WESTERN MONMOUTH UTILITY AUTHORITY REED BED STUDY

FINAL REPORT

JULY 15, 2009

The Purpose of this Study was to provide the Western Monmouth Utilities Authority (WMUA) management with information related to options for efficient disposal of WMUA reed bed sludge. We would like to thank the staff and management at WMUA and the New Jersey Department of Environmental Protection (NJDEP) for their suggestions and logistic support for this study.

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I. EXECUTIVE SUMMARY

In an effort to find a treatment(s) that would increase the Western Monmouth Utilities Authority's (WMUA) sludge disposal options, Rutgers University conducted experiments using the WMUA reed bed material. A main focus of these experiments was to evaluate the possibility of utilizing a composting treatment to kill *Phragmites'* rhizomes and/or fecal coliform indicator bacteria present in the WMUA reed bed sludge material. This research was conducted at both the laboratory scale employing bench top studies, and on site at the WMUA facility where compost piles of various size and composition were constructed.

After conducting the series of laboratory experiments, it was confirmed that a carbon source amendment would be required to allow the reed bed sludge material to heat to the required temperature of greater than 50 degrees C. Further benchtop tests indicated that green aboveground *Phragmites* biomass could be such an amendment, and so a small composting pile was constructed in the WMUA reed bed enclosure to test a ratio of 1:1 (w/w) green *Phragmites*:sludge material. Temperatures in this pile exceeded 50 degrees C, and so a larger pile was constructed consisting of a ratio of 1:2 (*Phragmites*:sludge, w/w). Temperatures in excess of 55 degrees C were observed in the large compost pile.

Phragmites rhizome samples that were placed in the large pile were recovered after the 55 degree C temperature was reached. The rhizomes were then re-planted and housed in the Rutgers experimental greenhouse. These rhizomes did not exhibit any signs of regenerating after three weeks under optimal greenhouse conditions. The results of these preliminary experiments indicate that heating the reed bed biosolid material by composting can indeed prevent *Phragmites* rhizomes from regenerating.

Composited samples of the sludge material were tested for fecal counts using the Most Probable Number (MPN) method. Fecal MPNs were below the regulatory standard both before and after the 55 degree C temperature was reached in the compost pile. However, over the time course of the composting process, MPNs exceeding the USEPA regulatory limit for pathogen destruction were observed. These MPN counts may be due to the sampling of a "hot spot" area. The counts could also be the result of the presence of non-fecal coliform bacterial species. After turning the on site compost pile twice over a period of two weeks, the temperature stabilized at approximately 35 degrees C. The USEPA pathogen kill criteria require that the pile be turned five times and that the 55 degree C temperature be achieved after each turning.

Due to the lack of success in meeting the USEPA pathogen kill criteria and the physical limitations of mixing and composting large piles at the WMUA facility, NJDEP suggested testing a physical screening process to remove the *Phragmites* rhizomes. With removal of the live rhizomes the material could potentially be designated as Class B. A McCloskey trommel screener (model 412) was rented and tested on site in December, 2008. The mechanical screening removed the rhizomes and above ground stems, producing a material that was rhizome free. Based on an examination of the post-screening material, NJDEP recommended that use of the material as a growth medium/nutrient source be pursued. One NJDEP suggestion was to consider using the material in parks.

Rutgers suggested that WMUA consider working with the Bergen County Parks Department and the Bergen County Improvement Authority (BCIA) to use the WMUA sludge as a growth medium for the Overpeck Park restoration. To facilitate these discussions, meetings were held with NJDEP, WMUA, and representatives from PMK, the environmental consultant on this project. NJDEP representatives said they would recommend to the Site Closure group (controlling regulatory authority for the Overpeck project) that the screened material is appropriate for this use. This disposal option would allow WMUA to clean out all 14 beds immediately.

II. COMPOSTING TEMPERATURE EXPERIMENTS

A. EXPERIMENTAL APPROACH

A test composting pile was constructed within a WMUA reed bed enclosure on January 19, 2008. Temperatures of this pile were monitored over a two week period, but no appreciable temperature change was observed, and so we determined that the reed bed material would not self-heat without additional treatments/amendments.

Bench top experiments (Fig. 1) were then conducted in the Rutgers University laboratories to determine appropriate amendments that would stimulate the WMUA reed bed sludge material to self-heat. The reed bed material was also analyzed at the Rutgers soil testing labs to determine the nutrient contents (see attached soil testing report, Appendix II). The laboratory test showed that WMUA sludge is acidic, with a pH of 4.5, whereas the optimum pH range for composting is 6 to 8. Sludge moisture content and the C:N ratio were near optimum values for composting. However, after anaerobic digestion and exposure in the reed beds for approximately ten years, the organic matter content of 43.7% suggests that the sludge has been considerably stabilized and there is very little readily available carbon. A number of substrates and substrate combinations were tested to determine their ability to self-heat (Table 1). Based on these experiments and the reed bed sludge nutrient content, we determined that a carbon source amendment was required for the WMUA reed bed material to self-heat under field conditions. The above ground green *Phragmites* biomass was selected as this amendment, since it is readily available on site and does not increase the volume of waste material requiring disposal.

Fig. 1. Insulated and aerated bench top compost experiment.

To verify the laboratory results under field conditions, a small composting pile approximately 6 ft long x 5 ft wide x 5 ft high was constructed within a WMUA reed bed enclosure on 9/12/08. Above ground green *Phragmites* was mixed with reed bed sludge material in a 2:1 ratio (w/w *Phragmites*:sludge), and the interior temperature of the pile reached 52 degrees C after 6 days.

While successful in stimulating self-heating, a 2:1 (w/w) *Phragmites*:sludge ratio presents a problem. The bulk density of the above ground material is much lower than that of the sludge, and so a ratio of 4:1 (v/v) *Phragmites* above ground material:sludge is required to achieve the 2:1 (w/w). In an effort to find a more efficient ratio that would self-heat using less *Phragmites* above ground biomass, on October 6, 2008 a larger compost pile, approximately 14 ft long x 10 ft wide x 6 ft high composed of a 1:1 (w/w) mixture was constructed within a WMUA reed bed enclosure (Fig. 2).

The pile temperature was monitored at multiple locations, and within less than a week, a temperature of $\geq$ 55 degrees C was observed in the pile interior. The pile was then turned and temperature monitoring continued (Fig. 3). Within a week the center interior of the pile exceed 50 degrees C, and so the pile was turned a third time. After the third turning, the overall pile temperature remained at approximately 35 degrees C.

Fig. 2. Compost field experiment. Pile constructed on 10/6/08 composed of 1:1 ratio green *Phragmites*:sludge material.

TABLE 1. Bench top Experiments Testing WMUA Sludge Ability to Self-Heat.

Amendment	Ratio to WMUA reed bed material	Moisture & pH	Temp Increase Observed	Temp	Comments
Experiments in Open Containers					
Phragmites above ground biomass	1:1 (v/v)	Not adjusted	20 C to 23 C (over 4 days aeration)	No	Not insulated enough
Phragmites above ground biomass	1:1 (v/v)	60% moisture, 75 g lime	18 C to 21 C (over 4 days aeration)	No	Not insulated enough
Primary Sludge	5% (v/v)	Not adjusted	16 C to 19 C (over 4 days aeration)	No	Not insulated enough
Primary Sludge	10% (v/v)	Not adjusted	16 C to 18.6 C (over 6 days aeration)	No	Not insulated enough
Digested Sludge	10% (v/v)	Not adjusted	16 C to 18 C (over 4 days aeration)	No	Not insulated enough
Digested Sludge	15% (v/v)	Not adjusted	14.4 C to 18.5 C (over 6 days aeration)	No	Not insulated enough
Saw Dust	1:1 (v/v)	Not adjusted	20 C to 21 C (over 4 days aeration)	No	Not insulated enough
Saw Dust	1:1 (v/v)	60% moisture, 75 g lime	18 C to 21.5 C (over 4 days aeration)	No	Not insulated enough
Experiments in Insulated Containers					
Oak Leaves	1:2 (v/v)	Not adjusted	18 C to 18.5 C	No	No aeration
Horse Manure	Only Horse manure	Not adjusted	24 C to 24 C	No	No aeration
Experiments in Insulated Containers with Aeration (v/v ratio)					
Dry Cat food	1:1 (v/v)	Not adjusted	19 C to 50 C (4 days discontinuous aeration)	Yes	Positive control
Dry Cat food	1:1 (v/v)	60% moisture	18 C to 56.5 C (4 days continuous aeration)	Yes	
Horse Manure	Only horse manure	Not adjusted	21 C to 35 C (6 days discontinuous aeration)	Yes	Positive control
Oak leaves	2:1 (v/v)	60% moisture	18.5 C to 18.5 C (5days continuous aeration)	No	Resistant to degradation
Primary Sludge	10% (v/v)	60% moisture	16 C to 17 C (5 days continuous aeration)	No	>95% moisture content
Digested Sludge	10% (v/v)	60% moisture	16 C to 17 C (5 days continuous aeration)	No	>95% moisture content
Saw Dust	2:1 (v/v)	60% moisture	19 C to 17.5 C (4 days continuous aeration)	No	Not a good carbon source
Green *Phragmites* above ground biomass	1.7:1 (v/v)	60% moisture	19 C to 20.5 C (4 days continuous aeration)	No	Retesting with higher ratio of leaves
Food grease (Vegetable oil as substitute)	2.5:1 (dry weight)	60% moisture	16.5 C to 36 C (5 days continuous aeration)	Yes	Easily available carbon, proper aeration & insulation
Experiments in Insulated Containers with Aeration (w/w ratio)					
Glass Cullet	1:1 (dry weight basis)	60% moisture	18 C to 18 C (4 days continuous aeration)	No	
Pre-Cured compost material (from Rutgers EcoComplex)	1:1 (dry weight basis)	60% moisture	18 C to 18.5 C (3 days continuous aeration)	No	Have to characterize the material
Green *Phragmites* above ground biomass	1:1 (w/w)	60% moisture	19 C to 35 C (Less than 24 hrs.)	Yes	To be field tested
Green *Phragmites* above ground biomass	1:2 (w/w)	60% moisture	19 C to 27 C (Less than 24 hrs.)	Yes	To be field tested

Based on the results of the field experiments, it appears that a 1:1 (w/w) ratio would not provide enough readily available carbon to allow the existing reed bed material to self-heat and maintain the 55 degree C temperature required by the USEPA to demonstrate pathogen destruction.

We note that even though the interior of the piles appeared to be anaerobic (no oxygen detected), there were ***no odor problems*** associated with the field test compost piles.

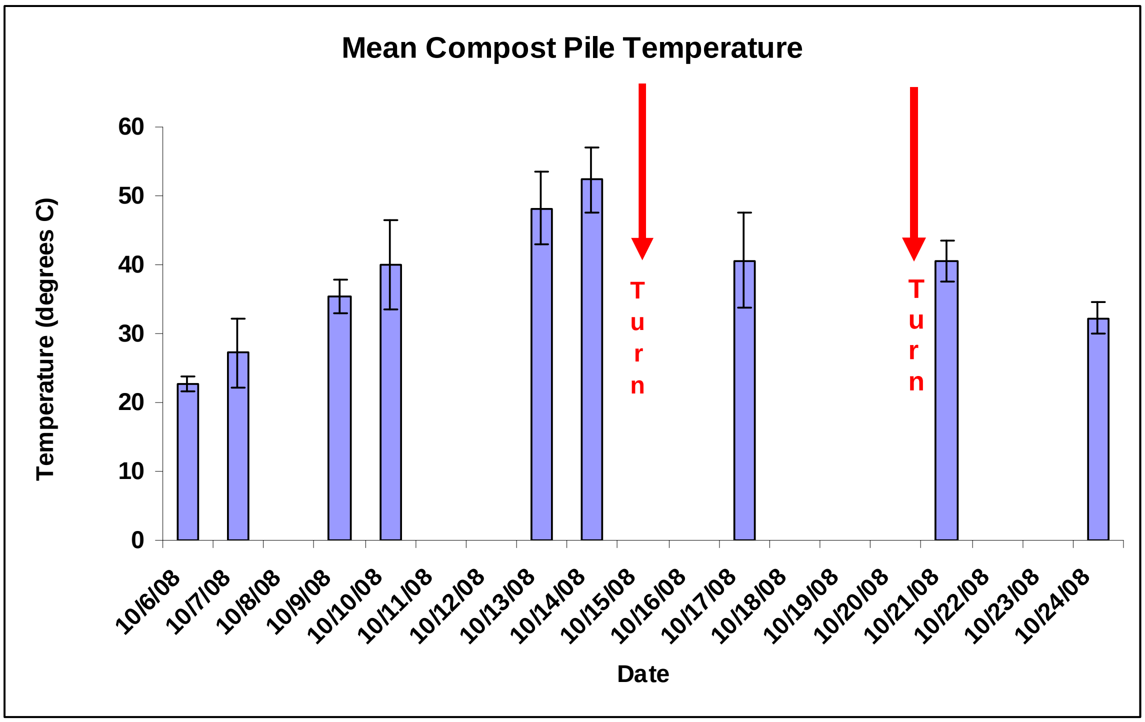


Fig. 3. Mean and standard deviation of daily temperatures achieved during compost field experiment. Pile constructed on 10/6/08 composed of 1:1 ratio green *Phragmites*:sludge material.

III. PHRAGMITES RHIZOME EXPERIMENTS

A. EXPERIMENTAL APPROACH

To determine the temperatures that would result in preventing *Phragmites* rhizomes from reproducing, laboratory experiments were conducted utilizing live rhizomes collected from the WMUA reed beds. Rhizome collection was accomplished by digging beneath growing *Phragmites* stems to recover their attached rhizomes. Rhizome clumps were severed from the parent plant and transported intact to the Rutgers University lab.

To expose the rhizomes to a temperature range between 30 – 50 degrees C, they were placed in a drying oven, and each temperature being tested was maintained for a period of 2 hours. The rhizomes were then planted in potting soil (Fig. 4a), placed in full sun (Fig. 4b), watered daily, and monitored to observe the growth of new shoots. Controls that were **not** placed in the ovens were planted at the same time to ensure that the rhizomes were capable of regeneration.

b. Rhizomes placed in full sunlight.

Fig. 4. Live *Phragmites* rhizomes a) regenerating after planting in potting soil and b) placed in full sunlight.

Fig. 5. Live *Phragmites* rhizomes after heat treatment, prior to planting in potting soil.

Prior to planting in Scotts MiracleGro™ potting soil (Fig. 5), rhizomes were washed and inspected to ensure that new bud growth was present (indicating viability), and that a minimum of 3 intact nodes were present.

B. RESULTS

Phragmites rhizomes produced growth after being heated at 30, 35, and 40 degrees C for 2 hours. Since ambient temperatures in the reed bed sludge were observed to reach 33 degrees C during the summer months, we were not surprise that re-growth was observed in rhizomes treated at 30-40 degrees C for only 2 hours. However, ***no growth was observed after the rhizomes were heated at 50 degrees C for 2 hours***. Based on the results obtained in the laboratory experiments, we decided to place live *Phragmites* rhizomes within the large compost test pile constructed on October 6, 2008 (Fig. 6). Three rhizomes, each containing new buds and three intact nodes, were housed in mesh bags, and 5 replicates bags were placed at 1 ft, 3 ft, and 5 ft heights within the pile as it was being constructed.

Three of the five replicates from each height were removed when the pile was turned on October 15, 2008. The remaining bags (6) plus 9 bags to replace the ones that were retrieved, were again incorporated into the pile that was constructed after turning. These 15 bags were retrieved a week after the second turning on October 29, 2008. The rhizomes recovered from the pile were transported to Rutgers and planted in potting soil as described above.

Fig. 6. Compost field experiment. Pile constructed on 10/6/08 containing 15 mesh bags of live *Phragmites* rhizomes.

Because control rhizomes were no longer regenerating outdoors (we believe this was due to cooling ambient temperatures and reduced sunlight), the rhizomes retrieved from the composting pile on October 6, 2008 were placed in the Rutgers experimental greenhouse on October 20, 2008. Greenhouse ambient temperatures are maintained at 60-65 degrees F, and light levels are 90 μEinsteins for 16 daylight hours. Under these conditions, our untreated control rhizomes were able to re-generate (Fig. 7), and so all further fall/winter 2008 rhizome experiments were conducted utilizing the greenhouse facility (Fig. 8).

Fig. 7. Control Phragmites rhizome re-growing in Rutgers experimental greenhouse. Photo taken Nov. 3, 2008.

Fig. 8. Phragmites rhizomes recovered from large WMUA compost pile after interior pile temperature reached 55 degrees C.

Although the control rhizomes placed in the greenhouse on Day 0 re-sprouted after approximately 20 days, no re-growth was observed in the rhizomes retrieved from the compost pile.

C. ADDITIONAL TEMPERATURE EXPERIMENTS

We resumed the outdoor rhizome experiments in March, 2009, to try and determine the composting temperature and time period required to completely inhibit rhizome growth. Because we had observed rhizome regeneration after exposure to temperatures of 30, 35, and 40 degrees C, we conducted these new experiments at 50 and 55 degrees C for 6 and 24 hour time periods. Rhizomes (10) with observable new growth buds were weighed (Tables 2 and 3), set on a tray with a thin layer of sludge cover, and placed in an oven at 50 degrees C. Five rhizomes were removed from the drying oven after six hours, planted in Miraclegro™ filled pots, and placed out doors in full sunlight. The remaining five rhizomes were removed from the oven after 24 hours, weighed, and planted as described. Five rhizome controls were left at room temperature for 24 hours, weighed, and then planted following the same protocols as the heated rhizomes. Rhizomes were watered daily and were observed for any new shoot growth. After one month, no growth was observed in the control or experimental pots. Lack of regeneration could have been due to the outside temperatures remaining too cold for shoot growth to occur, and so we decided to repeat the experiment when the outdoor ambient air temperature increased.

On April 7, 2009 a second set of rhizomes and controls was established as above. Growth was observed in four out of five controls after four weeks in the outdoors. Growth was also observed in one out of the five of the rhizomes heated at 55 degrees C after four weeks outdoors (Table 4). We will continue the rhizome experiments to try and determine whether growth after heating at 55 degrees C or higher can be replicated, and at what temperature no rhizome regeneration is observed.

Table 2. Rhizome Weight Before and After 50°C (6 hours)

Replicate #	Wt. before heating (gm)	Wt. after heating (gm)	Survival
1	12.42	11.55	No
2	7.94	7.19	No
3	11.97	10.40	No
4	10.57	8.44	No
5	14.63	12.11	No

Table 3. Rhizome Weight Before and After 50°C (24 hours)

Replicate #	Wt. before heating (gm)	Wt. after heating (gm)	Survival
1	11.19	10.00	No
2	14.63	13.69	No
3	19.20	18.88	No
4	14.29	13.42	No
5	16.66	15.20	No
Control #			
1	16.19	16.0	No
2	22.36	21.89	No
3	20.29	20	No
4	18.89	18.09	No
5	12.27	11.98	No

Table 4. Rhizome Weight Before and After 55°C (24 hours)

Replicate #	Wt. before heating (gm)	Wt. after heating (gm)	Survival
1	12.15	3.38	**Yes**
2	15.08	10.86	No
3	22.16	12.86	No
4	20.59	14.44	No
5	16.03	9.64	No
Control #			
1	21.55	20.15	Yes
2	12.3	12.12	No
3	16.06	15.37	Yes
4	23.70	22.48	Yes
5	13.95	12.49	Yes

IV. FECAL COLIFORM EXPERIMENTS

A. EXPERIMENTAL APPROACH

For land application of biosolids, USEPA regulations require that the density of fecal coliform be less than 1,000 MPN (Most Probably Number) per gram of total solids on a dry weight basis. MPN multiple tube fermentation experiments to test for presumptive and confirmed fecal coliform bacteria were carried out in the Rutgers laboratory (Fig. 9). These tests were based on the procedures described in *Standard Methods for the Examination of Water and Wastewater* (Eaton et al., 1995).

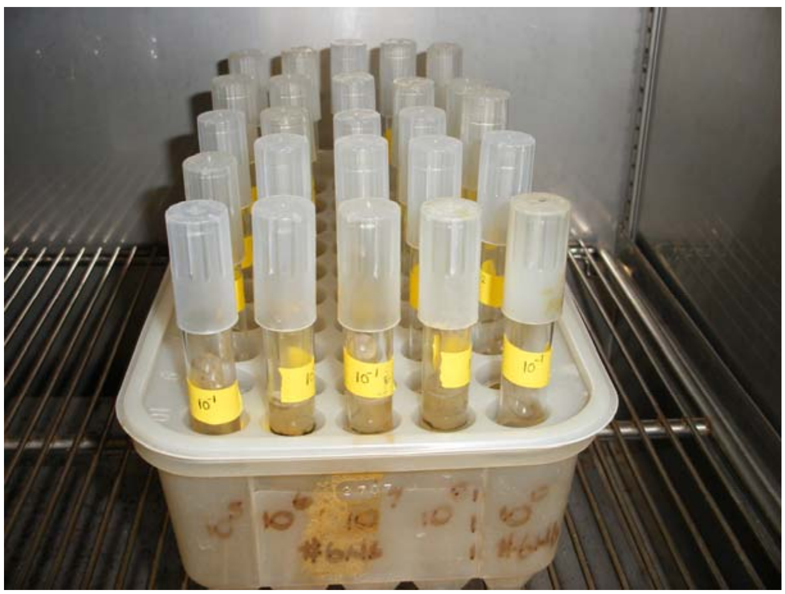


Fig. 9. Fecal Coliform MPN experiment set up.

Samples were collected from the WMUA reed beds (10/1/08) and MPN tests were performed in the Rutgers laboratory. We subsequently obtained samples: 1) during the composting field test of the larger pile on Day 0 (10/6/08) prior to composting activity; 2) from the pile interior on the day of the first turning (10/15/08); 3) from the pile interior on the day of the second turning (10/22/08); and 4) from the pile interior one week later (10/29/08). The MPNs in these samples were compared with USEPA regulatory limits for land application of sewage sludge. All the tests utilized dilutions ranging from 10^{-1} to 10^{-5} and each dilution series included five replicates (Table 4).

B. RESULTS

The MPN counts varied greatly over the course of the field composting experiment. The lowest MPN counts (175 MPN/g dry wt solids) were seen in the reed bed sludge material prior to the composting experiment and on Day 29 after the compost pile stabilized at approximately 35 degrees C. On Day 9, the MPN count was 550 MPN/g dry wt solids, which is under the USEPA regulatory limit. However, on Day 0 and on Day 16, we observed MPN counts that were above the regulatory standard (Table 2). We note that other than the MPN count observed on Day 16, our counts are within the MPN range observed by the WMUA's NJDEP certified laboratory. We do not know whether the Day 16 MPN counts represented a "hotspot," or if this number resulted from the presence of non-coliform bacteria such as *Bacillus* species.

TABLE 4. WMUA Reed Bed Sludge Fecal Coliform MPN Counts

Sampling Date	Sample Location	MPN Fecal Coliform Estimate
October 1, 2008	WMUA Reed Bed Sludge	175 MPN/g dry wt solids
October 6, 2008	Compost Pile Day 0 Composite	4000 MPN/g dry wt total solids
October 15, 2008	Compost Pile Day 9 – 3 ft center	550 MPN/g dry wt total solids
October 22, 2008	Compost Pile Day 16 – 3 ft center	225000 MPN/g dry wt total solids
October 22, 2008	Compost Pile Day 16 – 1 ft center	>225000 MPN/g dry wt total solids
October 29, 2008	Compost Pile Day 23 – 3 ft center	175 MPN/g dry wt total solids

REFERENCES CITED:

Eaton, A.D., Slesceri, L.S., Greenberg, A.E. 1995. Standard Methods for the Examination of Water and Wastewater. American Public Health Association & American Waterworks Association & Water Environment Federation. Washington, D.C.

V. SCREENING EXPERIMENT

While the experiments demonstrated that composting could potentially be a viable option to destroy live *Phragmites* rhizomes contained in the WMUA reed bed sludge material, determining the exact proportion and type of additional carbon source that will allow the material to heat to 55 degrees C for a time period that meets the USEPA regulations for pathogen kill was more problematical. To maintain the 55 degree C temperature for a longer time period utilizing green *Phragmites* biomass as the carbon source, the ratio of aboveground material to sludge must be greater than 1:1. Based on the bulk densities of these materials, acquiring enough aboveground biomass to compost all the material housed in the 14 WMUA reed beds would not be feasible. In addition, WMUA does not have the manpower or the equipment to continue constructing large compost piles. In light of these considerations, the NJDEP staff suggested that we consider a physical removal process to eliminate the *Phragmites* rhizomes. This approach would result in a disposal product that could be classified as a Class B material.

TROMMEL SCREENING

To test the viability of mechanically screening the sludge to remove *Phragmites* biomass, we contacted McCloskey International and arranged to have a test demonstration of a McCloskey 412 trommel screener on site at the WMUA facility. The machine was delivered on December 23, 2008, and the screening test was conducted the following day. The sludge was fed into the top of the screening equipment, and as a drum rotates, the smaller particles are sifted onto a conveyer that moves the screened material to a pile next to the machine (Fig. 10). The McCloskey 412 screener was able to remove both rhizomes and aboveground Phragmites biomass, producing a product without rhizomes (Fig. 11). The efficiency of this process would be improved by maintaining a full load in the screener and conducting the screening during warmer weather to eliminate the presence of icy balls of sludge. It was estimated by the McCloskey representative that all 14 beds could be screened within a period of 3-4 weeks with the equipment tested.

Fig. 10. McCloskey 412 trommel screening equipment and WMUA bobcat.

Fig. 11. WMUA sludge pre (b) and post (a) screening with McCloskey 412 trommel screener.

VI. SLUDGE DISPOSAL OPTIONS

The material produced after screening was sampled and the samples were shown to the NJDEP staff. We also shared metal and nutrient concentration test results (QC Laboratories, NJDEP certified lab) of the screened product with NJDEP. NJDEP staff suggested that we identify projects/sites that have need for a high nutrient growth material.

CLASS B DISPOSAL

The mechanical removal process does not meet USEPA requirements for demonstration of pathogen kill, and so the screened material would likely receive a Class B designation. Disposal of Class B material is highly controlled to protect both the environment and humans who could potentially come in contact with the material. Under a Class B designation, NJDEP would require WMUA to track and monitor the amount of sludge applied at any given disposal site. This involves generation and maintenance of paperwork as well as NJDEP reporting requirements. Should WMUA determine that they wish to pursue a Class B disposal option, the Authority will need to identify potential sites, which would then have to be approved by NJDEP. WMUA would be responsible for reporting metal and nutrient loadings to the NJDEP for any site selected, and for maintaining these records.

BERGEN COUNTY PARK RESTORATION

Dr. Ravit is involved in restoration activities in Bergen County, NJ, and was aware of the extensive restoration occurring in the County owned Overpeck Park. She contacted Bergen Country Parks Department representatives to see if they would be interested in taking the WMUA sludge for use in this major restoration. Bergen County contacted the project Environmental Consultant (PMK) and Dr. Ravit delivered samples of the screened sludge to their offices in Cranford, NJ. Subsequent meetings were held with NJDEP, PMK, WMUA (represented by Mike Dimino), and NJDEP to determine if use of the sludge for this project would be appropriate.

Because the restoration is occurring on a closed landfill, the controlling regulatory authority is the Site Closure group within NJDEP. The proposed use of the sludge for this project is as a high nutrient growth medium, to be covered with topsoil. The NJDEP residuals group indicated that they would favorably support the use of the sludge for this purpose, but added that this specific use with a topsoil cover is outside the established regulatory guidelines.

The Overpeck restoration plans call for growth medium that meets an older USEPA metal regulatory standard, rather than the more current 2008 standard. The WMUA sludge tested appears to meet the newer standard, but may have higher zinc concentrations that the older standard. Use of the material would have to be approved by the NJDEP Site Closure group.

CONCLUSIONS

Based on the favorable support from the NJDEP Residuals staff, we recommend strongly that WMUA continue to work with PMK and NJDEP to utilize the Overpeck resoration project to clean out the reed bed material. The main benefit is that all the beds could be emptied at one time, and so the Authority would recover full use of the reed beds immediately. A plan could then be put in place to systematically empty the beds on a rotating schedule, providing WMUA with continuous usable reed bed capacity. To dispose of smaller amounts of sludge more frequently would require identifying potential Class B users now, and incorporating regular bed clean outs into WMUA's operation and maintenance schedule.

Appendix I.

Rutgers Laboratory Data

Temperature and Oxygen Readings of Compost Pile(large) Set-Up on 10/6/08

Sludge:*Phragmites* (2:1 w/w)

Date	Depth(ft)	Temp	O_2	Height(ft)
10/6/08	3	21.5	17.4	1
10/6/08	3	20.4	12.1	1
10/6/08	3	22.3	7.3	1
10/6/08	3	22.3	9.4	1
10/6/08	3	23.1	5.9	1
10/6/08	3	24.3	13.2	3
10/6/08	3	24.3	11.9	3
10/6/08	3	23.9	7.6	3
10/6/08	3	23	8.4	3
10/6/08	3	24.3	11.1	3
10/6/08	3	22.4	13.9	5
10/6/08	3	22.6	13.7	5
10/6/08	3	22.9	13.5	5
10/6/08	3	21.6	12.6	5
10/6/08	3	21.8	18.6	5
10/7/08	3	25.6	6.5	1
10/7/08	3	24.9	11.4	1
10/7/08	3	26.2	9.1	1
10/7/08	3	25.4	17.3	1
10/7/08	3	27.8	17.1	1
10/7/08	3	29.3	11.6	3
10/7/08	3	27.8	16.2	3
10/7/08	3	27.7	12.1	3
10/7/08	3	27.2	14.6	3
10/7/08	3	30.1	16.6	3
10/7/08	3	30.2	16.4	5
10/7/08	3	27.4	14.6	5
10/7/08	3	25.6	12.9	5
10/7/08	3	27.8	14.4	5
10/7/08	3	26.1	13.6	5
10/9/08	3	24.8	3	1
10/9/08	3	28.9	4.7	1
10/9/08	3	34.1	1.7	1
10/9/08	3	30.5	0.2	1
10/9/08	3	34.4	0.5	1
10/9/08	3	39.5	0.9	3
10/9/08	3	34.5	2.3	3
10/9/08	3	34.1	0.2	3
10/9/08	3	28.8	0.9	3
10/9/08	3	35.1	0.6	3
10/9/08	3	43.1	2.3	5
10/9/08	3	39.7	2.2	5
10/9/08	3	37.2	0.9	5
10/9/08	3	42.1	2.8	5
10/9/08	3	44.2	1.9	5

Date	Depth(ft)	Temp	O_2	Height(ft)
10/10/08	1c	30.3	19.3	1
10/10/08	2c	41.9	16.5	1
10/10/08	3c	41.3	12	1
10/10/08	4c	35	3	1
10/10/08	5c	30.2	0.8	1
10/10/08	6c	28	0.3	1
10/10/08	1c	45.1	13.1	3
10/10/08	2c	49.4	12	3
10/10/08	1c	45.4	6.8	3
10/10/08	4c	39.3	0.6	3
10/10/08	5c	36	0.5	3
10/10/08	6c	42.4	0.3	3
10/10/08	7c	46.6	6.1	3
10/10/08	1c	34.8	20.2	5
10/10/08	2c	35.8	16.6	5
10/10/08	3c	36.9	13.1	5
10/10/08	4c	34.6	10.1	5
10/10/08	5c	31.7		5
10/10/08	1r	39.9		3
10/10/08	2r	45.9		3
10/10/08	3r	46.4		3
10/10/08	4r	42.2		3
10/10/08	5r	40.7		3
10/10/08	6r	46.5		3
10/10/08	7r	52		3
10/13/08	1c	35.2	17.5	1
10/13/08	2c	41.5	13.5	1
10/13/08	3c	47.4	7.5	1
10/13/08	4c	52.1	2.3	1
10/13/08	5c	51	1.5	1
10/13/08	6c	43.7	0	1
10/13/08	1c	49.2	13.3	3
10/13/08	2c	58.2	7.6	3
10/13/08	3c	51.1	5.1	3
10/13/08	4c	46.9	1	3
10/13/08	5c	46.7	0.8	3
10/13/08	6c	50.4	4.1	3
10/13/08	7c	55.3	8.7	3
10/13/08	1c	47.5	16.4	5
10/13/08	2c	45.3	11.2	5
10/13/08	3c	45	11.4	5
10/13/08	4c	46.3	12.6	5
10/13/08	1r	40.1	18.1	3
10/13/08	2r	47.8	9.6	3
10/13/08	3r	55.6	2.7	3
10/13/08	4r	50.1	1.2	3
10/13/08	5r	46	0.4	3
10/13/08	6r	48.6	0.3	3
10/13/08	7r	56.6	0.3	3

Date	Depth(ft)	Temp	O_2	Height(ft)
10/14/08	1c	46.7	18.5	3
10/14/08	2c	58.5	12.7	3
10/14/08	3c	56.7	7.7	3
10/14/08	4c	49.3	3.3	3
10/14/08	5c	46.7	1.2	3
10/14/08	6c	52.7	0.7	3
10/14/08	7c	55.9	0.9	3
10/14/08	1r	46.7	18.5	3
10/14/08	2r	58.5	12.7	3
10/14/08	3r	56.7	7.7	3
10/14/08	4r	49.3	3.3	3
10/14/08	5r	46.7	1.2	3
10/14/08	6r	52.7	0.7	3
10/14/08	7r	55.9	0.9	3
10/17/08	1c	31.9	6.6	1
10/17/08	2c	35.6	6.2	1
10/17/08	3c	34.3	5.6	1
10/17/08	4c	37.8	5.9	1
10/17/08	5c	39.6	4.5	1
10/17/08	6c	41.1	0	1
10/17/08	1c	37.8	14.6	3
10/17/08	2c	41.2	15.1	3
10/17/08	3c	42.2	6.4	3
10/17/08	4c	41	1.8	3
10/17/08	5c	41.1	1.2	3
10/17/08	6c	42.6	1	3
10/17/08	7c	43.6	0.9	3
10/17/08	1c	41	13.5	5
10/17/08	2c	43.7	5.5	5
10/17/08	3c	43.3	4.2	5
10/17/08	4c	43.9	3.8	5
10/17/08	5c	44.6	4.8	5
10/17/08	6c	44.3	0	5
10/17/08	7c	42.1	0	5
10/17/08	1r	36.4	9.9	1
10/17/08	2r	37.8	6.9	1
10/17/08	3r	38.4	4.6	1
10/17/08	4r	38.7	4.3	1
10/17/08	5r	38.4	4.3	1
10/17/08	6r	38.1	0	1
10/17/08	7r	38.4	0	1
10/17/08	1r	42	15.6	3
10/17/08	2r	43.4	14.1	3
10/17/08	3r	42.4	9.6	3
10/17/08	4r	41.3	3.9	3
10/17/08	5r	40.5	4.9	3
10/17/08	6r	40.4	3.4	3
10/17/08	7r	41.5	2	3
10/17/08	1r	42	16.9	5
10/17/08	2r	43.5	6.6	5
10/17/08	3r	44.3	6.9	5
10/17/08	4r	44.2	4.6	5
10/17/08	5r	44.8	3.6	5
10/17/08	6r	43.2	0	5
10/17/08	7r	33.2	0	5

Date	Depth(ft)	Temp	O_2	Height(ft)
10/21/08	1c	37.8	18.1	1
10/21/08	2c	39.2	13.8	1
10/21/08	3c	39.8	11.1	1
10/21/08	4c	37.8	8	1
10/21/08	5c	36.1	7.5	1
10/21/08	6c	35.9	13.2	1
10/21/08	7c	35.5	18.2	1
10/21/08	1c	43.2	17.7	3
10/21/08	2c	49.4	16.5	3
10/21/08	3c	50.5	5.2	3
10/21/08	4c	49.6	1.8	3
10/21/08	5c	47.8	0.7	3
10/21/08	6c	47.4	0.6	3
10/21/08	7c	44.9	0.6	3
10/21/08	1c	38.9	18.1	5
10/21/08	2c	43.4	13.8	5
10/21/08	3c	42.9	11.1	5
10/21/08	4c	42.4	8	5
10/21/08	5c	38.4	7.5	5
10/21/08	6c	28.3	13.2	5
10/21/08	7c	22.5	18.2	5
10/24/08	1c	31.3	12.1	1
10/24/08	2c	36	12	1
10/24/08	3c	35.8	9.9	1
10/24/08	4c	34.6	9.9	1
10/24/08	5c	34.4	10.1	1
10/24/08	6c	32.8	4.6	1
10/24/08	7c		4.2	1
10/24/08	1c	29.1	14.6	3
10/24/08	2c	32.8	14.1	3
10/24/08	3c	34.1	12.6	3
10/24/08	4c	33.4	6.7	3
10/24/08	5c	32.6	4.6	3
10/24/08	6c	32.7	4.3	3
10/24/08	7c	33	4	3
10/24/08	1c	25.7	16.2	5
10/24/08	2c	30.7	13.4	5
10/24/08	3c	31.1	15.6	5
10/24/08	4c	30.6	11	5
10/24/08	5c	30.8	9.6	5
10/24/08	6c	31.6	9.1	5
10/24/08	7c	31.2	4.1	5
10/24/08	3r	34.5		1
10/24/08	4r	33.7		1
10/24/08	1r	32.3		3
10/24/08	2r	34.6		3
10/24/08	3r	35.3		3
10/24/08	4r	34.2		3
10/24/08	5r	33.1		3
10/24/08	6r	32.9		3
10/24/08	7r	34.1		3
10/24/08	1r	28.9		5
10/24/08	2r	27.6		5
10/24/08	3r	30.4		5
10/24/08	4r	30.2		5
10/24/08	5r	30.3		5

Laboratory Rhizome Mortality Tests

Date	ID	Oven TempC	Time(Hrs)	Room TempC	Initial Wt. g	Final Wt.g	Moisture%	Intl. L(mm)	Final L(mm)	Survival
7/7/08	1	30	2	26				56	66	1
7/7/08	2	30	2	26				45	60	1
7/7/08	3	30	2	26				28	36	1
7/7/08	4	30	2	26				92	110	1
7/7/08	5	30	2	26				50	63	1
7/7/08	**6**	26	2	26						
7/7/08	**7**	26	2	26						
7/7/08	**8**	26	2	26						
7/7/08	**9**	26	2	26						
7/7/08	**10**	26	2	26						
7/8/08	1	40	2	25.1	24.61	20.29	17.55	40	40	0
7/8/08	2	40	2	25.1	21.72	15.9	26.80	60	60	0
7/8/08	3	40	2	25.1	10.35	8.49	17.97	62	62	0
7/8/08	4	40	2	25.1	12.81	8.82	31.15	98	98	0
7/8/08	5	40	2	25.1	10.09	7.82	22.50	0	0	0
7/8/08	**6**	25	2	25.1	9.55	8.85	7.33	70	79	1
7/8/08	**7**	25	2	25.1	13.6	11.7	13.97	145	150	1
7/8/08	**8**	25	2	25.1	14.4	12.16	15.56	30	37	1
7/8/08	**9**	25	2	25.1	14.05	11.88	15.44	78	83	1
7/8/08	**10**	25	2	25.1						
7/9/08	1	50	2	26.5						0
7/9/08	2	50	2	26.5						0
7/9/08	3	50	2	26.5						0
7/9/08	4	50	2	26.5						0
7/9/08	5	50	2	26.5						0
7/9/08	**6**	26	2	26.5				40	45	1
7/9/08	**7**	26	2	26.5				0	6	1
7/9/08	**8**	26	2	26.5				60	73	1
7/9/08	**9**	26	2	26.5				76	89	1
7/9/08	**10**	26	2	26.5						0

Date	ID	Oven TempC	Time(Hrs)	Room TempC	Initial Wt. g	Final Wt.g	Moisture%	Intl. L(mm)	Final L(mm)	Survival
7/14/08	**1**	35	2	23.5	6.67	5.21	21.89	66	74	1
7/14/08	**2**	35	2	23.5	12.5	10.47	16.24	0	4	1
7/14/08	**3**	35	2	23.5	6.02	4.5	25.25	72	72	0
7/14/08	**4**	35	2	23.5	9.41	8.49	9.78	69	74	1
7/14/08	**5**	35	2	23.5	10.5	7.82	25.52	72	79	1
7/14/08	**Control**	23	2	23.5						
7/14/08	**Control**	23	2	23.5						
7/14/08	**Control**	23	2	23.5						
7/14/08	**Control**	23	2	23.5						
7/14/08	**Control**	23	2	23.5						
8/5/08	**1**	30	2	24	1.11	0.95	14.41			1
8/5/08	**2**	30	2	24	25.9	21.9	15.44			1
8/5/08	**3**	30	2	24	15.63	11.09	29.05			1
8/5/08	**4**	30	2	24	6.18	5.02	18.77			1
8/5/08	**5**	30	2	24						
8/5/08	**Control**	30	2	24	9.52	8.69	8.72			1
8/5/08	**Control**	30	2	24	12.05	11.3	6.22			1
8/5/08	**Control**	30	2	24	5.49	4.99	9.11			1
8/5/08	**Control**	30	2	24	2.98	2.52	15.44			1
8/5/08	**Control**	30	2	24	6.6	6	9.09			0
7/23/08	**1**	35	2	24	9.37	7.85	16.22			1
7/23/08	**2**	35	2	24	15.01	9.62	35.91			1
7/23/08	**3**	35	2	24	13.97	11.55	17.32			0
7/23/08	**4**	35	2	24	11.75	8.47	27.91			0
7/23/08	**5**	35	2	24	10.01	8.27	17.38			1
7/23/08	**Control**	35	2	24						
7/23/08	**Control**	35	2	24						
7/23/08	**Control**	35	2	24						
7/23/08	**Control**	35	2	24						
7/23/08	**Control**	35	2	24						

Date	ID	Oven TempC	Time(Hrs)	Room TempC	Initial Wt. g	Final Wt.g	Moisture%	Intl. L(mm)	Final L(mm)	Survival
7/22/08	**1**	40	2	24	15.16	5.01	66.95			1
7/22/08	**2**	40	2	24	25.2	15.3	39.29			1
7/22/08	**3**	40	2	24	9.3	7.99	14.09			1
7/22/08	**4**	40	2	24	29.81	22.8	23.52			0
7/22/08	**5**	40	2	24	18	11.85	34.17			0
7/22/08	**Control**	40	2	24						
7/22/08	**Control**	40	2	24						
7/22/08	**Control**	40	2	24						
7/22/08	**Control**	40	2	24						
7/22/08	**Control**	40	2	24						
10/29/08	**1**	55	6	24	10.41	9.77				
10/29/08	**2**	55	6	24	7.64	6.42				
10/29/08	**3**	55	6	24	25.26	22.3				
10/29/08	**4**	55	6	24	9.8	7.9				
10/29/08	**5**	55	6	24	7.29	7				
10/29/08	**Control**	24	24	24	16.54	15.49				
10/29/08	**Control**	24	24	24	10.84	16.4				
10/29/08	**Control**	24	24	24	6.05	5.89				
10/29/08	**Control**	24	24	24	18.32	18.01				
10/29/08	**Control**	24	24	24	12.35	11.26				
10/29/08	**1**	55	24	24	7.82	6.89				
10/29/08	**2**	55	24	24	13.04	12.02				
10/29/08	**3**	55	24	24	11.58	10.89				
10/29/08	**4**	55	24	24	14.21	13.26				
10/29/08	**5**	55	24	24	7.9	6.46				

APPENDIX II.

Rutgers Soil Testing Laboratory Data

THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS COOPERATIVE EXTENSION
New Jersey Agricultural Experiment Station

Rutgers Soil Testing Laboratory
P.O. Box 902
Milltown, NJ 08850
(732) 932-9295 x 4231
FAX (732) 932-9292
www.rce.rutgers.edu/soiltestinglab

Soil Test Research Report

Rutgers, Dr. Elizabeth A. Ravit (Cook)
ENR, Environmental Sciences
Room 356, 14 College Farm Road
New Brunswick, NJ 08901

Date Reported: 02/13/2008

Serial No -

LabNo	Sample ID	Texture	pH	LRI	P	K	Mg	Ca	Cu	Mn	Zn	B	Fe
					Mehlich3 Values (lbs/A)				Micronutrients (ppm)				
0352	W M U A 1/31/08		4.55	6.85	718	91	266	7092	32.3	57.6	232.5	5.4	327.6

Electrical Conductivity: Soluble Salt Level = 1.21 mmho/cm (High)
Loss On Ignition: Organic Matter = 43.72%, Organic Carbon = 25.36%
Total Kjeldahl Nitrogen: 0.80%. (Ammonia nitrogen + org. nitrogen)
Inorganic Nitrogen: Nitrate-N = 170 ppm, Ammonium-N = 80 ppm

Rough estimate

Converting pounds/Acre to ppm
Acre furrow slice of soil = 2 million pounds
So, divide lb/A by 2 to get ppm.

So,

P = 718/2 = 359 ppm
K = 91/2 = 45.5 ppm
Mg = 266/2 = 133 ppm
Ca = 7092/2 = 3546 ppm

Whether they are capturing all Nitrate & Nitrite

RUTGERS

New Jersey Agricultural Experiment Station

Soil Testing Laboratory
Rutgers, The State University
P.O. Box 902
Milltown, NJ 08850-0902
Phone: (732) 932-9295

Soil Test Report

Lab No: 2008-**0352**

Name:	Rutgers, Dr. Elizabeth A. Ravit (Cook)	**Date Received:**	02/04/2008
	ENR, Environmental Sciences	**Date Reported:**	02/13/2008
Address:	Room 356, 14 College Farm Road	**Serial No:**	-
	New Brunswick, NJ 08901	**Sample ID:**	W M U A 1/31/08
Phone:	(732) 932-9763		
Fax:	(732) 932-8965		
Referred To:	Rutgers Cooperative Ext.		

Crop or Plant

Soil Tests and Interpretation

pH: 4.55 Very strongly acidic, suitable for blueberry, cranberry, azalea, rhododendron, and holly, but too acidic for most other plants.

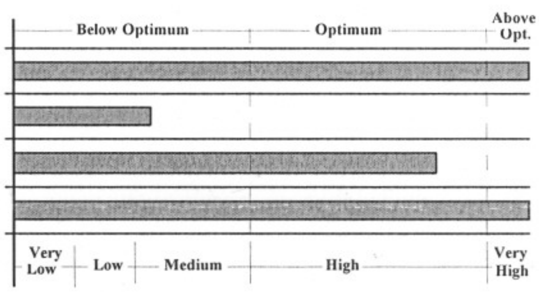
Lime Requirement Index: 6.85

Adams-Evans LRI is a measure of the soil's buffering capacity (resistance to change in pH).
It is used to determine liming rate, when necessary.

Macronutrients (pounds/acre)

Phosphorus:	718	(Above Optimum) ✓
Potassium:	91	(Below Optimum)
Magnesium:	266	(Optimum) ✓
Calcium:	7092	(Above Optimum) ✓

by Mehlich 3 extraction



Micronutrients (parts per million)

Zinc:	Copper:	Manganese:	Boron:	Iron:
232 (High)	32. (High)	57. (Adequate)	5.4 (Adequate)	327 (High)

Special Tests and Results

Electrical Conductivity: Soluble Salt Level = 1.21 mmho/cm (High soluble salt content -- may 'burn' plant roots, causing drought-like symptoms)
Loss On Ignition: Organic Matter = 43.72%, Organic Carbon = 25.36%
Total Kjeldahl Nitrogen: 0.80%
Inorganic Nitrogen: Nitrate-N = 170 ppm, Ammonium-N = 80 ppm

ELEVEN TINDALL ROAD, MIDDLETOWN, NJ 07748-2792
(732) 671-6400 * fax (732) 671-7365 * www.tandmassociates.com

T&M ASSOCIATES

WMUA-01900 May 27, 2009

Mr. Michael A. Dimino, P.E., Executive Director
Western Monmouth Utilities Authority
103 Pension Road
Manalapan, NJ 07726

Re: Western Monmouth Utilities Authority
April 2009 Reed Bed Sampling Results

Dear Mr. Dimino:

Please find enclosed a summary spreadsheet of the analytic results from the above referenced reed bed sampling event. This round of sampling analyzed the previously un-tested reed beds #3, #7, #8, #9, #10, #11, and #13. The enclosed spreadsheet lists any substance that was detectable (aka hit) during the TCLP, PP+40, and the hexavalent chromium analysis. The summary also compares the test data to the 1999 and 2008 soil clean-up criteria.

You will note that the concentrations of beryllium, copper and/or zinc exceeded the 1999 standards for one or more beds each. None of the beds exceeded the 2008 standards. For use in Overpeck Park, the material must meet the 1999 standards unless Bergen County applies to the NJDEP to modify their landfill disruption permit.

The original data were forwarded to Dave Bachman of PMK/Birdsall for his review. If you have any questions, or require more information, please call either Beth Engelbert or me at our office.

Very truly yours,

KEVIN F. TOOLAN, P.E.
WESTERN MONMOUTH UTILITIES
AUTHORITY ENGINEER

Keith W. Henderson/SCB
KEITH W. HENDERSON, P.E.
SR. VICE PRESIDENT

Enclosure
KWH:EAE:scb
cc (w/ enclosures):
- Authority Commissioners
- John Wisniewski, Esq.
- Dane Martindell, Plant Superintendent
- Ed Leatherman
- Robert Smith
- Beth Ravit, PhD, Rutgers University

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Western Monmouth Utilites Authority
Sample Results from April 16, 2009

DETECTABLE PARAMETER	2008 Non-Residental Direct Contact Soil Remediation Standard (mg/kg)	2008 Residental Direct Contact Soil Remediation Standard (mg/kg)	1999 NJRDCSCC (mg/kg)	REED BED # 3 RESULTS	REED BED #7 RESULTS	REED BED # 8 RESULTS
1,4-DICHLOROBENZENE (p-Dichlorobenze)	13	5	570000	ND	ND	ND
2-BUTANONE (Methyl ethyl ketone MEK)	44,000	3100	1000000	ND	ND	ND
4-CHLOROANILINE			230000	2380 J ug/kg DRY	1990 J ug/kg DRY	2000 J ug/kg DRY
ACETONE (2-propanone)	NA	70,000	1000000	ND	ND	ND
ANTIMONY	450	31	14	ND	ND	6.58 mg/kg DRY
ARSENIC	19	19	20	6.83 mg/kg DRY	6.89 mg/kg DRY	8.44 mg/kg DRY
BARIUM-TCLP	59,000	16000		0.197 mg/l	0.188 mg/l	0.252 mg/l
BERYLLIUM	140	16	1	2.61 mg/kg DRY	2.82 mg/kg DRY	3.53 mg/kg DRY
BIS(2-ETHYLHEXYL)PHTHALATE	140	35	49000	2880 J ug/kg DRY	3090 J ug/kg DRY	3320 J ug/kg DRY
CHROMIUM				34.2 mg/kg DRY	24.5 mg/kg DRY	33.4 mg/kg DRY
COPPER	45,000	3,100	600	477 mg/kg DRY	527 mg/kg DRY	703 mg/kg DRY
CYANIDE, TOTAL	23,000	1,600		1100	ND	ND
CYCLOPENTASILOXANE, DECAMETHYL-				ND	ND	ND
LEAD	800	400	400	32.4 mg/kg DRY	35.5 mg/kg DRY	41.9 mg/kg DRY
MERCURY	65	23	14	3.51 mg/kg DRY	3.11 mg/kg DRY	3.3 mg/kg DRY
NICKEL	23,000	1,600	250	15.8 mg/kg DRY	19 mg/kg DRY	19.9 mg/kg DRY
PHENOL	210,000	18,000	10000	12.4 mg/kg DRY	9.36 mg/kg DRY	22.2 mg/kg DRY
SILVER	5,700	390	110	47.2 mg/kg DRY	43.3 mg/kg DRY	67.7 mg/kg DRY
TOLUENE	91,000	6,300	1000000	ND	ND	ND
ZINC	110,000	23,000	1500	1220 mg/kg DRY	1460 mg/kg DRY	1600 mg/kg DRY
TOTAL SOLIDS PERCENT				44.48 %	43.68 %	30.57 %
TOTAL SOLIDS PERCENT				42.84 %	61.15 %	32.21 %
UNKNOWN				ND	ND	ND
UNKNOWN				67.6 J ug/kg	6840 J ug/kg DRY	122. J ug/kg
UNKNOWN-1				ND	ND	ND
UNKNOWN-2				ND	ND	ND
UNKNOWN-3				ND	ND	ND
UNKNOWN-4				ND	ND	ND

Result above 1999 NJRDCSCC Standard

Western Monmouth Utilites Authority
Sample Results from April 16, 2009

DETECTABLE PARAMETER	2008 Non-Residental Direct Contact Soil Remediation Standard (mg/kg)	2008 Residental Direct Contact Soil Remediation Standard (mg/kg)	1999 NJRDCSCC (mg/kg)	REED BED # 9 RESULTS	REED BED # 10 RESULTS	REED BED # 11 RESULTS	REED BED # 13 RESULTS
1,4-DICHLOROBENZENE (p-Dichlorobenze)	13	5	570000	ND	ND	22.3 J ug/kg	36.7 J ug/kg
2-BUTANONE (Methyl ethyl ketone MEK)	44,000	3100	1000000	ND	373 ug/kg	444 ug/kg	263 ug/kg
4-CHLOROANILINE			230000	2210 J ug/kg DRY	1830 J ug/kg DRY	1820 J ug/kg DRY	1620 J ug/kg DRY
ACETONE (2-propanone)	NA	70,000	1000000	ND	1530 ug/kg	1930 ug/kg	1680 ug/kg
ANTIMONY	450	31	14	ND	ND	ND	ND
ARSENIC	19	19	20	8.15 mg/kg DRY	7.8 mg/kg DRY	8.77 mg/kg DRY	7.07 mg/kg DRY
BARIUM-TCLP	59,000	16000		0.214 mg/l	0.293 mg/l	0.263 mg/l	0.232 mg/l
BERYLLIUM	140	16	1	3.46 mg/kg DRY	3.75 mg/kg DRY	4.05 mg/kg DRY	3.9 mg/kg DRY
BIS(2-ETHYLHEXYL)PHTHALATE	140	35	49000	3320 J ug/kg DRY	4180 J ug/kg DRY	4800 J ug/kg DRY	6660 J ug/kg DRY
CHROMIUM				30.9 mg/kg DRY	30.6 mg/kg DRY	26.7 mg/kg DRY	25.4 mg/kg DRY
COPPER	45,000	3,100	600	676 mg/kg DRY	764 mg/kg DRY	770 mg/kg DRY	761 mg/kg DRY
CYANIDE, TOTAL	23,000	1,600		ND	10.2 mg/kg DRY	ND	ND
CYCLOPENTASILOXANE, DECAMETHYL-				ND	ND	8110 JNB ug/kg DRY	ND
LEAD	800	400	400	42.6 mg/kg DRY	44.8 mg/kg DRY	42.8 mg/kg DRY	42.1 mg/kg DRY
MERCURY	65	23	14	4.09 mg/kg DRY	3.45 mg/kg DRY	2.97 mg/kg DRY	4.86 mg/kg DRY
NICKEL	23,000	1,600	250	18.9 mg/kg DRY	29.2 mg/kg DRY	29.8 mg/kg DRY	30.2 mg/kg DRY
PHENOL	210,000	18,000	10000	20.8 mg/kg DRY	13.6 mg/kg DRY	27.2 mg/kg DRY	14.4 mg/kg DRY
SILVER	5,700	390	110	67.9 mg/kg DRY	62.4 mg/kg DRY	53.2 mg/kg DRY	51.4 mg/kg DRY
TOLUENE	91,000	6,300	1000000	ND	8.31 J ug/kg	ND	ND
ZINC	110,000	23,000	1500	1320 mg/kg DRY	2090 mg/kg DRY	2460 mg/kg DRY	2540 mg/kg DRY
TOTAL SOLIDS PERCENT				35.22 %	30.12 %	26.9 %	25.9 %
TOTAL SOLIDS PERCENT				37.56 %	40.1 %	26.73 %	22.67 %
UNKNOWN				ND	ND	16000 J ug/kg DRY	9900 J ug/kg DRY
UNKNOWN				ND	ND	ND	ND
UNKNOWN-1				ND	162. J ug/kg	348. J ug/kg	329. J ug/kg
UNKNOWN-2				ND	75.4 J ug/kg	107. J ug/kg	254. J ug/kg
UNKNOWN-3				ND	68.8 J ug/kg	99.4 J ug/kg	ND
UNKNOWN-4				ND	ND	131. J ug/kg	ND

Result above 1999 NJRDCSCC Standard