of water will remove the source area contamination. ▪ This scenario assumes that the groundwater will be pumped into a 5,000 gallon holding tank, and each batch will be transported off-site by a tanker truck for disposal as a hazardous waste. ▪ This scenario assumes that a pumping rate of 0.5 gpm can be sustained by the extraction well, and that a total run time of 80 days will be needed to capture the 42,000 gallons of source area groundwater. The 80 days accounts for start-up time, and downtime in the pumping when the batch holding tank is full and awaiting disposal. ▪ This scenario assumes that a propane generator will be used to power the pump and a control panel. ▪ Operation and maintenance for this scenario includes a start-up and shakedown visit, and 6 site visits associated with transport and disposal of each batch of groundwater (tank full). ▪ Monitoring associated with this scenario includes sampling 3 groundwater monitoring wells for arsenic. The monitoring will be completed quarterly during the first year of operation, and semi-annually for the next 2 years. This scenario assumes that the 2-years of groundwater monitoring will be sufficient to demonstrate successful remediation of the source area.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.
2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from –30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
3. Costs are rounded to the nearest ten thousand dollar.
4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued)
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Source Area	2	Pump and Treat On-site	$640,000	A groundwater extraction well will be constructed in the source area, and groundwater will be pumped from the well and treated in batches on-site. The treated groundwater will be discharged to the surface, and the residual solids will be transported off-site for disposal as a non-hazardous waste. ▪ This scenario assumes that treatment of 42,000 gallons of water will remove the source area contamination. ▪ The cost is based on treating the groundwater with 85 g/L ferric sulfate, 60 g/L limestone, and 1 mL/L peroxide (30%). ▪ The cost and feasibility is based on treating the groundwater in 1,000 gallon batches. ▪ The cost assumes that the solids can be dewatered with a filter press, and that approximately 60 tons of solids will be generated from the treatment process. ▪ This scenario assumes that a pumping rate of 0.5 gpm can be sustained by the extraction well, and that a total run time of 24 weeks will be needed to treat the 42,000 gallons of source area groundwater. The 24 weeks accounts for start-up time, and assumes that at least two 1,000 gallon batches will be completed per week. ▪ This scenario assumes that a propane generator will be used to power the pump, water treatment equipment, and a control panel. ▪ Operation and maintenance for this scenario includes a start-up and shakedown visit, and 26 site visits associated with restarting the batch treatment (refilling the hoppers with treatment chemicals) after each 1,000-gallon batch is complete, and controlling the solids dewatering operation.

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3. Costs are rounded to the nearest ten thousand dollar.
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5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued)
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Source Area (cont.)	2 (cont.)	Pump and Treat On-site (cont.)	$640,000	▪ Monitoring associated with this scenario includes sampling 3 groundwater monitoring wells for arsenic. The monitoring will be completed quarterly during the first year of operation, and semi-annually for the next 2 years. This scenario assumes that the 2-years of groundwater monitoring will be sufficient to demonstrate successful remediation of the source area. The monitoring also includes Wisconsin Pollutant Discharge Elimination System (WPDES) sampling for the treated groundwater, and verification sampling of up to 20 samples for arsenic during the in-situ treatment.
Source Area	3	In-situ Treatment	$250,000	The railroad ballast and any other overburden soils in the source area will be excavated and stockpiled on-site to expose the saturated zone. Treatment chemicals will be mechanically mixed into the saturated source area with a backhoe to treat the groundwater in-situ. The railroad ballast and other overburden soils will be replaced following treatment, and the site restored to existing conditions. ▪ This scenario assumes that treatment of 4 feet of saturated material in a 50 ft by 70 ft area (42,000 gallons of water) will remove the source area contamination. ▪ The cost is based on treating the groundwater in-situ with 85 g/L ferric sulfate, 60 g/L limestone, and 1 mL/L peroxide (30%). ▪ The cost is based on mixing in the treatment chemical in-situ with construction equipment, such as a backhoe. ▪ This cost assumes that the in-situ treatment and site restoration can be completed in two weeks, and that only one in-situ treatment will be necessary to achieve the clean-up criteria. ▪ There are no operation and maintenance costs associated with this option.

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3. Costs are rounded to the nearest ten thousand dollar.
4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued)
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Source Area (cont.)	3 (cont.)	In-situ Treatment (cont.)	$250,000	▪ Monitoring associated with this scenario includes sampling 3 groundwater monitoring wells for arsenic. The monitoring will be completed quarterly during the first year of operation, and semi-annually for the next 2 years. This scenario assumes that the 2-years of groundwater monitoring will be sufficient to demonstrate successful remediation of the source area.
Marsh Soil (and surface water runoff)	1	Excavation Large Area + Source Area Scenarios 1, 2, or 3	$2,990,000	The top 2 feet or marsh soil exceeding the soil clean-up criteria (including the marsh material under the cap) will be excavated and disposed off-site as non-hazardous waste. ▪ The cost is based on excavating the top 2 feet marsh material over 470,400 sf (10.8 acres). This equates to approximately 67,500 tons of marsh material. ▪ The cost assumes that the cap will be excavated and stockpiled on-site, and will be replaced as general fill over the site following the excavation of the marsh sediment. ▪ The cost assumes that stabilized haul roads will be constructed in the marsh to provide access to the site for excavation. ▪ The cost assumes that the marsh sediment can be disposed as non-hazardous waste. ▪ The excavated marsh sediment will require dewatering on-site prior to disposal, and erosion control at the site will be necessary. ▪ The cost does not include backfilling the excavated area, or wetlands restoration. ▪ The cost assumes that the site preparation, excavation, and restoration, can be completed in two months. ▪ There are no operation and maintenance costs associated with this option. ▪ Monitoring associated with this scenario includes collecting 50 confirmation samples from the base of the excavation for arsenic analysis. The monitoring will be completed during the excavation.

Notes:

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3. Costs are rounded to the nearest ten thousand dollar.
4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued)
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Marsh Soil	2	Excavation Small Area + Source Area Scenarios 1, 2, or 3 + Slough Water Scenarios 1 or 2	$1,680,000	The top two feet or marsh soil exceeding the soil clean-up criteria outside the capped area will be excavated and disposed off-site as non-hazardous waste. ▪ The cost is based on excavating the top 2 feet marsh material over 315,000 sf (7.3 acres). This equates to approximately 37,500 tons of marsh material. This area is conservative, and could likely be reduced to more discrete areas based on additional soil sampling prior to the excavation. ▪ The cost assumes that the cap and material below the cap will be left in place. ▪ The cost assumes that the marsh sediment can be disposed as non-hazardous waste. ▪ The cost assumes that stabilized haul roads will be constructed in the marsh to provide access to the site for excavation. ▪ The excavated marsh soil will require dewatering on-site prior to disposal, and erosion control at the site will be necessary. ▪ The cost does not include backfilling the excavated area, or wetlands restoration. ▪ The cost assumes that the site preparation, excavation, and restoration, can be completed in two months. ▪ There are no operation and maintenance costs associated with this option. ▪ Monitoring associated with this scenario includes collecting 30 confirmation samples from the base of the excavation for arsenic analysis. The monitoring will be completed during the excavation.
Marsh Soil	3	Bioreduction (Total)	$610,000	Bioreduction is broken into a test plot portion and a full scale application which are summarized below.

Notes:
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2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from –30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
3. Costs are rounded to the nearest ten thousand dollar.
4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued)
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Marsh Soil	3A	Bioreduction Test Plots (to be used in development of Scenario 3B)	$80,000	Small test plots would be constructed outside the capped area to evaluate the performance of different bioreductants in reducing the arsenic concentrations in the field. These test plots would be used to develop a workplan for implementing the full scale bioreduction option in the field. ▪ The cost is based constructing five 10 ft x 10 ft test plots using general manual labor (no large construction equipment). ▪ The scenario assumes that bioreductants such as lactate, molasses, whey, or manure will be evaluated in the test plots. ▪ The cost assumes that the construction and performance monitoring for the test plots can be completed in six months. ▪ There are no operation and maintenance costs associated with this option. ▪ Monitoring associated with this scenario includes collecting 10 samples from each test plot for arsenic analysis. Baseline samples will be collected from the 10 locations within each plot prior to the application of the bioreductant, and monthly sampling will be completed for 5 months following the application of the bioreductant.

Notes:

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3. Costs are rounded to the nearest ten thousand dollar.
4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued)
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Marsh Soil	3B	Bioreduction Full Scale + Source Area Scenarios 1, 2, or 3 + Slough Water Scenarios 1 or 2	$530,000	The same area targeted for excavation under Scenario 2 will be treated with a bioreductant to enhance the reduction of arsenic in the field. The specific bioreductant and field application approach will be based on the results of the test plot study (Scenario 3A). ▪ The cost is based on treating marsh material over 315,000 sf (7.3 acres). This area is conservative, and could likely be reduced to more discrete areas based on additional soil sampling prior to the excavation. ▪ The cost is based on using lactate as the bioreductant, and applying sufficient quantity of lactate to the site to penetrated approximately 1 foot of soil to a concentration of 7,500 mg/L. The use of lactate as the bioreductant is conservative, and the specific bioreductant and concentration will be selected based on the results of the test plot studies. ▪ The bioreductant solution will be applied using an irrigation-like system, and the water for the creating the solution will be obtained from the Kewaunee River. ▪ The cost assumes that the irrigation system will operate for approximately one month and that only one application of the bioreductant will be required. The irrigation system will be rented, and removed from the site following the application. ▪ The cost assumes that stabilized haul roads will be constructed in the marsh to provide access to the site. ▪ Operation and maintenance for this scenario include annual clearing of the cattails and placement of the cut cattails across the treatment area to enhance the anaerobic conditions. The operation and maintenance will be completed for 5 years following the application of the bioreductant.

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2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from –30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
3. Costs are rounded to the nearest ten thousand dollar.
4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued)
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Marsh Soil (cont.)	3B (cont.)	Bioreduction Full Scale + Source Area Scenarios 1, 2, or 3 + Slough Water Scenarios 1 or 2 (cont.)	$530,000	▪ Monitoring associated with this scenario includes collecting 30 samples across the treatment area for arsenic analysis. One baseline monitoring event will be completed prior to the application of the bioreductant, and semi-annual sampling will be completed at the same 30 locations for 5 years. The sample locations will be identified and replicated using a GPS unit. This scenario assumes that the 5-years of sediment monitoring will be sufficient to demonstrate successful remediation of the marsh area.
Slough Water	1	Impermeable barrier + Source Area Scenarios 1, 2, or 3 + Marsh Area Scenarios 2 or 3	$410,000	An impermeable barrier would be constructed along the fence line at the site to prevent surface water runoff from reaching the Kewaunee river. ▪ The scenario assumes that the barrier will be constructed along the fence route, and span approximately 2,000 feet, extend 3 feet below ground surface, and extend approximately 2 feet above the surface. ▪ The cost assumes that the impermeable barrier will be constructed of ¼-inch polyethylene material. ▪ The scenario assumes that the barrier will effectively restrict the flow of surface water off the site, and that the trapped water will infiltrate back into the marsh such that additional management of the surface water will not be required. ▪ This scenario assumes that the barrier will be constructed during the winter to allow access to the site and improved construction conditions. ▪ The cost assumes that the barrier will be left in place after the site remediation is complete.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.
2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from –30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
3. Costs are rounded to the nearest ten thousand dollar.
4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued)
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Slough Water (cont.)	1 (cont.)	Impermeable barrier + Source Area Scenarios 1, 2, or 3 + Marsh Area Scenarios 2 or 3 (cont.)	$410,000	▪ Operation and maintenance for this scenario include semi-annual site visits to evaluate the integrity of the barrier. The operation and maintenance will be completed for 5 years following the completion of one of the Marsh Soil Remediation scenarios. If this option is used as a stand alone alternative (without treating the marsh sediment) the operation and maintenance would extend indefinitely, and the cost of the alternative would increase by a factor of 4 to 5. ▪ Monitoring associated with this scenario includes semi-annual collection of surface water from the two slough areas on the site for arsenic analysis. The monitoring will be completed for 5 years following the completion of one of the Marsh Sol Remediation scenarios. If this option is used as a stand alone alternative (without treating the marsh soil) the monitoring would extend indefinitely, and the cost of the alternative would increase by a factor of 4 to 5.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.
2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from –30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
3. Costs are rounded to the nearest ten thousand dollar.
4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued)
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Slough Water	2	Collection and On-site Treatment + Source Area Scenarios 1, 2, or 3 + Marsh Area Scenarios 2 or 3	$730,000	Surface water run-off would be collected from the two sloughs and pumped to a staging area near the railroad tracks to be treated on-site. The treated water would be discharged to the surface, and the residual solids would be disposed off-site as non-hazardous waste. ▪ This scenario assumes only 10,000 gallons of runoff water will be captured per flow event at the site. Any additional flow volume would be discharged to the Kewaunee river. This flow volume equates to an average sustained flow rate for 0.7 gpm from the two sloughs for 10 days, or a 10 gpm surge in the two sloughs over 16 hours. ▪ The scenario includes the construction of an outlet structure around each slough outlet to create surface water capture zones, and to allow overflow during high flow events. ▪ The scenario includes construction of above grade plumbing to connect the surface water capture zones around the sloughs to a on-site treatment staging area near the railroad. The staging area will include four 2,500 gallon equalization tanks and the water treatment equipment.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.
2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from –30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
3. Costs are rounded to the nearest ten thousand dollar.
4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued)
Summary of Conceptual Estimated Costs
WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES	ASSUMPTIONS
			BEST JUDGMENT	
Slough Water (cont.)	2 (cont.)	Collection and On-site Treatment + Source Area Scenarios 1, 2, or 3 + Marsh Area Scenarios 2 or 3 (cont.)	$730,000	▪ The cost is based on treating the groundwater with 0.056 g/L ferric sulfate, and 0.5 g/L limestone. ▪ The cost assumes that the solids can be dewatered with bag filters, and that approximately 2 tons of solids will be generated per year from the treatment process. ▪ This scenario assumes that a propane generator will be used to power the pumps, water treatment equipment, and a control panel. ▪ The cost assumes that the above grade all equipment and facilities will be decommissioned at the end of the slough water treatment. ▪ Operation and maintenance for this scenario includes seven visits per year to evaluate the operation of the water treatment system. The operation and maintenance will be completed for 5 years following the completion of one of the Marsh Soil Remediation scenarios. If this option is used as a stand alone alternative (without treating the marsh soil) the operation and maintenance would extend indefinitely, and the cost of the alternative would increase by a factor of 2 to 3. ▪ Monitoring associated with this scenario includes semi-annual collection of surface water from the two slough areas on the site for arsenic analysis. The monitoring will be completed for 5 years following the completion of one of the Marsh Soil Remediation scenarios. If this option is used as a stand alone alternative (without treating the marsh soil) the monitoring would extend indefinitely, and the cost of the alternative would increase by a factor of 2 to 3. The monitoring also includes Wisconsin Pollutant Discharge Elimination System (WPDES) sampling for the treated groundwater.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.
2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from –30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
3. Costs are rounded to the nearest ten thousand dollar.
4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 20
Comparative Summary of Conceptual Estimated Costs Presented(1)
WDNR – Kewaunee Marsh Remediation

			BEST JUDGMENT REMEDIATION CONCEPTUAL COST ESTIMATES				
					ANNUAL COSTS		
IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	TOTAL COST PRESENT WORTH(2)	YEAR 1 COSTS(3)	O&M	MONITORING	DURATION
Source Area	1	Pump and Dispose Off-site	**$280,000**	$230,000	--	$30,000	2 years
	2	Pump and Treat On-Site	**$640,000**	$590,000	--	$30,000	2 years
	3	*In situ* Treatment	**$250,000**	$200,000	--	$30,000	2 years
Marsh Soil + Slough Water	1	Excavation (large area)	**$2,990,000**	$2,990,000	--	--	--
Marsh Soil	2	Excavation (small area)	**$1,680,000**	$1,680,000	--	--	--
	3	Bioreduction Total	**$610,000**	$370,000	$20,000	$30,000	5 years
	A	Test Plots	**$80,000**	$80,000	--	--	--
	B	Fullscale	**$530,000**	$290,000	$20,000	$30,000	5 years
+ Slough Water	1	Impermeable Barrier	**$410,000**	$290,000	$15,000	$15,000	5 years
	2	Collection and Treatment On-Site	**$730,000**	$410,000	$55,000	$20,000	5 years

Notes:

(1) This table is a summary of information presented in Table 19, and is not intended to be used as a standalone document. This summary is compiled for comparative purposes only. Important descriptions, assumptions and uncertainties are discussed in Table 19, which must be read to correctly use this cost information.

(2) The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from –30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs. Costs rounded up to the nearest $10,000; total costs include year 1 costs, and present worth costs of the annual O&M and monitoring.

(3) Year 1 costs include direct and indirect capital costs, as well as the first year O&M and monitoring costs.

(4) Costs do not include monitoring and evaluation to bring the site to closure.

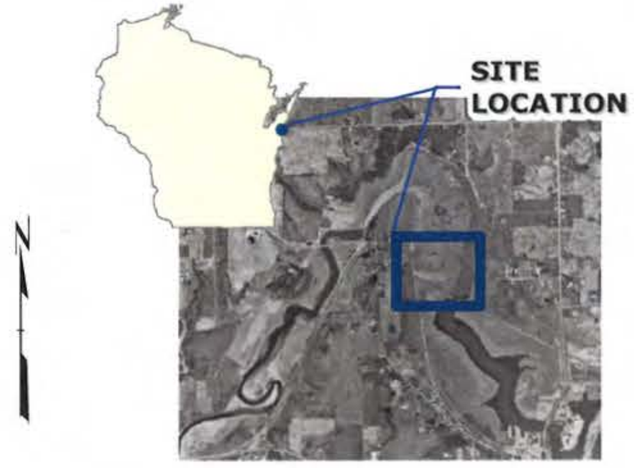
LEGEND

1994 ARSENIC CONCENTRATIONS (mg/kg)

- 🟢 < 100
- 🔵 100 - 1,000
- 🟠 > 1,000
- FENCE
- CAPPED AREA

NOTES

1. ARSENIC CONCENTRATIONS AND SAMPLE LOCATIONS FROM STS CONSULTANTS.



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PROJECT:	WISCONSIN DEPARTMENT OF NATURAL RESOURCES KEWAUNEE MARSH		
SHEET TITLE:	SOIL ARSENIC CONCENTRATIONS - 1994		
DRAWN BY: HANKLEY C	SCALE:	PROJ. NO.	00-07201.05
CHECKED BY: SELLWOOD A	AS NOTED	FILE NO.	72010502.mxd
APPROVED BY: STANFORTH B	DATE PRINTED:	FIGURE 1	
DATE: AUGUST 2007	8/3/2007		

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Fax: 608-831-3334

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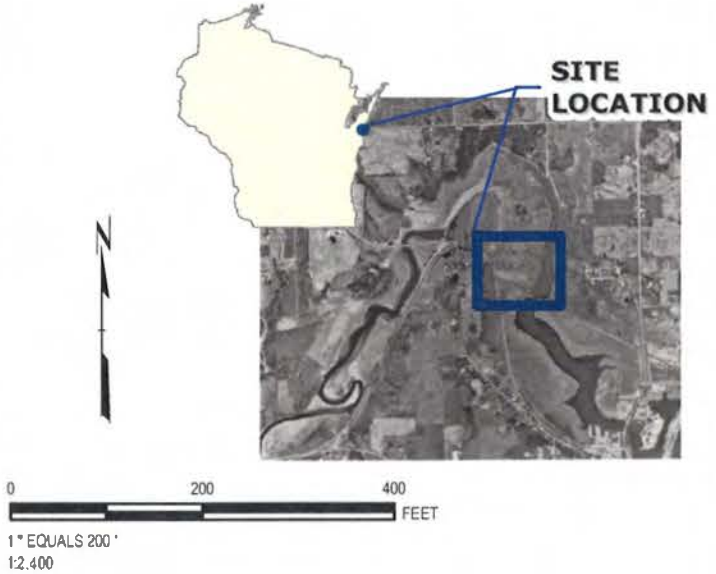
LEGEND

2002 ARSENIC CONCENTRATIONS (mg/kg)

🟢	< 100
○	10 - 1,000
●	> 1,000
⁄ ╲ ⁄	FENCE
▱	CAPPED AREA

NOTES

1. ARSENIC CONCENTRATIONS AND SAMPLE LOCATIONS FOR HISTORICAL SAMPLES FROM STS CONSULTANTS.
2. SAMPLES SHOWN WHERE SAMPLE DEPTH IS LISTED AS: BLANK, SOIL EX, OR 0-2.



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1:2,400

PROJECT:
WISCONSIN DEPARTMENT OF
NATURAL RESOURCES
KEWAUNEE MARSH

SHEET TITLE:
SOIL ARSENIC CONCENTRATIONS
2002

DRAWN BY:	HANKLEY C	SCALE:		PROJ. NO.	00-07201.05
CHECKED BY:	SELLWOOD A	AS NOTED		FILE NO.	72010503.mxd
APPROVED BY:	STANFORTH B	ATE PRINTED:		FIGURE 2	
DATE:	AUGUST 2007	8/6/2007			

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LEGEND

HISTORIC AVERAGE ARSENIC CONCENTRATION IN GROUNDWATER, NON-FILTERED SAMPLES (µg/L)

- ● < 100
- ● > 100
- FENCE
- CAPPED AREA

NOTES

1. ARSENIC CONCENTRATIONS AND SAMPLE LOCATIONS FOR HISTORICAL SAMPLES FROM STS CONSULTANTS.

0 200 400
FEET

1" EQUALS 200'
1:2,400

PROJECT:	**WISCONSIN DEPARTMENT OF NATURAL RESOURCES KEWAUNEE MARSH**		
SHEET TITLE:	**SHALLOW GROUNDWATER AVERAGE ARSENIC CONCENTRATIONS 2002 - 2005**		
DRAWN BY: HANKLEY C	SCALE:	PROJ. NO.	00-07201.05
CHECKED BY: SELLWOOD A	AS NOTED	FILE NO.	72010504.mxd
APPROVED BY: STANFORTH B	ATE PRINTED:	**FIGURE 3**	
DATE: AUGUST 2007	8/8/2007		

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LEGEND

T-01 ◕ RMT SAMPLE LOCATIONS-NOVEMBER 2005

HISTORIC SOIL ARSENIC CONCENTRATIONS IN SAMPLES COLLECTED BY STS
(mg/kg)

- 🟢 < 200
- 🔵 200 - 1,000
- 🟠 > 1,000

-·- FENCE

▭ CAPPED AREA

NOTES

1. ARSENIC CONCENTRATIONS AND SAMPLE LOCATIONS FOR HISTORICAL SAMPLES FROM STS CONSULTANTS.

1" EQUALS 200'
1:2.400

PROJECT:	WISCONSIN DEPARTMENT OF NATURAL RESOURCES KEWAUNEE MARSH		
SHEET TITLE:	NOVEMBER 2005 SOIL SAMPLE LOCATIONS		
DRAWN BY: HANKLEY C	SCALE:	PROJ. NO. 00-07201.05	
CHECKED BY: SELLWOOD A	AS NOTED	FILE NO. 72010505.mxd	
APPROVED BY: STANFORTH B	DATE PRINTED:	FIGURE 4	
DATE: AUGUST 2007	8/3/2007		

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FIGURE 5: Compositional Arsenic vs TCLP Arsenic

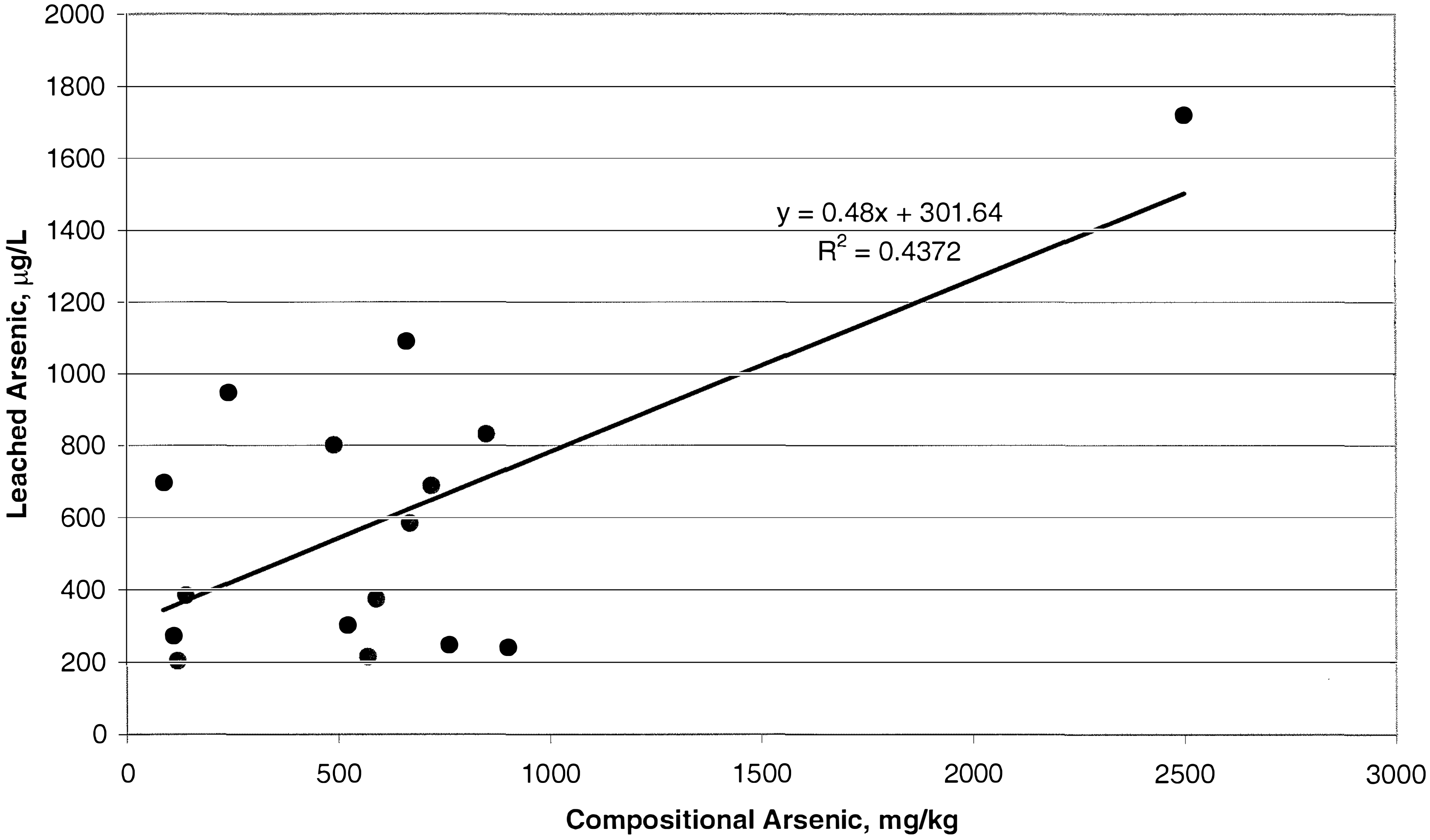


FIGURE 6: Compositional Arsenic vs SPLP Arsenic

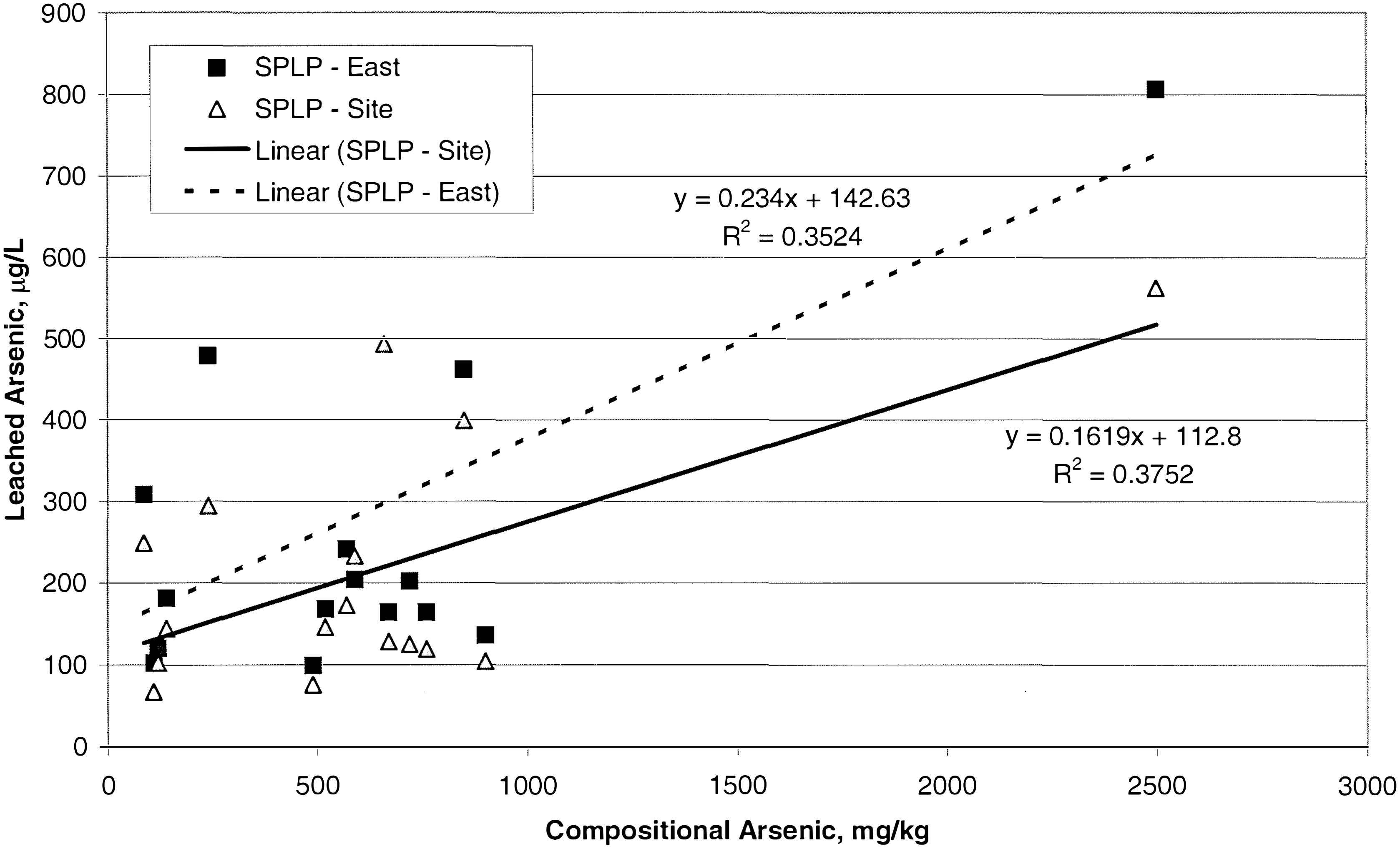


FIGURE 7: Pore Water vs SPLP Arsenic Concentration

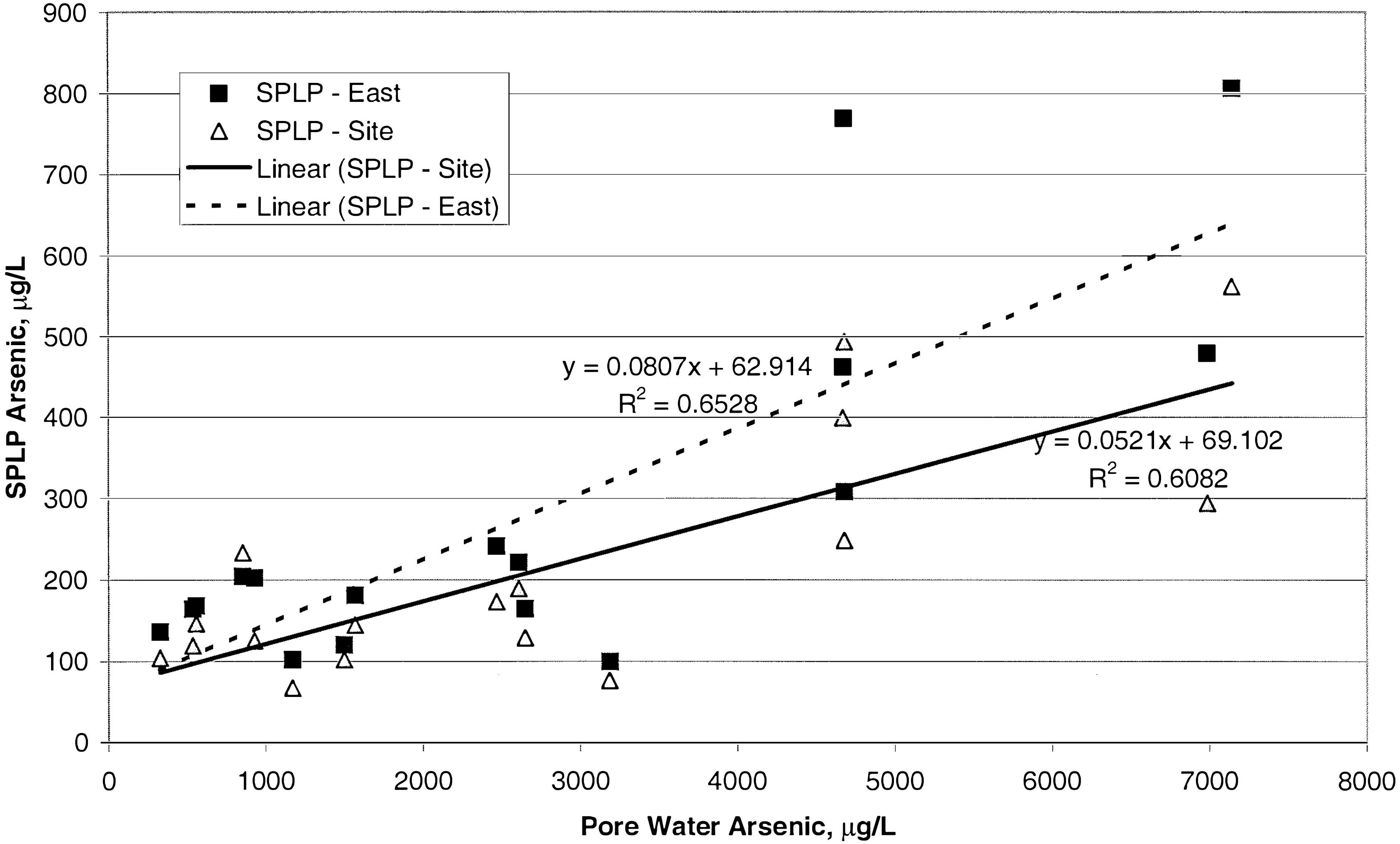
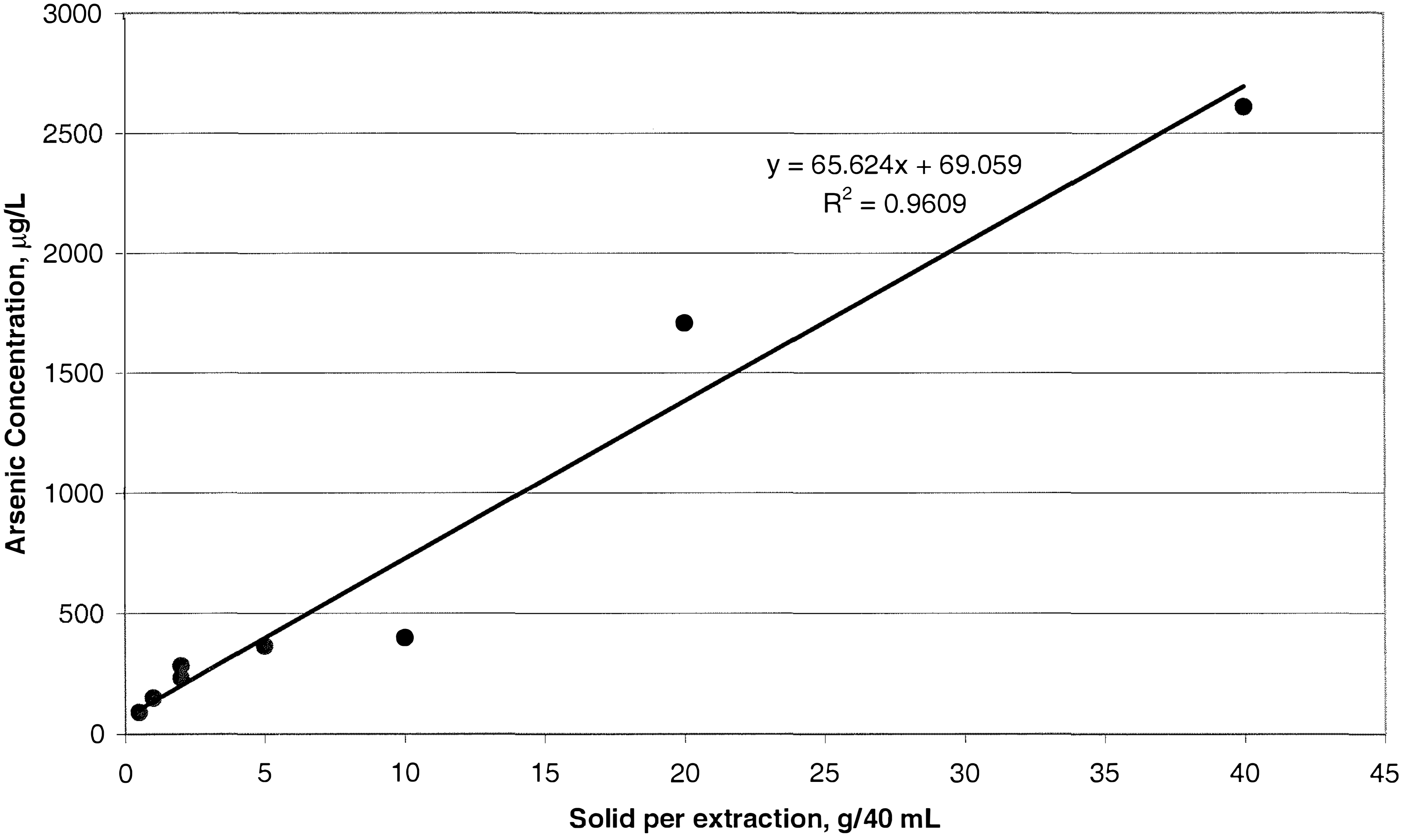


FIGURE 8: Solid-Solution Ratio Effect on Arsenic Leaching, Moderate Arsenic Composite



LEGEND

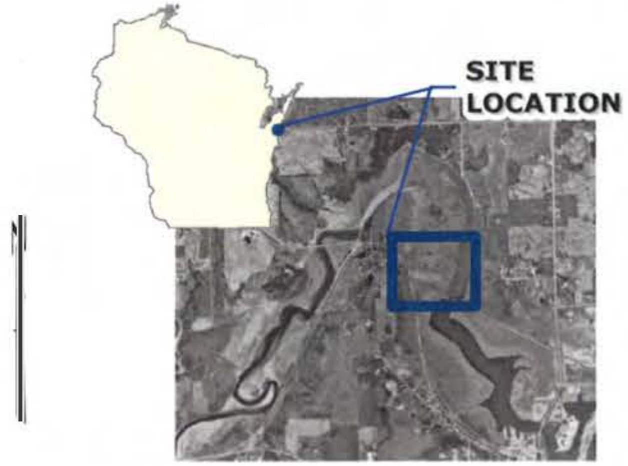
T-19 ◑	RMT SAMPLE LOCATIONS-JUNE 2006

HISTORIC SOIL ARSENIC CONCENTRATIONS IN SAMPLES COLLECTED BY STS
(mg/kg)

●	<200
●	200 - 1,000
●	> 1,000
⁄⁄	FENCE
▭	CAPPED AREA

NOTES

1. ARSENIC CONCENTRATIONS AND SAMPLE LOCATIONS FOR HISTORICAL SAMPLES FROM STS CONSULTANTS.



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FEET

1 " EQUALS 200 '
1:2,400

PROJECT:	WISCONSIN DEPARTMENT OF NATURAL RESOURCES KEWAUNEE MARSH		
SHEET TITLE:	JUNE 2006 SOIL SAMPLE LOCATIONS		
DRAWN BY: HANKLEY C	SCALE: AS NOTED	PROJ. NO. 00-07201.05	
CHECKED BY: SELLWOOD A		FILE NO. 72010506.mxd	
APPROVED BY: STANFORTH B	DATE PRINTED: 8/3/2007	FIGURE 9	
DATE: AUGUST 2007			

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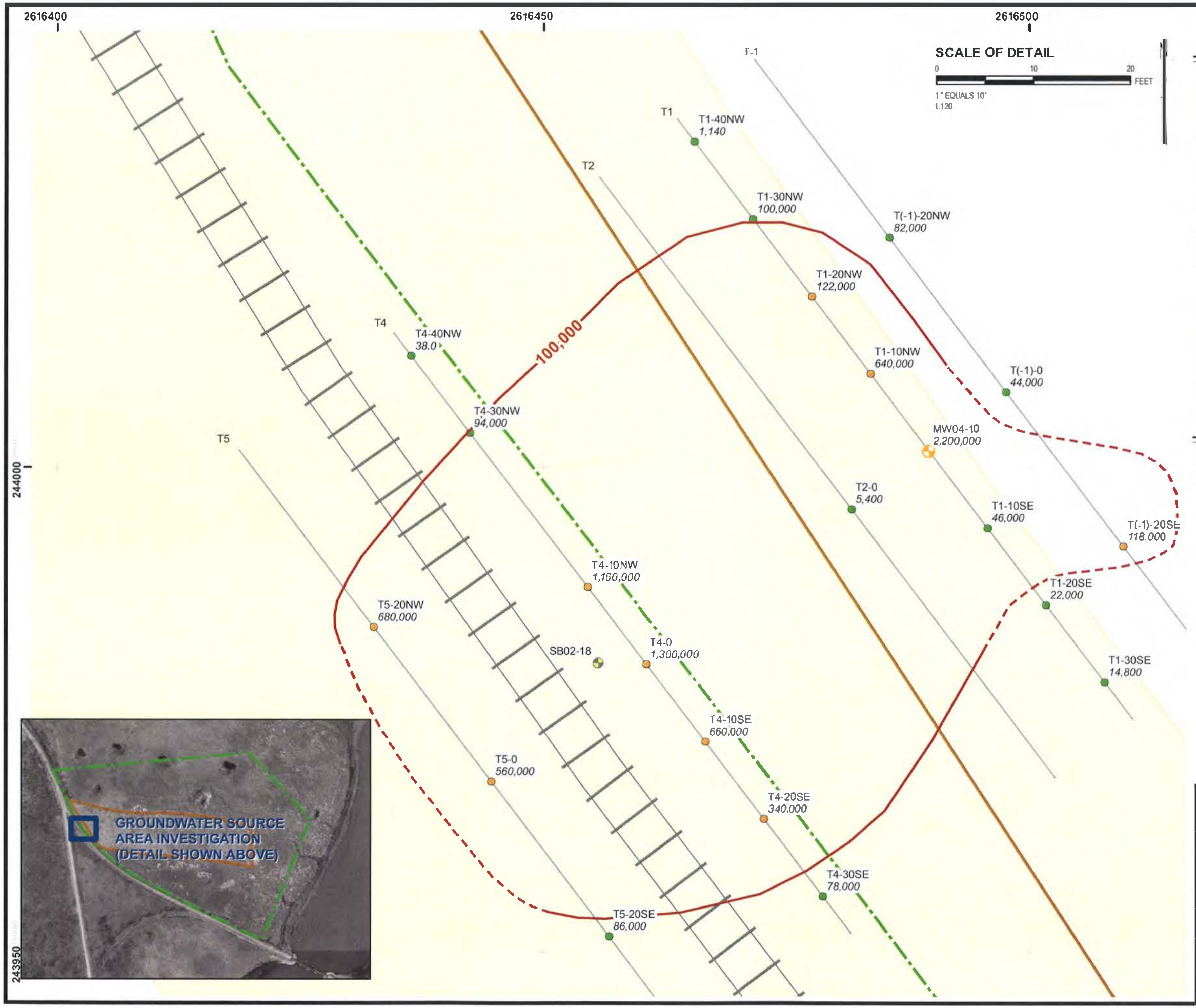


LEGEND

◐ SOIL BORING (STS HISTORICAL SAMPLE LOCATION)

⊕ MONITORING WELL LOCATION

— ARSENIC ISOCONCENTRATION (100,000 µg/L)
DASHED WHERE INFERRED

RMT TEMPORARY WELL LOCATION (APRIL 2007)
(ARSENIC CONCENTRATION COLOR CODE)

● < 100,000 µg/L

● > 100,000 µg/L

(*94,000* ARSENIC CONCENTRATION IN ug/L)

— INVESTIGATION TRANSECTS

FENCE

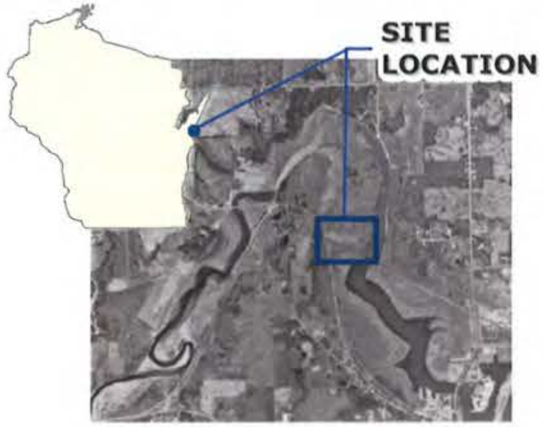
CAPPED AREA

RAILROAD TRACKS

RAILROAD RIGHT OF WAY (50')

NOTES

1. LOCATION OF MW04-10 AND SB02-18 FROM STS CONSULTANTS.
2. GROUNDWATER SAMPLES COLLECTED ALONG TRANSECTS PARALLEL TO RAILROAD BED. TRANSECTS NUMBERED IN REFERENCE TO MW04-10 AND DISTANCE IN FEET TO THE NW OR SE FROM MW04-10 ALONG THE TRANSECT.



PROJECT:	WISCONSIN DEPARTMENT OF NATURAL RESOURCES KEWAUNEE MARSH		
SHEET TITLE:	APRIL 2007 GROUNDWATER SOURCE AREA INVESTIGATION		
DRAWN BY: HANKLEY C	SCALE: AS NOTED	PROJ. NO.	00-07201.05
CHECKED BY: SELLWOOD A		FILE NO.	72010507.mxd
APPROVED BY: STANFORTH B	DATE PRINTED: 8/6/2007	FIGURE 10	
DATE: AUGUST 2007			

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FIGURE 11: Arsenic Conc vs Cation Concentration in Groundwater
April 2007

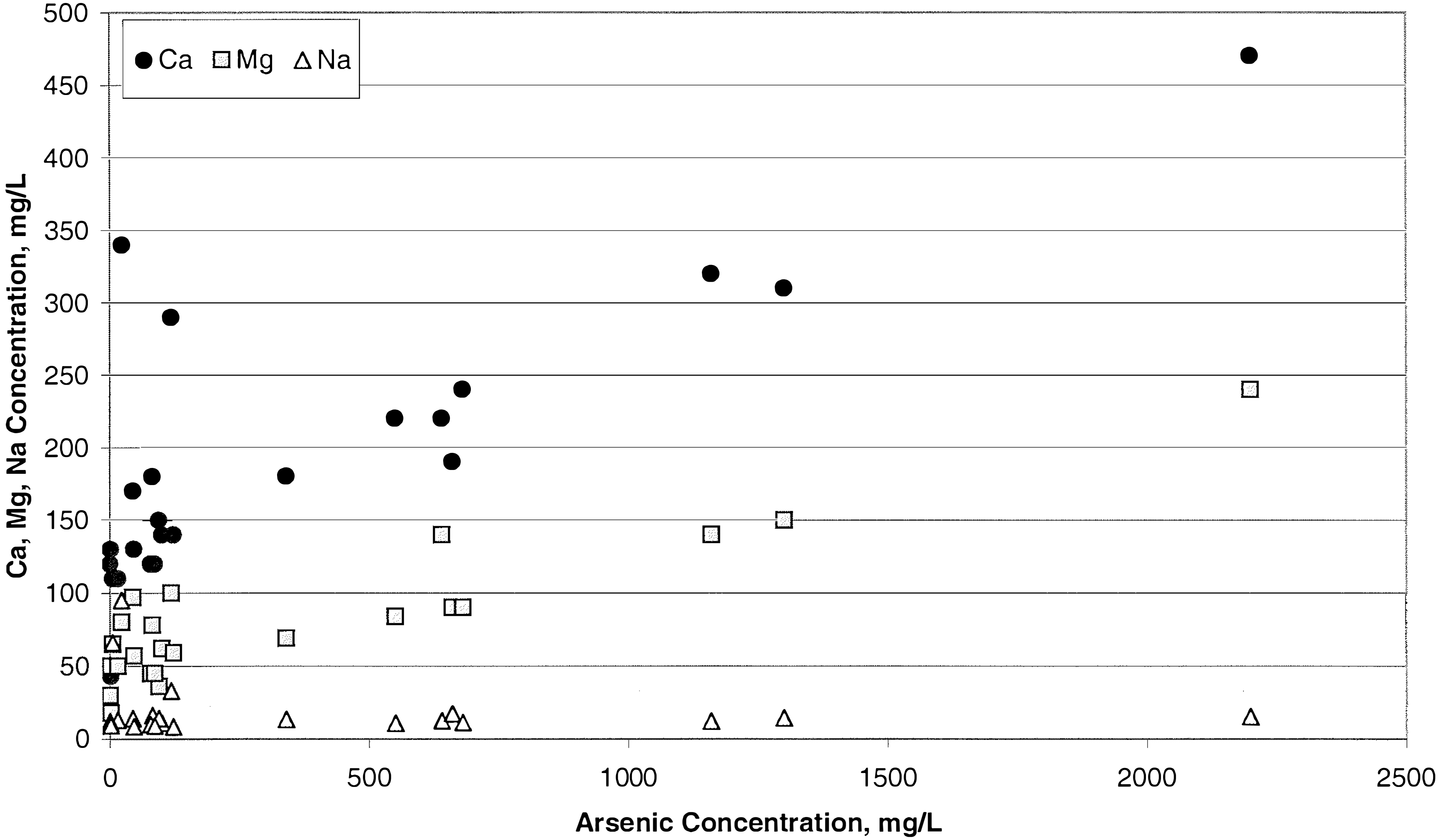

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FIGURE 12: Arsenic vs Cation Concentration in Groundwater (mequiv/L)
April 2007

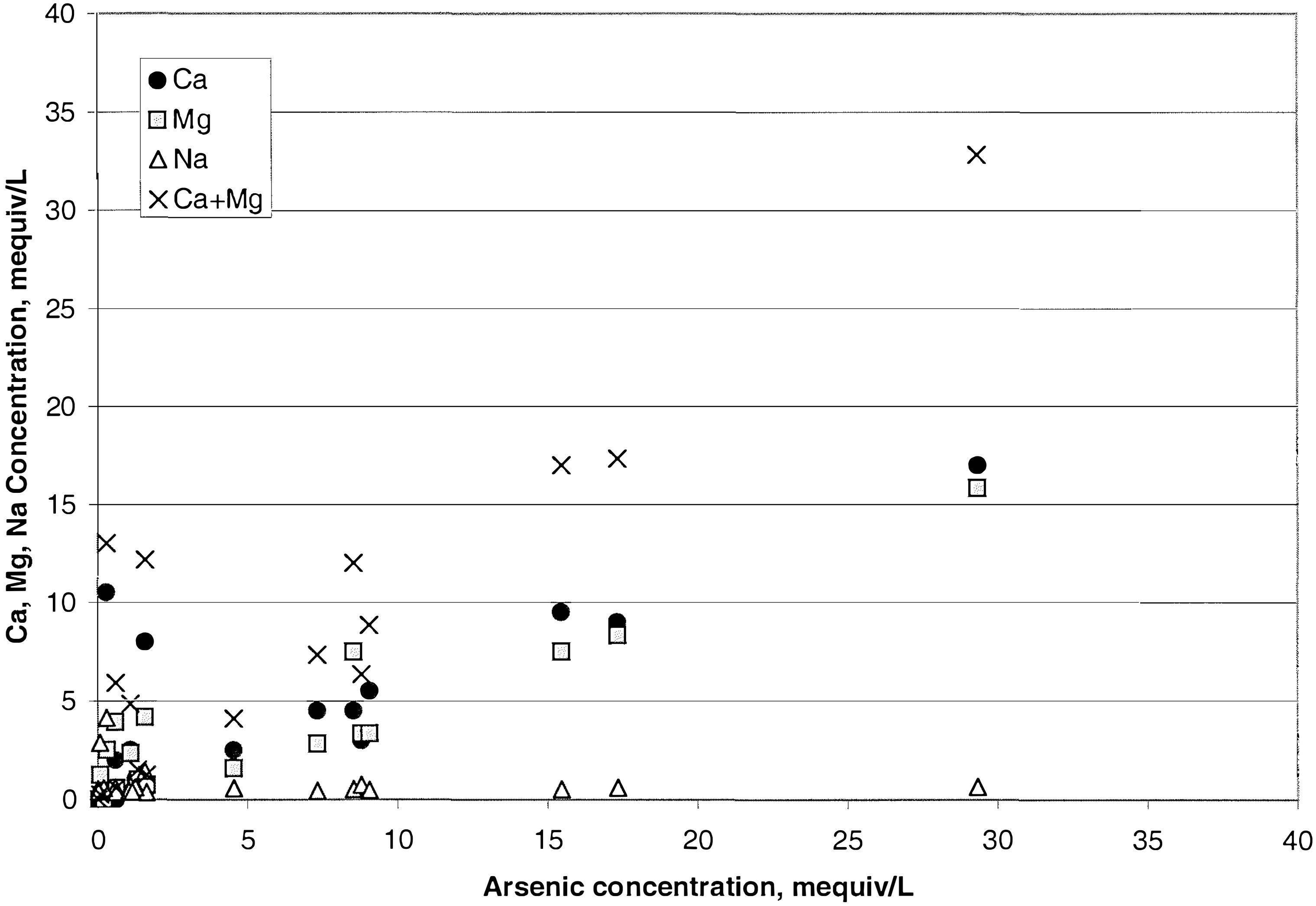

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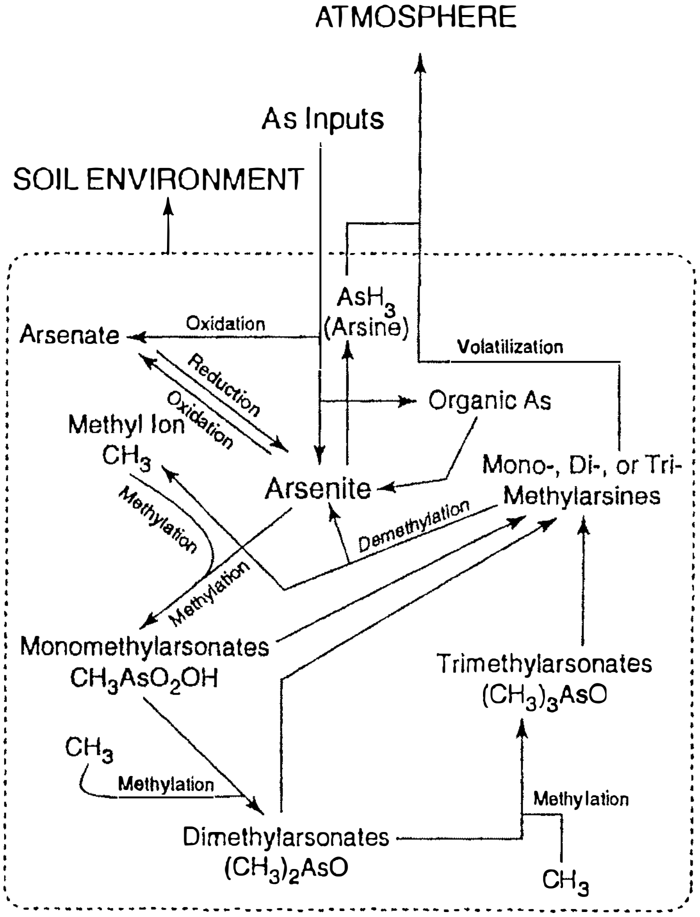
Figure 13
Biological Transformations of Arsenic in Soil



From Frankenberger, W.T. Jr. and M. Arshad. Volatilization of Arsenic In *Environmental Chemistry of Arsenic.* W.T. Frankenberger, Jr. Marcel Dekker, Inc. 2002. pg 365.

FIGURE 14: SPLP-Site Groundwater Dose Response: High Arsenic Sample

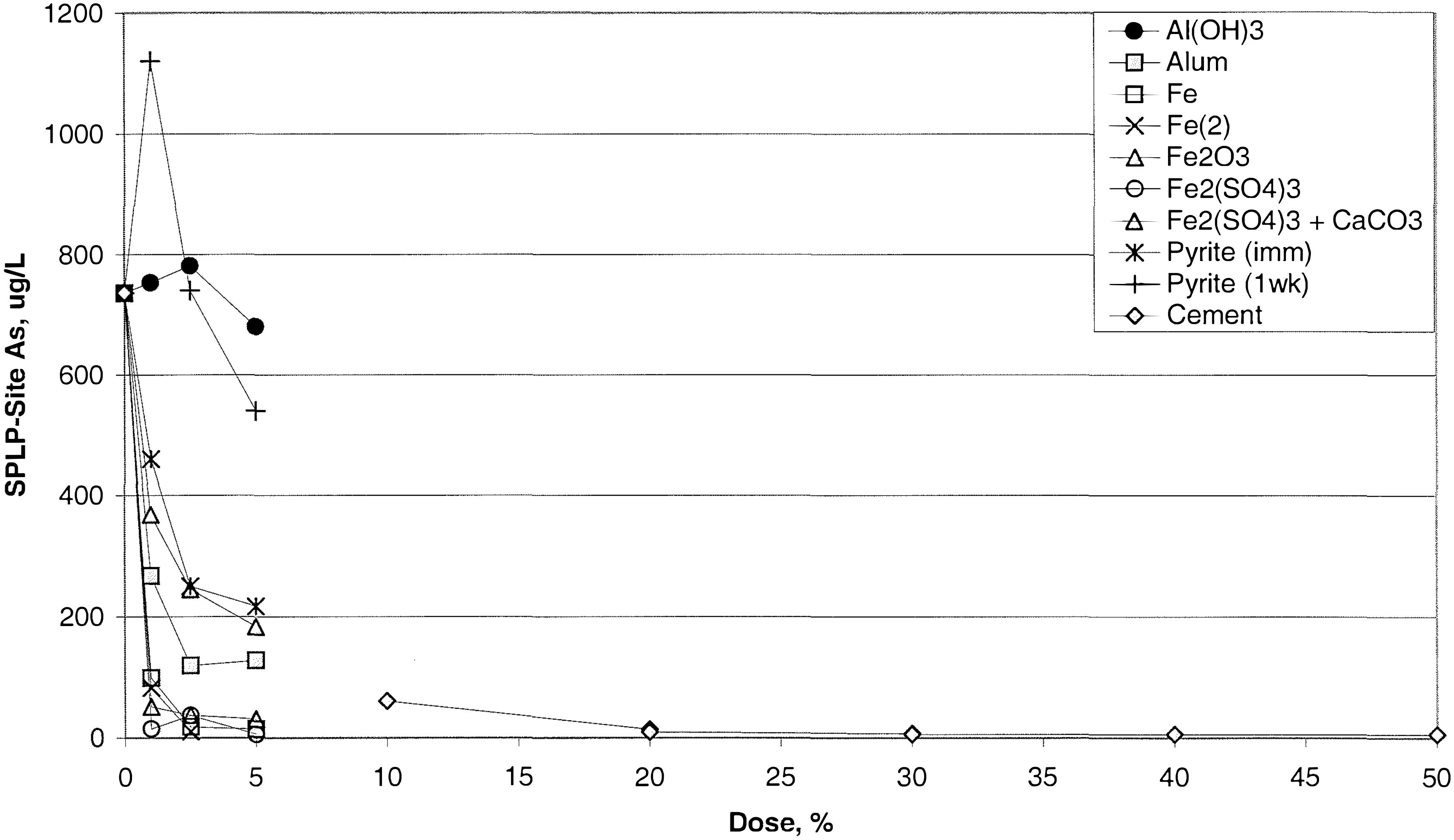


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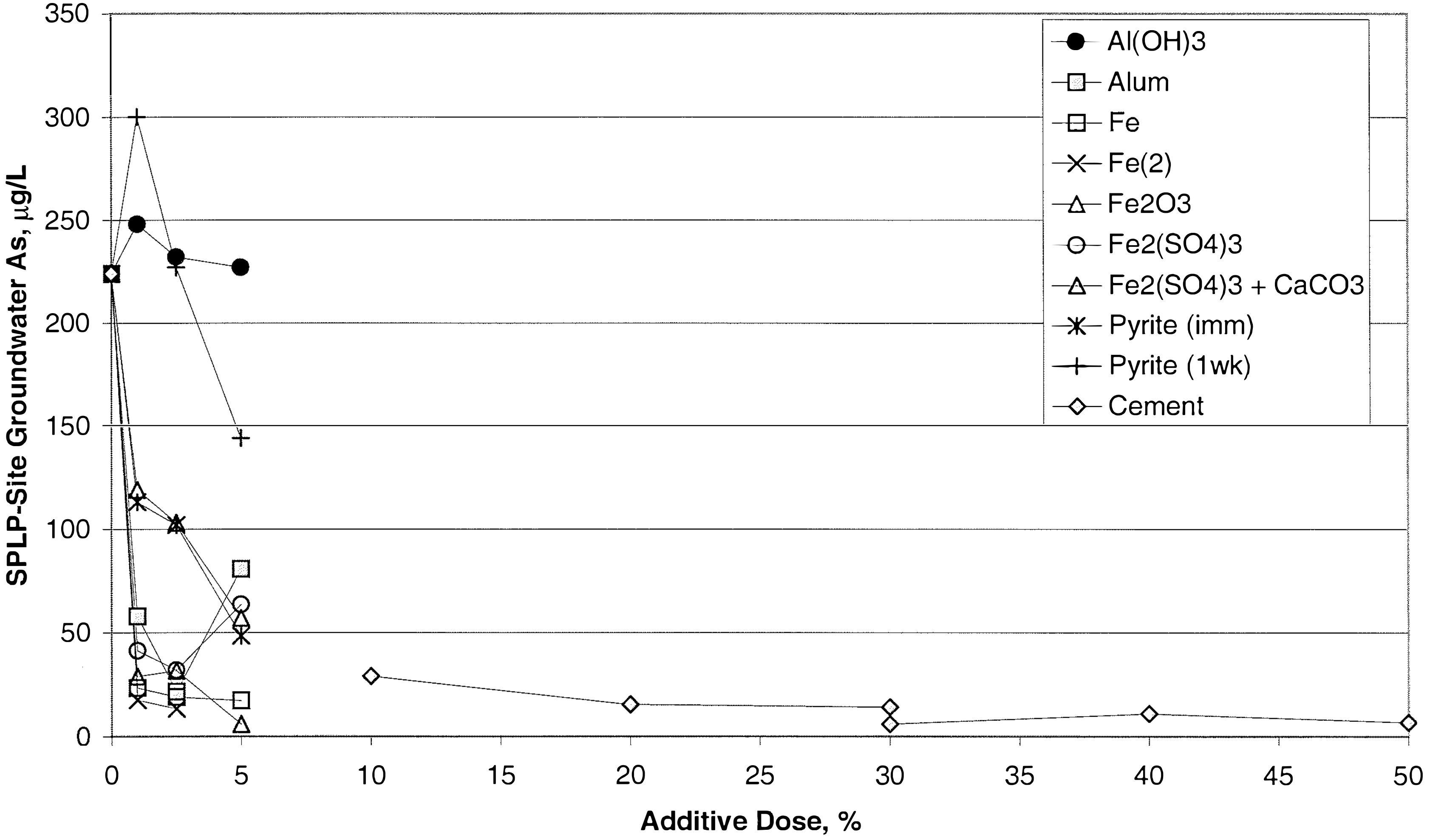
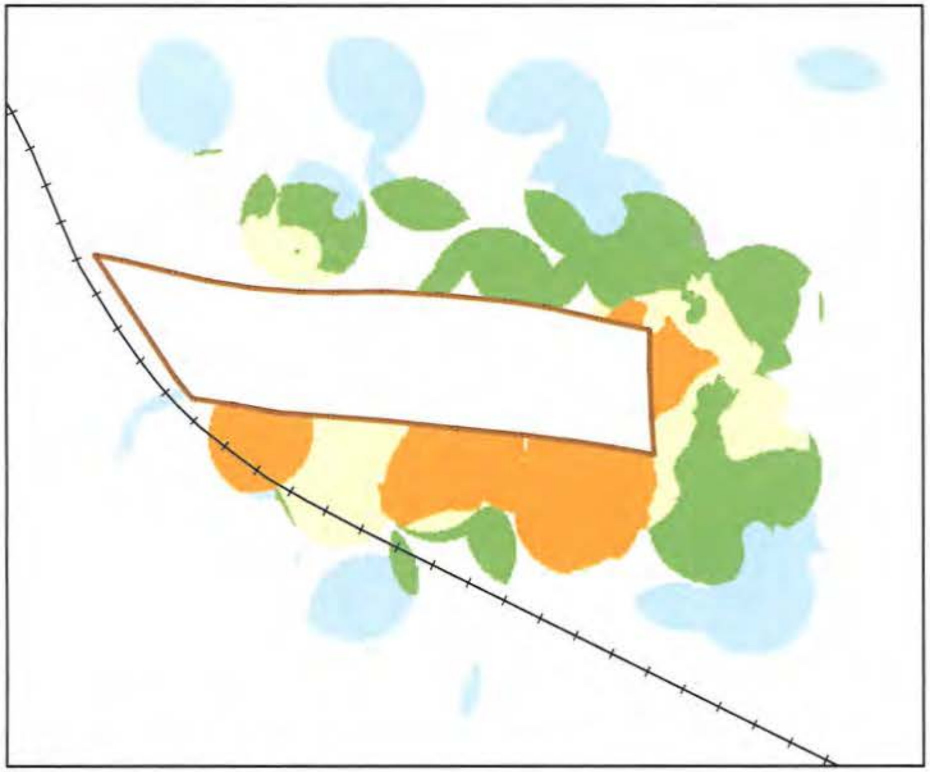
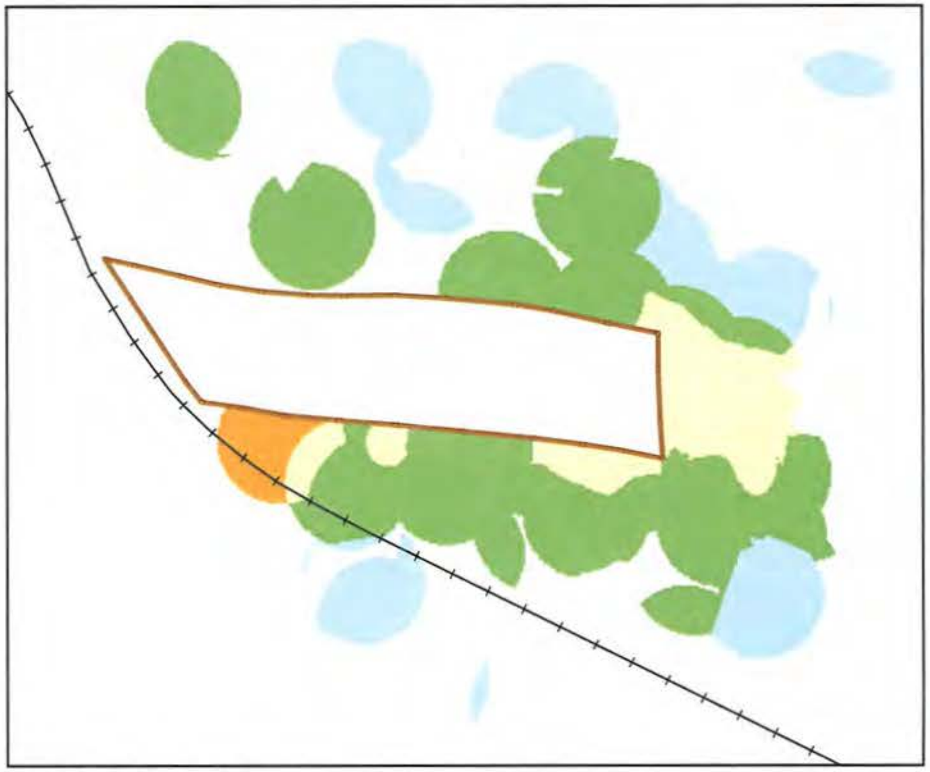
FIGURE 15: SPLP-Site Groundwater Dose-Response Results: Moderate Arsenic Composite





Pre-Cap (1994, 1995, 1996 samples)



Post-Cap (2002 samples)

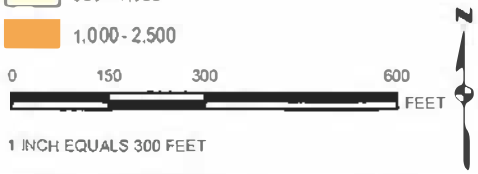
LEGEND

▭ CAP PERIMETER

+—+ RAILROAD TRACKS

INTERPOLATED As CONCENTRATIONS

🟦	0 - 100
🟩	100 - 500
🟨	500 - 1,000
🟧	1,000 - 2,500



1 INCH EQUALS 300 FEET

	SUM of all Cells (mg/Kg)	Mass(Kg)
Pre Cap	21,997,100	6.705
Post Cap	12,291,400	3.746
	Reduction:	**56%**

The model environment is comprised of 1 m^2 cells. The model assigns an interpolated concentration of to each cell. Assuming a 1 foot thickness, then the volume associated with each cell is 0.304804 m^3 (1/3.2808). Assuming a bulk density of 1 kg/l for the soil at the site, and applying unit conversions, multiply the value of each cell by 3.05E-04 to obtain the mass of As (in Kg) for each cell. Summing these results will provide total mass. Alternatively multiplying the sum of all the concentrations by 3.05E-04 would arrive at the same result.

Interpolation performed using Inverse Distance Weighting with the following settings:

- Power: 2
- Search Radius: Variable
  - Number of Nearest Points in Search Radius used for interpolation: 12
  - Maximum Distance for Search Radius: 30.480371 m (100 ft)

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Fax: 608-831-3021

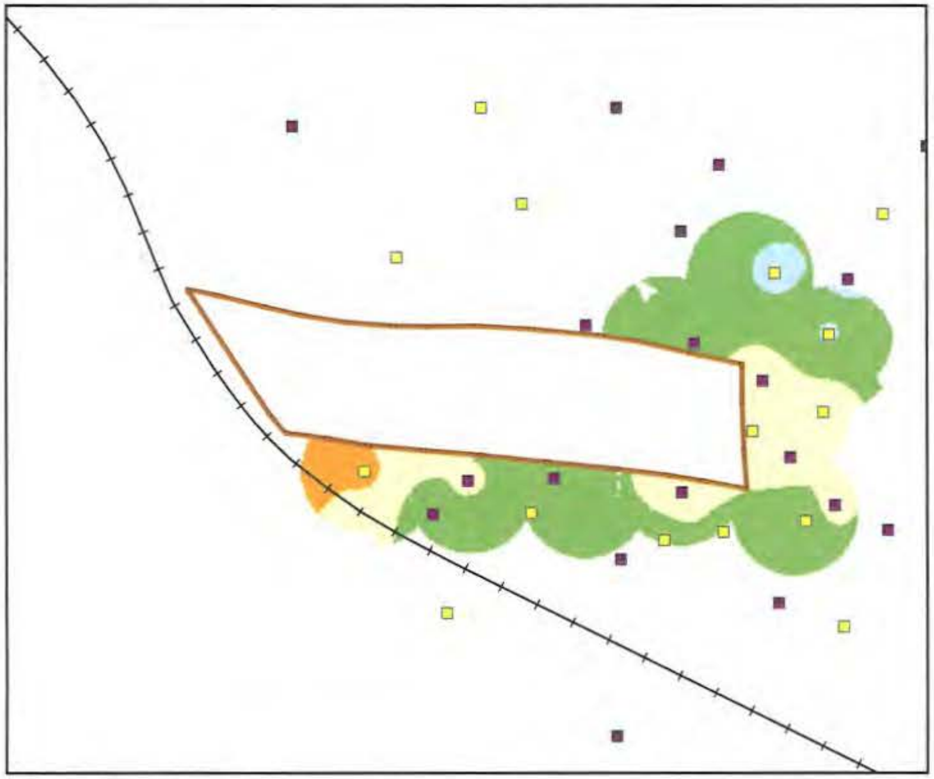
CALCULATION OF ARSENIC MASS IN AREA OUTSIDE THE CAP PERIMETER

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
KEWAUNEE MARSH

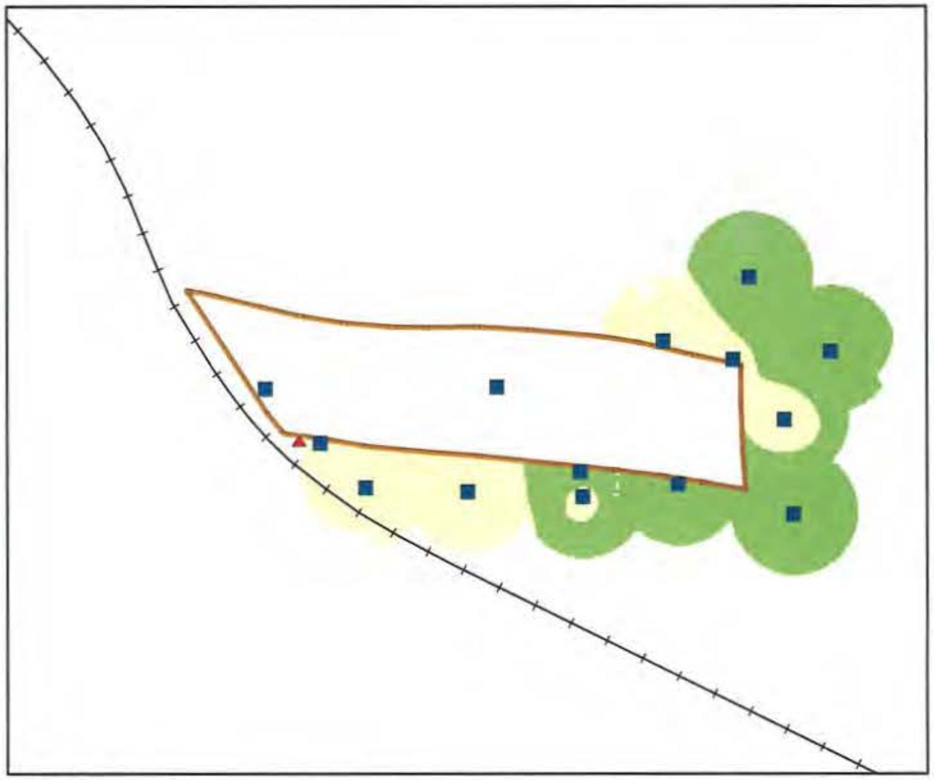
DRAWN BY:	HANKLEY C
APPROVED BY:	STANFORTH B
PROJ. NO.:	00-07201.05
FILE NO.:	Base.mxd
DATE:	AUGUST 2007

D:\07201\03\GIS\GRIDs\AsModeling\Base.mxd 8/6/2007 13:07:11

FIGURE 16



Post-Cap (2002 samples)



2004/2005 Samples

LEGEND

POST CAP (STS) SAMPLES

- ▢ JULY 2002
- ■ NOVEMBER 2002
- ■ RMT, NOVEMBER 2005
- ▲ STS, APRIL 2004
- ▭ CAP PERIMETER

INTERPOLATED As CONCENTRATIONS (MG/KG)

- 🟦 0 - 100
- 🟩 100 - 500
- ⬜ 500 - 1,000
- 🟧 1,000 - 2,500
- +—+ RAILROAD TRACKS

0 150 300 600

FEET

N

1 INCH EQUALS 300 FEET

	SUM of all Cells (mg/Kg)	Mass (Kg)
Pre Cap	8,591,420	2,619
Post Cap	8,221,170	2,506
	Reduction:	**4%**

The model environment is comprised of 1 m^2 cells. The model assigns an interpolated concentration of to each cell. Assuming a 1 foot thickness, then the volume associated with each cell is 0.304804 m^3 (1/3.2808). Assuming a bulk density of 1 kg/l for the soil at the site, and applying unit conversions, multiply the value of each cell by 3.05E-04 to obtain the mass of As (in Kg) for each cell. Summing these results will provide total mass. Alternatively multiplying the sum of all the concentrations by 3.05E-04 would arrive at the same result.

Interpolation performed using Inverse Distance Weighting with the following settings:

Power: 2
Search Radius: Variable
Number of Nearest Points in Search Radius used for interpolation: 12
Maximum Distance for Search Radius: 30.48 m (100 ft)

RMT

744 Heartland Trail
Madison, WI 53717 - 1934

P.O. Box 8923
Madison, WI 53708 - 8923
Phone: 608-831-4444
Fax: 608-831-3021

CALCULATION OF ARSENIC MASS IN AREA OUTSIDE THE CAP PERIMETER (TIME INTERVAL 2)

WISCONSIN DEPARTMENT OF NATURAL RESOURCES KEWAUNEE MARSH

DRAWN BY:	HANKLEY C
APPROVED BY:	STANFORTH B
PROJ. NO.:	00-07201.05
FILE NO.:	Base2.mxd
D TE:	AUGUST 2007

D:\07201\03\GIS\GRIDs\AsModeling\Base2.mxd 8/6/2007 13:24:23

FIGURE 17

Figure 18
Gas Generation From Treated Marsh Solids in Bioreductant Test 1

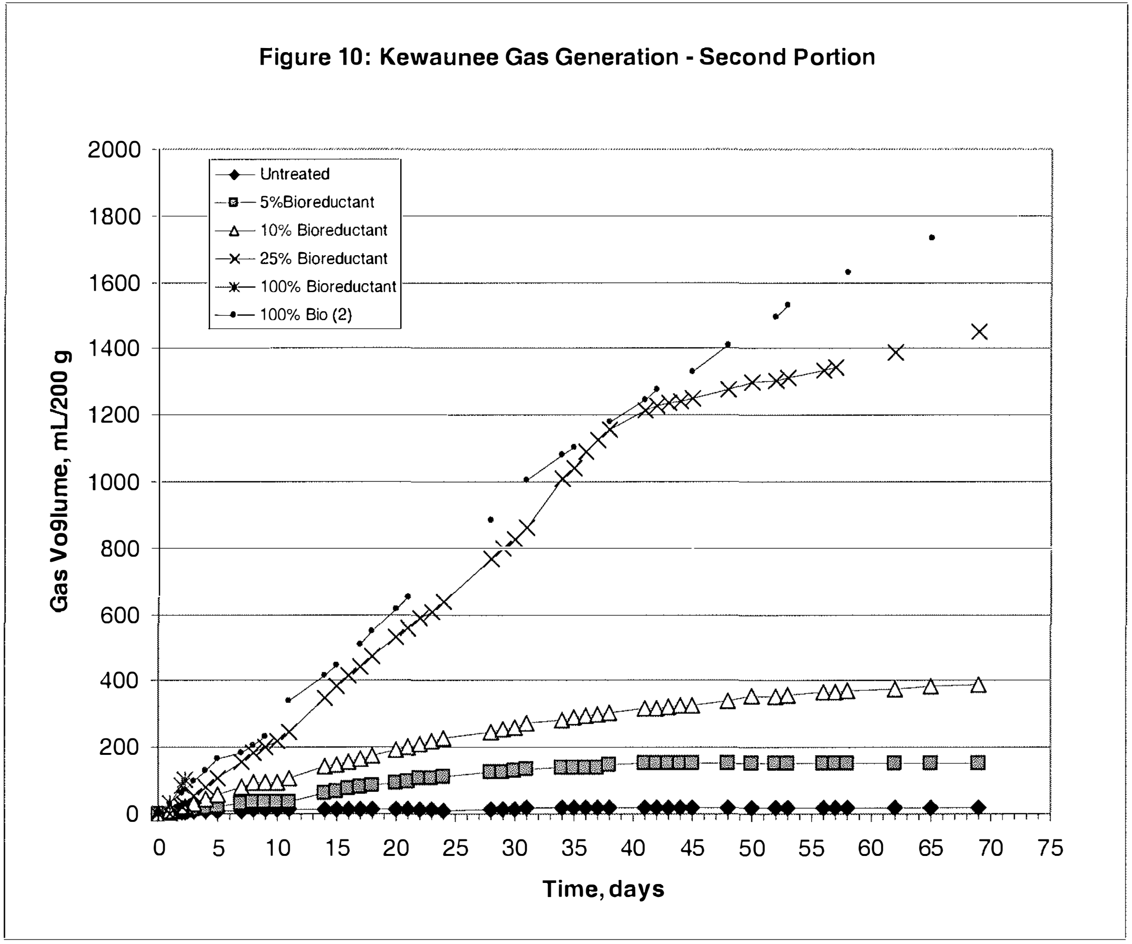


Figure 19
Gas Generation From Treated Marsh Solids in Bioreductant Test 2

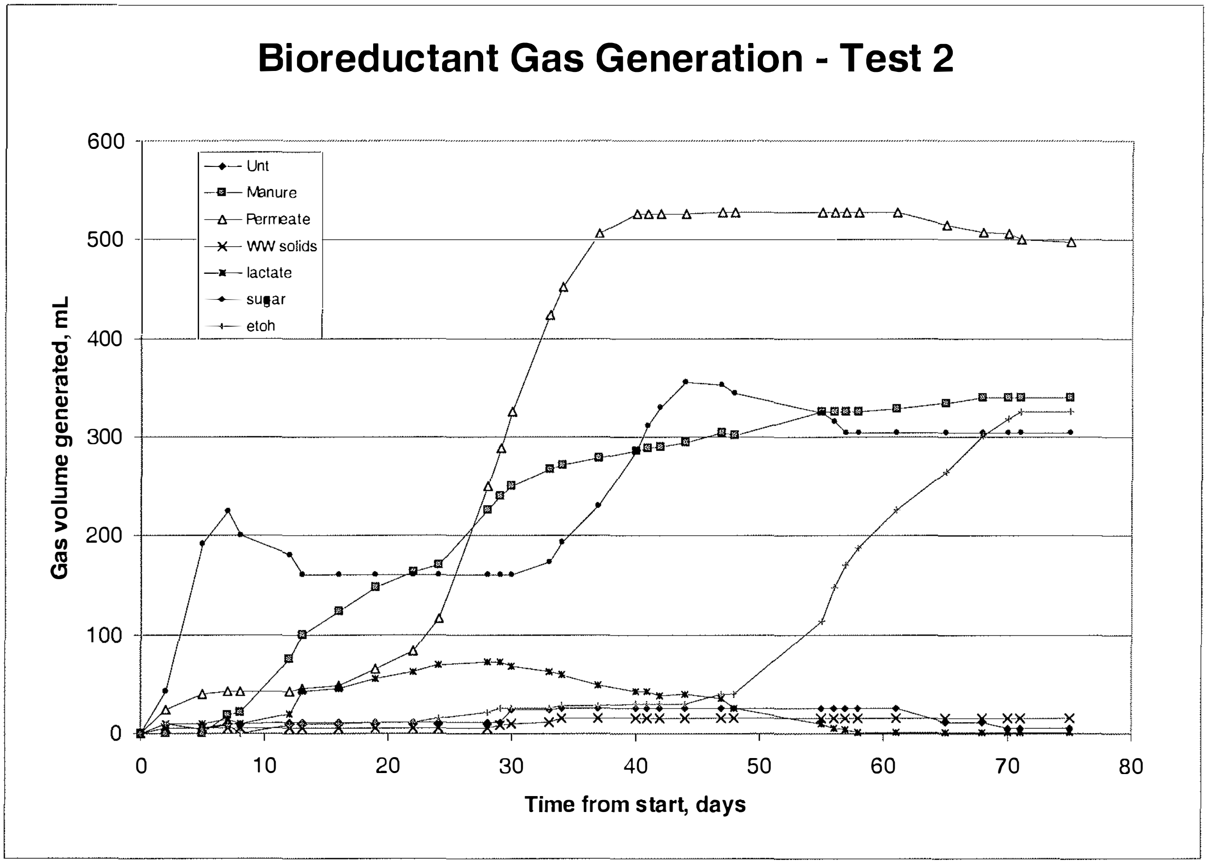
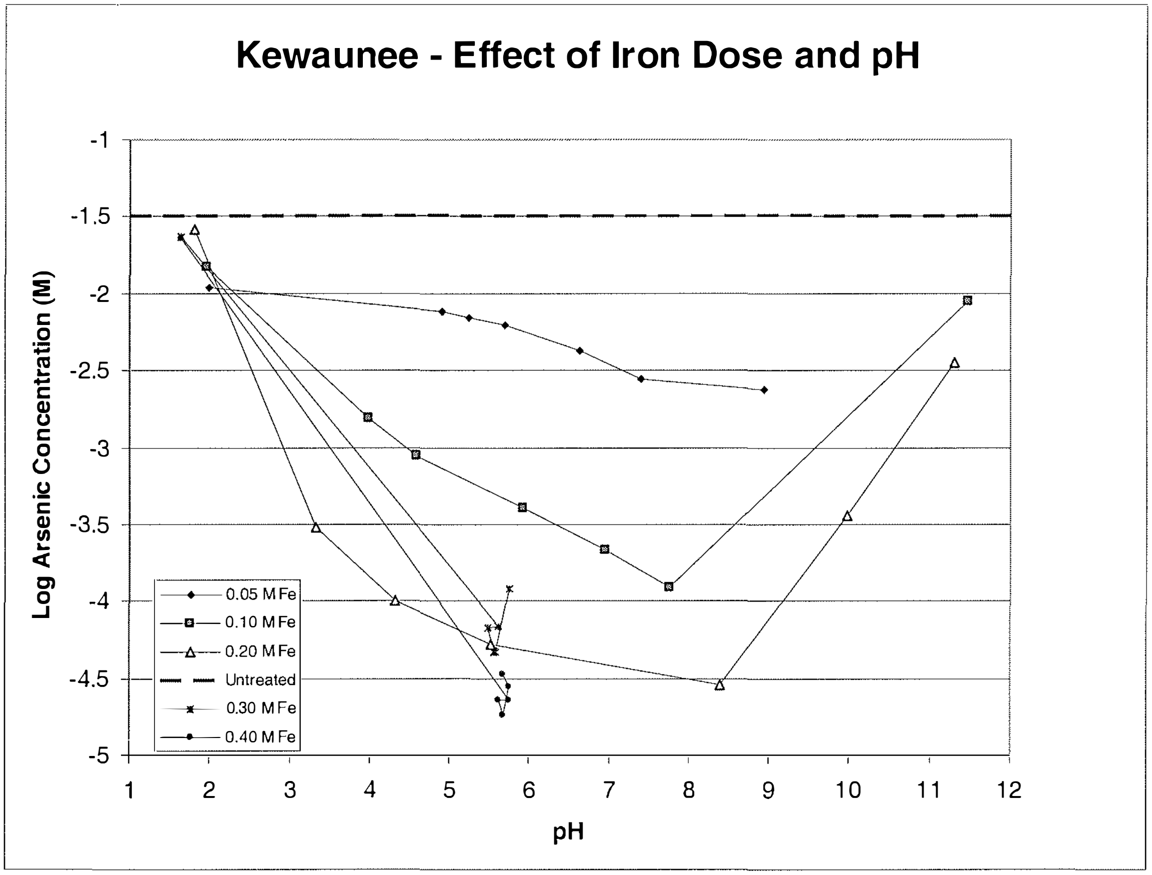
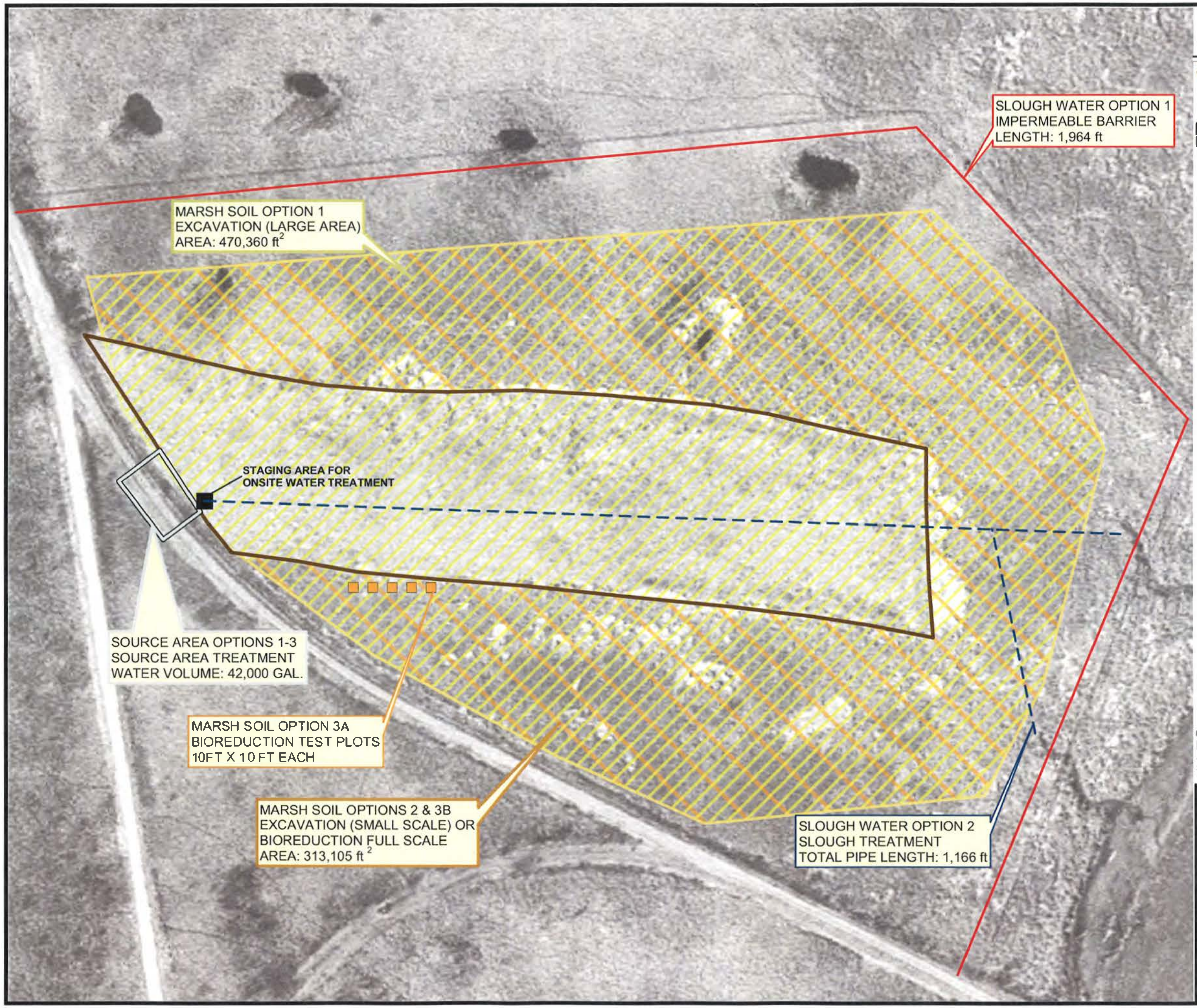


Figure 20
Log Arsenic Concentration vs. pH Plot for MW04-10 Groundwater Treated With Various Doses of Iron





LEGEND

CAP AREA

SOURCE AREA

SOURCE AREA TREATMENT - OPTIONS 1-3

MARSH SOIL

EXCAVATION (LARGE AREA) - OPTION 1

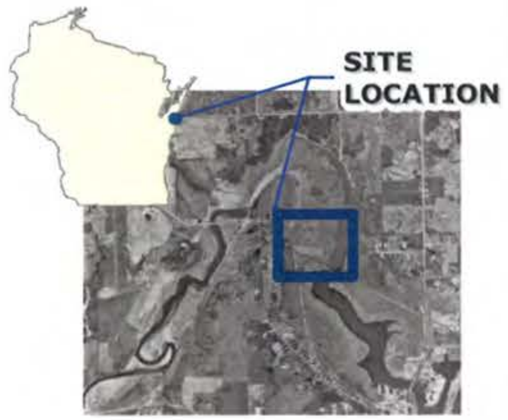
EXCAVATION (SMALL AREA) OR BIOREDUCTION FULL SCALE - OPTIONS 2& 3B

🟧 BIOREDUCTION TEST PLOTS - OPTION 3A

SLOUGH WATER

IMPERMEABLE BARRIER - OPTION 1

– – ON-SITE TREATMENT - OPTION 2



0 100 200 FEET

1 " EQUALS 100 '
1:1,200

PROJECT:
WISCONSIN DEPARTMENT OF NATURAL RESOURCES
KEWAUNEE MARSH

SHEET TITLE:
REMEDIAL OPTIONS ANALYSIS

DRAWN BY:	PAPEZ J	SCALE:		PROJ. NO.	00-007201.05
CHECKED BY:	SELLWOOD A		AS NOTED	FILE NO.	72010501.mxd
APPROVED BY:	STANFORTH B	DATE PRINTED:		**FIGURE 21**	
DATE:	AUGUST 2007		8/3/2007		

RMT

744 Heartland Trail
Madison, WI 53717-1934

P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

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Appendix A
Lake Michigan Hydrograph and Water Level Data

Average Water Level for Lake Michigan/Huron

Data from USACE Web site (www.lre.usace.army.mil)
IGLD = International Great Lakes Datum

P:\7201\05\Lake Level Hydrograph.xls 8/6/2007

DETROIT DISTRICT

United States Army Corps of Engineers

Return To The Previous Page

Great Lakes Water Level Table for Lake Michigan/Huron

Lake Michigan/Huron: 1945-2006
(Meters, IGLD 1985)

Historic Great Lakes Water Levels

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1945	176.36	176.33	176.36	176.45	176.55	176.72	176.78	176.74	176.70	176.66	176.62	176.57
1946	176.56	176.57	176.65	176.70	176.70	176.75	176.77	176.69	176.60	176.49	176.42	176.32
1947	176.28	176.28	176.25	176.39	176.57	176.72	176.80	176.81	176.77	176.72	176.65	176.56
1948	176.48	176.42	176.47	176.61	176.72	176.73	176.72	176.67	176.57	176.40	176.32	176.26
1949	176.20	176.19	176.19	176.26	176.31	176.34	176.38	176.34	176.22	176.14	176.02	175.94
1950	175.96	175.99	176.02	176.17	176.27	176.34	176.42	176.44	176.43	176.40	176.34	176.35
1951	176.34	176.34	176.41	176.58	176.75	176.82	176.91	176.93	176.92	176.93	176.95	176.95
1952	176.95	176.96	176.96	177.08	177.17	177.22	177.26	177.28	177.22	177.06	176.94	176.92
1953	176.85	176.82	176.83	176.91	177.00	177.07	177.12	177.11	177.02	176.92	176.81	176.74
1954	176.63	176.60	176.64	176.71	176.83	176.92	176.96	176.94	176.90	176.98	176.95	176.89
1955	176.83	176.78	176.76	176.82	176.88	176.91	176.88	176.79	176.64	176.54	176.46	176.38
1956	176.31	176.30	176.32	176.37	176.50	176.57	176.62	176.62	176.56	176.45	176.37	176.29
1957	176.22	176.19	176.17	176.20	176.28	176.35	176.43	176.38	176.33	176.24	176.21	176.16
1958	176.15	176.13	176.12	176.14	176.12	176.12	176.15	176.11	176.07	175.98	175.91	175.81
1959	175.75	175.75	175.79	175.92	176.06	176.11	176.12	176.12	176.10	176.10	176.13	176.12
1960	176.14	176.16	176.14	176.24	176.50	176.64	176.72	176.77	176.73	176.64	176.57	176.48
1961	176.38	176.31	176.33	176.36	176.42	176.44	176.46	176.45	176.43	176.38	176.32	176.24
1962	176.20	176.17	176.19	176.26	176.34	176.37	176.36	176.32	176.26	176.17	176.06	175.97
1963	175.89	175.85	175.85	175.94	176.02	176.06	176.04	176.03	175.98	175.90	175.80	175.71
1964	175.63	175.59	175.58	175.61	175.74	175.76	175.78	175.77	175.76	175.70	175.65	175.62
1965	175.60	175.62	175.67	175.77	175.94	176.00	176.02	176.04	176.07	176.10	176.07	176.09
1966	176.10	176.08	176.13	176.20	176.26	176.30	176.28	176.24	176.17	176.08	176.01	176.08
1967	176.07	176.07	176.06	176.23	176.35	176.45	176.50	176.48	176.40	176.34	176.34	176.32
1968	176.29	176.30	176.27	176.35	176.40	176.47	176.55	176.58	176.60	176.57	176.50	176.48
1969	176.47	176.47	176.45	176.54	176.70	176.82	176.94	176.95	176.86	176.78	176.73	176.64

1970	176.59	176.56	176.53	176.58	176.68	176.76	176.80	176.78	176.77	176.73	176.69	176.67
1971	176.63	176.62	176.68	176.76	176.86	176.94	176.96	176.96	176.90	176.84	176.76	176.75
1972	176.73	176.65	176.65	176.72	176.88	176.93	176.99	177.05	177.07	177.03	177.00	176.96
1973	176.98	176.95	176.98	177.10	177.20	177.30	177.30	177.29	177.21	177.13	177.04	177.00
1974	176.95	176.97	177.00	177.07	177.19	177.28	177.32	177.26	177.15	177.04	176.98	176.91
1975	176.87	176.86	176.87	176.92	177.06	177.14	177.15	177.10	177.07	176.95	176.87	176.82
1976	176.76	176.75	176.87	177.02	177.11	177.15	177.15	177.08	176.95	176.80	176.64	176.51
1977	176.42	176.38	176.44	176.56	176.57	176.55	176.56	176.54	176.53	176.50	176.50	176.51
1978	176.48	176.45	176.43	176.51	176.61	176.67	176.69	176.68	176.71	176.70	176.62	176.54
1979	176.51	176.48	176.54	176.71	176.88	176.95	176.98	177.00	176.96	176.88	176.83	176.81
1980	176.78	176.72	176.68	176.77	176.84	176.90	176.93	176.93	176.90	176.82	176.72	176.65
1981	176.59	176.56	176.60	176.67	176.75	176.80	176.82	176.81	176.80	176.73	176.66	176.59
1982	176.51	176.46	176.45	176.56	176.62	176.66	176.69	176.69	176.65	176.62	176.60	176.67
1983	176.67	176.66	176.68	176.76	176.90	177.02	177.02	176.98	176.93	176.87	176.77	176.74
1984	176.70	176.70	176.72	176.81	176.91	177.01	177.06	177.04	177.02	176.96	176.93	176.88
1985	176.88	176.86	176.98	177.14	177.24	177.25	177.23	177.19	177.20	177.16	177.19	177.20
1986	177.14	177.11	177.12	177.23	177.28	177.33	177.39	177.39	177.38	177.50	177.38	177.26
1987	177.18	177.10	177.06	177.07	177.06	177.07	177.04	176.99	176.90	176.79	176.70	176.68
1988	176.63	176.60	176.57	176.67	176.70	176.67	176.61	176.57	176.48	176.42	176.43	176.42
1989	176.38	176.33	176.32	176.41	176.44	176.56	176.57	176.54	176.47	176.34	176.27	176.18
1990	176.15	176.16	176.19	176.27	176.35	176.44	176.51	176.49	176.45	176.41	176.39	176.39
1991	176.36	176.31	176.33	176.48	176.60	176.66	176.64	176.59	176.48	176.40	176.38	176.40
1992	176.38	176.36	176.38	176.44	176.53	176.52	176.54	176.53	176.52	176.49	176.52	176.54
1993	176.54	176.51	176.48	176.58	176.70	176.82	176.91	176.88	176.83	176.76	176.70	176.64
1994	176.57	176.56	176.59	176.63	176.70	176.72	176.82	176.81	176.78	176.71	176.66	176.59
1995	176.53	176.49	176.47	176.49	176.58	176.64	176.63	176.64	176.55	176.46	176.44	176.41
1996	176.37	176.39	176.39	176.46	176.63	176.76	176.83	176.84	176.82	176.80	176.79	176.77
1997	176.79	176.82	176.89	176.95	177.07	177.13	177.19	177.16	177.12	177.02	176.89	176.78
1998	176.74	176.71	176.74	176.89	176.91	176.90	176.88	176.80	176.68	176.55	176.44	176.36
1999	176.27	176.28	176.24	176.25	176.28	176.34	176.40	176.36	176.24	176.14	176.04	175.99
2000	175.92	175.87	175.90	175.92	176.00	176.10	176.13	176.13	176.09	175.98	175.89	175.81
2001	175.77	175.78	175.78	175.85	175.95	176.06	176.05	176.03	176.01	176.03	176.05	176.05
2002	175.99	175.95	175.99	176.06	176.19	176.29	176.33	176.32	176.24	176.14	176.01	175.91
2003	175.82	175.75	175.73	175.82	175.92	176.00	176.04	176.02	175.94	175.87	175.89	175.90
2004	175.87	175.84	175.90	175.98	176.12	176.31	176.37	176.33	176.28	176.15	176.10	176.08
2005	176.08	176.10	176.10	176.14	176.19	176.21	176.19	176.17	176.09	176.00	175.93	175.88
2006	175.88	175.92	175.93	176.01	176.09	176.14	176.14	176.13	176.04	175.99	175.94	175.98

NOTICE: All data contained herein is preliminary in nature and therefore subject to change. The data is for general information purposes ONLY and SHALL NOT be used in technical applications such as, but not limited to, studies or designs. All critical data should be obtained from and verified by the United States Army Corps of Engineers, Detroit District, Engineering and Technical Services, Great Lakes Hydraulics and Hydrology Office, 477 Michigan Ave., Detroit, MI 48226. The United States of America assumes no liability for the completeness or accuracy of the data contained herein and any use of such data inconsistent with this disclaimer shall be solely at the risk of the user.

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508 Bobby APPROVED

Appendix B
Laboratory Reports

Table of Contents

November 2005 Samples

1241 Bellevue Street, Suite 9
Green Bay, WI 54302
920-469-2436, Fax: 920-469-8827

Analytical Report Number: 872615

Client: RMT - MADISON
Lab Contact: Tod Noltemeyer
Project Name: KEWAUNEE
Project Number: 7201.02

Lab Sample Number	Field ID	Matrix	Collection Date
872615-001	T-1 0512017	SED	06/01/06
872615-002	T-3 0512018	SED	06/01/06
872615-003	T-5 0512019	SED	06/01/06
872615-004	T-6 0512020	SED	06/01/06
872615-005	T-7 0512021	SED	06/01/06
872615-006	T-8 0512022	SED	06/01/06
872615-007	T-9 0512023	SED	06/01/06
872615-008	T-10 0512024	SED	06/01/06
872615-009	T-10A 0512025	SED	06/01/06
872615-010	T-10B 0512026	SED	06/01/06
872615-011	T-11 0512027	SED	06/01/06
872615-012	T-12 0512028	SED	06/01/06
872615-013	T-14 0512029	SED	06/01/06
872615-014	T-15 0512030	SED	06/01/06
872615-015	T-16 0512031	SED	06/01/06
872615-016	T-17 0512032	SED	06/01/06

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and Laboratory Standard Operating Procedure. Exceptions, if any, are discussed in the accompanying sample comments. Release of this final report is authorized by Laboratory management, as is verified by the following signature. This report shall not be reproduced, except in full, without the written consent of Pace Analytical Services, Inc. The sample results relate only to the analytes of interest tested.

Approval Signature

6/15/06
Date

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-1 0512017

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-001

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	2500	4.8	16		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	92000	57	190		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	6400	28	95		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	17.6				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	830	66	220		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	630000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	590000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	710000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	440000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	760000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	61.3			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Pace Analytical Services, Inc.

Analytical Report Number: 872615

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-3 0512018

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-002

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	900	4.6	15		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	33000	54	180		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	5300	27	91		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	18.4				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	680	48	160		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	380000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	300000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	390000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	280000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	560000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	61.3			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

All soil results are reported on a dry weight basis unless otherwise noted.

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201 02
Field ID : T-5 0512019

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-003

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	720	7.1	24		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	58000	85	280		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	7400	43	140		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	11.7				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1400	66	220		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	350000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	570000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	270000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	240000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	310000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	61.9			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

All soil results are reported on a dry weight basis unless otherwise noted.

Pace Analytical Services, Inc.

Analytical Report Number: 872615

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client :	RMT - MADISON	**Matrix Type :**	SEDIMENT
Project Name :	KEWAUNEE	**Collection Date :**	06/01/06
Project Number :	7201 02	**Report Date :**	06/14/06
Field ID :	T-6 0512020	**Lab Sample Number :**	872615-004

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	240	4.3	14		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	61000	51	170		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	8200	25	85		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	19.6				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1100	45	150		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	480000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	320000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	530000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	760000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	320000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	42.0			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

All soil results are reported on a dry weight basis unless otherwise noted.

Pace Analytical Services, Inc.

Analytical Report Number: 872615

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-7 0512021

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-005

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	86	2.7	9.0		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	35000	32	110		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	10000	16	54		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	31.1				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1300	26	88		1	mg/kg		06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	380000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	520000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	410000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	360000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	230000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	26.8			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

All soil results are reported on a dry weight basis unless otherwise noted.

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-8 0512022

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-006

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	140	6.0	20		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	34000	71	240		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	6500	36	120		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	14.0				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1200	57	190		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	560000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	610000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	570000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	540000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	500000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	75.9			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Pace Analytical Services, Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Analytical Report Number: 872615

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201 02
Field ID : T-9 0512023

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-007

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	660	5.8	19		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	22000	69	230		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	5000	35	120		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	14.4				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1300	100	330		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	640000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	630000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	630000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	790000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	520000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	79 1			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

All soil results are reported on a dry weight basis unless otherwise noted.

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-10 0512024

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-008

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	760	11	38		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	30000	140	450		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	5600	68	230		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	7.35				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1600	120	390		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	490000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	310000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	380000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	490000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	780000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	80.2			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Client :	RMT - MADISON	**Matrix Type :**	SEDIMENT
Project Name :	KEWAUNEE	**Collection Date :**	06/01/06
Project Number :	7201.02	**Report Date :**	06/14/06
Field ID :	T-10A 0512025	**Lab Sample Number :**	872615-009

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	590	9.7	32		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	26000	120	390		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	4600	58	190		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	8.64				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	2100	130	450		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	510000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	440000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	440000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	520000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	650000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	83.1			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-10B 0512026

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-010

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	850	9.5	32		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	38000	110	380		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	6700	56	190		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	8.86				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1700	79	260		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	430000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	510000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	410000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	340000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	440000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	82.7			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Pace Analytical Services, Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Analytical Report Number: 872615

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-11 0512027

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-011

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	670	10	34		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	87000	120	400		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	16000	60	200		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	8.29				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	2600	110	380		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	290000	24000	80000		1	mg/kg	*	06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	350000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	170000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	400000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	260000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	53.5			1.00	1	%	*	06/06/06	EPA 160.4	EPA 160.4

All soil results are reported on a dry weight basis unless otherwise noted.

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Pace Analytical Services, Inc.

Analytical Report Number: 872615

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-12 0512028

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-012

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	570	7.4	25		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	25000	88	290		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	5700	44	150		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	11.3				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	2200	76	250		1	mg/kg		06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	340000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	430000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	410000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	320000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	220000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	60.6			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

All soil results are reported on a dry weight basis unless otherwise noted.

Pace Analytical Services, Inc.

Analytical Report Number: 872615

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-14 0512029

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-013

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	110	7.8	26		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	24000	93	310		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	6100	46	150		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	10.8				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1900	90	300		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	450000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	440000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	390000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	400000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	570000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	79.3			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

All soil results are reported on a dry weight basis unless otherwise noted.

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-15 0512030

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-014

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	120	14	47		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	15000	170	560		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	2900	84	280		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	5.93				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1600	200	650		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	480000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	460000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	540000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	570000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	360000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	88.6			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Pace Analytical Services, Inc.

Analytical Report Number: 872615

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-16 0512031

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-015

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	490	6.2	21		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	44000	74	250		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	8500	37	120		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	13.5				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	980	38	130		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	460000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	730000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	250000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	500000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	350000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	70.9			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

All soil results are reported on a dry weight basis unless otherwise noted.

Client : RMT - MADISON
Project Name : KEWAUNEE
Project Number : 7201.02
Field ID : T-17 0512032

Matrix Type : SEDIMENT
Collection Date : 06/01/06
Report Date : 06/14/06
Lab Sample Number : 872615-016

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	520	13	42		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	24000	150	500		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	4900	76	250		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	6.62				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1400	120	390		1	mg/kg	A	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	410000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	350000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	350000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	520000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	410000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	79.9			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Lab Number	TestGroupID	Field ID	Comment
872615	W-TPO4-S	All Samples	A - Analyte is detected in the method blank at a concentration of 4.0 mg/kg for samples 001-004, 006-011 and 013-016.
872615-011	W-TOCQA-S	T-11 0512027	* - Duplicate analyses not within control limits.

Qualifier Codes

Flag	Applies To	Explanation
A	Inorganic	Analyte is detected in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
B	Inorganic	The analyte has been detected between the method detection limit and the reporting limit.
B	Organic	Analyte is present in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
C	All	Elevated detection limit.
D	All	Analyte value from diluted analysis or surrogate result not applicable due to sample dilution.
E	Inorganic	Estimated concentration due to matrix interferences. During the metals analysis the serial dilution failed to meet the established control limits of 0-10%. The sample concentration is greater than 50 times the IDL for analysis done on the ICP or 100 times the IDL for analysis done on the ICP-MS. The result was flagged with the E qualifier to indicate that a physical interference was observed.
E	Organic	Analyte concentration exceeds calibration range.
F	Inorganic	Due to potential interferences for this analysis by Inductively Coupled Plasma techniques (SW-846 Method 6010), this analyte has been confirmed by and reported from an alternate method.
F	Organic	Surrogate results outside control criteria.
G	All	The result is estimated because the concentration is less than the lowest calibration standard concentration utilized in the initial calibration. The method detection limit is less than the reporting limit specified for this project.
H	All	Preservation, extraction or analysis performed past holding time.
HF	Inorganic	This test is considered a field parameter, and the recommended holding time is 15 minutes from collection. The analysis was performed in the laboratory beyond the recommended holding time.
J	All	Concentration detected equal to or greater than the method detection limit but less than the reporting limit.
K	Inorganic	Sample received unpreserved. Sample was either preserved at the time of receipt or at the time of sample preparation.
K	Organic	Detection limit may be elevated due to the presence of an unrequested analyte.
L	All	Elevated detection limit due to low sample volume.
M	Organic	Sample pH was greater than 2
N	All	Spiked sample recovery not within control limits.
O	Organic	Sample received overweight.
P	Organic	The relative percent difference between the two columns for detected concentrations was greater than 40%.
Q	All	The analyte has been detected between the limit of detection (LOD) and limit of quantitation (LOQ). The results are qualified due to the uncertainty of analyte concentrations within this range.
S	Organic	The relative percent difference between quantitation and confirmation columns exceeds internal quality control criteria. Because the result is unconfirmed, it has been reported as a non-detect with an elevated detection limit.
U	All	The analyte was not detected at or above the reporting limit.
V	All	Sample received with headspace.
W	All	A second aliquot of sample was analyzed from a container with headspace.
X	All	See Sample Narrative.
Z	Organics	This compound was separated in the check standard but it did not meet the resolution criteria as set forth in SW846.
&	All	Laboratory Control Spike recovery not within control limits.
*	All	Precision not within control limits.
+	Inorganic	The sample result is greater than four times the spike level: therefore, the percent recovery is not evaluated.
<	All	The analyte was not detected at or above the reporting limit.
1	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses passed QC based on precision criteria.
2	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses failed QC based on precision criteria.
3	Inorganic	BOD result is estimated due to the BOD blank exceeding the allowable oxygen depletion.
4	Inorganic	BOD duplicate precision not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
5	Inorganic	BOD result is estimated due to insufficient oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
6	Inorganic	BOD laboratory control sample not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
7	Inorganic	BOD result is estimated due to complete oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.

Analysis Summary by Laboratory

Test Group Name	872615-001	872615-002	872615-003	872615-004	872615-005	872615-006	872615-007	872615-008	872615-009	872615-010	872615-011	872615-012	872615-013	872615-014	872615-015	872615-016
ARSENIC	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
CALCIUM	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
IRON	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
PERCENT SOLIDS	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
PHOSPHORUS, TOTAL	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
SOLIDS, TOTAL VOLATILE	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
TOC AS NPOC, QUAD + AVERAGE	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K

Code	Facility	Address	WI Certification
B	Green Bay Lab (Bellevue St)	1241 Bellevue Street, Suite 9 Green Bay, WI 54302	405132750 / DATCP: 105-444
K	Kimberly Laboratory	1090 Kennedy Ave. Kimberly, WI 54136	445134030

Pace Analytical Services, Inc.

QC Summary

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
Fax: 920-469-8827

Batch:	872615
Lab Section:	WETCHEM
QC Batch Number:	11817
Prep Method:	EPA M365.4
Analytical Method:	EPA M365.4

QC Type	Client Sample ID	Lab Sample ID
MB	WCG1888-032MB	WCG1888-032MB
LCS	WCG1888-032MBLCS	WCG1888-032MBLCS
MS	T-17 0512032MS	872615-016MS
MS	T-10 0512024MS	872615-008MS
MSD	T-17 0512032MSD	872615-016MSD
MSD	T-10 0512024MSD	872615-008MSD

Client Sample ID	Lab Sample ID	MB ID	Client Sample ID	Lab Sample ID	MB ID
T-1 0512017	872615-001	MB	T-3 0512018	872615-002	MB
T-5 0512019	872615-003	MB	T-6 0512020	872615-004	MB
T-7 0512021	872615-005	MB	T-8 0512022	872615-006	MB
T-9 0512023	872615-007	MB	T-10 0512024	872615-008	MB
T-10A 0512025	872615-009	MB	T-10B 0512026	872615-010	MB
T-11 0512027	872615-011	MB	T-12 0512028	872615-012	MB
T-14 0512029	872615-013	MB	T-15 0512030	872615-014	MB
T-16 0512031	872615-015	MB	T-17 0512032	872615-016	MB

Test Name	Method Blank Result Conc	LCS Spiked Conc	LCS Recovery			LCSD Spiked Conc	LCSD Recovery			LCS/ LCSD RPD		LCS/LCSD Control Limits			Parent Sample Number	Parent Result Conc	MS Spiked Conc	MS Recovery			MSD Spiked Conc	MSD Recovery			MS/ MSD RPD		MS/MSD Control Limits		
			Conc	%	C		Conc	%	C	%	C	LCL %	UCL %	RPD %				Conc	%	C		Conc	%	C	%	C	LCL %	UCL %	RPD %
Phosphorus	20	500.00	499.3	99.9		---	---	---		---		79	125	20	872615-008	1634.2	3887.3	5191.1	91.5		3887.3	4911.4	84.3		5.5		54	139	20
Phosphorus	20	500.00	499.3	99.9		---	---	---		---		79	125	20	872615-016	1353.3	3873.3	5691.8	112.0		3873.3	5901.6	117.4		3.6		54	139	20

Conc = mg/kg unless otherwise noted
C = QC Code, see Qualifer Sheet
Parent Result is reported down to MDL in order to allow Validation of this worksheet
The %R and RPD results are calculated from raw data values with more significant figures than are reported on this form.

Report Date: 6/29/2006
QC Batch Number: 11817

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Pace Analytical Services, Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
Fax: 920-469-8827

QC Summary

Batch: 872615
Lab Section: WETCHEM
QC Batch Number: 11819
Prep Method: EPA 160.4
Analytical Method: EPA 160.4

QC Type	Client Sample ID	Lab Sample ID
MB	WCG1892-062MB	WCG1892-062MB
LCS	WCG1892-062MBLCS	WCG1892-062MBLCS
DUP	T-11 0512027DUP	872615-011DUP
DUP	T-1 0512017DUP	872615-001DUP

Client Sample ID	Lab Sample ID	MB ID	Client Sample ID	Lab Sample ID	MB ID
T-1 0512017	872615-001	MB	T-3 0512018	872615-002	MB
T-5 0512019	872615-003	MB	T-6 0512020	872615-004	MB
T-7 0512021	872615-005	MB	T-8 0512022	872615-006	MB
T-9 0512023	872615-007	MB	T-10 0512024	872615-008	MB
T-10A 0512025	872615-009	MB	T-10B 0512026	872615-010	MB
T-11 0512027	872615-011	MB	T-12 0512028	872615-012	MB
T-14 0512029	872615-013	MB	T-15 0512030	872615-014	MB
T-16 0512031	872615-015	MB	T-17 0512032	872615-016	MB

Test Name	Method Blank Result Conc	LCS Spiked Conc	LCS Recovery			LCSD Spiked Conc	LCSD Recovery			LCS/ LCSD RPD		LCS/LCSD Control Limits			Parent Sample Number	Parent Result Conc	MS Spiked Conc	MS Recovery			MSD Spiked Conc	MSD Recovery			MS/ MSD RPD		MS/MSD Control Limits		
			Conc	%	C		Conc	%	C	%	C	LCL %	UCL %	RPD %				Conc	%	C		Conc	%	C	%	C	LCL %	UCL %	RPD %
Total Volatile Solids	< 1	100.0	100	100.0		---	---	---		---		80	120	20	872615-001	61.27	---	---	---		---	---	---		---		---	---	---
Total Volatile Solids	< 1	100.0	100	100.0		---	---	---		---		80	120	20	872615-011	53.45	---	---	---		---	---	---		---		---	---	---

Conc = % unless otherwise noted
C = QC Code, see Qualifer Sheet
Parent Result is reported down to MDL in order to allow Validation of this worksheet
The %R and RPD results are calculated from raw data values with more significant figures than are reported on this form.

Report Date: 6/29/2006
QC Batch Number: 11819

Pace Analytical Services, Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
Fax: 920-469-8827

QC Summary

Batch: 872615
Lab Section: METALS
QC Batch Number: 11833
Prep Method: SW846 3050B
Analytical Method: SW846 6010B

QC Type	Client Sample ID	Lab Sample ID
MB	MBSMTG1912-39	MBSMTG1912-39
LCS	LCSSMTG1912-39	LCSSMTG1912-39
MS	872577-018MS	872577-018MS
MSD	872577-018MSD	872577-018MSD

Client Sample ID	Lab Sample ID	MB ID	Client Sample ID	Lab Sample ID	MB ID
T-1 0512017	872615-001	MB	T-3 0512018	872615-002	MB
T-5 0512019	872615-003	MB	T-6 0512020	872615-004	MB
T-7 0512021	872615-005	MB	T-8 0512022	872615-006	MB
T-9 0512023	872615-007	MB	T-10 0512024	872615-008	MB
T-10A 0512025	872615-009	MB	T-10B 0512026	872615-010	MB
T-11 0512027	872615-011	MB	T-12 0512028	872615-012	MB
T-14 0512029	872615-013	MB	T-15 0512030	872615-014	MB
T-16 0512031	872615-015	MB	T-17 0512032	872615-016	MB

Test Name		Method Blank Result Conc	LCS Spiked Conc	LCS Recovery			LCSD Spiked Conc	LCSD Recovery			LCS/ LCSD RPD		LCS/LCSD Control Limits			Parent Sample Number		Parent Result Conc	MS Spiked Conc	MS Recovery			MSD Spiked Conc	MSD Recovery			MS/ MSD RPD		MS/MSD Control Limits		
				Conc	%	C		Conc	%	C	%	C	LCL %	UCL %	RPD %					Conc	%	C		Conc	%	C	%	C	LCL %	UCL %	RPD %
Arsenic	<	0.84	50.0	47.6	95.2		---	---	---		---		80	120	20	872577-018		1.72	55.0	51.1	89.8		55.0	53	93.1		3.5		75	125	20
Calcium		13	500.00	491.9	98.4		---	---	---		---		80	120	20	872577-018		1749.3	550.36	1863.8	20.8	N	550.36	2013.1	47.9	N	7.7		75	125	20
Iron		5.5	500	504	100.8		---	---	---		---		80	120	20	872577-018		1.5E+7	550000	2.5e+007	1910.1	+	550000	2.2e+007	1374.0	+	12.4		75	125	20

Conc = mg/Kg unless otherwise noted
C = QC Code, see Qualifer Sheet
Parent Result is reported down to MDL in order to allow Validation of this worksheet
The %R and RPD results are calculated from raw data values with more significant figures than are reported on this form.

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Pace Analytical Services, Inc.

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
Fax: 920-469-8827

QC Summary

Batch: 872615
Lab Section: WETCHEM-K
QC Batch Number: 11960
Prep Method: SW846 9060
Analytical Method: SW846 9060

QC Type	Client Sample ID	Lab Sample ID
MB	WCK0927-012MB	WCK0927-012MB
LCS	WCK0927-012MBLCS	WCK0927-012MBLCS
MS	T-3 0512018MS	872615-002MS
MSD	T-3 0512018MSD	872615-002MSD

Client Sample ID	Lab Sample ID	MB ID	Client Sample ID	Lab Sample ID	MB ID
T-1 0512017	872615-001	MB	T-3 0512018	872615-002	MB
T-5 0512019	872615-003	MB	T-6 0512020	872615-004	MB
T-7 0512021	872615-005	MB	T-8 0512022	872615-006	MB
T-9 0512023	872615-007	MB	T-10 0512024	872615-008	MB
T-10A 0512025	872615-009	MB	T-10B 0512026	872615-010	MB

Test Name	Method Blank Result Conc		LCS Spiked Conc	LCS Recovery			LCSD Spiked Conc	LCSD Recovery			LCS/LCSD RPD		LCS/LCSD Control Limits			Parent Sample Number	Parent Result Conc	MS Spiked Conc	MS Recovery			MSD Spiked Conc	MSD Recovery			MS/MSD RPD		MS/MSD Control Limits		
				Conc	%	C		Conc	%	C	%	C	LCL %	UCL %	RPD %				Conc	%	C		Conc	%	C	%	C	LCL %	UCL %	RPD %
TOC as NPOC Avg of Reps	<	60	1000	972.9	97.3		---	---	---		---		80	120	10	872615-002	380000	200000	570000	93.0		200000	630000	123.6		10.2		50	150	30
TOC as NPOC Replicate 1	<	60	---	---	---		---	---	---		---		---	---	---	872615-002	300000	---	---	---		---	---	---		---		---	---	---
TOC as NPOC Replicate 2	<	60	---	---	---		---	---	---		---		---	---	---	872615-002	390000	---	---	---		---	---	---		---		---	---	---
TOC as NPOC Replicate 3	<	60	---	---	---		---	---	---		---		---	---	---	872615-002	280000	---	---	---		---	---	---		---		---	---	---
TOC as NPOC Replicate 4	<	60	---	---	---		---	---	---		---		---	---	---	872615-002	560000	---	---	---		---	---	---		---		---	---	---

Conc = mg/kg unless otherwise noted
C = QC Code, see Qualifer Sheet
Parent Result is reported down to MDL in order to allow Validation of this worksheet
The %R and RPD results are calculated from raw data values with more significant figures than are reported on this form.

Report Date: 6/29/2006
QC Batch Number: 11960

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Pace Analytical Services, Inc.

QC Summary

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
Fax: 920-469-8827

Batch: 872615
Lab Section: WETCHEM-K
QC Batch Number: 11979
Prep Method: SW846 9060
Analytical Method: SW846 9060

QC Type	Client Sample ID	Lab Sample ID
MB	WCK0927-013MB	WCK0927-013MB
LCS	WCK0927-013MBLCS	WCK0927-013MBLCS
MS	T-11 0512027MS	872615-011MS
MSD	T-11 0512027MSD	872615-011MSD

Client Sample ID	Lab Sample ID	MB ID	Client Sample ID	Lab Sample ID	MB ID
T-11 0512027	872615-011	MB	T-12 0512028	872615-012	MB
T-14 0512029	872615-013	MB	T-15 0512030	872615-014	MB
T-16 0512031	872615-015	MB	T-17 0512032	872615-016	MB

Test Name		Method Blank Result	LCS Spiked	LCS Recovery			LCSD Spiked	LCSD Recovery			LCS/ LCSD RPD		LCS/LCSD Control Limits			Parent Sample Number	Parent Result	MS Spiked	MS Recovery			MSD Spiked	MSD Recovery			MS/ MSD RPD		MS/MSD Control Limits		
		Conc	Conc	Conc	%	C	Conc	Conc	%	C	%	C	LCL %	UCL %	RPD %		Conc	Conc	Conc	%	C	Conc	Conc	%	C	%	C	LCL %	UCL %	RPD %
TOC as NPOC Avg of Reps	<	60	1000	964.2	96.4		---	---	---		---		80	120	10	872615-011	290000	200000	430000	70.5		200000	590000	147.2		30.0		50	150	30
TOC as NPOC Replicate 1	<	60	---	---	---		---	---	---		---		---	---	---	872615-011	350000	---	---	---		---	---	---		---		---	---	---
TOC as NPOC Replicate 2	<	60	---	---	---		---	---	---		---		---	---	---	872615-011	170000	---	---	---		---	---	---		---		---	---	---
TOC as NPOC Replicate 3	<	60	---	---	---		---	---	---		---		---	---	---	872615-011	400000	---	---	---		---	---	---		---		---	---	---
TOC as NPOC Replicate 4	<	60	---	---	---		---	---	---		---		---	---	---	872615-011	260000	---	---	---		---	---	---		---		---	---	---

Conc = mg/kg unless otherwise noted
C = QC Code, see Qualifer Sheet
Parent Result is reported down to MDL in order to allow Validation of this worksheet
The %R and RPD results are calculated from raw data values with more significant figures than are reported on this form.

Report Date: 6/29/2006
QC Batch Number: 11979

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Sample Condition Upon Receipt

Pace Analytical

Client Name: RMT Project # 872615

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☒ Commercial M ☒ Pace Other________

Optional
Proj. Due Date:
Proj. Name:

Custody Seal on Cooler/Box Present: ☐ yes ☒ no Seals intact: ☐ yes ☐ no

Packing Material: ☒ Bubble Wrap ☒ Bubble Bags ☐ None ☐ Other________

Thermometer Used JB Type of Ice: [✓ Wet] Blue None ☒ Samples on ice, cooling process has begun

Cooler Temperature 1°C Biological Tissue is Frozen: Yes No

Temp should be above freezing to 6°C

Date and Initials of person examining contents: MP 6/1/06
C 6/6/06

Comments:

Chain of Custody Present:	☒Yes	☐No	☐N/A	1.
Chain of Custody Filled Out:	☒Yes	☐No	☐N/A	2.
Chain of Custody Relinquished:	☒Yes	☐No	☐N/A	3.
Sampler Name & Signature on COC:	☒Yes	☐No	☐N/A	4.
Samples Arrived within Hold Time:	☒Yes	☐No	☐N/A	5.
Short Hold Time Analysis (<72hr):	☒Yes	☒No C 6/6	☐N/A	6. TVS
Rush Turn Around Time Requested:	☐Yes	☒No	☐N/A	7.
Sufficient Volume:	☒Yes	☐No	☐N/A	8.
Correct Containers Used:	☒Yes	☐No	☐N/A	9.
-Pace Containers Used:	M ☒Yes	☐No	☐N/A	
Containers Intact:	☒Yes	☐No	☐N/A	10.
Filtered volume received for Dissolved tests	☐Yes	☒No	☐N/A	11.
Sample Labels match COC:	☒Yes	☐No	☐N/A	12.
-Includes date/time/ID/Analysis Matrix: Sol				
All containers needing preservation have been checked.	☐Yes	☐No	☒N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation.	☐Yes	☐No	☒N/A	
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	☐Yes	☐No		Initial when completed
Samples checked for dechlorination:	☐Yes	☒No	☐N/A	14.
Headspace in VOA Vials (>6mm):	☐Yes	☐No	☒N/A	15.
Trip Blank Present:	☐Yes	☐No	☒N/A	16.
Trip Blank Custody Seals Present	☐Yes	☐No	☒N/A	
Pace Trip Blank Lot # (if purchased):____________				

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted: ____________________ Date/Time: ____________

Comments/ Resolution: ________________________________

Project Manager Review: Date: 6/15/06

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

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(Please Print Legibly)
Company Name: RMT, INC
Branch or Location: MADISON
Project Contact: Greg Graf
Telephone: 608-662-5306
Project Number: 7201.02
Project Name: Kewaunee
Project State: WI
Sampled By (Print): W. Show
PO #:

Data Package Options - (please circle if requested
Sample Results Only (no QC)
[✓ EPA Level II (Subject to Surcharge)] ✱
EPA Level III (Subject to Surcharge)
EPA Level IV (Subject to Surcharge)

EN CHEM INC.
A Division of Pace Analytical Services, Inc.

☐ 1241 Bellevue St., Suite 9
Green Bay, WI 54302
920-469-2436
Fax 920-469-8827

CHAIN OF CUSTODY No. 131761

Page 1 of 2
Quote #:
Mail Report To: Bob Stanforth
Company: RMT
Address: MADISON

Invoice To: Same
Company:
Address:

Mail Invoice To:

***Preservation Codes**
A=None B=HCL C=H2SO4 D=HNO3 E=EnCore F=Methanol G-NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

FILTERED? (YES/NO)
PRESERVATION (CODE)*

Regulatory Program
UST
RCRA
SDWA
NPDES
CERCLA
2006

Matrix Codes
GW=Ground Water
W=Water
S=Soil
A=Air
C=Charcoal
B=Biota
Sl=Sludge
WP=Wipe

ANALYSES REQUESTED

LABORATORY ID (Lab Use Only)	FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	Total As, Fe, Ca, P	TOC 4 reps	Total Solids	Ash Content (Vol. solids)				TOTAL # OF BOTTLES SENT	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)
001	T-1 0512017	6-1	12:01	Sed	X	X	X	X				1		8 1-4oz gl
002	T-3 0512018	↓	12:03	↓	↓	↓	↓	↓				1		↓
003	T-5 0512019	↓	12:05	↓	↓	↓	↓	↓				1		↓
004	T-6 0512020	↓	12:07	↓	↓	↓	↓	↓				1		↓
005	T-7 0512021	↓	12:09	↓	↓	↓	↓	↓				1		↓
006	T-8 0512022	↓	12:11	↓	↓	↓	↓	↓				1		↓
007	T-9 0512023	↓	12:13	↓	↓	↓	↓	↓				1		↓
008	T-10 0512024	↓	12:15	↓	↓	↓	↓	↓				1		↓
009	T-10A 0512025	↓	12:17	↓	↓	↓	↓	↓				1		↓
010	T-10B 0512026	↓	12:19	↓	↓	↓	↓	↓				1		↓
011	T-11 0512027	↓	12:21	↓	↓	↓	↓	↓				1		↓
012	T-12 0512028	↓	12:23	↓	↓	↓	↓	↓				1		↓

Rush Turnaround Time Requested (TAT) - Prelim
(Rush TAT subject to approval/surcharge)
Date Needed:
Transmit Prelim Rush Results by (circle):
Phone Fax E-mail
Phone #:
Fax #:
E-Mail Address:

29 **Samples on HOLD are subject to special pricing and release of liability**

Relinquished By:	Date/Time:	Received By:	Date/Time:
Walter M Shaw	6/1 1400	Rob Nettesmeyer / Pace	6-2-06 0930
Rob Nettesmeyer / Pace	6-5-06 1425	[illegible]	6/5/06 1425

En Chem Project No. 872615
Sample Receipt Temp. 1°c
Sample Receipt pH (Wet/Metals)
Cooler Custody Seal
Present / [✓ Not Present]
Intact / Not intact

Version 4.0: 09/04

(Please Print Legibly)
Company Name: RMT, INC
Branch or Location: MADISON
Project Contact: Greg Graf
Telephone: 608-662-5306
Project Number: 7201.02
Project Name: Kewaunee
Project State: WI
Sampled By (Print): W. Shaw
PO #:

EN CHEM INC.
A Division of Pace Analytical Services, Inc.

☐ 1241 Bellevue St., Suite 9
Green Bay, WI 54302
920-469-2436
Fax 920-469-8827

CHAIN OF CUSTODY No.131762

Page 2 of 2
Quote #:
Mail Report To: Bob Stanforth
Company: RMT
Address: MADISON

Invoice To: Same
Company:
Address:

Mail Invoice To:

***Preservation Codes**
A=None B=HCL C=H2SO4 D=HNO3 E=EnCore F=Methanol G-NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

FILTERED? (YES/NO)
PRESERVATION (CODE)*

Data Package Options - (please circle if requested
Sample Results Only (no QC)
[✓ EPA Level II (Subject to Surcharge)] *
EPA Level III (Subject to Surcharge)
EPA Level IV (Subject to Surcharge)

Regulatory Program
UST
RCRA
SDWA
NPDES
CERCLA
2006

Matrix Codes
GW=Ground Water
W=Water
S=Soil
A=Air
C=Charcoal
B=Biota
Sl=Sludge
WP=Wipe

LABORATORY ID (Lab Use Only)	FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	ANALYSES REQUESTED: Total As Fe, Cu, P	TOC 4 reps	Total Solids	Ash Content (Vol Solids)				TOTAL # OF BOTTLES SENT	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)
013	T-14 0512029	6-1	12:25	SED	X	X	X	X				1		1-8 oz [illegible]
014	T-15 0512030	↓	12:27	↓	↓	↓	↓	↓				1		↓
015	T-16 0512031	↓	12:29	↓	↓	↓	↓	↓				1		↓
016	T-17 0512032	↓	12:31	↓	↓	↓	↓	↓				1		↓

Rush Turnaround Time Requested (TAT) - Prelim
(Rush TAT subject to approval/surcharge)
Date Needed:
Transmit Prelim Rush Results by (circle):
Phone Fax E-mail
Phone #:
Fax #:
E-Mail Address:

30

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
Walter M Shaw	6/1 1400	Bill [illegible] / Pace	6-2-06 0930
Bill [illegible] / Pace	6-5-06 1425	M [illegible]	6/5/06 1438

En Chem Project No. [illegible]
Sample Receipt Temp. 1°
Sample Receipt pH (Wet/Metals)
Cooler Custody Seal
Present / [✓ Not Present]
Intact / Not intact

Version 4.0: 09/04

June 2006 Samples

Pace Analytical Services, Inc.

Analytical Report Number: 873179

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-18,3-4.5

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-004

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	340	3.5	12		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids	23.8				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-18,6.5-7

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-005

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	3.8	3.2	11		1	mg/Kg	Q	06/27/06	SW846 3050B	SW846 6010B
Percent Solids	26.2				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-18,10-12

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-006

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	2.6	2.3	7.6		1	mg/Kg	Q	06/27/06	SW846 3050B	SW846 6010B
Percent Solids	36.9				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

Pace Analytical Services, Inc.

Analytical Report Number: 873179

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-19,2-4

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-001

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	6100	2.7	9.1		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids	30.7				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

Pace Analytical
Services, Inc.

Analytical Report Number: 873179

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-19,6-8

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-002

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	5100	5.6	19		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids	15.0				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-19,13-15

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-003

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	36	2.0	6.6		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids	42.4				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

Pace Analytical Services, Inc.

Analytical Report Number: 873179

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-20,3-5

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-007

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	910	2.5	8.3		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids	33.6				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

Pace Analytical Services, Inc.

Analytical Report Number: 873179

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-21,2-4

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-008

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	640	3.4	11		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids	24.4				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-22,2.5-3.5

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-009

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	1800	4.5	15		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids	18.7				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

Pace Analytical Services, Inc.

Analytical Report Number: 873179

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-23,1.5-3.5

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-010

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	1500	3.8	13		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids	22.2				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

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Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.02
Field ID : TS-24,1.5-3.5

Matrix Type : SOIL
Collection Date : 06/16/06
Report Date : 06/29/06
Lab Sample Number : 873179-011

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	1100	5.1	17		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids	16.4				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

April 2007 Samples

Pace Analytical

1241 Bellevue Street, Suite 9
Green Bay, WI 54302
920-469-2436, Fax: 920-469-8827

Analytical Report Number: 882460

Client: RMT - MADISON

Lab Contact: Tod Noltemeyer

Project Name: KEWAUNEE MARSH

Project Number: 7201.04

Lab Sample Number	Field ID	Matrix	Collection Date
882460-001	AC 0704014 1:1 DIL	WATER	04/09/07
882460-002	AC 0704015 1:1 DIL	WATER	04/09/07
882460-003	AC 0704018 1:1 DIL	WATER	04/09/07
882460-004	AC 0704019 1:1 DIL	WATER	04/09/07
882460-005	AC 0704021 1:1 DIL	WATER	04/09/07
882460-006	AC 0704022 1:1 DIL	WATER	04/09/07
882460-007	AC 0704023 1:1 DIL	WATER	04/09/07
882460-008	AC 0704024 1:1 DIL	WATER	04/09/07
882460-009	AC 0704025 1:1 DIL	WATER	04/09/07
882460-010	AC 0704026 1:1 DIL	WATER	04/09/07
882460-011	AC 0704027 1:1 DIL	WATER	04/09/07
882460-012	AC 0704028 1:1 DIL	WATER	04/09/07
882460-013	AC 0704029 1:1 DIL	WATER	04/09/07
882460-014	AC 0704001 1:1 DIL	WATER	04/09/07
882460-015	AC 0704002 1:1 DIL	WATER	04/09/07
882460-016	AC 0704003 1:1 DIL	WATER	04/09/07
882460-017	AC 0704004 1:1 DIL	WATER	04/09/07
882460-018	AC 0704005 1:1 DIL	WATER	04/09/07
882460-019	AC 0704006 1:1 DIL	WATER	04/09/07
882460-020	AC 0704007 1:1 DIL	WATER	04/09/07
882460-021	AC 0704008 1:1 DIL	WATER	04/09/07
882460-022	AC 0704009 1:1 DIL	WATER	04/09/07
882460-023	AC 0704010 1:1 DIL	WATER	04/09/07
882460-024	AC 0704011 1:1 DIL	WATER	04/09/07
882460-025	AC 0704012 1:1 DIL	WATER	04/09/07
882460-026	AC 0704013 1:1 DIL	WATER	04/09/07

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and Laboratory Standard Operating Procedure. Exceptions, if any, are discussed in the accompanying sample comments. Release of this final report is authorized by Laboratory management, as is verified by the following signature. This report shall not be reproduced, except in full, without the written consent of Pace Analytical Services, Inc. The sample results relate only to the analytes of interest tested.

aleeAn for Tod N

Approval Signature

4/18/07

Date

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704014 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-001

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	2300	1.3	4.2		10	ug/L		04/16/07	SW846 3020A	SW846 6020

48

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704015 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-002

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	2600	1.3	4.2		10	ug/L		04/16/07	SW846 3020A	SW846 6020

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704018 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-003

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	190	0.13	0.42		1	ug/L		04/16/07	SW846 3020A	SW846 6020

50

Client :	RMT - MADISON	**Matrix Type :**	WATER
Project Name :	KEWAUNEE MARSH	**Collection Date :**	04/09/07
Project Number :	7201.04	**Report Date :**	04/17/07
Field ID :	AC 0704019 1:1 DIL	**Lab Sample Number :**	882460-004

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	47000	16	52		100	ug/L		04/16/07	SW846 3020A	SW846 6020

51

Client :	RMT - MADISON	Matrix Type :	WATER
Project Name :	KEWAUNEE MARSH	Collection Date :	04/09/07
Project Number :	7201.04	Report Date :	04/17/07
Field ID :	AC 0704021 1.1 DIL	Lab Sample Number :	882460-005

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	580000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020

52

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201 04
Field ID : AC 0704022 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-006

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	330000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020

53

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704023 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-007

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	170000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020

54

Pace Analytical Services, Inc.

Analytical Report Number: 882460

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704024 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-008

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	39000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

55

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704025 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-009

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	340000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020

56

Analytical Report Number: 882460

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704026 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-010

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	280000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020

57

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704027 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-011

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	43000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704028 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-012

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	650000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020

59

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704029 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-013

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	540	1.3	4.2		10	ug/L		04/16/07	SW846 3020A	SW846 6020

60

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704001 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-014

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	41000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

61

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704002 1.1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-015

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	22000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

62

Pace Analytical Services, Inc.

Analytical Report Number: 882460

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704003 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-016

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	59000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

63

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704004 1.1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-017

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	570	1.3	4.2		10	ug/L		04/16/07	SW846 3020A	SW846 6020

64

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704005 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-018

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	50000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

65

Client :	RMT - MADISON	Matrix Type :	WATER
Project Name :	KEWAUNEE MARSH	Collection Date :	04/09/07
Project Number :	7201.04	Report Date :	04/17/07
Field ID :	AC 0704006 1:1 DIL	Lab Sample Number :	882460-019

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	61000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

66

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704007 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-020

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	320000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020

47

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704008 1.1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-021

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	23000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

68

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704009 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-022

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	11000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704010 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-023

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	7400	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

70

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704011 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-024

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	2700	0.16	0.52		1	ug/L		04/12/07	SW846 3020A	SW846 6020

71

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704012 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-025

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	1800	0.13	0.42		1	ug/L		04/12/07	SW846 3020A	SW846 6020

72

Client : RMT - MADISON
Project Name : KEWAUNEE MARSH
Project Number : 7201.04
Field ID : AC 0704013 1:1 DIL

Matrix Type : WATER
Collection Date : 04/09/07
Report Date : 04/17/07
Lab Sample Number : 882460-026

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	2800	0.13	0.42		1	ug/L		04/12/07	SW846 3020A	SW846 6020

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Lab Number	TestGroupID	Field ID	Comment
882460	M-AS-D	All Samples	Inadequate sample volume received to perform the method required MS/MSD This flag applies to samples 1-20.

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Qualifier Codes

Flag	Applies To	Explanation
A	Inorganic	Analyte is detected in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
B	Inorganic	The analyte has been detected between the method detection limit and the reporting limit.
B	Organic	Analyte is present in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
C	All	Elevated detection limit.
D	All	Analyte value from diluted analysis or surrogate result not applicable due to sample dilution.
E	Inorganic	Estimated concentration due to matrix interferences. During the metals analysis the serial dilution failed to meet the established control limits of 0-10%. The sample concentration is greater than 50 times the IDL for analysis done on the ICP or 100 times the IDL for analysis done on the ICP-MS. The result was flagged with the E qualifier to indicate that a physical interference was observed.
E	Organic	Analyte concentration exceeds calibration range.
F	Inorganic	Due to potential interferences for this analysis by Inductively Coupled Plasma techniques (SW-846 Method 6010), this analyte has been confirmed by and reported from an alternate method.
F	Organic	Surrogate results outside control criteria.
G	All	The result is estimated because the concentration is less than the lowest calibration standard concentration utilized in the initial calibration. The method detection limit is less than the reporting limit specified for this project.
H	All	Preservation, extraction or analysis performed past holding time.
HF	Inorganic	This test is considered a field parameter, and the recommended holding time is 15 minutes from collection The analysis was performed in the laboratory beyond the recommended holding time.
J	All	Concentration detected equal to or greater than the method detection limit but less than the reporting limit
K	Organic	Detection limit may be elevated due to the presence of an unrequested analyte.
L	All	Elevated detection limit due to low sample volume.
M	Organic	Sample pH was greater than 2
N	All	Spiked sample recovery not within control limits.
O	Organic	Sample received overweight.
P	Organic	The relative percent difference between the two columns for detected concentrations was greater than 40%
Q	All	The analyte has been detected between the limit of detection (LOD) and limit of quantitation (LOQ). The results are qualified due to the uncertainty of analyte concentrations within this range.
S	Organic	The relative percent difference between quantitation and confirmation columns exceeds internal quality control criteria. Because the result is unconfirmed, it has been reported as a non-detect with an elevated detection limit.
U	All	The analyte was not detected at or above the reporting limit.
V	All	Sample received with headspace.
W	All	A second aliquot of sample was analyzed from a container with headspace.
X	All	See Sample Narrative.
Z	Organics	This compound was separated in the check standard but it did not meet the resolution criteria as set forth in SW846.
&	All	Laboratory Control Spike recovery not within control limits.
*	All	Precision not within control limits.
+	Inorganic	The sample result is greater than four times the spike level: therefore, the percent recovery is not evaluated.
<	All	The analyte was not detected at or above the reporting limit.
1	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses passed QC based on precision criteria.
2	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses failed QC based on precision criteria.
3	Inorganic	BOD result is estimated due to the BOD blank exceeding the allowable oxygen depletion.
4	Inorganic	BOD duplicate precision not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
5	Inorganic	BOD result is estimated due to insufficient oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
6	Inorganic	BOD laboratory control sample not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
7	Inorganic	BOD result is estimated due to complete oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
8	Inorganic	Sample was received unpreserved. Sample was preserved either at the time of receipt or at the time of sample preparation.
9	Inorganic	Sample was received with insufficient preservation. Acid was added either at the time of receipt or at the time of sample preparation

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Analysis Summary by Laboratory

Test Group Name	882460-001	882460-002	882460-003	882460-004	882460-005	882460-006	882460-007	882460-008	882460-009	882460-010	882460-011	882460-012	882460-013	882460-014	882460-015	882460-016	882460-017	882460-018	882460-019	882460-020	882460-021	882460-022	882460-023	882460-024	882460-025	882460-026
ARSENIC - DISSOLVED	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B

Code	WI Certification
B	405132750 / DATCP: 105-444

Pace Analytical
Services, Inc.

QC Summary

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
Fax: 920-469-8827

Batch: 882460
Lab Section: METALS
QC Batch Number: 19714
Prep Method: SW846 3020A
Analytical Method: SW846 6020

QC Type	Client Sample ID	Lab Sample ID
MB	MBDMTG2102-66	MBDMTG2102-66
LCS	LCSDMTG2102-66	LCSDMTG2102-66
MS	882481-001MS	882481-001MS
MSD	882481-001MSD	882481-001MSD

Client Sample ID	Lab Sample ID	MB ID	Client Sample ID	Lab Sample ID	MB ID
AC 0704008 1.1 DIL	882460-021	MB	AC 0704009 1.1 DIL	882460-022	MB
AC 0704010 1:1 DIL	882460-023	MB	AC 0704011 1:1 DIL	882460-024	MB
AC 0704012 1:1 DIL	882460-025	MB	AC 0704013 1:1 DIL	882460-026	MB

Test Name	Method Blank Result Conc	LCS Spiked Conc	LCS Recovery Conc	LCS Recovery %	C	LCSD Spiked Conc	LCSD Recovery Conc	LCSD Recovery %	C	LCS/LCSD RPD %	C	LCS/LCSD Control Limits LCL %	LCS/LCSD Control Limits UCL %	LCS/LCSD Control Limits RPD %	Parent Sample Number	Parent Result Conc	MS Spiked Conc	MS Recovery Conc	MS Recovery %	C	MSD Spiked Conc	MSD Recovery Conc	MSD Recovery %	C	MS/MSD RPD %	C	MS/MSD Control Limits LCL %	MS/MSD Control Limits UCL %	MS/MSD Control Limits RPD %
Arsenic - Dissolved	< 0.13	200.0	200.6	100.3		---	---	---		---		75	125	20	882481-001	0.3800	200.0	200	99.8		200.0	192	95.8		4.1		75	125	20

Conc = ug/L unless otherwise noted
C = QC Code, see Qualifer Sheet
Parent Result is reported down to MDL in order to allow Validation of this worksheet
The %R and RPD results are calculated from raw data values with more significant figures than are reported on this form.

Report Date: 4/17/2007
QC Batch Number: 19714

Pace Analytical Services, Inc.

QC Summary

1241 Bellevue Street
Green Bay, WI 54302
920-469-2436
Fax: 920-469-8827

Batch: 882460
Lab Section: METALS
QC Batch Number: 19715
Prep Method: SW846 3020A
Analytical Method: SW846 6020

QC Type	Client Sample ID	Lab Sample ID
MB	MBDMTG2102-65	MBDMTG2102-65
LCS	LCSDMTG2102-65	LCSDMTG2102-65
LCSD	LCSDDMTG2102-65	LCSDDMTG2102-65

Client Sample ID	Lab Sample ID	MB ID	Client Sample ID	Lab Sample ID	MB ID
AC 0704014 1:1 DIL	882460-001	MB	AC 0704015 1:1 DIL	882460-002	MB
AC 0704018 1:1 DIL	882460-003	MB	AC 0704019 1:1 DIL	882460-004	MB
AC 0704021 1:1 DIL	882460-005	MB	AC 0704022 1:1 DIL	882460-006	MB
AC 0704023 1:1 DIL	882460-007	MB	AC 0704024 1:1 DIL	882460-008	MB
AC 0704025 1:1 DIL	882460-009	MB	AC 0704026 1:1 DIL	882460-010	MB
AC 0704027 1:1 DIL	882460-011	MB	AC 0704028 1:1 DIL	882460-012	MB
AC 0704029 1:1 DIL	882460-013	MB	AC 0704001 1:1 DIL	882460-014	MB
AC 0704002 1:1 DIL	882460-015	MB	AC 0704003 1:1 DIL	882460-016	MB
AC 0704004 1:1 DIL	882460-017	MB	AC 0704005 1:1 DIL	882460-018	MB
AC 0704006 1:1 DIL	882460-019	MB	AC 0704007 1:1 DIL	882460-020	MB

Test Name		Method Blank Result Conc	LCS Spiked Conc	LCS Recovery Conc	LCS Recovery %	LCS Recovery C	LCSD Spiked Conc	LCSD Recovery Conc	LCSD Recovery %	LCSD Recovery C	LCS/LCSD RPD %	LCS/LCSD RPD C	LCS/LCSD Control Limits LCL %	LCS/LCSD Control Limits UCL %	LCS/LCSD Control Limits RPD %	Parent Sample Number	Parent Result Conc	MS Spiked Conc	MS Recovery Conc	MS Recovery %	MS Recovery C	MSD Spiked Conc	MSD Recovery Conc	MSD Recovery %	MSD Recovery C	MS/MSD RPD %	MS/MSD RPD C	MS/MSD Control Limits LCL %	MS/MSD Control Limits UCL %	MS/MSD Control Limits RPD %
Arsenic - Dissolved	<	0.13	200.0	201	100.5		200.0	201.5	100.8		0.2		75	125	20	---	---	---	---	---		---	---	---		---		---	---	---

Conc = ug/L unless otherwise noted
C = QC Code, see Qualifer Sheet
Parent Result is reported down to MDL in order to allow Validation of this worksheet
The %R and RPD results are calculated from raw data values with more significant figures than are reported on this form.

Report Date: 4/17/2007
QC Batch Number: 19715

Sample Condition Upon Receipt

Pace Analytical

Client Name: RMT

Project # 882460

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☒ Pace Other ________

Tracking #: ________

Optional
Proj. Due Date
Proj. Name

Custody Seal on Cooler/Box Present: ☐ yes ☒ no Seals intact: ☐ yes ☐ no

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☒ None ☐ Other ________

Thermometer Used —

Type of Ice: [✓ Wet] Blue None

☒ Samples on ice, cooling process has begun

Cooler Temperature ROT

Temp should be above freezing to 6°C

Biological Tissue is Frozen: Yes No

Date and Initials of person examining contents: 4-10-07 cg
LM 4-10-07

Comments:

Chain of Custody Present:	☒Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☒Yes ☐No ☐N/A	2.
Chain of Custody Relinquished:	☒Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☒Yes ☐No ☐N/A	4.
Samples Arrived within Hold Time:	☒Yes ☐No ☐N/A	5.
Short Hold Time Analysis (<72hr):	☐Yes ☒No ☐N/A	6.
Rush Turn Around Time Requested:	☐Yes ☒No ☐N/A	7.
Sufficient Volume:	☒Yes ☐No ☐N/A	8.
Correct Containers Used:	☒Yes ☐No ☐N/A	9.
-Pace Containers Used:	☐Yes ☒No ☐N/A	
Containers Intact:	☒Yes ☐No ☐N/A	10.
Filtered volume received for Dissolved tests	☒Yes ☐No ☐N/A	11.
Sample Labels match COC:	☒Yes ☐No ☐N/A	12. No date or time on samples. cg 4-10-07
-Includes date/time/ID/Analysis Matrix: GW		
All containers needing preservation have been checked.	☒Yes ☐No ☐N/A	13. Added .3 ml to all except 001/015 4-10-07 16:40-16:47
All containers needing preservation are found to be in compliance with EPA recommendation.	☐Yes ☒No ☐N/A	cg 4-10-07
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	☐Yes ☐No	Initial when completed cg Lot # of added preservative A10040
Samples checked for dechlorination:	☐Yes ☐No ☒N/A	14.
Headspace in VOA Vials (>6mm):	☐Yes ☐No ☒N/A	15.
Trip Blank Present:	☐Yes ☒No ☐N/A	16.
Trip Blank Custody Seals Present	☐Yes ☐No ☒N/A	
Pace Trip Blank Lot # (if purchased):________		

Client Notification/ Resolution:

Field Data Required? Y / N

Person Contacted: ________ Date/Time: ________

Comments/ Resolution: ________

Project Manager Review: AH for TN

Date: 4/18/07

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

(Please Print Clearly)

Company Name: RMT
Branch/Location: MADISON
Project Contact: Bob Stanforth
Phone: 608-662-5310
Project Number: 7201.04
Project Name: Kewaunee Marsh
Project State: WI
Sampled By (Print): Shaw
Sampled By (Sign): for W. Shaw
PO #:
Regulatory Program:

Pace Analytical®
www.pacelabs.com

CHAIN OF COSTODY

UPPER MIDWEST REGION
MN: 612-607-1700 **WI:** 920-469-2436

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COC No. 013219

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=DI Water F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

Quote #:
Mail To Contact: Bob Stanforth
Mail To Company: RMT
Mail To Address: Madison
Invoice To Contact: Same.
Invoice To Company:
Invoice To Address:
Invoice To Phone:

Data Package Options (billable)
☐ EPA Level III
☐ EPA Level IV

MS/MSD
☐ On your sample (billable)
☐ NOT needed on your sample

Matrix Codes
A = Air W = Water
B = Biota DW = Drinking Water
C = Charcoal GW = Ground Water
O = Oil SW = Surface Water
S = Soil WW = Waste Water
SI = Sludge WP = Wipe

FILTERED? (YES/NO) — Y/N: Y
PRESERVATION (CODE)* — Pick Letter: D
Analyses Requested: AS

PACE LAB #	CLIENT FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	AS	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)	Profile #
001	AC 0704014 1:1 DIL	4/9/07	1500	GW			2oz poly, D	
002	| 0704015 |	|	|	|			|	
003	| 0704018 |	|	|	|			|	
004	| 0704019 |	|	|	|			|	
005	| 0704021 |	|	|	|			|	
006	| 0704022 |	|	|	|			|	
007	| 0704023 |	|	|	|			|	
008	| 0704024 |	|	|	|			|	
009	| 0704025 |	|	|	|			|	
010	| 0704026 |	|	|	|			|	
011	| 0704027 |	|	|	|			|	
012	| 0704028 |	↓	↓	↓			|	
013	↓ 0704029 ↓						↓	

Rush Turnaround Time Requested - Prelims
(Rush TAT subject to approval/surcharge)
Date Needed:

Transmit Prelim Rush Results by (complete what you want):
Email #1:
Email #2:
Telephone:
Fax:

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
	4/9/07 1530		4-9-07
	4-10-07 145		4/10/07 1:45

PACE Project No. 882460

Receipt Temp = ROI °C

Sample Receipt pH
OK / Adjusted

Cooler Custody Seal
Present / Not Present
Intact / Not Intact

Version 6.0 06/14/06

ORIGIN

(Please Print Clearly)

Company Name: RMT
Branch/Location: Madison
Project Contact: Bob Stanforth
Phone: 608-662-5310
Project Number: 7201.04
Project Name: Kewaunee Marsh
Project State: WI
Sampled By (Print): Shaw
Sampled By (Sign): for W. Shaw
PO #:
Regulatory Program:

PaceAnalytical®
www.pacelabs.com

UPPER MIDWEST REGION
MN: 612-607-1700 **WI:** 920-469-2436

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COC No. 013220

CHAIN OF COUNTODY

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=DI Water F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

Quote #:
Mail To Contact: Bob Stanforth
Mail To Company: RMT
Mail To Address: Madison
Invoice To Contact: Same.
Invoice To Company:
Invoice To Address:
Invoice To Phone:

Data Package Options (billable)
☐ EPA Level III
☐ EPA Level IV

MS/MSD
☐ On your sample (billable)
☐ NOT needed on your sample

Matrix Codes
A = Air
B = Biota
C = Charcoal
O = Oil
S = Soil
Sl = Sludge
W = Water
DW = Drinking Water
GW = Ground Water
SW = Surface Water
WW = Waste Water
WP = Wipe

FILTERED? (YES/NO) — Y/N: Y
PRESERVATION (CODE)* — Pick Letter: D
Analyses Requested: As

PACE LAB #	CLIENT FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	As								CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)	Profile #
014	AC 0704001 1:1 Dil	4/9/07	1500	GW										2oz poly D	
015	AC 0704002		|	|	|										|	
016	| 0704003 |	|	|	|										|	
017	| 0704004 |	|	|	|										|	
018	| 0704005 |	|	|	|										|	
019	| 0704006 |	|	|	|										|	
020	| 0704007 |	|	|	|										|	
021	| 0704008 |	|	|	|										|	
022	| 0704009 |	|	|	|										|	
023	| 0704010 |	|	|	|										|	
024	| 0704011 |	|	|	|										|	
025*	| 0704012 |	|	|	|										|	
026	↓ 0704013 ↓	↓	↓	↓										↓	

Rush Turnaround Time Requested - Prelims
(Rush TAT subject to approval/surcharge)
Date Needed:

Transmit Prelim Rush Results by (complete what you want):
Email #1:
Email #2:
Telephone:
Fax:

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
	4/9/07 1530		4-9-07 1615
	4-10-07 1:30	L. Mann	4/10/07 1:30

PACE Project No. 882460

Receipt Temp = NOT °C

Sample Receipt pH
OK / Adjusted

Cooler Custody Seal
Present / Not Present
Intact / Not Intact

Version 6.0 06/14/06

ORIGINAL

Appendix C
Screening Leaching Test Procedures

Table of Contents

Screening TCLP Procedure

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SCREENING TCLP TEST PROCEDURE
APPLIED CHEMISTRY LABORATORY
RMT, INC.

1. Background

RMT uses a modified TCLP test for screening possible additives for the treatment of hazardous waste. The modified TCLP procedure uses one-tenth of the prescribed sample weight and reagent volume, and uses the same sample preparation guidelines and TCLP solutions as prescribed in EPA Method 1311. Metals analyses are performed using either Inductively Coupled Plasma (ICP) or Graphite Furnace Atomic Absorption (GFAA) spectrometry, with no digestion or matrix spikes. The test was designed primarily for use in optimizing dosages of treatment chemicals in treatability studies.

2. Procedure

Pretest for Determination of the Appropriate TCLP Extraction Solution

1. Weigh 5 g of sample into a beaker.
2. Add 96.5 mL deionized water, cover, and stir vigorously for 5 minutes.
3. Measure pH.
4. If pH < 5.0, then use extraction solution #1.
5. If pH > 5.0, then add 3.5 mL 1N HCl, and cover.
6. Heat, with stirring, to 50°C; and maintain the temperature at 50°C for 10 minutes.
7. Cool to room temperature.
8. Measure pH.
9. If pH < 5.0, then use extraction solution #1. If pH is greater than *or equal to* 5.0, then use extraction solution #2.

Leaching Procedure

1. Run the pretest (above) to determine the appropriate extraction solution, unless this is clearly known from prior experience with the waste.
2. Place 10 g of sample in a 250-mL plastic bottle.
3. Add 200 mL of the appropriate TCLP extraction solution (from step 1).
4. Shake on the rotary mixer overnight.
5. Filter the sample through an 0.45-micron pore-size filter.
6. Measure the pH of the filtrate.

7. Acidify the filtrate to pH < 2 with concentrated nitric acid.

8. Record the TCLP solution used, the final pH, and the sample number (AC number) on the "Screening Test Lab Form"; and analyze for the metals of interest. Mercury is to be analyzed using the cold vapor technique. All others may be analyzed using ICP spectroscopy.

Solution Preparation

1. **TCLP Solution #1.** Add 11.4 mL glacial acetic acid to 1,000 mL deionized water. Add 128.6 mL 1N NaOH to the acetic acid solution, and dilute to 2,000 mL. Solution pH should be in the range 4.95 ± 0.05.

TCLP Solution #2. Dilute 11.4 mL glacial acetic acid to 2,000 mL with deionized water. Solution pH should be in the range 2.88 ± 0.05.

Screening SPLP Test Procedure

SCREENING SPLP
APPLIED CHEMISTRY LABORATORY
RMT, INC.

1. Background

RMT uses a scaled-down version of the Synthetic Precipitation Leaching Procedure (SPLP) for screening the leaching potential of soil and screening possible additives for the treatment of hazardous waste. The screening SPLP uses on tenth of the prescribed sample weight and reagent volume, and uses the same sample preparation guidelines and SPLP solutions as prescribed in EPA SW846 Method 1312. Analyses of the metals are performed using an ICP, with no digestion or matrix spikes. The test was designed primarily for use in optimizing dosages of treatment chemicals in treatability studies, and is not intended as the sole source of leaching data for regulatory submittals.

2. Equipment

- Plastic bottles with air/liquid-tight closures, 250 mL
- Balance, accurate to ± 0.01 g
- Solution dispenser, 100 mL
- Tumble box
- pH meter
- Filter, cartridge, Whatman Autovial®, 0.45 µ, PTFE.
- Vial, 28 mL plastic for ICP auto sampler.

3. Reagents

- pH Buffers, calibration, 4.0 and 7.0
- Deionized water
- Sulfuric Acid (H_2SO_4), concentrated analytical reagent grade
- Nitric Acid (HNO_3) , concentrated analytical reagent grade

4. Procedure

Solution Preparation

Prepare **sulfuric acid/nitric acid, 60/40 weight percent mixture** in dilute solution:

- To 90 grams of deionized water, cautiously add 6.0 grams concentrated sulfuric acid and 4.0 grams concentrated distilled nitric acid. (This solution will be used to prepare a synthetic acid rain fluid.)
- **SPLP East Extraction Fluid:** Add the 60/40 acid mixture drop wise to deionized water until the pH is 4.20 ± 0.05.
- **SPLP West Extraction Fluid:** Add the 60/40 acid mixture drop wise to deionized water until the pH is 5.00 ± 0.05.

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Leaching Procedure

1. Prepare a bench sheet for recording the sample data.
2. Label a 250-mL plastic bottle with the appropriate sample information.
3. Place 10.0 g of sample in the 250-mL plastic bottle.
4. Dispense 200 mL of the appropriate SPLP extraction fluid to the bottle.
5. Seal the bottle with the closure and place the bottle in the tumbler.
6. Tumble the sample overnight (18 ± 2 hours).
7. Measure and record the pH of the leachate.
8. Filter the sample using a filter cartridge.
9. Acidify/preserve the filtrate to a pH < 2 with concentrated nitric acid.
10. Record any pertinent information on the bench sheet.
11. Analyze the sample using the standard ICP laboratory method.

Appendix D
Borehole Abandonment Forms

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: ______
~~Hicap #~~ T2-0
Latitude / Longitude (Degrees and Minutes): ___ ° ___ . ___ ' N / ___ ° ___ . ___ ' W
Method Code (see instructions): ______
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: ______

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 30
Casing Diameter (in.): -
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks] Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	30	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 1/28

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☑ Remediation/Redevelopment ☐ Other: ____

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
Hicap #: T(-1) - 20NW
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N; __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☑ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): -
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ____

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8 2007

DNR Use Only
Date Received:
Noted By:
Comments: 2

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ____

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ T(-1) - 0
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): -
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): -
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing le t in olace?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ____

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface		≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 3

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ T(-1)-20SE
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): -
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 4

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

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Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ T1 - 40NW
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼ ¼ SW
or Gov't Lot #
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): -
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks] Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 5

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
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Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

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Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~: T1 - 30NW
Latitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): ______
¼ / ¼: ______ ¼: SW or Gov't Lot #: ______
Section: 7 Township: 23 N Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee Well ZIP Code: 54216
Subdivision Name: ______ Lot #: ______
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS): ______
License/Permit/Monitoring #: ______
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner: ______
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee State: WI ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10 Casing Diameter (in.): —
Lower Drillhole Diameter (in.): 2 Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)? ______ Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks] Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #: ______
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie State: WI ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received: ______ Noted By: ______
Comments: 6

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293. 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☑ Remediation/Redevelopment ☐ Other: ____

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ TI-20NW
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawno Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☑ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): –
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ____

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, Sacks Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 7

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)
Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ TI-10NW
Latitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): —
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, Sacks Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 8

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☑ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ T1-10SE
Latitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): ______
¼ / ¼: ______ ¼: SW
or Gov't Lot #: ______
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name: ______
Lot #: ______
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS): ______
License/Permit/Monitoring #: ______
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner: ______
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Green Bay
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☑ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): —
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)? ______
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #: ______
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received: ______
Noted By: ______
Comments: 9

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ____

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~: T1-205E
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): -
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in olace?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ____

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, Sacks Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 10

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

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Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~dicap #~~ TI-30SE
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawno Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): –
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): –

Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks] Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ ¼ bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 11

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: _ _ _ _ _
~~Hicap #~~ T4 - 40NW
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼ ¼ SW or Gov't Lot #
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: _ _ _ _ _

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): -
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): -
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks] Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ ¼ bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 12

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☑ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ T4-30 NW
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☑ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): –
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): –
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 13

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~: T4-10NW
Latitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N; __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): —
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, Sacks Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth

DNR Use Only
Date Received:
Noted By:
Comments: 14
Date Signed: Aug 8, 2007

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other:

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: ___ ___ ___ ___ ___
Hicap #: T4-0
Lattitude / Longitude (Degrees and Minutes): ___ ° ___ . ___ ' N ___ ° ___ . ___ ' W
Method Code (see instructions):
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: ___ ___ ___ ___ ___

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☑ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): --
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): --
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain):

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 15

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
Hicap #: T4-10SE
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N; __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): -
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ■ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 16

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

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Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __ __
~~Hicap #~~: T4-20SE
Latitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: | ¼: SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): –
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): –
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 17

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)
Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ T4-305E
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): -
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 230
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 18

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)
Page 1 of 2

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Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☑ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ T5-20MW
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Traditional Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☑ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): –
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): –
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☑ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks] Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 19

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

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Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ____

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ T4-0
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ 'N; __ __ ° __ __ . __ __ __ 'W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ____ ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): —
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ____

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 20

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ____

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: _ _ _ _ _
Hicap #: T5-20SE
Lattitude / Longitude (Degrees and Minutes): __ °__ . ___ ' N / __ °__ . ___ ' W
Method Code (see instructions): ______
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: _ _ _ _ _

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 04/03/2007
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 10
Casing Diameter (in.): –
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): –
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 5

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☒ No	☐ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ____

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	10	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 04/03/2007
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 21

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
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Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

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Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ TS-18
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions):
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopme
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawno Ave.
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 06/16/2006

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 15
Casing Diameter (in.): –
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 3

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☐ No	☒ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, Sacks Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	15	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 06/16/2006
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 22

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
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Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

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Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ____

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ TS-19
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼ ¼ SW or Gov't Lot #
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 06/16/2006
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 15
Casing Diameter (in.): –
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 3

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☐ No	☒ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ____

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, Sacks Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	15	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 06/16/2006
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 23

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ____

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~: TS-20
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopm
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawno Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 06/16/2006

If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 7
Casing Diameter (in.): –
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): –
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 3

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☐ No	☒ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ____

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	7	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 06/16/2006
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 24

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ____

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ TS-21
Latitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __ __
¼ / ¼:
¼: SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopment
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawno Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 06/16/2006
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 7
Casing Diameter (in.): –
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 3

4. Pump, Liner, Screen, Casing & Sealing Material

	Yes	No	N/A
Pump and piping removed?	☐	☐	☒
Liner(s) removed?	☒	☐	☐
Screen removed?	☐	☐	☒
Casing left in place?	☐	☐	☒
Was casing cut off below surface?	☐	☐	☒
Did sealing material rise to surface?	☐	☐	☒
Did material settle after 24 hours?	☐	☒	☐
If yes, was hole retopped?	☐	☐	☐
If bentonite chips were used, were they hydrated with water from a known safe source?	☐	☒	☐

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ____

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	7	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 06/16/2006
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 25

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

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Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ________

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~: TS-22
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N; __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __
¼ / ¼ or Gov't Lot #: ¼ SW
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopme
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 06/16/2006
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 7
Casing Diameter (in.): -
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 3

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☐ No	☒ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ________

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	7	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 06/16/2006
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 26

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07) Page 1 of 2

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Route to:
☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other:

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ TS-23
Lattitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N; __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions):
¼ / ¼: ¼ SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W
Well Street Address: Kewaunee Marsh
Well City, Village or Town: Kewaunee
Well ZIP Code: 54216
Subdivision Name:
Lot #:
Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh
Facility ID (FID or PWS):
License/Permit/Monitoring #:
Original Well Owner: WDNR - Bureau of Remediation and Redevelopm
Present Well Owner:
Mailing Address of Present Owner: 2984 Shawano Ave
City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 06/16/2006
If a Well Construction Report is available, please attach.

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 7
Casing Diameter (in.): —
Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —
Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown
If yes, to what depth (feet)?
Depth to Water (feet): 3

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☐ No	☒ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain):

Sealing Materials
☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	7	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 06/16/2006
Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992
City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only
Date Received:
Noted By:
Comments: 27

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

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Route to:

☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☒ Remediation/Redevelopment ☐ Other: ______

1. Well Location Information

County: Kewaunee
WI Unique Well # of Removed Well: __ __ __ __ __
~~Hicap #~~ TS-24

Latitude / Longitude (Degrees and Minutes): __ __ ° __ __ . __ __ __ ' N / __ __ ° __ __ . __ __ __ ' W
Method Code (see instructions): __ __ __ __ __ __

¼ / ¼:
¼: SW
or Gov't Lot #:
Section: 7
Township: 23 N
Range: 25 ☒ E ☐ W

Well Street Address: Kewaunee Marsh

Well City, Village or Town: Kewaunee
Well ZIP Code: 54216

Subdivision Name:
Lot #:

Reason For Removal From Service: Temporary Investigative Borehole
WI Unique Well # of Replacement Well: __ __ __ __ __

2. Facility / Owner Information

Facility Name: Kewaunee Marsh

Facility ID (FID or PWS):

License/Permit/Monitoring #:

Original Well Owner: WDNR - Bureau of Remediation and Redevelopment

Present Well Owner:

Mailing Address of Present Owner: 2984 Shawano Ave

City of Present Owner: Kewaunee
State: WI
ZIP Code: 54307

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy): 06/16/2006

If a Well Construction Report is available, please attach.

Construction Type:

☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☒ Other (specify): Geoprobe (Direct Push)

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Ground Surface (ft.): 7
Casing Diameter (in.): -

Lower Drillhole Diameter (in.): 2
Casing Depth (ft.): —

Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown

If yes, to what depth (feet)?
Depth to Water (feet): 3

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	☐ Yes	☐ No	☒ N/A
Liner(s) removed?	☒ Yes	☐ No	☐ N/A
Screen removed?	☐ Yes	☐ No	☒ N/A
Casing left in place?	☐ Yes	☐ No	☒ N/A
Was casing cut off below surface?	☐ Yes	☐ No	☒ N/A
Did sealing material rise to surface?	☐ Yes	☐ No	☒ N/A
Did material settle after 24 hours?	☐ Yes	☒ No	☐ N/A
If yes, was hole retopped?	☐ Yes	☐ No	☐ N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	☐ Yes	☒ No	☐ N/A

Required Method of Placing Sealing Material

☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): ______

Sealing Materials

☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)
☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "
☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:

☐ Bentonite Chips ☐ Bentonite - Cement Grout
☐ Granular Bentonite ☐ Bentonite - Sand Slurry

5. Material Used To Fill Well / Drillhole

5. Material Used To Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, [✓ Sacks Sealant] or Volume (circle one)	Mix Ratio or Mud Weight
Screened and Poured Bentonite Chips	Surface	7	≤ 1/4 bag	

6. Comments

7. Supervision of Work

Name of Person or Firm Doing Filling & Sealing: On-Site Environmental Services, Inc.
License #:
Date of Filling & Sealing (mm/dd/yyyy): 06/16/2006

Street or Route: P.O. Box 280
Telephone Number: (608) 837-8992

City: Sun Prairie
State: WI
ZIP Code: 53590
Signature of Person Doing Work: Robert Stanforth
Date Signed: Aug 8, 2007

DNR Use Only

Date Received:
Noted By:
Comments: 28/28

Appendix E
Detailed Cost Estimate Spreadsheets

OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

MARSH SOIL/SLOUGH WATER: (1) Excavation and Disposal (Large Area)

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	$10,000	1	$10,000
Site Preparation (road building)	ls	$15,000	1	$15,000
Erosion Control	ls	$5,000	1	$5,000
Excavation	tons	$1.5	85,500	$128,250
Dewatering	days	$1,000	30	$30,000
Transportation	tons	$10	67,500	$675,000
Disposal	tons	$20	67,500	$1,350,000
Cap Replacement	tons	$1	18,000	$18,000
SUBTOTAL OF DIRECT CAPITAL COST				$2,231,250
30 % CONTINGENCY (DIRECT CAPITAL)	%	30%		$669,375
INDIRECT CAPITAL COSTS				
Project management/administration	hr	$195	30	$5,850
Workplan	hr	$130	30	$3,900
Design and subcontracting	hr	$130	80	$10,400
Permitting	hr	$100	30	$3,000
Construction oversight	hr	$100	350	$35,000
Documentation reporting	hr	$130	40	$5,200
SUBTOTAL OF INDIRECT CAPITAL COSTS				$63,350
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				$2,963,975
MONITORING (ONE BASELINE AND ONE CONFIRMATION ROUND)				
Project management/administration	hr	$195	10	$1,950
Soil/sediment sampling (50 points, twice)	hr	$100	80	$8,000
Field equipment/expenses	ls	$2,000	1	$2,000
Lab - As	each	$15	100	$1,500
Data evaluation	hr	$130	30	$3,900
SUBTOTAL OF FIRST YEAR OF MONITORING				$17,350
30 % CONTINGENCY	%	30%		$5,205
SUBTOTAL OF CAPITAL AND MONITORING COSTS				$2,986,530

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

MARSH SOIL/SLOUGH WATER: (1) Excavation and Disposal (Large Area)

ITEM	UNIT	UNIT COST	QTY	TOTAL
O&M COST				
None	ls	$0	1	$0
SUBTOTAL FOR ANNUAL O&M				$0
30 % CONTINGENCY	%	30%		$0
LONG-TERM MONITORING COSTS				
None	ls	$0	1	$0
SUBTOTAL FOR MONITORING				$0
30 % CONTINGENCY	%	30%		$0
PRESENT WORTH OF O&M	5	years @	3%	$0
PRESENT WORTH OF MONITORING	5	years @	3%	$0
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			**Total**	**$2,990,000**
			+ 50%	**$4,490,000**
			- 30%	**$2,100,000**

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

1. Costs rounded up to the nearest ten thousand dollars.
2. Costs determined from experience and estimates from other similar projects.
3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
4. Indirect costs do not include legal fees or public relations assistance.
5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting.

SPECIFIC

1. Assumes all marsh material can be disposed as non-hazardous waste.
2. Assumes the cap material will be replaced into the marsh.
3. Cost includes minor wetlands restoration, but no backfilling.
4. Assumes one round of confirmation soil sampling will be completed following the excavation.

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

MARSH SOIL: (2) Excavation and Disposal (Small Area)

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	$10,000	1	$10,000
Site Preparation (road building)	ls	$15,000	1	$15,000
Erosion Control	ls	$5,000	1	$5,000
Excavation	tons	$1.5	37,500	$56,250
Dewatering	days	$1,000	25	$25,000
Transportation	tons	$10	37,500	$375,000
Disposal	tons	$20	37,500	$750,000
SUBTOTAL OF DIRECT CAPITAL COST				$1,236,250
30 % CONTINGENCY (DIRECT CAPITAL)	%	30%		$370,875
INDIRECT CAPITAL COSTS				
Project management/administration	hr	$195	30	$5,850
Workplan	hr	$130	30	$3,900
Design and subcontracting	hr	$130	80	$10,400
Permitting	hr	$100	30	$3,000
Construction oversight	hr	$100	250	$25,000
Documentation reporting	hr	$130	40	$5,200
SUBTOTAL OF INDIRECT CAPITAL COSTS				$53,350
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				$1,660,475
MONITORING (ONE BASELINE AND ONE CONFIRMATION ROUND)				
Project management/administration	hr	$195	10	$1,950
Soil/sediment sampling (30 points, twice)	hr	$100	70	$7,000
Field equipment/expenses	ls	$1,000	1	$1,000
Lab - As	each	$15	60	$900
Data evaluation	hr	$130	30	$3,900
SUBTOTAL OF FIRST YEAR OF MONITORING				$14,750
30 % CONTINGENCY	%	30%		$4,425
SUBTOTAL OF CAPITAL AND MONITORING COSTS				$1,679,650

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

MARSH SOIL: (2) Excavation and Disposal (Small Area)

ITEM	UNIT	UNIT COST	QTY	TOTAL
O&M COST				
None	ls	$0	1	$0
SUBTOTAL FOR ANNUAL O&M				$0
30 % CONTINGENCY	%	30%		$0
LONG-TERM MONITORING COSTS				
None	ls	$0	1	$0
SUBTOTAL FOR MONITORING				$0
30 % CONTINGENCY	%	30%		$0
PRESENT WORTH OF O&M	5	years @	3%	$0
PRESENT WORTH OF MONITORING	5	years @	3%	$0
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			**Total**	**$1,680,000**
			+ 50%	**$2,520,000**
			- 30%	**$1,180,000**

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

1. Costs rounded up to the nearest ten thousand dollars.
2. Costs determined from experience and estimates from other similar projects.
3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
4. Indirect costs do not include legal fees or public relations assistance.
5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting.

SPECIFIC

1. Assumes all marsh material can be disposed as non-hazardous waste, and that the capped area will be left in place.
2. Cost includes minor wetlands restoration, but no backfilling.

2\. Assumes one round of confirmation soil sampling will be completed following the excavation.

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

MARSH SOIL: (3A) Bioreduction test plots

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	$5,000	1	$5,000
Site preparation (test plot marking and clearing)	ls	$5,000	1	$5,000
Bioreductant Cost				
- lactate	ls	$100	1	$100
- molasses	ls	$100	1	$100
- manure	ls	$100	1	$100
SUBTOTAL OF DIRECT CAPITAL COST				$10,300
30 % CONTINGENCY	%	30%		$3,090
INDIRECT CAPITAL COSTS				
Project management/administration	hr	$195	20	$3,900
Workplan	hr	$130	40	$5,200
Design and subcontracting	hr	$130	50	$6,500
Test plot construction and bioreductant application	hr	$100	80	$8,000
Documentation reporting	hr	$130	30	$3,900
SUBTOTAL OF INDIRECT CAPITAL COSTS				$27,500
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				$40,890
MONITORING				
Project management/administration	hr	$195	20	$3,900
Baseline Soil/Sediment Sampling (5 plots, 10 per plot)	hr	$100	12	$1,200
Monthly Soil/Sediment Sampling (5 months)	hr	$100	60	$6,000
Field Expenses	trip	$500	6	$3,000
Lab - As	each	$15	300	$4,500
Data evaluation	hr	$130	40	$5,200
SUBTOTAL OF MONITORING				$23,800
30 % CONTINGENCY	%	30%		$7,140
SUBTOTAL OF CAPITAL AND MONITORING COSTS				$71,830

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

MARSH SOIL: (3A) Bioreduction test plots

ITEM	UNIT	UNIT COST	QTY	TOTAL
O&M COST				
None	ls	$0	1	$0
SUBTOTAL FOR O&M				$0
30 % CONTINGENCY	%	30%		$0
ANNUAL MONITORING COSTS				
None	ls	$0	1	$0
SUBTOTAL FOR ANNUAL GROUNDWATER MONITORING				$0
30 % CONTINGENCY	%	30%		$0
PRESENT WORTH OF O&M (additional injections)	5	years @	3%	$0
PRESENT WORTH OF MONITORING	5	years @	3%	$0
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			**Total**	**$80,000**
			+ 50%	**$120,000**
			- 30%	**$60,000**

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

1. Costs rounded up to the nearest ten thousand dollars.
2. Costs determined from experience and estimates from other similar projects.
3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
4. Indirect costs do not include legal fees or public relations assistance.
5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting.

SPECIFIC

1. Assumes five test plots of 10ft x 10ft each will be constructed in the uncapped area.
1. Assumes only one application of the bioreductant will be required for each plot.
2. Assumes that 5 months of performance monitoring will be required to evaluate the test plots, 10 monthly samples per test plot.

OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

MARSH SOIL: (3B) Bioreduction full scale

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	$10,000	1	$10,000
Site Preparation (staging area and mats/roads)	ls	$15,000	1	$15,000
Erosion Control	ls	$5,000	1	$5,000
Site Clearing (Cattail cutting and placement)	acre	$1,000	7.5	$7,500
Bioreductant Cost	lb	$1.10	99,225	$109,148
Bioreductant Application (Irrigation rental)	ls	$30,000	1	$30,000
SUBTOTAL OF DIRECT CAPITAL COST				$176,648
30 % CONTINGENCY	%	30%		$52,994
INDIRECT CAPITAL COSTS				
Project management/administration	hr	$195	30	$5,850
Workplan	hr	$130	40	$5,200
Design and subcontracting	hr	$130	80	$10,400
Construction Oversight	hr	$100	200	$20,000
Documentation reporting	hr	$130	50	$6,500
SUBTOTAL OF INDIRECT CAPITAL COSTS				$47,950
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				$277,592
MONITORING				
Project management/administration	hr	$198	10	$1,980
Soil/sediment sampling (20 points, once)	hr	$100	36	$3,600
Field equipment/expenses	ls	$1,000	1	$1,000
Lab - As	each	$15	20	$300
Data evaluation	hr	$130	20	$2,600
SUBTOTAL OF MONITORING				$9,480
30 % CONTINGENCY	%	30%		$2,844
SUBTOTAL OF CAPITAL AND MONITORING COSTS				$289,916
O&M COST				
Mobilization	ls	$3,000	1	$3,000
Site Clearing (cattails)	acre	$1,000	7.5	$7,500
Project Management	hr	$195	10	$1,950
Oversight + travel expenses	Is	$2,000	1	$2,000
Reporting	hr	$130	10	$1,300
SUBTOTAL FOR O&M				$15,750
30 % CONTINGENCY	%	30%		$4,725

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

MARSH SOIL: (3B) Bioreduction full scale

ITEM	UNIT	UNIT COST	QTY	TOTAL
MONITORING COSTS (SEMI-ANNUAL)				
Project management/administration	hr	$195	30	$5,850
Soil/Sediment Sampling (20 points, twice/yr)	hr	$100	50	$5,000
Field equipment and expenses	ls	$2,000	1	$2,000
Lab - As	each	$15	40	$600
Data evaluation	hr	$100	40	$4,000
Reporting	hr	$130	50	$6,500
SUBTOTAL FOR ANNUAL MONITORING				$23,950
30 % CONTINGENCY	%	30%		$7,185
PRESENT WORTH OF O&M	5	years @	3%	$93,770
PRESENT WORTH OF MONITORING	5	years @	3%	$142,589
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			**Total**	**$530,000**
			+ 50%	**$800,000**
			- 30%	**$380,000**

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

1. Costs rounded up to the nearest ten thousand dollars.
2. Costs determined from experience and estimates from other similar projects.
3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
4. Indirect costs do not include legal fees or public relations assistance.
5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting.

SPECIFIC

1. Assumes only one application of the bioreductant will be required.
2. Assumes the site will require 5 years of performance monitoring to evaluate the bioreduction of arsenic.
3. Assumes lactate will be used as the bioreductant, and will be applied with an irrigation system.
4. Assumes yearly clearing of cattails will be required, and cut vegetation will be used as cover in the marsh.

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SOURCE AREA: (1) Pump and dispose off-site as hazardous

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	$5,000	1	$5,000
Site Preparation/Staging Area	ls	$5,000	1	$5,000
Electrical service (propane generator or temp power)	ls	$10,000	1	$10,000
Well installation	ls	$10,000	1	$10,000
Manifold construction	ls	$5,000	1	$5,000
Holding tank - Deliver/Pick-Up (6000 gallon)	ls	$1,200	1	$1,200
Holding tank - Rental	days	$50	80	$4,000
Submersible pump	each	$2,000	1	$2,000
Control panel	ls	$15,000	1	$15,000
Misc electrical/plumbing supplies	ls	$5,000	1	$5,000
Transportation	5000 gal	$1,000	9	$9,000
Disposal (Hazardous groundwater)	gal	$0.81	42,000	$34,020
SUBTOTAL OF DIRECT CAPITAL COST				$105,220
30 % CONTINGENCY	%	30%		$31,566
INDIRECT CAPITAL COSTS				
Project management/administration	hr	$195	30	$5,850
Workplan	hr	$130	30	$3,900
Design and subcontracting	hr	$130	80	$10,400
Permitting	hr	$130	20	$2,600
Construction oversight (10 hr/day + expenses)	day	$1,000	5	$5,000
System start-up	hr	$100	60	$6,000
Documentation reporting	hr	$130	40	$5,200
SUBTOTAL OF INDIRECT CAPITAL COSTS				$38,950
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				$175,736
FIRST YEAR O&M COSTS				
Project Management	hr	$195	30	$5,850
Shakedown visits	hr	$100	20	$2,000
Tank change out visits	hr	$100	108	$10,800
Field equipment and travel expenses	ls	$2,000	1	$2,000
Misc Repairs	ls	$1,500	1	$1,500
Utilities/Fuel	mo	$1,000	3	$3,000
SUBTOTAL OF FIRST YEAR O&M				$25,150
30 % CONTINGENCY	%	30%		$7,545

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SOURCE AREA: (1) Pump and dispose off-site as hazardous

ITEM	UNIT	UNIT COST	QTY	TOTAL
FIRST YEAR OF GROUNDWATER MONITORING				
Project management/administration	hr	$195	20	$3,900
Groundwater sampling (3 samples, 4 times/yr)	hr	$100	50	$5,000
Field equipment/expenses	ls	$2,000	1	$2,000
Lab - As	each	$15	12	$180
Data evaluation	hr	$130	40	$5,200
SUBTOTAL OF FIRST YEAR OF MONITORING				$16,280
30 % CONTINGENCY	%	30%		$4,884
SUBTOTAL OF CAPITAL AND FIRST YEAR COSTS				$229,595
ANNUAL O&M COSTS				
None	ls	$0	1	$0
SUBTOTAL FOR ANNUAL O&M				$0
30 % CONTINGENCY	%	30%		$0
MONITORING COSTS (SEMI-ANNUAL)				
Project management/administration	hr	$195	30	$5,850
Groundwater sampling (3 wells, twice/yr)	hr	$100	30	$3,000
Field equipment and expenses	ls	$1,000	1	$1,000
Lab - As	each	$15	6	$90
Data evaluation	hr	$100	30	$3,000
Reporting	hr	$130	50	$6,500
SUBTOTAL FOR ANNUAL GROUNDWATER MONITORING				$19,440
30 % CONTINGENCY	%	30%		$5,832
PRESENT WORTH OF O&M	2	years @	3%	$0
PRESENT WORTH OF MONITORING	2	years @	3%	$48,357
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			**Total**	**$280,000**
			+ 50%	**$420,000**
			- 30%	**$200,000**

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SOURCE AREA: (1) Pump and dispose off-site as hazardous

ITEM	UNIT	UNIT COST	QTY	TOTAL

ASSUMPTIONS:

GENERAL

1. Costs rounded up to the nearest ten thousand dollars.
2. Costs determined from experience and estimates from other similar projects.
3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
4. Indirect costs do not include legal fees or public relations assistance.
5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting.

SPECIFIC

1. Assumes source area groundwater can be captured in one year.
2. Assumes 2 years of monitoring will be required to evaluate the performance of the source area treatment.

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SOURCE AREA: (2) Pump and treat on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	$5,000	1	$5,000
Site Preparation/Staging Area	ls	$10,000	1	$10,000
Electrical service (propane generator or temp power)	ls	$10,000	1	$10,000
Well installation	ls	$10,000	1	$10,000
Manifold construction	ls	$5,000	1	$5,000
Submersible pump	ls	$1,500	1	$1,500
Treatment Shed	ls	$15,000	1	$15,000
Water Treatment System	ls	$100,000	1	$100,000
- Solids handling	ls	$60,000	1	$60,000
- Delivery and removal roll-off box	ls	$1,000	1	$1,000
- Solids roll off box for disposal	day	$50	150	$7,500
Control panel	ls	$30,000	1	$30,000
Misc electrical/plumbing supplies	ls	$10,000	1	$10,000
Treatment Chemicals				
- Ferric sulfate	lb	$1.04	30,000	$31,200
- Limestone	tons	$35	11	$385
- Peroxide	gal	$45	45	$2,025
Transport and disposal of solids (non-hazardous)	tons	$70	60	$4,200
Demobilization (Site Restoration and Decommission)	ls	$10,000	1	$10,000
SUBTOTAL OF DIRECT CAPITAL COST				$312,810
30 % CONTINGENCY	%	30%		$93,843
INDIRECT CAPITAL COSTS				
Project management/administration	hr	$195	30	$5,850
Workplan	hr	$130	40	$5,200
Design and subcontracting	hr	$130	80	$10,400
Permitting	hr	$130	20	$2,600
Construction oversight	ls	$20,000	1	$20,000
System start-up	hr	$100	60	$6,000
Documentation reporting	hr	$130	40	$5,200
SUBTOTAL OF INDIRECT CAPITAL COSTS				$55,250
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				$461,903

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SOURCE AREA: (2) Pump and treat on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
FIRST YEAR O&M COSTS				
Project Management	hr	$195	50	$9,750
Shakedown visits + Travel time	hr	$100	40	$4,000
Batch refill visits	hr	$100	420	$42,000
Field equipment and travel expenses	ls	$4,000	1	$4,000
Misc Repairs	ls	$1,500	1	$1,500
Utilities/Fuel	mo	$3,000	3	$9,000
SUBTOTAL OF FIRST YEAR O&M				$70,250
30 % CONTINGENCY	%	30%		$21,075
FIRST YEAR OF GROUNDWATER MONITORING				
Project management/administration	hr	$195	20	$3,900
Groundwater sampling (3 samples, 4 times/yr)	hr	$100	50	$5,000
WPDES sampling	hr	$100	50	$5,000
Field equipment/expenses	ls	$2,000	1	$2,000
Lab - As	each	$15	12	$180
Lab - WPDES	each	$75	12	$900
Data evaluation	hr	$130	40	$5,200
SUBTOTAL OF FIRST YEAR OF MONITORING				$22,180
30 % CONTINGENCY	%	30%		$6,654
SUBTOTAL OF CAPITAL AND FIRST YEAR COSTS				$582,062

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SOURCE AREA: (2) Pump and treat on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
ANNUAL O&M COSTS				
None	ls	$0	1	$0
SUBTOTAL FOR ANNUAL O&M				$0
30 % CONTINGENCY	%	30%		$0
MONITORING COSTS (SEMI-ANNUAL)				
Project management/administration	hr	$195	30	$5,850
Groundwater sampling (3 wells, twice/yr)	hr	$100	30	$3,000
Field equipment and expenses	ls	$1,000	1	$1,000
Lab - As	each	$15	6	$90
Data evaluation	hr	$100	30	$3,000
Reporting	hr	$130	50	$6,500
SUBTOTAL FOR ANNUAL GROUNDWATER MONITORING				$19,440
30 % CONTINGENCY	%	30%		$5,832
PRESENT WORTH OF O&M	2	years @	3%	$0
PRESENT WORTH OF MONITORING	2	years @	3%	$48,357
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			**Total**	**$640,000**
			+ 50%	**$960,000**
			- 30%	**$450,000**

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

1. Costs rounded up to the nearest ten thousand dollars.
2. Costs determined from experience and estimates from other similar projects.
3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
4. Indirect costs do not include legal fees or public relations assistance.
5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting.

SPECIFIC

1. Assumes source area groundwater can be captured in one year.
2. Assumes 2 years of monitoring will be required to evaluate the performance of the source area treatment.
3. Water treatment system includes power generation, chemical metering pumps, solids hoppers, mixing tanks, and mixers.

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SOURCE AREA: (3) In-situ treatment of water

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	$10,000	1	$10,000
Site Preparation	ls	$10,000	1	$10,000
Excavation and stockpile of overburden soil	cy	$10	650	$6,500
Mixing of treatment chemicals	day	$2,000	10	$20,000
Treatment Chemicals				
- Ferric sulfate	lb	$1.04	30,000	$31,200
- Limestone	tons	$35	11	$385
- Peroxide	gal	$45	45	$2,025
Replace overburden soil and compaction	cy	$10	650	$6,500
Site restoration	ls	$7,000	1	$7,000
SUBTOTAL OF DIRECT CAPITAL COST				$93,610
30 % CONTINGENCY	%	30%		$28,083
INDIRECT CAPITAL COSTS				
Project management/administration	hr	$195	40	$7,800
Workplan	hr	$130	40	$5,200
Design and subcontracting	hr	$130	100	$13,000
Permitting	hr	$130	20	$2,600
Construction oversight	ls	$20,000	1	$20,000
Misc expenses	ls	$2,000	1	$2,000
Documentation reporting	hr	$130	40	$5,200
SUBTOTAL OF INDIRECT CAPITAL COSTS				$55,800
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				$177,493
FIRST YEAR O&M COSTS				
None	ls	$0	1	$0
SUBTOTAL OF FIRST YEAR O&M				$0
30 % CONTINGENCY	%	30%		$0

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SOURCE AREA: (3) In-situ treatment of water

ITEM	UNIT	UNIT COST	QTY	TOTAL
FIRST YEAR OF GROUNDWATER MONITORING				
Project management/administration	hr	$195	20	$3,900
Groundwater sampling (3 samples, 4 times/yr)	hr	$100	50	$5,000
Field equipment/expenses	ls	$2,000	1	$2,000
Lab - As	each	$15	12	$180
Lab - As (Field verification sampling - quick turn)	each	$40	20	$800
Data evaluation	hr	$130	40	$5,200
SUBTOTAL OF FIRST YEAR OF MONITORING				$17,080
30 % CONTINGENCY	%	30%		$5,124
SUBTOTAL OF CAPITAL AND FIRST YEAR COSTS				$199,697
ANNUAL O&M COSTS				
None	ls	$0	1	$0
SUBTOTAL FOR ANNUAL O&M				$0
30 % CONTINGENCY	%	30%		$0
MONITORING COSTS (SEMI-ANNUAL)				
Project management/administration	hr	$195	30	$5,850
Groundwater sampling (3 wells, twice/yr)	hr	$100	30	$3,000
Field equipment and expenses	ls	$1,000	1	$1,000
Lab - As	each	$15	6	$90
Data evaluation	hr	$100	30	$3,000
Reporting	hr	$130	50	$6,500
SUBTOTAL FOR ANNUAL GROUNDWATER MONITORING				$19,440
30 % CONTINGENCY	%	30%		$5,832
PRESENT WORTH OF O&M	2	years @	3%	$0
PRESENT WORTH OF MONITORING	2	years @	3%	$48,357
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			**Total**	**$250,000**
			+ 50%	**$380,000**
			- 30%	**$180,000**

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SOURCE AREA: (3) In-situ treatment of water

ITEM	UNIT	UNIT COST	QTY	TOTAL

ASSUMPTIONS:

GENERAL

1. Costs rounded up to the nearest ten thousand dollars.
2. Costs determined from experience and estimates from other similar projects.
3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
4. Indirect costs do not include legal fees or public relations assistance.
5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting.

SPECIFIC

1. Assumes one in-situ treatment will adequately address the source area.
2. Assumes 2 years of monitoring will be required to evaluate the performance of the source area treatment.

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SLOUGH WATER: (1) Impermeable barrier

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	$10,000	1	$10,000
Site Preparation (road building or mats)	ls	$15,000	1	$15,000
Vertical barrier cost (installation included)	sf	$15	10,000	$150,000
Erosion Control	ls	$5,000	1	$5,000
SUBTOTAL OF DIRECT CAPITAL COST				$180,000
30 % CONTINGENCY (DIRECT CAPITAL)	%	30%		$54,000
INDIRECT CAPITAL COSTS				
Project management/administration	hr	$195	30	$5,850
Workplan	hr	$130	40	$5,200
Design and subcontracting	hr	$130	80	$10,400
Permitting	hr	$100	20	$2,000
Construction oversight	hr	$100	150	$15,000
Documentation reporting	hr	$130	40	$5,200
SUBTOTAL OF INDIRECT CAPTIAL COSTS				$43,650
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				$277,650
FIRST YEAR OF SLOUGH MONITORING				
Project management/administration	hr	$195	15	$2,925
Surface water sampling (2 points, twice)	hr	$100	20	$2,000
Field equipment/expenses	ls	$2,000	1	$2,000
Lab - As	each	$15	4	$60
Data evaluation	hr	$130	25	$3,250
SUBTOTAL OF FIRST YEAR OF MONITORING				$10,235
30 % CONTINGENCY	%	30%		$3,071
SUBTOTAL OF CAPITAL AND MONITORING COSTS				$290,956

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SLOUGH WATER: (1) Impermeable barrier

ITEM	UNIT	UNIT COST	QTY	TOTAL
O&M COST				
Project management/administration	hr	$175	10	$1,750
Semi-annual Site Visit	hr	$100	20	$2,000
Field Expenses	ls	$1,000	1	$1,000
Misc Repairs	ls	$3,000	1	$3,000
Reporting	hr	$130	25	$3,250
SUBTOTAL FOR ANNUAL O&M				$9,250
30 % CONTINGENCY	%	30%		$2,775
MONITORING COSTS				
Project management/administration	hr	$195	15	$2,925
Surface water sampling (2 points, twice a yr)	hr	$100	20	$2,000
Field equipment/expenses	ls	$1,000	1	$1,000
Lab - As	each	$15	4	$60
Data evaluation and reporting	hr	$130	25	$3,250
SUBTOTAL FOR ANNUAL MONITORING				$9,235
30 % CONTINGENCY	%	30%		$2,771
PRESENT WORTH OF O&M	5	years @	3%	$55,071
PRESENT WORTH OF MONITORING	5	years @	3%	$54,982
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			**Total**	**$410,000**
			+ 50%	**$620,000**
			- 30%	**$290,000**

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

1. Costs rounded up to the nearest ten thousand dollars.
2. Costs determined from experience and estimates from other similar projects.
3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
4. Indirect costs do not include legal fees or public relations assistance.
5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting.

SPECIFIC

1. Assumes this option will be used in conjuction with marsh sediment treatment, such that 5 years of monitoring and O&M will be required following construction. If used as a stand alone option, the time for treatment and cost would increase.

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SLOUGH WATER: (1) Impermeable barrier

ITEM	UNIT	UNIT COST	QTY	TOTAL

2. Assumes the barrier will be left in place following the 5 years of monitoring.
3. Assumes no surface water management will be required once the barrier is in place.
4. Assumes a vertical barrier that is 2000 ft long, 5 feet deep, and made of either 100 mil HDPE or 1/4-inch thick polyethylene.
5. Assumes the barrier will be installed using a trench, if conditions are dry enough, or another appropriate method.

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SLOUGH WATER: (2) Capture and treat water on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	$10,000	1	$10,000
Site Preparation (Staging area and road building)	ls	$15,000	1	$15,000
Pipe installation cost (above grade)	ft	$5	1,100	$5,500
Electrical service (propane generator or temp power)	ls	$10,000	1	$10,000
Control Panel	ls	$30,000	1	$30,000
Pumps and control instrumentations	ls	$5,000	1	$5,000
Slough retention/overflow structure	each	$10,000	2	$20,000
Holding Tanks (2,500 gallons)	each	$5,000	4	$20,000
Sump pumps for holding tanks	each	$200	4	$800
Treatment Shed	ls	$15,000	1	$15,000
Misc electrical and plumbing	ls	$10,000	1	$10,000
Water Treatment System	ls	$100,000	1	$100,000
Solids separation	ls	$20,000	1	$20,000
Treatment Chemicals				
- Ferric sulfate	lb	$1.04	30	$31
- Limestone	lb	$1	250	$250
- 55-gallon drums for solids	each	$50	2	$100
Transport and disposal of solids (non-hazardous)	ls	$500	1	$500
SUBTOTAL OF DIRECT CAPITAL COST				$262,181
30 % CONTINGENCY (DIRECT CAPITAL)	%	30%		$78,654
INDIRECT CAPITAL COSTS				
Project management/administration	hr	$195	30	$5,850
Workplan	hr	$130	40	$5,200
Design and subcontracting	hr	$130	80	$10,400
Permitting	hr	$100	20	$2,000
Construction oversight	ls	$20,000	1	$20,000
Documentation reporting	hr	$130	15	$1,950
SUBTOTAL OF INDIRECT CAPITAL COSTS				$45,400
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				$386,236

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SLOUGH WATER: (2) Capture and treat water on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
FIRST YEAR O&M COSTS				
Project Management	hr	$195	40	$7,800
Shakedown visits	hr	$130	40	$5,200
Site Visits	hr	$100	70	$7,000
Misc Repairs	ls	$2	1	$2
Utilities/Fuel	mo	$3,000	3	$9,000
SUBTOTAL OF FIRST YEAR O&M				$29,002
30 % CONTINGENCY	%	30%		$8,701
FIRST YEAR OF SLOUGH MONITORING				
Project management/administration	hr	$195	10	$1,950
Surface water sampling (2 points, twice)	hr	$100	20	$2,000
WPDES Samples (6 times)	hr	$100	50	$5,000
Field equipment/expenses	ls	$1,000	1	$1,000
Lab - As	each	$15	4	$60
Lab - WPDES	each	$75	6	$450
Data evaluation	hr	$130	15	$1,950
SUBTOTAL OF FIRST YEAR OF MONITORING				$12,410
30 % CONTINGENCY	%	30%		$3,723
SUBTOTAL OF CAPITAL AND MONITORING COSTS				$402,369

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SLOUGH WATER: (2) Capture and treat water on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
O&M COST				
Project management/administration	hr	$195	20	$3,900
Site visits	hr	$100	70	$7,000
Field expenses	ls	$3,000	1	$3,000
Control Panel management	ls	$5,000	1	$5,000
Treatment Chemicals				
- Ferric sulfate	lb	$1.04	30	$31
- Limestone	lb	$1	250	$250
- 55-gallon drums for solids	each	$50	2	$100
Transport and disposal of solids (non-hazardous)	ls	$500	1	$500
Misc Repairs	ls	$1,500	1	$1,500
Documentation	hr	$130	20	$2,600
Utilities/Fuel	mo	$3,000	4	$12,000
Decommissioning (cost/5yrs)	ls	$5,000	1	$5,000
SUBTOTAL FOR ANNUAL O&M				$40,881
30 % CONTINGENCY	%	30%		$12,264
MONITORING COSTS				
Project management/administration	hr	$195	15	$2,925
Surface water sampling (2 points, twice a yr)	hr	$100	20	$2,000
WPDES Samples (6 times)	hr	$100	50	$5,000
Field equipment/expenses	ls	$1,000	1	$1,000
Lab - As	each	$15	4	$60
Lab - WPDES	each	$75	6	$450
Data evaluation and reporting	hr	$130	20	$2,600
SUBTOTAL FOR ANNUAL MONITORING				$14,035
30 % CONTINGENCY	%	30%		$4,211
PRESENT WORTH OF O&M	5	years @	3%	$243,391
PRESENT WORTH OF MONITORING	5	years @	3%	$83,559
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			**Total**	**$730,000**
			+ 50%	**$1,100,000**
			- 30%	**$520,000**

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

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OPINION OF PROBABLE COST
WDNR - KEWAUNEE MARSH FEASIBILITY STUDY
KEWAUNEE, WI
PROJECT NO. 7201.05

SLOUGH WATER: (2) Capture and treat water on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL

1. Costs rounded up to the nearest ten thousand dollars.
2. Costs determined from experience and estimates from other similar projects.
3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
4. Indirect costs do not include legal fees or public relations assistance.
5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting.

SPECIFIC

1. Assumes 10,000 gallons of water = max water captured per flow event, and 6 flow events per year.
2. Assumes above grade plumbing and utilities to run system, and decommissioning of the equipment and plumbing at the end of treatment.
3. Assumes this option will be used in conjunction with marsh sediment treatment, such that 5 years of monitoring and O&M will be required following construction. If used as a stand alone option, the time for treatment and cost would increase.
4. Water treatment system includes power generation, chemical metering pumps, solids hoppers, mixing tanks, and mixers.

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