MEMORANDUM

TO: Mr. Robert Antonelli, Jr. – City of Worcester DPW&P
FROM: Frank Ricciardi, PE, LSP, Daron Kurkjian, PE, Tony Zerilli,
DATE: June 7, 2017
SUBJECT: Bench-Scale Study Results, Salisbury Pond

On behalf of the City of Worcester, Weston & Sampson is pleased to provide the results of a bench-scale study evaluating the feasibility of Salisbury Pond dredging. The purpose of the study was to better understand the sediment characteristic and simulate dredging and dewatering techniques methods to reduce disposal weight. Reduced sediment mass and water weight will reduce transport and disposal costs that, based on arsenic-impacts to sediment, are high.

Site History:
In May 2016, Weston & Sampson collected sediments samples for laboratory analysis to pre-characterize Salisbury Pond sediment. The purpose of this sampling effort was to evaluate disposal options for dredged sediment. The analytical results from this pre-characterization indicate that arsenic detections above in-state landfill disposal levels are present across a large area of the pond. Please refer to Figure 1 for areas which exceed in-state disposal levels (Comm-97). Sediments in the northwestern lobe of the pond have arsenic concentrations that on average are below the Comm-97 standards, however, MassDEP does not typically allow averaging of results for waste characterization purposes.

Weston & Sampson recommended and performed a bench-scale study to evaluate potential dredging methods and dewatering technologies. The bench-scale study summarized in this memo provided data allowing for more accurate cost estimating for Salisbury pond dredging project.

Bench-Scale Study:
On December 13, 2017, Weston & Sampson collected sediment samples for the bench-scale study. Weston & Sampson collected five sediment samples for the following off-Site laboratory geotechnical analysis.

- Percent solids/percent moisture analysis
- Sieve analysis with hydrometer testing to determine clay fraction
Ice on the pond restricted sediment coring to the far west, north and east of the pond, however representative samples were collected from accessible pond locations. The sediment sample locations are depicted on Figure 1.

Weston & Sampson also collected 15 gallons of sediment and 15 gallons of surface water for dredging and dewatering bench-scale testing. Six grab sediment samples were composited to provide the volume needed for the sediment sample. Surface water was collected from various locations across the pond. Please refer to Figure 1 for a graphical depiction of the sediment sample locations. The sediment and surface water samples were appropriately packaged and shipped to GeoTesting Express, Inc. of Acton, Massachusetts and Infrastructure Alternatives, Inc. (IAI) of Rockford, Michigan for evaluation of dry and wet dredging scenarios as further detailed below:

1) Wet Dredging Scenario: Hydraulic Dredging
   a. Evaluate geotube (filter bag dewatering) with bench-scale analysis of dewatering efficiency at 24 hours, 7 days, and 28 days.
   b. Chemical conditioning analysis.

2) Mechanical Dredging (Wet and Dry Dredging Scenario):
   a. Decant free water from sediment, bench-scale testing of various polymers and coagulants.
   b. Evaluate percent water reduction, change in weight after decanting and post-dewatering.
   c. Record dewatering time and efficiency.

Please refer to Attachments A & B for the geotechnical and bench-scale study results summarized in the section below.

Results:
Geotechnical Results:
The geotechnical data generated from this study indicated that sediment ranged from approximately 40 to 50 percent solids. Based on Particle Size Analysis by ASTM D422, the sediment consisted of 75 to nearly 100 percent fines (silt and/or clay). One exception was sample SED-2 that was mostly sand.

Based on Weston & Sampson’s prior knowledge of the high level of fines, we submitted the sediment samples for Atterberg Limits analysis by ASTM D4318. This analysis was used to determine if fines were silt or clay. The Atterberg Limits analytical results indicated that the sediment to be elastic silt and not clay. While fines are the most difficult grain size to dewater, silt is preferable and less costly to dewater than clay. Please refer to Attachment A for the geotechnical results.

Bench-Scale Study Results:
Concurrent to geotechnical analysis, the composite samples of 15 gallons of sediment and 15 gallons of pond surface water were submitted for a hydraulic/mechanical dredging bench-scale study. The results of this study found that the sediments would be suitable for wet or dry dredging techniques.
In wet dredging, either a liquid slurry or fully saturated sediment is generated. To evaluate dewatering alternatives of these wet sediments, coagulants and geotubes were evaluated. IAI evaluated approximately a dozen different polymer coagulants in jar tests. Jar testing was performed by adding a preset volume of coagulant to a sediment sample and recording the water release rate, water clarity and appearance of floc. The best performing coagulant was WaterSolve’s Solve-9248; this coagulant had a high water release rate, good water clarity and low appearance of floc. A photo of the jar tests is presented above and the full results of the coagulant review are included in Attachment B.

To simulate sediment agitation and creation of a liquid slurry during hydraulic dredging, IAI mixed pond sediment, surface water and coagulant (Solve-9248) into a slurry. This slurry was then pumped into Geotubes to evaluate dewatering. In the short-term and within five days the slurry shed water and achieved a moisture content of its in situ pre-mixed state. After 28 days, the dewatering effective increased significantly with water content reductions of approximately 20 percent.

A paint filter test was also conducted with the pond sediment to assess if the material has free liquids that would preclude transportation. Simulated wet mechanical dredging indicated free liquids were present even after 24 hours of passive drainage. Amendments were required to pass paint-filter test in the simulated wet mechanical dredging scenario. Amendments including Portland cement and Calciment bound free liquids to pass the paint filter test. This has implications for the off-Site disposal as the stabilizing agents and sediment blending would result in increased mass of sediment resulting in additional costs and disposal tonnages.

Finally, dry dredging techniques, such as draining portions of the pond using temporary dams, were reviewed. The provided sediment was amended with limited pond water to simulate the dryer conditions
likely after draining the pond. After 24 hours of passive drainage, the sediment passed paint filter tests without the need for amendments. As amendments add weight by binding free water, dry dredging showed promise for reduced weight. Please refer to Attachment B for the full bench-scale study results including photographs of the testing processes and graphs of bench-scale data. Based on the geotechnical results, dry dredging of the silty sediment would represent construction challenges as saturated silts have limited bearing capacity for heavy equipment. Extensive construction mats would be required in a dry dredging scenario.

**Generated Water:**
The contact water generated from the Geotubes was identified to contain dissolved arsenic. Similarly, contact water generated from draining excavated sediment in wet/dry mechanical scenarios would also contain dissolved arsenic. Based on this, Weston & Sampson recommends particulate filtration followed by granular activated carbon (GAC) adsorption for arsenic removal from dewatering fluids prior to return to the pond.

**Cost Review:**
Weston & Sampson has developed initial cost estimates of the various dredging technologies. With approximately 50,000 CY of sediment to remove and dispose of off-Site, total project costs can be reduced by performing the work in phases and/or focusing on the northern lobe of the pond that is less-impacted and in more-time sensitive need of dredging. Another option to save costs would be to meet with the MassDEP and request approval to relocate these soils within Worcester at a similarly arsenic-impacted Site. The relocated sediment would then require a cover system. This would require an appropriate receiving location in the city of Worcester and MassDEP approval but is the least costly alternative available. Meeting with the MassDEP may also be useful to request in-state disposal of the northern lobe sediment that on average are below Comm-97 arsenic standards but have several individual locations that are above the arsenic standard.

Using MassDEP approved disposal options, Weston & Sampson has prepared preliminary cost estimates for sediment removal, summarized below:

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Estimated Costs (million)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic Dredging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Pond</td>
<td>$9.0</td>
<td>Sediment pumped to geotubes for dewatering. Less equipment needed than mechanical dredging.</td>
</tr>
<tr>
<td>North Lobe</td>
<td>$4.3</td>
<td></td>
</tr>
<tr>
<td>South Lobe</td>
<td>$5.0</td>
<td></td>
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<tr>
<td>Wet Mechanical Dredging</td>
<td>$14.7</td>
<td>Most costly option.</td>
</tr>
<tr>
<td>Dry Dredging</td>
<td>$8.5</td>
<td>AquaDam cannot exceed 10’, amendment (added weight) needed to pass paint filter test</td>
</tr>
<tr>
<td>Excavator Dredging from Shore</td>
<td>$2.4</td>
<td>Includes removal from shore only (i.e. to a distance of 30’). Significant vegetation clearing, restoration of the shore and removal of peninsula and island are not included in this cost estimate.</td>
</tr>
</tbody>
</table>

**Conclusions and Recommendations:**
Weston & Sampson has prepared this memo to summarize the results of the Salisbury Pond bench scale study. Results indicate several dredging techniques are suitable for the pond and that the sediments are typically silt. Space constraints in the pond’s urban location limit handling/sediment
management options. The City’s budgetary and timing goals will also inform which technology is best suited.

While dry dredging is the least costly option for full pond dredge, odors and construction noise will require the most management. Each section of dry dredging will require draining the dredge area, placement of mats to traverse soft sediment and use of heavy excavation machinery. To minimize the noise and odor impacts to the neighborhood, Weston & Sampson recommends hydraulic dredging with geotubes. This option will readily remove sediment and achieve dewatering. As requested by the City of Worcester, Weston & Sampson will provide samples of the geotube materials.

The most significant dredging cost is transport and disposal of arsenic-impacted sediment. Weston & Sampson has reviewed dewatering technologies to reduce sediment weight. Treatment of sediment for removal of arsenic is also costly. Obtaining site-specific approval from MassDEP to dispose of this portion of the sediment in-state may be possible considering that average concentrations in the northwestern lobe are below Comm-97 standards. At this time, costs are presented assuming only the western-most sediment can be disposed of in-state.

Weston & Sampson has also reviewed a fourth option of a partial pond dredge whereby sediment along the pond perimeter is excavated using standard excavating equipment located on the bank or on swamp mats placed on the water’s edge. Assuming an accessible reach of 30 feet into the pond from the bank, this would remove approximately 10,000 CY of sediment. A challenge with this approach is the vegetation on portions of the shore would require clearing prior to excavation work followed by appropriate restoration upon completion of excavation activities. This shore-based option would be a less costly option as shore-accessible soils are limited in volume and disposal includes limited stockpiling and on-Site treatment to bind free water.
<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Cost</th>
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<tr>
<td>Wet-Site Preperation</td>
<td>LS</td>
<td>$2,500</td>
</tr>
<tr>
<td>Shore-Based Prep (SWPPP, CGP, etc.)</td>
<td>LS</td>
<td>$500</td>
</tr>
<tr>
<td>Establish Fenced Sediment Staging Areas</td>
<td>EA</td>
<td>$30,000</td>
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<tr>
<td>Vegetation Clearing</td>
<td>CY</td>
<td>$325</td>
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<tr>
<td>Temporary Berm/Fencing</td>
<td>LF</td>
<td>$900</td>
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<tr>
<td>Access Road Construction</td>
<td>LY</td>
<td>$300</td>
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<td>Access Road Relocation</td>
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<td>Turbidity Curtain</td>
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<td>Turbidity Monitoring</td>
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<td>$700</td>
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<tr>
<td>Sediment Preperation</td>
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<tr>
<td>Mechanical Dredging Equipment and graphene</td>
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<td>$500</td>
</tr>
<tr>
<td>Dewatering Setup</td>
<td>LA</td>
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<tr>
<td>Mechanical Dry-Dredging</td>
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</tr>
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<td>Excavation, Bulk Scrapers, Common Earth, 1000' haul, Land-based</td>
<td>CY</td>
<td>$200</td>
</tr>
<tr>
<td>Excavation, Bulk Scrapers, Common Earth, 1000' haul, Water-based</td>
<td>CY</td>
<td></td>
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<td>Construction Mats</td>
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<td>Construct Dam</td>
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<tr>
<td>Water Treatment System for dewatering pond</td>
<td>CY</td>
<td>$2,000</td>
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<td>Water Treatment System - Wet sediment</td>
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<td>Water Treatment System - Shore Sediment</td>
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<tr>
<td>Transport &amp; Disposal</td>
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<tr>
<td>Pipeline: Out-of-state portion of southern lobe</td>
<td>Total CY</td>
<td>12,600</td>
</tr>
<tr>
<td>Mechanical Dredging: Out-of-state portion of southern lobe</td>
<td>Total CY</td>
<td>19,960</td>
</tr>
<tr>
<td>Mechanical Dredging: In-state portion of southern lobe</td>
<td>Total CY</td>
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<tr>
<td>Pipeline: In-state portion of southern lobe</td>
<td>Total CY</td>
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</tr>
<tr>
<td>Pipeline: Land-based portion</td>
<td>Total CY</td>
<td>12,560</td>
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<tr>
<td>Mechanical Dredging: Land-based portion</td>
<td>Total CY</td>
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<tr>
<td>Mechanical Dredging: In-state portion</td>
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<td>Site Restoration</td>
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<tr>
<td>Stormwater Mitigation</td>
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<td>10,000.00</td>
</tr>
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<td>SUBTOTAL CONSTRUCTION COSTS</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% Contingency</td>
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<td></td>
</tr>
<tr>
<td>TOTAL CONSTRUCTION COSTS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Engineer's estimate is within minus 30 percent to plus 50 percent of actual prices.
CY = cubic yard
SF = square foot
LY = linear foot
LS = cubic yard
LF = linear foot
SY = square yard
Notes:
Engineer's estimate is within minus 30 percent to plus 50 percent of actual prices.
CY = cubic yard
SF = square foot
LY = linear foot
LS = cubic yard
LF = linear foot
SY = square yard
FIGURE 1
WORCESTER, MA
SALISBURY POND DREDGING FEASIBILITY STUDY

SAMPLING LOCATIONS

Sample Type
- Composite
- Discrete
- COMM-97 Exceedance
- GeoTesting Sampling & IAI
- IAI Sediment & Surface water only

Scale in Feet

PATH: O:\Worcester MA\Salisbury Pond Dredging\GIS\technical memo\sed thickness 2016.mxd
User: PetersenT
Saved: 5/23/2016 3:56:26 PM
Opened: 6/2/2016 10:26:26 AM

USGS, MassGIS
Transmittal

TO:
Daron Kurkjian
Weston & Sampson Engineers
5 Centennial Drive
Peabody, MA 01960

DATE: 1/6/2017  GTX NO: 305772

RE: Salisbury Pond

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<th>DATE</th>
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<td>1/6/2017</td>
<td>December 2016 Laboratory Test Report</td>
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</tbody>
</table>

REMARKS:

SIGNED: ___________________________________________________

CC: Joe Tomei, Laboratory Manager

APPROVED BY: ________________________________________________
Nancy Hubbard, Project Manager
January 6, 2017

Daron Kurkjian
Weston & Sampson Engineers
5 Centennial Drive
Peabody, MA 01960

RE: Salisbury Pond, (GTX-305772)

Dear Daron:

Enclosed are the test results you requested for the above referenced project. GeoTesting Express, Inc. (GTX) received five samples from you on 12/13/2016. These samples were labeled as follows:

| Sample  | Sed-1 | Sed-2A | Sed-2B | Sed-3 | Sed-4 |

GTX performed the following tests on these samples:

- 5 ASTM D2216 - Moisture Contents
- 5 GTX-S1076 - Total Solids
- 4 ASTM D422 - Grain Size Analyses - Sieve and Hydrometer
- 1 ASTM D422 - Grain Size Analysis - Sieve Only
- 4 ASTM D4318 - Atterberg Limits

A copy of your test request is attached.

The results presented in this report apply only to the items tested. This report shall not be reproduced except in full, without written approval from GeoTesting Express. The remainder of these samples will be retained for a period of sixty (60) days and will then be discarded unless otherwise notified by you. Please call me if you have any questions or require additional information. Thank you for allowing GeoTesting Express the opportunity of providing you with testing services. We look forward to working with you again in the future.

Respectfully yours,

Joe Tomei
Laboratory Manager
## Moisture Content of Soil and Rock - ASTM D2216

<table>
<thead>
<tr>
<th>Boring ID</th>
<th>Sample ID</th>
<th>Depth</th>
<th>Description</th>
<th>Moisture Content, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>---</td>
<td>Sed- 1</td>
<td>---</td>
<td>Wet, very dark gray silt with sand</td>
<td>160.4</td>
</tr>
<tr>
<td>---</td>
<td>Sed- 2A</td>
<td>---</td>
<td>Wet, very dark gray silt with sand</td>
<td>95.1</td>
</tr>
<tr>
<td>---</td>
<td>Sed- 2B</td>
<td>---</td>
<td>Wet, very dark gray sand with silt</td>
<td>32.9</td>
</tr>
<tr>
<td>---</td>
<td>Sed- 3</td>
<td>---</td>
<td>Wet, very dark gray silt</td>
<td>109.2</td>
</tr>
<tr>
<td>---</td>
<td>Sed- 4</td>
<td>---</td>
<td>Wet, very dark gray silt</td>
<td>168.7</td>
</tr>
</tbody>
</table>

Notes: Temperature of Drying : 110° Celsius
Total Solids

<table>
<thead>
<tr>
<th>Boring ID</th>
<th>Sample ID</th>
<th>Depth, ft</th>
<th>Visual Description</th>
<th>Moisture Content, %</th>
<th>Total Solids, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>---</td>
<td>Sed-1</td>
<td>---</td>
<td>Wet, very dark gray silt with sand</td>
<td>160.4</td>
<td>38.4</td>
</tr>
<tr>
<td>---</td>
<td>Sed-2A</td>
<td>---</td>
<td>Wet, very dark gray silt with sand</td>
<td>95.1</td>
<td>51.3</td>
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<tr>
<td>---</td>
<td>Sed-2B</td>
<td>---</td>
<td>Wet, very dark gray sand with silt</td>
<td>32.9</td>
<td>75.3</td>
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<tr>
<td>---</td>
<td>Sed-3</td>
<td>---</td>
<td>Wet, very dark gray silt</td>
<td>109.2</td>
<td>47.8</td>
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<tr>
<td>---</td>
<td>Sed-4</td>
<td>---</td>
<td>Wet, very dark gray silt</td>
<td>168.7</td>
<td>37.2</td>
</tr>
</tbody>
</table>

Notes: Moisture Content = (mass of water) / (mass of dry soil)  
Total Solids = (mass of dry soil) / (mass of wet soil)
Particle Size Analysis - ASTM D422

**Visual Description:** Wet, very dark gray silt with sand

### Particle Size Analysis

<table>
<thead>
<tr>
<th>Sieve Name</th>
<th>Sieve Size, mm</th>
<th>Percent Finer</th>
<th>Spec. Percent</th>
<th>Complies</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75 in</td>
<td>19.00</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5 in</td>
<td>12.50</td>
<td>91</td>
<td></td>
<td></td>
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<tr>
<td>0.375 in</td>
<td>9.50</td>
<td>91</td>
<td></td>
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</tr>
<tr>
<td>#4</td>
<td>4.75</td>
<td>89</td>
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<td>#20</td>
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<table>
<thead>
<tr>
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</tr>
<tr>
<td>0.0015</td>
<td>6</td>
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</tr>
</tbody>
</table>

**Coefficients**

- $D_{95} = 0.8596\ mm$  
- $D_{60} = 0.0363\ mm$  
- $D_{40} = 0.0203\ mm$  
- $C_y = 15.125$  
- $C_c = 0.810$

**Classification**

- **ASTM** Elastic silt with sand (MH)
- **AASHTO** Clayey Soils (A-7-5 (47))

**Sample/Test Description**

- Sand/Gravel Particle Shape : ANGULAR
- Sand/Gravel Hardness : HARD
- Dispersion Device : Apparatus A - Mech Mixer
- Dispersion Period : 1 minute
- Specific Gravity : 2.65
- Separation of Sample: #200 Sieve
Client: Weston & Sampson Engineers  
Project: Salisbury Pond  
Location: ---  
Boring ID: ---  
Sample ID: Sed-2A  
Depth: ---  
Sample Type: jar  
Test Date: 12/20/16  
Tested By: GA  
Checked By: emm  
Test Comment: ---  
Visual Description: Wet, very dark gray silt with sand  
Sample Comment: ---  

**Particle Size Analysis - ASTM D422**

<table>
<thead>
<tr>
<th>Percent Finer</th>
<th>Sieve Size (mm)</th>
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</thead>
<tbody>
<tr>
<td>25.7</td>
<td>0.0</td>
</tr>
<tr>
<td>% Cobble</td>
<td>% Gravel</td>
</tr>
<tr>
<td>74.3</td>
<td>% Sand</td>
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<table>
<thead>
<tr>
<th>Sieve Name</th>
<th>Sieve Size, mm</th>
<th>Percent Finer</th>
<th>Spec. Percent</th>
<th>Complies</th>
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<tr>
<td>#4</td>
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<td>#10</td>
<td>2.00</td>
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<tr>
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<td>74</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Sieve Name</th>
<th>Sieve Size (mm)</th>
<th>Percent Finer</th>
<th>Spec. Percent</th>
<th>Complies</th>
</tr>
</thead>
<tbody>
<tr>
<td>---</td>
<td>0.0310</td>
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<td></td>
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<tr>
<td>---</td>
<td>0.0305</td>
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<tr>
<td>---</td>
<td>0.0090</td>
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<td>---</td>
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<td>19</td>
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</tr>
<tr>
<td>---</td>
<td>0.0047</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>0.0033</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>0.0015</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Coefficients**

- $D_{85} = 0.1504\text{ mm}$
- $D_{50} = 0.0447\text{ mm}$
- $D_{30} = 0.0310\text{ mm}$
- $C_u = 16.556$
- $C_c = 1.115$

**Classification**

- ASTM: Elastic silt with sand (MH)
- AASHTO: Clayey Soils (A-7-5 (16))

**Sample/Test Description**

- Sand/Gravel Particle Shape: ---
- Sand/Gravel Hardness: ---
- Dispersion Device: Apparatus A - Mech Mixer
- Dispersion Period: 1 minute
- Specific Gravity: 2.65
- Separation of Sample: #200 Sieve
Client: Weston & Sampson Engineers
Project: Salisbury Pond
Location: ---

Boring ID: ---
Sample ID: Sed-2B
Sample Type: Jar
Test Date: 12/20/16

Tested By: GA
Checked By: emm
Test Comment: ---
Visual Description: Wet, very dark gray sand with silt
Sample Comment: ---

Particle Size Analysis - ASTM D422

<table>
<thead>
<tr>
<th>Sieve Name</th>
<th>Sieve Size, mm</th>
<th>Percent Finer</th>
<th>Spec. Percent</th>
<th>Complies</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75 in</td>
<td>19.00</td>
<td>100</td>
<td></td>
<td></td>
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<tr>
<td>0.5 in</td>
<td>12.50</td>
<td>98</td>
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<tr>
<td>0.375 in</td>
<td>9.50</td>
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<td>#4</td>
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<tr>
<td>#40</td>
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<td>43</td>
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<td>0.25</td>
<td>18</td>
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<td>0.15</td>
<td>10</td>
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<td>#200</td>
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</table>

Coefficients

D_50 = 1.1849 mm  D_20 = 0.3214 mm
D_60 = 0.5887 mm  D_15 = 0.2033 mm
D_50 = 0.4861 mm  D_10 = 0.1466 mm
C_u = 4.016       C_c = 1.197

Classification

ASTM  N/A
AASHTO  Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape: ANGULAR
Sand/Gravel Hardness: HARD
Client: Weston & Sampson Engineers
Project: Salisbury Pond
Location: ---

Boring ID: ---
Sample ID: Sed-3
Sample Type: jar
Depth: ---

Test Date: 12/20/16
Test Id: 400762
Tested By: GA
Checked By: emm

Test Comment: ---
Visual Description: Wet, very dark gray silt
Sample Comment: ---

### Particle Size Analysis - ASTM D422

<table>
<thead>
<tr>
<th>Sieve Name</th>
<th>Sieve Size, mm</th>
<th>Percent Finer</th>
<th>Spec. Percent</th>
<th>Complies</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>4.75</td>
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<td>2.00</td>
<td>100</td>
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<td>100</td>
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<tr>
<td>#40</td>
<td>0.42</td>
<td>100</td>
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<td>0.25</td>
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<table>
<thead>
<tr>
<th>Sieve Name</th>
<th>Sieve Size (mm)</th>
<th>Percent Finer</th>
<th>Spec. Percent</th>
<th>Complies</th>
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<td></td>
<td>0.0311</td>
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<tr>
<td></td>
<td>0.0015</td>
<td>5</td>
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<td></td>
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</table>

### Coefficients
- \(D_{95} = 0.0730 \text{ mm}\)
- \(D_{60} = 0.0373 \text{ mm}\)
- \(D_{50} = 0.0279 \text{ mm}\)
- \(C_s = 10.081\)
- \(C_c = 1.132\)

### Classification
- ASTM Elastic silt (MH)
- AASHTO Clayey Soils (A-7-5 (24))

### Sample/Test Description
- Sand/Gravel Particle Shape: ---
- Sand/Gravel Hardness: ---
- Dispersion Device: Apparatus A - Mech Mixer
- Dispersion Period: 1 minute
- Specific Gravity: 2.65
- Separation of Sample: #200 Sieve

---

print 12/21/2016 11:33:01 AM
Client: Weston & Sampson Engineers
Project: Salisbury Pond
Location: ---
Boring ID: ---
Sample Type: jar
Sample ID: Sed-4
Depth: ---
Test Date: 12/20/16
Tested By: GA
Tested By: GA
Checked By: emm
Test Id: 400763

Sample Comment: ---
Visual Description: Wet, very dark gray silt

Particle Size Analysis - ASTM D422

<table>
<thead>
<tr>
<th>Particle Size (mm)</th>
<th>% Cobble</th>
<th>% Gravel</th>
<th>% Sand</th>
<th>% Silt &amp; Clay Size</th>
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</thead>
<tbody>
<tr>
<td>100</td>
<td>0.0</td>
<td>1.7</td>
<td>98.3</td>
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<table>
<thead>
<tr>
<th>Sieve Name</th>
<th>Sieve Size, mm</th>
<th>Percent Finer</th>
<th>Spec. Percent</th>
<th>Complies</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>4.75</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
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<td>0.85</td>
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</tr>
<tr>
<td>#40</td>
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<table>
<thead>
<tr>
<th>Particle Size (mm)</th>
<th>Percent Finer</th>
<th>Spec. Percent</th>
<th>Complies</th>
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<tr>
<td>0.0015</td>
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</tbody>
</table>

Coefficients
- $D_{85} = 0.0403 \text{ mm}$
- $D_{50} = 0.0140 \text{ mm}$
- $D_{50} = 0.0103 \text{ mm}$
- $C_u = \text{N/A}$
- $C_c = \text{N/A}$

Classification
- ASTM: Elastic silt (MH)
- AASHTO: Clayey Soils (A-7-5 (80))

Sample/Test Description
- Sand/Gravel Particle Shape: ---
- Sand/Gravel Hardness: ---
- Dispersion Device: Apparatus A - Mech Mixer
- Dispersion Period: 1 minute
- Specific Gravity: 2.65
- Separation of Sample: #200 Sieve
Atterberg Limits - ASTM D4318

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Sample ID</th>
<th>Boring</th>
<th>Depth</th>
<th>Natural Moisture Content, %</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>Liquidity Index</th>
<th>Soil Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sed-1</td>
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<td>---</td>
<td>160</td>
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<td>56</td>
<td>50</td>
<td>2.1</td>
<td>Elastic silt with sand (MH)</td>
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</table>

Sample Prepared using the WET method
18% Retained on #40 Sieve
Dry Strength: HIGH
Dilatancy: NONE
Toughness: MEDIUM
### Atterberg Limits - ASTM D4318

#### Plasticity Chart

![Plasticity Chart](image)

#### Table: Atterberg Limits

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Sample ID</th>
<th>Boring</th>
<th>Depth</th>
<th>Natural Moisture Content, %</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>Liquidity Index</th>
<th>Soil Classification</th>
</tr>
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<tbody>
<tr>
<td>⭕</td>
<td>Sed-2A</td>
<td>---</td>
<td>---</td>
<td>95</td>
<td>59</td>
<td>41</td>
<td>18</td>
<td>3</td>
<td>Elastic silt with sand (MH)</td>
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</table>

Sample Prepared using the WET method

3% Retained on #40 Sieve

Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: MEDIUM
Atterberg Limits - ASTM D4318

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: MEDIUM

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Sample ID</th>
<th>Boring</th>
<th>Depth</th>
<th>Natural Moisture Content, %</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>Liquidity Index</th>
<th>Soil Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>⭐️</td>
<td>Sed-3</td>
<td>---</td>
<td>---</td>
<td>109</td>
<td>65</td>
<td>45</td>
<td>20</td>
<td>3.2</td>
<td>Elastic silt (MH)</td>
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</table>
Client: Weston & Sampson Engineers
Project: Salisbury Pond
Location: ---
Boring ID: ---
Sample ID: Sed-4
Sample Type: jar
Tested By: GA
Test Date: 12/20/16
Test Id: 400767
Checked By: emm
Visual Description: Wet, very dark gray silt
Sample Comment: ---

Atterberg Limits - ASTM D4318

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: MEDIUM
# Chain of Custody

**Company Name:** Weston & Sampson

**Address:** 5 Centennial Drive, Peabody, MA

**Contact:** Barry Kurkjian

**Email:** Kurkjian@wseinc.com

**Phone Number:** 800-5AMPSON

**Fax Number:**

**Project Name:** Salisbury Pond

**Project Number:** 01069304

**Project Location:** Salisbury Pond

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>Container Size</th>
<th>Sampling Date/Time</th>
<th>Sample Type</th>
<th>Moisture</th>
<th>Solids</th>
<th>Sieve 9.5mm</th>
<th>Sieve 4.75mm</th>
<th>Sieve 2.36mm</th>
<th>Sieve 1.18mm</th>
<th>Sieve 0.85mm</th>
<th>Sieve 0.425mm</th>
<th>Comments</th>
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</tbody>
</table>

**Relinquished By:** [Signature]

**Date:** 12/13/16 14:55

**Received By:** [Signature]

**Date:** 12/13/16 14:55

**Relinquished By:** [Signature]

**Date:** [Blank]

**Time:** [Blank]

**Relinquished By:** [Signature]

**Date:** [Blank]

**Time:** [Blank]

**Relinquished By:** [Signature]

**Date:** [Blank]

**Time:** [Blank]

**Turn-Around Time Requested:** [Blank]

**No. of Business Days:** [Blank]

**Special Instructions:** [Blank]
WARRANTY and LIABILITY

GeoTesting Express (GTX) warrants that all tests it performs are run in general accordance with the specified test procedures and accepted industry practice. GTX will correct or repeat any test that does not comply with this warranty. GTX has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

GTX may report engineering parameters that require us to interpret the test data. Such parameters are determined using accepted engineering procedures. However, GTX does not warrant that these parameters accurately reflect the true engineering properties of the in situ material. Responsibility for interpretation and use of the test data and these parameters for engineering and/or construction purposes rests solely with the user and not with GTX or any of its employees.

GTX’s liability will be limited to correcting or repeating a test which fails our warranty. GTX’s liability for damages to the Purchaser of testing services for any cause whatsoever shall be limited to the amount GTX received for the testing services. GTX will not be liable for any damages, or for any lost benefits or other consequential damages resulting from the use of these test results, even if GTX has been advised of the possibility of such damages. GTX will not be responsible for any liability of the Purchaser to any third party.

Commonly Used Symbols

A  pore pressure parameter for $\Delta \sigma_1 - \Delta \sigma_3$
B  pore pressure parameter for $\Delta \sigma_3$
CAI CERCHAR Abrasiveness Index
CIU isostropically consolidated undrained triaxial shear test
CR compression ratio for one dimensional consolidation
CSR cyclic stress ratio
Cc coefficient of curvature, $(D_{30})^2 / (D_{10} \times D_{60})$
C_u coefficient of uniformity, $D_{60}/D_{10}$
Cc compression index for one dimensional consolidation
c coefficient of secondary compression
c cohesion intercept for total stresses
c' cohesion intercept for effective stresses
D diameter of specimen
Damping ratio
D_{10} diameter at which 10% of soil is finer
D_{15} diameter at which 15% of soil is finer
D_{20} diameter at which 30% of soil is finer
D_{50} diameter at which 50% of soil is finer
D_{60} diameter at which 60% of soil is finer
D_{85} diameter at which 85% of soil is finer
d_{50} displacement for 50% consolidation
d_{90} displacement for 90% consolidation
d_{100} displacement for 100% consolidation
E Young’s modulus
e void ratio
e' void ratio after consolidation
e_c initial void ratio
G shear modulus
G_{s} specific gravity of soil particles
H height of specimen
H_R Rebound Hardness number
i gradient
I_s Uncorrected point load strength
I_{s(0)} Size corrected point load strength index
H_A Modified Taber Abrasion
H_T Total hardness
K_s lateral stress ratio for one dimensional strain
k permeability
L_I Liquidity Index
m_v coefficient of volume change
n porosity
P_I plasticity index
P_s preconsolidation pressure
p $(\sigma_1 + \sigma_3)/2, (\sigma_1 + \sigma_3)/2$
p' $(\sigma_1' + \sigma_3')/2, (\sigma_1' + \sigma_3')/2$
p' c p' at consolidation
Q quantity of flow
q $(\sigma_1 + \sigma_3)/2$
qu q at failure
qu, q_i initial q
qu, q_i q at consolidation
Sr Post cyclic undrained shear strength
T temperature
t time
U, UC unconfined compression test
UU, Q unconsolidated undrained triaxial test
u_p pore gas pressure
u_e excess pore water pressure
u_w pore water pressure
V total volume
V_g volume of gas
V_s volume of solids
V_s shear wave velocity
V_v volume of voids
V_w volume of water
V_o initial volume
v velocity
W total weight
w_s weight of solids
w_w weight of water
w water content
w_c water content at consolidation
w_f final water content
w_1 liquid limit
w_n natural water content
w_p plastic limit
w_s shrinkage limit
w_o, w_i initial water content
a slope of q_f versus p_f
a' slope of q_f' versus p_f'
γ_t total unit weight
γ_d dry unit weight
γ_s unit weight of solids
γ_w unit weight of water
γ strain
ε_v volume strain
ε_h, ε_v horizontal strain, vertical strain
μ Poisson’s ratio, also viscosity
σ normal stress
σ' effective normal stress
σ_c, σ_c' consolidation stress in isotropic stress system
σ_h, σ_h' horizontal normal stress
σ_v, σ_v' vertical normal stress
σ' ve Effective vertical consolidation stress
σ_1 major principal stress
σ_2 intermediate principal stress
σ_3 minor principal stress
τ shear stress
φ friction angle based on total stresses
φ' friction angle based on effective stresses
φ' r residual friction angle
φ_ult φ for ultimate strength
February 6, 2017

Mr. Daron G. Kurkjian, P.E., Project Manager  
Weston & Sampson  
5 Centennial Drive  
Peabody, MA 01960

SALISBURY POND TREATABILITY REPORT, Rev. 1

Mr. Kurkjian,

Infrastructure Alternatives has performed a series of treatability evaluations on sediment samples provided by Weston & Sampson, collected from Salisbury Pond, in Worcester, MA. Results are presented, below.

Test Results

- Polymer product screening and gravity drainage test was performed by a trusted polymer vendor. The vendor recommended a single product application of Solve-9248 at a dose of 3.2 lbs./dry ton, for geotextile tube dewatering.

- Geotube® Dewatering Test results indicated the material passed paint filter test (EPA 9095B) after 24 hrs., and exceeded in-situ percent solids (ASTM D2216) after 5 days. Density of the in-situ material was found to be 79.29 lbs./cu. ft., and the density of the GDT contents after 28 days was 66.26 lbs./cu. ft. The dry cake density was 48.14 lbs./cu. ft.

- A dose of 3.65 lbs./dry ton of Solve-9248 was utilized in the GDT. This dose was selected based on jar testing in our shop and our experience with geotextile tube dewatering.

- Arsenic was found in the filtrate collected from the GDT test, at 84.8 mg/L or about 8.5 times the U.S. drinking water drinking water standard (MCL).

- Simulation of mechanical dredging in the dry, and subsequent amendment testing, showed the material passed paint filter test and exceeded in-situ percent solids after 24 hrs., without amendment. With the addition of 3% of amendment, the material passed paint filter and exceeded in-situ percent solids after 1 hr.

- Simulation of mechanical dredging in the wet, and subsequent amendment testing, showed the material passed paint filter test and exceeded in-situ percent solids after 24 hrs., with the addition of 0.5% of Portland Cement and 1% of Calciment. The material passed paint filter test and exceeded in-situ percent solids after 1 hr., with the addition of 10% Portland cement and 14% of Calciment.
Summary

Evaluations indicate this material can be effectively dewatered in geotextile tubes, and/or stabilized with amendment. Our test results indicate that amended dewatered sediment can realize better than in-situ percent solids almost directly, and that non-amended sediment can reach similar percent solids, given a bit more time.

Therefore, if the project completion is budget-sensitive, the cost for amendments can be avoided, given ample time to allow the dewatered material to continue in the geotextile tubes. If, on the other hand, the project completion is schedule-sensitive, amendment addition can decrease the sediment dewatering time requirement.

Due to the presence of arsenic, it is likely that contact water treatment will be required, regardless of which material removal and handling methods are selected.

Please let us know if you have any questions about this report. We welcome an opportunity to work further with Weston & Sampson, as a technical approach is developed for this project.

Sincerely,

INFRASTRUCTURE ALTERNATIVES, INC.

Scott Ponstein, Project Manager
616-866-1600 ext. 22

Enclosed: Dewatering Performance Trial Report
GDT Summary
Amendment Testing Summary
Photo Log
Percent solids graphs
Filtrate chemical analysis
Safety Data Sheets for polymer and amendment products
DEWATERING PERFORMANCE TRIAL
SALSISBURY POND

For:
Infrastructure Alternatives
7888 Childsdale Avenue
Rockford, MI 49341
(616) 866-1600

By:
WaterSolve, LLC
5031 68th St., SE
Caledonia, MI 49316
www.gowatersolve.com
616-575-8693

December 22, 2016
1. Scope of Work

WaterSolve, LLC was tasked to perform a Geotube® dewatering performance trial and cone tests on a sample from Salisbury Pond. The objectives of these dewatering trials were to identify chemical conditioning program(s), identify polymer flocculant(s), and dosing rate(s) for a potential Geotube® dewatering application. The objectives of subsequent Cone tests were to measure total solids (TS) of the flocculated, contained, and dewatered residual after passage through the GT500D Geotube® fabric.

2. Materials & Methods

Two 5 gallon buckets were delivered to WaterSolve’s Laboratory (Caledonia, MI) on December 20, 2016. Preliminary testing determined dilution would be necessary. A 1:2 dilution (sample: provided water) was used to identify the correct chemical conditioning. Samples of residual were mixed 1:2, and were placed in graduated, glass jars.

Several polymers (emulsions) were “made-down” (200-mL) at a 0.5% concentration for this dewatering trial. Polymer (4 to 10-mL; 133 to 333-ppm) was added to a sample with a 10-mL plastic syringe and moderately tumbled five to seven times. Observations of water release rate, water clarity, and flocculent appearance were recorded on appropriate data sheets (Appendix A). Polymer(s) that flocculated and dewatered these residuals most effectively were re-evaluated with lower doses in order to isolate the most efficient dewatering and flocculating polymer(s). A Hach DR 2800 was used to measure TSS (Total Suspended Solids) and an 2100P Turbidimeter was used to measure Turbidity after the samples were poured through the Geotube® GT500D fabric with a measurable limit of up to 750-mg/L suspended solids and 1000 NTU’s, respectively.

Percent total solids (dry weight) of the initial residual samples, diluted residual samples, and dewatered cake samples (captured on GT500D Geotube® fabric) were measured.

3. Results

Chemical conditioning with Solve 9248 was determined to flocculate and dewater the residual most effectively compared to the other chemical conditioning programs (Appendix A). Water release volume and flocculent appearance were good to excellent at a 7-mL (233-ppm, 3.2-lbs/dry ton) dose of Solve 9248 in the 150-mL sample.

Prior to dilution, the sample was measured at 53.1-percent dry weight solids. The diluted test sample (1:2, sample: provided water) was 14.5-percent dry weight solids. After passing a 1000-mL diluted (1:2) and conditioned (233-ppm Solve 9248) test sample through the GT500D Geotube® fabric, percent solids increased to 41.0-percent after sixty minutes of drying time. From this 1000-mL sample, 650-mL and 720-mL of water was released in one minute and sixty minutes, respectively, after passage through the filter. TSS and Turbidity on the filtrate was 54-mg/L and 52 NTU, respectively.
4. Recommendations

We recommend an application of Solve 9248 (233-ppm, 3.2-lbs/dry ton) for dewatering residuals in a Geotube® application in order to pass paint filter test for subsequent disposal. The dose may vary based on the solids concentration in the pumped line. Additional evaluation is recommended for determining optimal inline percent solids thresholds for Geotube® performance including filtrate release and solids consolidation over time.

Solve 9248 is required to be made-down at 0.5-percent with a polymer make-down unit or aged in batch/feed tanks prior to injection into the residual line. Moderate mixing energy is required between the polymer introduction point and the Geotube® containers (e.g., two to three bends in the discharge line and/or inline static mixers). To ensure the most effective treatment of the residuals, the polymer dose should be spilt and be injected at multiple points within the line.

Expected time to being able to pass a Paint Filter Test is unpredictable in a Geotube® container from these bench-scale experiments. An onsite, laboratory hanging bag or Geotube® dewatering trial (GDT) may be used and is recommended if the timeline for achieving project goals of dry weight solids and Geotube® filtrate characteristics are in question for this application. Additional dewatering evaluations over time are recommended if project objectives for consolidation are greater than passing a Paint Filter Test.

Please note, while a composite sample may give us an indication of an average treatment scenario, it does not indicate pockets of concern for treatment effectiveness or areas that may require a higher or lower dose of chemistry, or contain higher in situ solids, since the areas of concern may be masked by factors of dilution from other areas.

Due to potential variability of the material, daily on-site testing and chemical conditioning verification are recommended during pumping operations.
### DEWATERING PERFORMANCE TRIAL

<table>
<thead>
<tr>
<th>Jar Number</th>
<th>Polymer Name</th>
<th>Polymer Dosage (mL)</th>
<th>Sample Size (mL)</th>
<th>Water Rel. (1-6)</th>
<th>Water Clarity (1-6)</th>
<th>Floc Appearance (1-6)</th>
<th>Comments</th>
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<td>137</td>
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<tr>
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<td>150 mL</td>
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</tr>
<tr>
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<td>124</td>
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<td>150 mL</td>
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<tr>
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<td>124</td>
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<tr>
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<td>1</td>
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<tr>
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<tr>
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<td>12 mL</td>
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<td>11</td>
<td>124</td>
<td>8 mL</td>
<td>150 mL</td>
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</tr>
<tr>
<td>12</td>
<td>124</td>
<td>12 mL</td>
<td>150 mL</td>
<td>1</td>
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<tr>
<td>13</td>
<td>124</td>
<td>8 mL</td>
<td>150 mL</td>
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<tr>
<td>14</td>
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<td>12 mL</td>
<td>150 mL</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
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</tbody>
</table>

Polymer make-down concentration = 0.5 %

Dilution of test sample = 1:2

Sediment provided in tube

**Cone Test / RDT:** 600 mL sample conditioned with 55 mL of 9240 poured thru GT500D Geotube® filter.

**Filtrate Quality:** TSS <4 mg/L Turbidity <2 NTU

Filtrate collected @ 1 min: 650, 60 min: 70
Appendix B – Photographs

One hundred fifty milliliters of diluted sample prior to conditioning (Left). One hundred fifty milliliters of diluted sample conditioned with Solve 9248 (Right).

One thousand milliliters of diluted sample conditioned with Solve 9248 was poured through the GT500D Geotube® fabric. The captured cake (Left) and filtrate (Right) are shown above.
## Appendix C – Percent Solids

### Total Solids Determination - Percent Dry Weight

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Dish Number</th>
<th>Dilution</th>
<th>Dish (dry)</th>
<th>Dish, Sample (wet)</th>
<th>Dish, Sample (dry)</th>
<th>Dish, sample (wet) – Dish (dry)</th>
<th>Dish, sample (dry) – Dish (dry)</th>
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<tbody>
<tr>
<td>LAB INS113</td>
<td>5</td>
<td>0</td>
<td>48.683 g</td>
<td>150.821 g</td>
<td>102.831 g</td>
<td>102.138 (A)</td>
<td>54.199 (B)</td>
</tr>
<tr>
<td>LAB HOMOGEN180</td>
<td>4</td>
<td>0</td>
<td>48.419 g</td>
<td>161.097 g</td>
<td>103.568 g</td>
<td>115.413 (A)</td>
<td>59.914 (B)</td>
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<tr>
<td>1:1 DILUTION</td>
<td>7</td>
<td>1:1</td>
<td>50.027 g</td>
<td>132.087 g</td>
<td>73.143 g</td>
<td>121.065 (A)</td>
<td>22.521 (B)</td>
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<tr>
<td>1:2 DILUTION</td>
<td>1</td>
<td>1:2</td>
<td>49.226 g</td>
<td>129.419 g</td>
<td>60.518 g</td>
<td>80.193 (A)</td>
<td>11.592 (B)</td>
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<tr>
<td>CUNE TEST/ HOME</td>
<td>1</td>
<td>6</td>
<td>50.847 g</td>
<td>191.715 g</td>
<td>108.845 g</td>
<td>140.816 (A)</td>
<td>57.98 (B)</td>
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<table>
<thead>
<tr>
<th>Total Solids</th>
<th>B ÷ A x 100</th>
<th>58.1 % Dry Weight Solids</th>
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<tr>
<td>Total Solids</td>
<td>B ÷ A x 100</td>
<td>47.6 % Dry Weight Solids</td>
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<tr>
<td>Total Solids</td>
<td>B ÷ A x 100</td>
<td>27.6 % Dry Weight Solids</td>
</tr>
<tr>
<td>Total Solids</td>
<td>B ÷ A x 100</td>
<td>14.5 % Dry Weight Solids</td>
</tr>
<tr>
<td>Total Solids</td>
<td>B ÷ A x 100</td>
<td>41.0 % Dry Weight Solids</td>
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# Chain of Custody Record

## Analysis Requested

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<th>Parameter</th>
<th>Limit</th>
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<th>Limit</th>
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<td>GeoMedia® Dewatering</td>
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<td>Other* (comments)</td>
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<td>Total Suspended Solids</td>
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<td>Turbidity</td>
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<td>Other** (comments)</td>
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<td>Other*** (comments)</td>
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</table>

*Please note any known hazardous material contained in the samples or any other helpful information about the samples below.*

## Field Sample ID

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<th>Schedule</th>
<th>Matrix Code</th>
<th>Sample Number</th>
<th>Field Sample ID</th>
<th>Container ID/Type</th>
<th>Sample Date</th>
<th>Sample Time</th>
<th>Comp</th>
<th>Group</th>
<th>Matrix</th>
<th>Limit mg/L</th>
<th>Unit</th>
<th>Limit NTU</th>
<th>Unit</th>
<th>Limit Units</th>
<th>Unit</th>
<th>Sample Comments</th>
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<td>51</td>
<td>SPTW - COMP 1 Sed</td>
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<td>13:30</td>
<td>X</td>
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<td>SPTW - Water</td>
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<td>X</td>
<td></td>
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</tbody>
</table>

## Sampled by (print)

Weston & Sampson

## Sampled by (signature)

Weston & Sampson

## Project Information

Briefly describe the project objectives:

- Type of Material/Residue: Municipal Wastewater, Municipal Water Treatment, Lake/Pond/River Sediment (circle one) Industrial/Process, Mine Drainage, Other
- Application: GeoMedia® Dewatering, Setting, Clarification, Mechanical Dewatering, Thickening, Other
- How was the sample obtained? Individual Core(s) (Best sample collection technique with only solids from core, discard overflow water, overflow water should be sent separately). X Composite (PLEASE NOTE, while a composite sample may give us an indication of an average treatment scenario, it does not indicate pockets of concern for treatment effectiveness or areas that may require a higher or lower dose of chemistry, or contain higher in-situ solids since the area of concern may be masked by factors of dilution from other areas). Other
- Are there specific requirements or permit limitations? (i.e. filtrate turbidity, TSS, or other parameters)
- Where will the filtrate/treatment effluent be discharged?
- solids concentration of sample (w-dr dry weight solids)

## Project Comments

[Diagonal line drawing of sample collection process]
Geotube Dewatering Test Results

Project ID: Salisbury Pond
Location: Worcester, MA
Date: 1/5/2017
Time: 16:00

In-situ % Solids: 43.75%
Slurry % Solids: 11.99%
GDT % Solids after 24 hours: 37.53%
GDT % Solids after 5 days: 45.35%
GDT % Solids after 7 days: 47.95%
GDT % Solids after 28 days: 65.73%

<table>
<thead>
<tr>
<th>Time (Min.)</th>
<th>Pore Water Collected (L)</th>
<th>Estimated Pore Water Flow Rate (mL/min)</th>
<th>Pore Water Turbidity (NTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>18760</td>
<td>3752.0000</td>
<td>35.5</td>
</tr>
<tr>
<td>5-10</td>
<td>3300</td>
<td>1100.0000</td>
<td>51.7</td>
</tr>
<tr>
<td>10-30</td>
<td>1200</td>
<td>80.0000</td>
<td>72</td>
</tr>
<tr>
<td>30-60</td>
<td>1075</td>
<td>35.8333</td>
<td>32.7</td>
</tr>
<tr>
<td>24 hr</td>
<td>590</td>
<td>9.8333</td>
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</tr>
<tr>
<td>Total</td>
<td>24925</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Heavy yellow color in filtrate. It is presumed to be caused by oxidation of dissolved iron. Turbidity tests were completed on filtrate from the RDT; the turbidity increased nearly 300% after sitting for 30 minutes. Michigan-10 metals analysis was requested for the GDT filtrate. (waiting on results).

Analyst: Scott Ponstein
### Wet Mechanical Dewatering Test Results

**Project ID:** Salisbury Pond  
**Date:** 1/12/2017  
**Location:** Worcester, MA  
**Time:** 10:00

<table>
<thead>
<tr>
<th>In-situ % Solids:</th>
<th>Water Added (mL)</th>
<th>Ex-situ % Solids:</th>
<th>Sediment Added (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>43.75%</td>
<td>1000</td>
<td>38.04%</td>
<td>5000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amendment</th>
<th>Dose Rate (% Weight)</th>
<th>Percent Solids (% weight)</th>
<th>Paint Filter (Pass/Fail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement</td>
<td>5%</td>
<td>42.15%</td>
<td>Fail</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>7%</td>
<td>43.14%</td>
<td>Fail</td>
</tr>
<tr>
<td>Portland Cement</td>
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<td>45.27%</td>
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<tr>
<td>Portland Cement</td>
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<td>Portland Cement</td>
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</tr>
<tr>
<td>Calciment</td>
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<td>42.00%</td>
<td>Fail</td>
</tr>
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<td>7%</td>
<td>43.30%</td>
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<td>45.49%</td>
<td>Fail</td>
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<td>Calciment</td>
<td>12%</td>
<td>46.01%</td>
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</tr>
<tr>
<td>Calciment</td>
<td>14%</td>
<td>47.58%</td>
<td>Pass</td>
</tr>
</tbody>
</table>

Notes: Portland Cement performed better with wet material, pass the paint filter test with 10% by weight, where Calciment showed similar percent solids, it did not pass paint filter till 14% by weight was added.

**Analyst:** Scott Ponstein
### Wet Mechanical Dewatering Test Results

**Project ID:** Salisbury Pond  
**Date:** 1/12/2017  
**Location:** Worcester, MA  
**Time:** 13:00

<table>
<thead>
<tr>
<th>In-situ % Solids:</th>
<th>Water Added (mL)</th>
<th>Ex-situ % Solids:</th>
<th>Sediment Added (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>43.75%</td>
<td>1000</td>
<td>38.04%</td>
<td>5000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amendment</th>
<th>Dose Rate (% Weight)</th>
<th>Test Results (24 hours post-amendment)</th>
<th>Percent Solids (% weight)</th>
<th>Paint Filter (Pass/Fail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement</td>
<td>0.5%</td>
<td>Pass</td>
<td>44.65%</td>
<td></td>
</tr>
<tr>
<td>Portland Cement</td>
<td>1%</td>
<td>Pass</td>
<td>43.03%</td>
<td></td>
</tr>
<tr>
<td>Portland Cement</td>
<td>3%</td>
<td>Pass</td>
<td>45.73%</td>
<td></td>
</tr>
<tr>
<td>Portland Cement</td>
<td>5%</td>
<td>Pass</td>
<td>47.26%</td>
<td></td>
</tr>
<tr>
<td>Portland Cement</td>
<td>7%</td>
<td>Pass</td>
<td>49.13%</td>
<td></td>
</tr>
<tr>
<td>Portland Cement</td>
<td>10%</td>
<td>Pass</td>
<td>50.69%</td>
<td></td>
</tr>
<tr>
<td>Portland Cement</td>
<td>12%</td>
<td>Pass</td>
<td>51.43%</td>
<td></td>
</tr>
<tr>
<td>Portland Cement</td>
<td>14%</td>
<td>Pass</td>
<td>52.89%</td>
<td></td>
</tr>
<tr>
<td>Calciment</td>
<td>0.5%</td>
<td>Pass</td>
<td>42.84%</td>
<td>Fail</td>
</tr>
<tr>
<td>Calciment</td>
<td>1%</td>
<td>Pass</td>
<td>44.84%</td>
<td></td>
</tr>
<tr>
<td>Calciment</td>
<td>3%</td>
<td>Pass</td>
<td>46.89%</td>
<td></td>
</tr>
<tr>
<td>Calciment</td>
<td>5%</td>
<td>Pass</td>
<td>48.04%</td>
<td></td>
</tr>
<tr>
<td>Calciment</td>
<td>7%</td>
<td>Pass</td>
<td>48.88%</td>
<td></td>
</tr>
<tr>
<td>Calciment</td>
<td>10%</td>
<td>Pass</td>
<td>51.93%</td>
<td></td>
</tr>
<tr>
<td>Calciment</td>
<td>12%</td>
<td>Pass</td>
<td>53.29%</td>
<td></td>
</tr>
<tr>
<td>Calciment</td>
<td>14%</td>
<td>Pass</td>
<td>55.71%</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** The sample passed paint filter after 24 hrs. with 0.5% Portland cement by weight added. The sample amended with 1% Calciment by weight passed paint filter after 24 hrs.

**Analyst:** Scott Ponstein
## Dry Mechanical Dewatering Test Results

### Project Information
- **Project ID:** Salisbury Pond
- **Date:** 1/11/2017
- **Location:** Worcester, MA
- **Time:** 10:00

### Test Results (1 hour post-amendment)

<table>
<thead>
<tr>
<th>Amendment</th>
<th>Dose Rate (% Weight)</th>
<th>Percent Solids (% weight)</th>
<th>Paint Filter (Pass/Fail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement</td>
<td>1%</td>
<td>42.83%</td>
<td>Fail</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>3%</td>
<td>44.22%</td>
<td>Fail</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>5%</td>
<td>45.03%</td>
<td>Pass</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>7%</td>
<td>46.36%</td>
<td>Pass</td>
</tr>
<tr>
<td>Calciment</td>
<td>1%</td>
<td>42.58%</td>
<td>Fail</td>
</tr>
<tr>
<td>Calciment</td>
<td>3%</td>
<td>44.34%</td>
<td>Fail</td>
</tr>
<tr>
<td>Calciment</td>
<td>5%</td>
<td>45.42%</td>
<td>Pass</td>
</tr>
<tr>
<td>Calciment</td>
<td>7%</td>
<td>47.26%</td>
<td>Pass</td>
</tr>
</tbody>
</table>

**Notes:** Portland Cement and Calciment performed equally well, passing paint filter after 1 hour, with 5% by weight added to the sediment.

### Analyst
- **Scott Ponstein**
# Dry Mechanical Dewatering Test Results

<table>
<thead>
<tr>
<th>Amendment</th>
<th>Dose Rate (% Weight)</th>
<th>Test Results (24 hours post-amendment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0%</td>
<td>48.08%  Pass</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>0.5%</td>
<td>47.73%  Pass</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>1%</td>
<td>50.30%  Pass</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>3%</td>
<td>49.89%  Pass</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>5%</td>
<td>52.82%  Pass</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>7%</td>
<td>54.06%  Pass</td>
</tr>
<tr>
<td>Calciment</td>
<td>0.5%</td>
<td>48.79%  Pass</td>
</tr>
<tr>
<td>Calciment</td>
<td>1%</td>
<td>50.44%  Pass</td>
</tr>
<tr>
<td>Calciment</td>
<td>3%</td>
<td>50.62%  Pass</td>
</tr>
<tr>
<td>Calciment</td>
<td>5%</td>
<td>52.90%  Pass</td>
</tr>
<tr>
<td>Calciment</td>
<td>7%</td>
<td>54.20%  Pass</td>
</tr>
</tbody>
</table>

Notes: All test passed paint filter, including no amendment added to the sediment. For sediment excavated in the dry, 24 hours of dry time with good weather conditions could produce material that will pass paint filter without the addition of amendment.

---

Analyst: Scott Ponstein
Mixing the sediment with water to create a slurry

Jar testing polymer
Comparing jar test results

Evaluating floc formation and separated water clarity
Mixing polymer solution for GDT

Homogenizing the sediment slurry
Mixing polymer-slurry

Adding polymer to slurry
Collecting filtrate from GDT container

Close up of filtrate collection
Filtrate samples precipitating solids

Close up of filtrate precipitating solids
Comparison of filtered and raw filtrate, side-by-side

GDT container after 24 hrs. dewatering
Amendment test samples

Amendment test samples
GDT Percent Solids, Rev. 1

In-situ Slurry 24 hour 5 day 7 day 28 day
Mechanical Dredging in the Wet

- PC - 1 hr
- PC - 24 hr
- Calciment - 1 hour
- Calciment - 24 hr

% Solids vs % Amendment graph.
**Lab ID:** 1701122-001  
**Client Sample ID:** IAI-SPTW-1-5-17  
**Collection Date:** 1/5/2017  
**Received Date:** 1/5/2017

<table>
<thead>
<tr>
<th>Analyses</th>
<th>Result</th>
<th>PQL</th>
<th>Units</th>
<th>DF</th>
<th>Date Analyzed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>METALS, TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>&lt; 6.00</td>
<td>6.00</td>
<td>µg/L</td>
<td>1</td>
<td>1/9/2017</td>
</tr>
<tr>
<td><strong>METALS, TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>84.8</td>
<td>1.00</td>
<td>µg/L</td>
<td>1</td>
<td>1/9/2017</td>
</tr>
<tr>
<td><strong>METALS, TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>&lt; 0.0020</td>
<td>0.00020</td>
<td>mg/L</td>
<td>1</td>
<td>1/11/2017</td>
</tr>
<tr>
<td><strong>METALS, TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barium</td>
<td>150</td>
<td>2.0</td>
<td>µg/L</td>
<td>1</td>
<td>1/9/2017</td>
</tr>
<tr>
<td>Cadmium</td>
<td>&lt; 4.0</td>
<td>4.0</td>
<td>µg/L</td>
<td>1</td>
<td>1/9/2017</td>
</tr>
<tr>
<td>Chromium</td>
<td>&lt; 8.0</td>
<td>8.0</td>
<td>µg/L</td>
<td>1</td>
<td>1/9/2017</td>
</tr>
<tr>
<td>Copper</td>
<td>&lt; 4.0</td>
<td>4.0</td>
<td>µg/L</td>
<td>1</td>
<td>1/9/2017</td>
</tr>
<tr>
<td>Lead</td>
<td>&lt; 10</td>
<td>10</td>
<td>µg/L</td>
<td>1</td>
<td>1/9/2017</td>
</tr>
<tr>
<td>Zinc</td>
<td>52</td>
<td>2.0</td>
<td>µg/L</td>
<td>1</td>
<td>1/9/2017</td>
</tr>
<tr>
<td><strong>METALS, TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selenium</td>
<td>&lt; 1.00</td>
<td>1.00</td>
<td>µg/L</td>
<td>1</td>
<td>1/9/2017</td>
</tr>
<tr>
<td><strong>TOTAL SUSPENDED SOLIDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residue-non-filterable (TSS)</td>
<td>73.333</td>
<td>4.0000</td>
<td>mg/L</td>
<td>1</td>
<td>1/9/2017</td>
</tr>
</tbody>
</table>

**Analysts:**  
**SB:** Silver, Cadmium, Chromium, Copper, Lead, Zinc, Selenium  
**AB:** Residue-non-filterable (TSS)
<table>
<thead>
<tr>
<th>Lab ID:</th>
<th>1701652-001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client Sample ID:</td>
<td>IAI-SPTW-FE</td>
</tr>
<tr>
<td>Analyses</td>
<td>METALS, TOTAL</td>
</tr>
<tr>
<td></td>
<td>Iron</td>
</tr>
<tr>
<td>Result</td>
<td>53.3</td>
</tr>
<tr>
<td>PQL</td>
<td>0.010</td>
</tr>
<tr>
<td>Units</td>
<td>mg/L</td>
</tr>
<tr>
<td>DF</td>
<td>1</td>
</tr>
<tr>
<td>Date Analyzed</td>
<td>1/27/2017</td>
</tr>
<tr>
<td>Analyst:</td>
<td>SB</td>
</tr>
</tbody>
</table>

**Project:** SPTW-510  
**Project No:** 2010398  
**Matrix:** GROUNDWATER  
**Lab Order:** 1701652  
**Sampled By:** S. Ponstein  
**Collection Date:** 1/26/2017  
**Received Date:** 1/26/2017  

**Contact Name:** Mr. Scott Ponstein  
7888 Childsdale NE  
Rockford, MI 49341  

**Customer Name:** Infrastructure Alternatives  
7888 Childsdale NE  
Rockford, MI 49341  

**Analyses Result Units**  
**Units:** EPA 200.7  
**Date Analyzed:** 1/27/2017  
**DF:** 1  
**PQL:** 0.010  
**Result:** 53.3  
**Units:** mg/L  
**Analyst:** SB
Solve 9248

Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name:   Solve 9248
Company Identification: WaterSolve, LLC
5031 68th Street
Caledonia, Michigan 49316, USA  www.gowatersolve.com
For Product Information: 616-575-8693
For Chemical Emergency Spill, Leak, Fire, Exposure, or Accident
Call CHEMTREC Day or Night
Within USA and Canada: 1-800-424-9300
Outside USA and Canada: +1 703-527-3887 (collect calls accepted)

Recommended use of the chemical and restrictions on use
Use of Substance/Mixture:   Flocculating agent

2. HAZARDS IDENTIFICATION

GHS CLASSIFICATION
Skin irritation:   Category 2
Specific target organ systemic
Toxicity – single exposure: Category 3 (Central nervous system)

GHS LABEL ELEMENT

Hazard pictograms:   
Signal Word:   WARNING!

Hazard Statements:   Causes skin irritation.
May cause drowsiness or dizziness.

Precautionary Statements:
PREVENTION: Avoid breathing dust/fume/gas/mist/vapors/spray
Wash skin thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear Protective gloves.

RESPONSE:
IF ON SKIN: Wash with plenty of soap and water.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
Call a POISON CENTER or doctor/physician if you feel unwell.
If skin irritation occurs: Get medical advice/attention.
Take off contaminated clothing and wash before reuse.

STORAGE: Store in a well-ventilated place. Keep container tightly closed.
Store locked up.

DISPOSAL: Dispose of contents/container to an approved waste disposal plant.

OTHER HAZARDS:
Static Accumulating liquid
3. **COMPOSITION/INFORMATION ON INGREDIENTS**

**Substance/Mixture:** Mixture  
**Chemical nature:** Static accumulator  
**Chemical nature:** Defatter  

**Hazardous or Regulated Components**

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS#</th>
<th>Classification</th>
<th>CONCENTRATION %</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALIPHATIC HYDROCARBON</td>
<td>254504001-5164</td>
<td>Flam. Liq. 4; H227</td>
<td>&gt;=20.00 - &lt;30.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skin Irrit. 2; H315</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STOT SE 3; H336</td>
<td></td>
</tr>
<tr>
<td>ALCOHOL ALKOXYLATES</td>
<td>254504001-5466</td>
<td>Acute Tox. 4; H302</td>
<td>&gt;=1.50 - &lt;5.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skin Irrit. 2; H315</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eye Dam. 1; H318</td>
<td></td>
</tr>
</tbody>
</table>

Trade Secret Composition - Conceal the Identity + Concentration

4. **FIRST AID MEASURES**

**General Advice:** Move out of dangerous area. Call a POISON CENTRE or doctor/physician if exposed or you feel unwell. Show this safety data sheet to the doctor in attendance. Symptoms of poisoning may appear several hours later. Do not leave the victim unattended.

**If swallowed:** Obtain medical attention. Do NOT induce vomiting. Do not give milk or alcoholic beverages. Never give anything by mouth to a drowsy or unconscious person. If possible, do not leave individual unattended. If symptoms persist, call a physician.

**In case of Skin Contact:** First aid is not normally required. Remove contaminated clothing and shoes without delay. However it is recommended that exposed areas be cleaned by washing with soap and water. Do not reuse contaminated clothing without laundering. Get medical attention if irritation develops or persists.

**In case of Eye Contact:** Flush eyes with water as a precaution. Remove contact lenses. Protect unharmed eye. If eye irritation persists, consult a specialist.

**If Inhalation:** Move to fresh air. If unconscious place in recovery position and seek medical advice. Consult a physician after significant exposure.

**Most important symptoms and effects, both acute and delayed:**

- Inhalation of high concentrations of this material, as could occur in enclosed spaces or during deliberate abuse, may be associated with cardiac arrhythmias. Sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to this material.
- This material is an aspiration hazard. Potential danger from aspiration must be weighed against possible oral toxicity (See Section 2 – Swallowing) when deciding whether to induce vomiting.
- Signs and symptoms of exposure to this material through breathing, swallowing, and/or passage of the material through the skin may include: stomach or intestinal upset (nausea, vomiting, diarrhea), irritation (nose, throat, airways), lung irritation, drowsiness, confusion, irregular heartbeat, convulsions. Causes skin irritations. May cause drowsiness or dizziness.

**Notes to physician:** No hazards which require special first aid measures.

5. **FIRE FIGHTING MEASURES**

**Suitable Extinguishing Media:** Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Water spray, foam, carbon dioxide or dry chemical.

**Unsuitable extinguishing media:** High volume water jet.

**Specific hazards during firefighting:**

Do not allow run-off from fire fighting to enter drains or water courses.
Hazardous combustion products:
Carbon dioxide and carbon monoxide, Hydrocarbons, Nitrogen oxides (NOx), toxic fumes
Specific extinguishing methods: Product is compatible with standard fire-fighting agents.
Keep containers cool by spraying with water if exposed to fire.
Further information: When product is wet it causes a danger for slipping. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.
Special Protective Equipment for fire-fighters:
Firefighters, and others exposed, wear self-contained breathing apparatus and protective suit. Wear full firefighting protective clothing. Use NIOSH/MSHA approved respiratory protection.

6. ACCIDENTAL RELEASE MEASURES
Personal precautions, protective equipment and emergency procedures:
Use personal protective equipment. Ensure adequate ventilation. Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Material can create slippery conditions.
Environmental precautions:
Do not let product enter drains. Prevent further leakage or spillage if safe to do so. If the product contaminates rivers and lakes or drains inform respective authorities. Do not flush into surface water or sanitary sewer system. Do not allow contact with soil, surface or ground water.
Methods and materials for containment and cleaning up:
Keep in suitable, closed containers, for disposal. Soak up with inert absorbent and non-combustible absorbent material, (e.g. sand, silica gel, acid binder, universal binder, sawdust).
Other information:
Comply with all applicable federal, state, international and local regulations.

7. HANDLING AND STORAGE
ADVICE ON SAFE HANDLING:
Avoid formation of aerosol. Provide sufficient air exchange and /or exhaust in work rooms. Do not breathe vapours/dust. Do not smoke. Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and / or solid), all hazard precautions given in the data sheet must be observed. Avoid exposure-obtain special instructions before use. This material is slippery when wet. Do not eat, drink or smoke when using this product and in application area. For personal protection (see Section 8). Dispose of rinse water in accordance with local and state and national regulations. Keep away from heat and sources of ignition. Handle in accordance with good industrial hygiene and safety practice.
CONDITIONS FOR SAFE STORAGE:
Keep container tightly closed in a dry and well-ventilated place. Keep away from food, drink and smoking. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Observe label precautions. Electrical installations/working materials must comply with the technological safety standards. Store in original container in a cool, dry ventilated area.

8 EXPOSURE CONTROLS/PERSOINAL PROTECTION
Components with workplace control parameters

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>CAS-No.</th>
<th>Value type (form of exposure)</th>
<th>Control parameters/ permissible concentration</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALIPHATIC HYDROCARBON</td>
<td>254504001-5164</td>
<td>TWL</td>
<td>200 mg/m³ Non-aerosol (as total hydrocarbon vapor)</td>
<td>ACGIH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REL</td>
<td>100 mg/m³</td>
<td>NIOSH/GUIDE</td>
</tr>
</tbody>
</table>

Engineering measures:
Provide sufficient mechanical (general and / or local exhaust) ventilation to maintain exposure below exposure guidelines (if applicable) or below levels that cause known, suspected or apparent adverse effects.
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product. Avoid contact with skin and eyes. Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation.

**Personal protective equipment:**

**Respiratory protection:**
In case of vapour formation use a respirator with an approved filter. A NIOSH-approved air-purifying respirator with an appropriate cartridge and/or filter may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits (if applicable) or if overexposure has otherwise been determined. Protection provided by air-purifying respirators is limited. Use a positive pressure, air-supplied respirator if there is any potential for uncontrolled release, exposure levels are not known or any other circumstances where an air-purifying respirator may not provide adequate protection.

**Hand protection:**
The suitability for a specific workplace should be discussed with the producers of the protective gloves.

**Eye protection**
Wear tightly fitting splash-proof safety goggles or face-shield if there is a potential for exposure of the eyes to liquid, vapor or mist. Ensure that eyewash stations and safety showers are close to the workstation location.

**Skin and body protection**
Wear as appropriate impervious clothing, safety shoes. Wear resistant gloves (consult your safety equipment supplier). Choose body protections according to the amount and concentration of the dangerous substances at the work place. Launder clothing before reuse. If skin irritation develops, contact your facility health and safety professional or your local safety equipment supplier to determine the proper personal protective equipment for your use.

**Hygiene measures:** Wash hands before breaks and at the end of the workday. When using do not eat, drink or smoke when using this product.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

**General Information**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical state:</strong></td>
<td>liquid</td>
</tr>
<tr>
<td><strong>Appearance:</strong></td>
<td>viscous</td>
</tr>
<tr>
<td><strong>Color:</strong></td>
<td>White</td>
</tr>
<tr>
<td><strong>Odor:</strong></td>
<td>mild, hydrocarbon-like</td>
</tr>
<tr>
<td><strong>Odour threshold:</strong></td>
<td>(ca.) 3.7 , Concentration: 10 g/l (20º C)</td>
</tr>
<tr>
<td><strong>pH:</strong></td>
<td>(ca.) 3.7, Concentration: 10 g/l (20º C)</td>
</tr>
<tr>
<td><strong>Melting point/freezing point:</strong></td>
<td>&lt;5 ºF / -15ºC</td>
</tr>
<tr>
<td><strong>Boiling Point boiling range:</strong></td>
<td>217°F/103°C</td>
</tr>
<tr>
<td><strong>Flash point:</strong></td>
<td>&gt; 212°F/&gt;100°C Method: Cleveland open cup</td>
</tr>
<tr>
<td><strong>Evaporation Rate:</strong></td>
<td>&lt;1</td>
</tr>
<tr>
<td><strong>Flammability (solid, gas):</strong></td>
<td>No data available</td>
</tr>
<tr>
<td><strong>Flammability (liquids):</strong></td>
<td>Static Accumulating liquid</td>
</tr>
<tr>
<td><strong>Explosive properties:</strong></td>
<td>No data available</td>
</tr>
<tr>
<td><strong>Lower / upper limits:</strong></td>
<td>No data available</td>
</tr>
<tr>
<td><strong>Vapor Pressure:</strong></td>
<td>23.300 hPa @ 20ºC Method: ASTM D 2879-86</td>
</tr>
<tr>
<td><strong>Relative vapor density:</strong></td>
<td>No data available</td>
</tr>
<tr>
<td><strong>Relative density:</strong></td>
<td>1.03 – 1.04</td>
</tr>
<tr>
<td><strong>Density:</strong></td>
<td>Approximate 1.03 g/cm³</td>
</tr>
<tr>
<td><strong>Solubility in Water:</strong></td>
<td>Soluble</td>
</tr>
<tr>
<td><strong>Solubility in other solvents:</strong></td>
<td>No data available</td>
</tr>
<tr>
<td><strong>Partition coefficient</strong></td>
<td>(n-octanol/water): No data available</td>
</tr>
<tr>
<td><strong>Thermal decomposition:</strong></td>
<td>No data available</td>
</tr>
<tr>
<td><strong>Viscosity, dynamic</strong></td>
<td>(&gt;7 mPa.s @ 40ºC)</td>
</tr>
<tr>
<td><strong>Viscosity, kinematic</strong></td>
<td>(&gt;20.5 mm²/s @ 40ºC)</td>
</tr>
<tr>
<td><strong>Oxidizing properties:</strong></td>
<td>No data available</td>
</tr>
</tbody>
</table>
10. **STABILITY AND REACTIVITY**

   Reactivity: No decompositions if stored and applied as directed.
   Chemical Stability: Stable under recommended storage conditions.
   Possibility of Hazardous reactions: Product will not undergo hazardous polymerization.
   Conditions to avoid: Heat, flames and sparks.
   Incompatible Materials: Aluminum, copper, copper alloys, strong acids, strong oxidizers agents, strong bases, strong reducing agents.
   Hazardous decomposition products: Carbon dioxide, carbon monoxide, hydrocarbons, nitrogen oxides

11. **TOXICOLOGICAL INFORMATION**

   Information on likely routes of exposure: Inhalation, skin absorption, skin contact, eye contact, ingestion
   Acute toxicity: Not classified based on available information.

   **Components:**
   **ALIPHATIC HYDROCARBON:**
   - Acute oral Toxicity: LD 50 Rat: > 5,000 mg/kg
   - Acute inhalation toxicity: LD 50 Rat, male and female: > 5.28 mg/l
     Exposure time: 4 hr.
     Test atmosphere: vapour
     Method: OECD Test Guideline 403
   Assessment: No adverse effect has been observed in acute inhalation toxicity tests.

   Acute dermal toxicity: LD 50 Rabbit: > 2,000 mg/kg
   Assessment: No adverse effect has been observed in acute dermal toxicity tests.
   **ALCOHOLS ALKOXYLATES:**
   - Acute oral toxicity: LD 50 Rat: 1380 mg/kg
   Skin corrosion/irritation: Causes skin irritation.
   Product: Result: Possibly irritating to skin. Repeated exposure may cause skin dryness or cracking.

   **Components:**
   **ALIPHATIC HYDROCARBON:** Irritating to skin.
   **ALCOHOLS ALKOXYLATES:** Irritating to skin.
   **Serious eye damage/eye irritation:** Not classified based on available information.
   Product: Possibly irritating to eyes.
   Unlikely to cause eye irritation or injury.

   **Components:**
   **ALIPHATIC HYDROCARBON:** Mildly irritating to eyes.
   **ALCOHOLS ALKOXYLATES:** Risk of serious damage to eyes.
   **Respiratory or skin sensitization:** Skin sensitization:
   Not classified based on available information
   Respiratory sensitization:
   Not classified based on available information
   **Germ cell mutagenicity:** Not classified based on available information
   **Carcinogenicity:** Not classified based on available information
   **Reproductive toxicity:** Not classified based on available information
   **STOT – single exposure:** May cause drowsiness or dizziness.
Components:

ALIPHATIC HYDROCARBON: May cause drowsiness or dizziness.
STOT – repeated exposure: Not classified based on available information
Aspiration toxicity: Not classified based on available information

Further information

Product: Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting. Concentrations substantially above the TLV value may cause narcotic effects. Solvents may degrease the skin.

Carcinogenicity:

IARC: No component of this product presents at levels greater than or equal to 0.1 % is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA: No component of this product present at levels greater than or equal to 0.1 % is identified as carcinogen or potential carcinogen by OSHA.
NTP: No component of this product presents at levels greater than or equal to 0.1 % is identified as a known or anticipated carcinogen by NTP.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:
- Toxicity to fish: LC 50 fathead minnow (Pimephales promelas): 11 mg/l
  Exposure time: 48hr.
- Toxicity of daphnia and other Aquatic invertebrates: LC 50 Water flea (Ceriodaphnia dubia): 1.75 mg/l
  Exposure time: 48hr.

Components:

ALIPHATIC HYDROCARBON:
- Toxicity to fish: LC 50 Rainbow trout (Oncorhynchus mykiss) 2 - 5 mg/l
  Exposure time: 96hr. Test Method: semi-static test
  Test substance: WAF Method: OECD Test Guideline 203

The information given is based on data obtained from similar substances.
- Toxicity of daphnia and other Aquatic invertebrates: EL 50 Water flea (Daphnia magna): 1.4 mg/l
  Exposure time: 48hr. Test Method: static test
  Test substance: WAF Method: OECD Test Guideline 202

The information given is based on data obtained from similar substances.
- Toxicity to Algae: EL50 green algae (Pseudokirchneriella subcapitata):>1-3 mg/l
  Exposure time: 72hr. Test Method: static test
  Test substance: WAF Method: OECD Test Guideline 201

The information given is based on data obtained from similar substances.
- Toxicity of daphnia and other Aquatic invertebrates (Chronic toxicity):
  NOEL: Species: Water flea (Daphnia magna): 0.48 mg/l
  Exposure time: 21 d Test Method: semi-static test
  Test substance: WAF Method: OECD Test Guideline 211

The information given is based on data obtained from similar substances.

ALCOHOL ALKOXYLATES:
- Toxicity to fish: LC50 Fish: > 1 – 10 mg/l
  Exposure time: 96h Test Type: static test
Toxicity of daphnia and other Aquatic invertebrates:
   EC50 Daphnia Water flea: > 1 – 10 mg/l
   Exposure time: 48h  Test Type: static test

Toxicity to Algae:
   ErC50 green algae: > 0.1 – 1.0 mg/l
   Exposure time: 96h  Test Type: static test

Toxicity of daphnia and other Aquatic Invertebrates (Chronic toxicity):
   EC10 Daphnia water flea: 0.17mg/l
   Exposure time: 21 d

Ecotoxicology Assessment:
   Acute aquatic toxicity: Very toxic to aquatic life.

Persistence and degradability
Product:
   Biochemical Oxygen Demand (BOD): Biochemical oxygen demand 383,000 mg/l
   Chemical Oxygen Demand (COD): 1,930,000 mg/l  Method: Chemical Oxygen demand

Components:
   ALIPHATIC HYDROCARBON:
      Biodegradability: Result: Inherently biodegradable
      Biodegradation: 58.6%  Exposure time: 28 days
      Method: OECD Test Guideline 301F

   ALCOHOL ALKOXYLATES:
      Biodegradability: Result: Readily biodegradable.
      Bioaccumulative potential
      Components:
      No data available
      Mobility in soil
      Components:
      No data available
      Other adverse effects:
      No data available
      Components:
      No data available
      Product:
      Additional ecological information: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life with long lasting effects.

Components:

13. **DISPOSAL CONSIDERATIONS**

Disposal methods:
General Advice: The product should not be allowed to enter drains, water courses or the soil. Do not contaminate ponds, waterways or ditches with chemical or used container. Send to a licensed waste management company. Dispose of in accordance with all applicable local, state, international and federal regulations.

Contaminated packaging: Empty remaining contents. Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers.
14. TRANSPORT INFORMATION

<table>
<thead>
<tr>
<th>ID NUMBER</th>
<th>PROPER SHIPPING NAME</th>
<th>HAZARD CLASS</th>
<th>SUBSIDIARY HAZARDS</th>
<th>PACKING GROUP</th>
<th>MARINE POLLUTANT / LTD. QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. DOT - ROAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not dangerous goods</td>
</tr>
<tr>
<td>U.S. DOT - RAIL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not dangerous goods</td>
</tr>
<tr>
<td>U.S. DOT – INLAND WATERWAYS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not dangerous goods</td>
</tr>
<tr>
<td>TRANSPORT CANADA - ROAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not dangerous goods</td>
</tr>
<tr>
<td>TRANSPORT CANADA - RAIL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not dangerous goods</td>
</tr>
<tr>
<td>TRANSPORT CANADA – INLAND WATERWAYS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not dangerous goods</td>
</tr>
<tr>
<td>INTERNATIONAL MARITIME DANGEROUS GOODS</td>
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<td></td>
<td></td>
<td></td>
<td>Not dangerous goods</td>
</tr>
<tr>
<td>INTERNATIONAL AIR TRANSPORT ASSOC. - CARGO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not dangerous goods</td>
</tr>
<tr>
<td>INTERNATIONAL AIR TRANSPORT ASSOC. - PASSENGER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not dangerous goods</td>
</tr>
<tr>
<td>MEXICAN REGULATION FOR THE LAND TRANSPORT OF HAZARDOUS MATERIALS AND WASTES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not dangerous goods</td>
</tr>
</tbody>
</table>

*ORM = ORM-D, CBL=COMBUSTIBLE LIQUID

Marine pollutant | yes

Dangerous goods description (if indicated above) may not reflect package size, quantity, end-use or region-specific exceptions that can be applied. Consult shipping documents for description that are specific to the shipment.

15. REGULATORY INFORMATION

SARA Hazard Classification
SARA 311/312
Acute health hazard

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

California Prop. 65-WARNINGS!
Proposition 65 warnings are not required for this product based on the results of a risk assessment.

The components of this product are reported in the following inventories:

TSCA: On TSCA Inventory
DSL: This product contains one or more components that are not on the Canadian DSL and have annual quantity limits.
AUSTR: On the inventory, or in compliance with the inventory.
ENCS: On the inventory, or in compliance with the inventory.
KECL: On the inventory, or in compliance with the inventory.
PHIL: On the inventory, or in compliance with the inventory.
IECSC: On the inventory, or in compliance with the inventory.

Inventories:
AICS (Australia), DSL (Canada), IECSC (China), REACH (European Union), ENCS (Japan), ISHL (Japan), KECI (Korea), NZIoC (New Zealand), PICCS (Philippines), TSCA (USA)

Registration: Trade Secret

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>IDENTIFICATION NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALIPHATIC HYDROCARBON</td>
<td>254504001-5164</td>
</tr>
<tr>
<td>ALCOHOL ALKOXYLATES</td>
<td>254504001-5466</td>
</tr>
</tbody>
</table>
Further information

Full text of H-Statements referred to under Sections 2 and 3.
H-227 Combustible liquid.
H302 Harmful if swallowed.
H315 Causes skin irritation.
H318 Causes serious eye damage.
H336 May cause drowsiness or dizziness.
H400 Very toxic to aquatic life.

DATE ISSUED: 03/17/2016
DATE REVISED: 03/17/2016  Revision number: 1.4

OTHER INFORMATION
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. Reasonable care has been taken in the preparation of this information, but the manufacturer makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. The manufacturer makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances. This information is for the specific material described only and may not be valid if the material is used in combination with any other materials or in any process. The user is responsible to determine the completeness of the information and suitability for the user’s own particular use. The knowledge and belief of the company, the information is accurate and reliable as of the date indicated but the company makes no express or implied warranty of merchantability for the material or the information. The company makes no express or implied warranty of fitness for a purpose for the material or for the information. Users of any chemical should educate themselves on all aspects of its use by independent investigation of current scientific and medical knowledge that the material can be used safely. Both the supplier and manufacturer make no representations and assume no liability for any direct, incidental or consequential damages resulting from its use. Both the supplier and manufacturer make no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances. This information is for the specific material described only and may not be valid if the material is used in combination with any other materials or in any process. The user is responsible to determine the completeness of the information and suitability for the user’s own particular use. Users of any chemical should educate themselves on all aspects of its use by independent investigation of current scientific and medical knowledge that the material can be used safely. The buyer assumes all responsibility for using and handling the product in accordance with applicable federal, state and local regulations.

List of abbreviations and acronyms that could be, but not necessarily are, used in the safety data sheet:
ACGIH: American Conference of Industrial Hygienists
BEI: Biological Exposure Index
CAS Chemical: Abstracts Service (Division of the American Chemical Society)
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
CMR: Carcinogenic, Mutagenic or Toxic for Reproduction
DOT: Department of Transportation
FG: Food grade
FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act
GHS: Globally Harmonized System of Classification and Labeling of Chemicals
H-statement: Hazard Statement
HMIRC: Hazardous Materials Information Review Commission
HMIS: Hazardous Materials Identification System
IATA: International Air Transport Association
IATA-DGR: Dangerous Goods Regulation by the “International Air Transport Association” (IATA)
ICAO: International Civil Aviation Organization
ICAO-TI (ICAO): Technical Instructions by the “International Civil Aviation Organization”
IMDG: International Maritime Code for Dangerous Goods
ISO: International Organization for Standardization
logPow: octanol-water partition coefficient
LCxx: Lethal Concentration, for xx percent of test population
LDxx: Lethal Dose, for xx percent of test population
ICxx: Inhibitory Concentration for xx of a substance
ECxx: Effective Concentration of xx
N.O.S.: Not otherwise Specified
NFPA: National Fire Protection Association
NIOSH: National Institute for Occupational Safety and Health
OECD: Organization for Economic Co-operation and Development
OEL: Occupational Exposure Limit
OSHA: Occupational Safety and Health Administration
P-Statement: Precautionary Statement
PBT: Persistent, Bioaccumulative and Toxic
PMRA: Health Canada Pest Management Regulatory Agency
PPE: Personal Protective Equipment
RTK: Right to Know
STEL: Short-term exposure limit
SDS Safety Data Sheet
STOT: Specific Target Organ Toxicity
TLV: Threshold Limit Value
TWA: Time-weighted average
VPVB: Very Persistent and Very Bioaccumulative
WEL: Workplace Exposure Level
WHMIS: Workplace Hazardous Materials Information System
(WAF): water-accommodated fraction
C6: Portland Cement Based Concrete Products

SAFETY DATA SHEET
(Complies with OSHA 29 CFR 1910.1200)

SECTION I: PRODUCT IDENTIFICATION

The QUIKRETE® Companies
One Securities Centre
3490 Piedmont Road, Suite 1300
Atlanta, GA 30305

Revision: Nov-16
SDS C6

QUIKRETE® Product Name                        Item #(s)                        
Fast-Setting Concrete Mix                     1004-50, -60                      
All-Star Fast Setting Concrete Mix            1004-50                           
Commercial Grade FastSet™ Concrete Mix       1004-51                           
Post Haste                                    1004-65                           
Q-MAX Pro Concrete Mix                       1004-81                           
All-Star 10 Minute Instant Post Mix           1005-51                           
FastSet™ Water-Stop Cement –Zip & Mix         1121-15                           
Commercial Grade FastSet™ Cement             1124-92                           
Hydraulic Water Stop                          1126-00                           
Concrete Resurfacer                           1131-40                           
Multipurpose Concrete Resurfacer              1131-45                           
Bonded Topping Mix                            1133-04, 1018, 1017               
FastSet™ Stucco Patch                         1139-92                           
Architectural Finish                          1220-55                           
Quick Setting Cement                          1240-00                           
Commercial Grade FastSet™ Repair Mortar – Zip And Mix 1241                     
Commercial Grade FastSet™ Repair Mortar      1241-60                           
Rapid Road Repair                             1242-50, -51, -52, -80             
Polymer Modified Structural Concrete – Extended Set 1242-85                    
Rapid Hardening Sand Mix                      1243-50                           
Commercial Grade FastSet™ Polymer Modified DOT Mix 1244-54                    
Commercial Grade FastSet™ DOT Mix             1244-56                           
Commercial Grade FastSet™ DOT Deck Repair – Polymer Modified 1244-58         
Commercial Grade FastSet™ DOT Mix – Extended  1244-81                           
Exterior use Anchoring Cement                 1245-80, -81                      
Commercial Grade FastSet™ Non-Shrink Grout    1585-09, -20, -50                
Commercial Grade FastSet™ All-Crete           1585-59                           
Mix 801 FastSet™ DOT PM Overlay               NR801552/80801552
Product Use: Portland cement-based, rapid-setting materials for general construction or repair.

SECTION II - HAZARD IDENTIFICATION

Hazard-determining components of labeling: Silica, Portland cement

2.1 Classification of the substance or mixture
Carcinogen – Category 1A
Skin Corrosion – Category 1B
Skin Sensitization – Category 1B
Specific Target Organ Toxicity Repeat Exposure – Category 1
Specific Target Organ Toxicity: Single Exposure – Category 3

2.2a Signal word DANGER!

2.2b Hazard Statements
May cause cancer through chronic inhalation
Causes severe skin burns and serious eye damage
May cause an allergic skin reaction
Causes damage to lungs through prolonged or repeated inhalation
May cause respiratory irritation

2.2c Pictograms

2.2d Precautionary statements
Do not handle until all safety precautions have been read and understood.
Wear impervious gloves, such as nitrile. Wear eye protection, and protective clothing.
Do not eat, drink or smoke when using this product.
Wash thoroughly after handling.
Use only in a well-ventilated area.
Do not breathe dust.

If swallowed: Rinse mouth. Do NOT induce vomiting.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If on skin (or hair): Remove immediately all contaminated clothing and wash before re-use. Rinse skin or hair with water.
If significant skin irritation or rash occurs: get medical advice or attention. 
**Immediately seek medical advice or attention if symptoms are significant or persist.**

Store in a well-ventilated place. Keep container tightly closed. 
Dispose of contents/containers in accordance with all regulations.

### 2.3 Additional Information

The Portland cement in this product can cause serious, potentially irreversible damage to skin, eye, respiratory and digestive tracts due to chemical (caustic) burns, including third degree burns. Burns from Portland cement may not cause immediate pain or discomfort. You cannot rely on pain to alert you to cement burns. Therefore precautions must be taken to prevent all contact with Portland cement. Cement burns can become worse even after contact has ended. If there is contact with this product, immediately remove all product from body and thoroughly rinse with water. If you experience or suspect a cement burn or inflammation you should immediately see a health care professional.

Skin burns and irritation may be caused by brief exposure, though often are caused by extended exposure of 15 minutes, an hour, or longer. Interaction of Portland cement with water or sweat releases a caustic solution which produces the burns or irritation. Any extended exposure should be treated as though a burn has occurred until determined otherwise.

Skin contact with Portland cement can also cause inflammation of the skin, referred to as dermatitis. Signs and symptoms of dermatitis can include itching, redness, swelling, blisters, scaling, and other changes in the normal condition of the skin. Signs and symptoms of burns include the above and whitening, yellowing, blackening, peeling or cracking of skin.

The Portland cement in this product may cause allergic contact dermatitis in sensitized individuals. This overreaction of the immune system can lead to severe inflammation. Sensitization may result from a single exposure to the low levels of Cr(VI) in Portland cement or repeated exposures over months or years. Sensitization is long lasting and, after sensitization, even very small quantities can trigger the dermatitis. Sensitization is uncommon. Individuals who experience skin problems, including seemingly minor ones, are advised to seek medical attention.

### 2.3a HNOC – Hazards not otherwise classified:  Not applicable

### 2.3b Unknown Acute Toxicity:  None

### 2.3c WHMIS Classification

- Class D2B – Skin/Eye Irritant
- Class D2A – Chronic Toxic Effects – Carcinogen
- Class E – Corrosive Material

### 2.3d Label Elements According To WHMIS
### SECTION III - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

<table>
<thead>
<tr>
<th>Hazardous Components</th>
<th>CAS No.</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand, Silica, Quartz</td>
<td>14808-60-7</td>
<td>40-70*</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>65997 15 1</td>
<td>10-30*</td>
</tr>
<tr>
<td>Calcium Sulfoaluminate</td>
<td>65997-16-2</td>
<td>10-30*</td>
</tr>
<tr>
<td>Calcium Aluminate</td>
<td>12042-68-1</td>
<td>5-10*</td>
</tr>
<tr>
<td>Calcium Sulfate</td>
<td>10101-41-4</td>
<td>1-5*</td>
</tr>
<tr>
<td>Limestone Dust</td>
<td>01317-65-3</td>
<td>1-5*</td>
</tr>
</tbody>
</table>

*The concentrations ranges are provided due to batch-to-batch variability. None of the constituents of this material are of unknown toxicity.

### SECTION IV – FIRST AID MEASURES

#### 4.1 Description of the first-aid measures

**General information:**

- **After inhalation:** Remove person to fresh air. If breathing is difficult, administer oxygen. If not breathing, give artificial respiration. In case of unconsciousness, place patient stably in side position for transportation.
- **After skin contact:** Wash skin with cool water and pH-neutral soap or a mild detergent. If significant skin irritation or rash occurs: get medical advice or attention.
- **After eye contact:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- **After swallowing:** Do not induce vomiting. If conscious, have the victim drink plenty of water and call a physician immediately. Never give anything by mouth to an unconscious person.

#### 4.2 Most important symptoms/effects, acute and delayed

**Inhalation:** May cause respiratory tract irritation. Causes damage to organs through prolonged or repeated inhalation. This product contains crystalline silica. Prolonged or repeated inhalation of respirable silica from this product can cause silicosis.

**Skin contact:** The Portland cement in this product can cause serious, potentially irreversible damage to skin, eye, respiratory and digestive tracts due to chemical (caustic) burns, including third degree burns.
Burns from Portland cement may not cause immediate pain or discomfort. You cannot rely on pain to alert you to cement burns. Therefore precautions must be taken to prevent all contact with Portland cement. Cement burns can become worse even after contact has ended. If there is contact with this product, immediately remove all product from body and thoroughly rinse with water. If you experience or suspect a cement burn or inflammation you should immediately see a health care professional.

Skin burns and irritation may be caused by brief exposure, though often are caused by extended exposure of 15 minutes, an hour, or longer. Interaction of Portland cement with water or sweat releases a caustic solution which produces the burns or irritation. Any extended exposure should be treated as though a burn has occurred until determined otherwise.

Skin contact with Portland cement can also cause inflammation of the skin, referred to as dermatitis. Signs and symptoms of dermatitis can include itching, redness, swelling, blisters, scaling, and other changes in the normal condition of the skin. Signs and symptoms of burns include the above and whitening, yellowing, blackening, peeling or cracking of skin.

The Portland cement in this product may cause allergic contact dermatitis in sensitized individuals. This overreaction of the immune system can lead to severe inflammation. Sensitization may result from a single exposure to the low levels of Cr(VI) in Portland cement or repeated exposures over months or years. Sensitization is long lasting and, after sensitization, even very small quantities can trigger the dermatitis. Sensitization is uncommon. Individuals who experience skin problems, including seemingly minor ones, are advised to seek medical attention.

**Eye Contact:** Causes serious eye damage. Symptoms may include discomfort or pain, excess blinking and tear production, with marked redness and swelling of the conjunctiva.

**Ingestion:** May be harmful if swallowed. Ingestion may cause discomfort and/or distress, nausea or vomiting.

**4.3 Indication of immediate medical attention and special treatment needed:**
Immediately seek medical advice or attention if symptoms are significant or persist.
SECTION VI – ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures: Wear personal protective equipment (See section VIII). Keep unprotected persons away.

6.2 Methods and material for containment and cleaning up:
Do not allow to enter sewers/ surface or ground water. Dispose of unwanted materials and containers properly in accordance with all regulations.

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND STORAGE

7.1 Handling
Precautions for safe handling: Ensure good ventilation/exhaustion at the workplace. DO NOT BREATHE DUST. In dusty environments, the use of an OSHA, MSHA or NIOSH approved respirator and tight fitting goggles is recommended. Wear appropriate PPE (See section 8). Do not mix with other chemical products, except as indicated by the manufacturer. Do not get in eyes, on skin or clothing. Good housekeeping is important to prevent accumulation of dust.

7.2 Storage
Requirements to be met by storerooms and receptacles: No special requirements.
Information about storage in one common storage facility: Not required.
Further information about storage conditions: Keep out of the reach of children. Keep container tightly closed and prevent exposure to humidity. Do not allow water to contact the product until time of use to preserve product utility.

SECTION VIII – EXPOSURE CONTROL MEASURES / PERSONAL PROTECTION

8.1 Components with limit values that require monitoring at the workplace:

<table>
<thead>
<tr>
<th>Hazardous Components</th>
<th>CAS No.</th>
<th>PEL (OSHA) mg/M³</th>
<th>TLV (ACGIH) mg/M³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica Sand, crystalline</td>
<td>14808-60-7</td>
<td>0.1</td>
<td>0.025 (resp)</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>65997-15-1</td>
<td>5 (resp) 15 (total)</td>
<td>10 (resp)</td>
</tr>
<tr>
<td>Calcium Sulfoaluminate</td>
<td>65997-16-2</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Calcium Aluminate</td>
<td>12042-68-1</td>
<td>5 (resp) 15 (total)</td>
<td>1 (resp)</td>
</tr>
<tr>
<td>Calcium Sulfate</td>
<td>10101-41-4</td>
<td>5 (resp) 15 (total)</td>
<td>10 (resp)</td>
</tr>
<tr>
<td>Limestone Dust</td>
<td>01317-65-3</td>
<td>5 (resp) 15 (total)</td>
<td>10 (resp)</td>
</tr>
</tbody>
</table>

8.2 Exposure Controls
Use ventilation adequate to keep exposures below recommended exposure limits.

8.3 General protective and hygienic measures
Keep away from foodstuffs, beverages and feed. Immediately remove all soiled and contaminated clothing. Wash hands before breaks and at the end of work. Avoid contact with the eyes and skin.

8.3a Personal protective equipment

Protection of hands:
Wear gloves of adequate length to offer appropriate skin protection from splashes. Nitrile, Butyl and PVC gloves have been found to offer adequate protection for incidental contact. Precautions must be observed because burns occur with little warning -- little heat is sensed.

Eye protection:
Wear approved eye protection properly fitted dust- or splash-proof chemical safety glasses.

Respiratory protection:
A NIOSH-approved dust mask or filtering face piece is recommended in poorly ventilated areas or when permissible exposure limits may be exceeded. Respirators should be selected by and used under the direction of a trained health and safety professional, following requirements found in OSHA’s respirator standard (29 CFR 1910.134) and ANSI’s standard for respiratory protection (Z88.2).

SECTION IX - PHYSICAL/CHEMICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>General Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Form: Granular Solid Color: Gray to gray-brown colored Odor: None</td>
</tr>
<tr>
<td>pH-value at 20°C (68 °F):</td>
<td>13 (10%)</td>
</tr>
<tr>
<td>Boiling point/Boiling range:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flash point:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Auto igniting:</td>
<td>Product is not self-igniting</td>
</tr>
<tr>
<td>Vapor pressure at 21°C (70°F)</td>
<td>Not available</td>
</tr>
<tr>
<td>Density at 25°C (77 °F):</td>
<td>2.6 to 3.15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solubility in / Miscibility with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water:</td>
</tr>
<tr>
<td>VOC content:</td>
</tr>
</tbody>
</table>

SECTION X – STABILITY AND REACTIVITY

10.1 Reactivity
No dangerous reaction known under conditions of normal use.

10.2 Chemical stability
Stable under normal storage conditions. Keep in dry storage.
10.3 Possibility of hazardous reaction
No dangerous reaction known under conditions of normal use.

10.4 Thermal decomposition / conditions to be avoided
No decomposition if used according to specifications.

10.5 Incompatible materials
Contact of silica with powerful oxidizing agents such as fluorine, chlorine trifluoride, manganese trioxide, or oxygen difluoride may cause fires.

10.6 Hazardous Decomposition or By-products
Silica will dissolve in Hydrofluoric Acid and produce a corrosive gas – silicon tetrafluoride.

SECTION XI – TOXICOLOGICAL INFORMATION

11.1 Exposure Routes: Skin contact, skin adsorption, eye contact, inhalation, or ingestion.

11.2 Symptoms related to physical/chemical/toxicological characteristics:
- **Inhalation:** May cause respiratory tract irritation. Causes damage to organs through prolonged or repeated exposure. This product contains crystalline silica. Prolonged or repeated inhalation of respirable silica from this product can cause silicosis.
- **Skin contact:** Causes skin irritation. Handling can cause dry skin, discomfort, irritation, and dermatitis. May cause sensitization by skin contact. Product becomes extremely alkaline when exposed to moisture, and can cause alkali burns and affect the mucous membranes.
- **Eye Contact:** Causes serious eye damage. Symptoms may include discomfort or pain, excess blinking and tear production, with marked redness and swelling of the conjunctiva.
- **Ingestion:** Harmful if swallowed. Ingestion may cause discomfort and/or distress, nausea or vomiting.

11.3 Delayed, immediate and chronic effects of short-term and long-term exposure

**Short Term**
- Skin Corrosion/Irritation: Causes severe skin burns.
- Serious Eye Damage/Irritation: Causes severe eye damage.
- Respiratory Sensitization: Not available
- Skin Sensitization: May cause an allergic skin reaction.
- Specific Target Organ Toxicity-Single Exposure: (Category 3) may cause respiratory irritation.
- Aspiration Hazard: Not available

**Long Term**
- Carcinogenicity: May cause cancer through chronic inhalation.
- Germ Cell Mutagenicity: Not available
- Reproductive Toxicity: Not available
Specific Target Organ Toxicity- Repeated Exposure: (Category 1) Causes damage to lungs through prolonged/repeated exposure
Synergistic/Antagonistic Effects: Not available.

SECTION XII – ECOLOGICAL INFORMATION

12.1 Ecotoxicity
May cause long-term adverse effects to the aquatic environment. Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system. Must not reach bodies of water or drainage ditch undiluted or un-neutralized

12.2 Persistence and degradability
No further relevant information available.

12.3 Bioaccumulative potential:
No further relevant information available.

12.4 Mobility in soil
No further relevant information available.

12.5 Other Adverse Effects
No further relevant information available.

SECTION XIII – DISPOSAL CONSIDERATIONS

13.1 Waste Disposal Method
The packaging and material may be land filled; however, material should be covered to minimize generation of airborne dust. This product is not classified as a hazardous waste under the authority of the RCRA (40CFR 261) or CERCLA (40CFR 117&302). Disposal must be made in accordance with local, state and federal regulations.

13.2 Other disposal considerations
Uncleaned packaging
Recommendation: Disposal must be made in accordance with local, state and federal regulations. Recommended cleansing agent: Water, if necessary with cleansing agents.

SECTION XIV – TRANSPORT INFORMATION

<table>
<thead>
<tr>
<th>UN-Number</th>
<th>DOT (U.S.)</th>
<th>TDG (Canada)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Regulated</td>
<td>Not Regulated</td>
</tr>
<tr>
<td>UN proper shipping name</td>
<td>Not Regulated</td>
<td>Not Regulated</td>
</tr>
<tr>
<td>Transport Hazard Class(es)</td>
<td>Not Regulated</td>
<td>Not Regulated</td>
</tr>
<tr>
<td>Packing Group (if applicable)</td>
<td>Not Regulated</td>
<td>Not Regulated</td>
</tr>
</tbody>
</table>
14.1 Environmental hazards:
Not Available

14.2 Transport in bulk according to Annex II of Marpol 73/78 and the IBC Code
Not available

14.3 Special precautions for user
Do not handle until all safety precautions have been read and understood.

SECTION XV – OTHER REGULATORY INFORMATION

15.1 Safety, Health and Environmental Regulations/Legislations specific for the chemical

Canada
WHMIS Classification: Considered to be a hazardous material under the Hazardous Products Act as defined by the Controlled Products Regulations and subject to the requirements of Health Canada’s Workplace Hazardous Material Information (WHMIS). This document complies with the WHMIS requirements of the Hazardous Products Act (HPA) and the CPR.

15.2 US Federal Information

SARA 302/311/312/313 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302, 311, 312 or 313.
RCRA: Crystalline silica (quartz) is not classified as a hazardous waste under the Resource Conservation and Recovery Act, or its regulations, 40 CFR §261 et seq.
CERCLA: Crystalline silica (quartz) is not classified as a hazardous substance under regulations of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), 40 CFR §302.
Emergency Planning and Community Right to Know Act (SARA Title III): Crystalline silica (quartz) is not an extremely hazardous substance under Section 302 and is not a toxic chemical subject to the requirements of Section 313.
FDA: Silica is included in the list of substances that may be included in coatings used in food contact surfaces, 21 CFR §175.300(b)(3)(xxvi).
NTP: Respirable crystalline silica, primarily quartz dusts occurring in industrial and occupational settings, is classified as Known to be a Human Carcinogen.
OSHA Carcinogen: Crystalline silica (quartz) is not listed.

15.3 State Right to Know Laws
California Prop. 65 Components

WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

California Inhalation Reference Exposure Level (REL): California established a chronic REL of 3 µg for silica (crystalline, respirable). A chronic REL is an airborne level of a substance at or below which no adverse health effects are anticipated in individuals indefinitely exposed to the substance at that level.

Massachusetts Toxic Use Reduction Act: Silica, crystalline (respirable size, <10 microns) is “toxic” for purposes of the Massachusetts Toxic Use Reduction Act.

15.4 Global Inventories

DSL All components of this product are on the Canadian DSL list.
TSCA No.: Crystalline silica (quartz) appears on the EPA TSCA inventory under the CAS No. 14808-60-7. All constituents are listed in the TSCA inventory.

15.5 NFPA Ratings
NOTE: The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, express or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to silica contained in our products.

Prepared by The QUIKRETE® Companies
Phone (800) 282-5828
www.QUIKRETE.com

End of SDS
Safety Data Sheet (SDS)


<table>
<thead>
<tr>
<th>Section 1. Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Name</strong></td>
</tr>
<tr>
<td>Calciment® BA</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Chemical Name</strong></td>
</tr>
<tr>
<td>Calcium Oxide, Calcium Carbonate, Calcium Hydroxide</td>
</tr>
<tr>
<td><strong>Uses</strong></td>
</tr>
<tr>
<td>De-Watering, Solidification, Fixation, Neutralization, Agriculture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION 2. HAZARDS IDENTIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Classification of the substance or mixture</strong></td>
</tr>
<tr>
<td>![GHS03 Exclamation Mark]</td>
</tr>
<tr>
<td>GHS03 Exclamation Mark</td>
</tr>
<tr>
<td><strong>Signal word</strong></td>
</tr>
<tr>
<td><strong>Hazard-determining components of labeling</strong></td>
</tr>
<tr>
<td>Calcium Oxide, Calcium Carbonate, Calcium Hydroxide</td>
</tr>
<tr>
<td><strong>Hazard Statements</strong></td>
</tr>
<tr>
<td>H303  May be harmful if swallowed</td>
</tr>
<tr>
<td>H315  Causes skin irritation</td>
</tr>
<tr>
<td>H319  Causes serious eye irritation</td>
</tr>
<tr>
<td>H335  May cause respiratory irritation</td>
</tr>
<tr>
<td><strong>Precautionary statements</strong></td>
</tr>
<tr>
<td>P101  If medical advice is needed, have product container or label at hand</td>
</tr>
</tbody>
</table>
Section 3. Composition

<table>
<thead>
<tr>
<th>Component</th>
<th>Formula</th>
<th>% Wt.</th>
<th>CAS No.</th>
<th>PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Carbonate</td>
<td>CaCO(_3)</td>
<td>10-40</td>
<td>1317-65-3</td>
<td>10 mg/m(^3)</td>
</tr>
<tr>
<td>Calcium Oxide</td>
<td>CaO</td>
<td>10-60</td>
<td>1305-78-8</td>
<td>2 mg/m(^3)</td>
</tr>
<tr>
<td>Calcium Hydroxide</td>
<td>Ca(OH)(_2)</td>
<td>0-70</td>
<td>1305-78-8</td>
<td>5 mg/m(^3)</td>
</tr>
<tr>
<td>Calcium Magnesium Carbonate</td>
<td>CaMg(CO(_3))(_2)</td>
<td>0-10</td>
<td>16389-88-1</td>
<td>10 mg/m(^3)</td>
</tr>
<tr>
<td>Crystalline Silica Quartz</td>
<td>SiO(_2)</td>
<td>0-30</td>
<td>14808-60-7</td>
<td>0.1 mg/m(^3) respirable</td>
</tr>
<tr>
<td>Aluminum Oxide</td>
<td>Al(_2)O(_3)</td>
<td>0-15</td>
<td>1344-28-1</td>
<td>10 mg/m(^3)</td>
</tr>
<tr>
<td>Ferric Oxide</td>
<td>Fe(_2)O(_3)</td>
<td>0-5</td>
<td>1309-37-1</td>
<td>15 mg/m(^3)</td>
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<tr>
<td>Magnesium Oxide</td>
<td>MgO</td>
<td>0-60</td>
<td>1309-48-4</td>
<td>5 mg/m(^3)</td>
</tr>
<tr>
<td>Sulfur Trioxide</td>
<td>SO(_3)</td>
<td>5-30</td>
<td>7704-34-9</td>
<td>10 mg/m(^3)</td>
</tr>
</tbody>
</table>

SECTION 4. First-Aid Measures

Effects:

**Inhalation:** Acute: Irritation, sore throat, cough, sneezing. Chronic: Persistent coughing and breathing problems. Long-term exposure to silica can cause a chronic lung disorder, silicosis.

**Eyes:** Acute: Severe irritation, intense tearing, burns. Chronic: Possible blindness when exposure is prolonged.

**Skin:** Acute: Removes natural skin oils, blotches, itching and superficial burns in case of sweating. Chronic: No known effects.

**Ingestion:** Acute: Sore throat, stomach aches, cramps, diarrhea, vomiting. Chronic: No known effects.

Treatments:

**Inhalation:** Move victim to fresh air. Seek medical attention if necessary. If breathing has stopped, give artificial respiration.

**Eyes:** Immediately flush eyes with large amounts of water for at least 15 minutes. Pull back the eyelid to make sure all the lime dust has been washed out. Seek medical attention immediately. Do not rub eyes.

**Skin:** Flush exposed area with large amounts of water. Seek medical attention immediately.

**Ingestion:** Give large quantities of water or fruit juice. Do not induce vomiting. Seek medical attention immediately. Never give anything by mouth if victim is rapidly losing consciousness or is unconscious or convulsing.
SECTION 5. Fire-Fighting Measures

Flash Point: Non-flammable

Autoignition Temperature: Non-flammable

Inflammability Limits: None, Non combustible solid, but will support combustion by liberation of oxygen

Explosion Risk: None by itself, but heat produced by reaction with strong acids can generate steam and pressure

Hazardous Combustion Products: Decomposes to produce calcium oxide (CaO), which can react with water to produce steam and pressure

Extinguishing Media: Use dry chemical fire extinguisher. Do not use water or halogenated compounds, except that large amounts of water may be used to deluge small quantities of lime kiln dust. Use appropriate extinguishing media for surrounding fire conditions.

Fire Fighting Instructions: Keep personnel away from and upwind of fire. Wear full fire-fighting turn-out gear (full Bunker gear), and respiratory protection (self-contained breathing apparatus).

SECTION 6. Accidental Release Measures

Individual and collective precautions: Avoid creating conditions which release dust – use mechanical vacuums to remove dust from work spaces.

Avoid inhalation of Dust: Wear respiratory protection – minimum NIOSH N-95 Dust Mask.

Cleaning methods (Leaks & Spills): Use personal protective equipment (eyes, skin and inhalation, see Section 8). Use dry methods (vacuuming, sweeping) to collect spilled materials. Avoid generating dust. For large spills, evacuate area downwind of clean-up area operations to minimize dust exposure. For small spills, store spilled materials in dry, sealed plastic or metal containers. Dust residue on surfaces may be washed with water.

Precautions for the protection of the environment: May not be released into surface waters without controls (increases pH).

Waste Disposal: Dispose according to federal, provincial/state and local environmental regulations.

SECTION 7. Handling and Storage

Handling: In open air or in ventilated places, avoid skin and eye contact, avoid creating airborne dust.

SECTION 8. Exposure Controls/Personal Protection

Exposure Limits:

Calcium Carbonate: 15 mg/m$^3$ (total dust), 5 mg/m$^3$ (respirable) (OSHA); 10 mg/m$^3$ (ACGIH, O. Reg. 833);
Calcium oxide: 5 mg/m$^3$ (OSHA); 2 mg/m$^3$ (ACGIH, O. Reg. 833);
Calcium Magnesium Carbonate: 10 mg/m$^3$ (ACGIH, OSHA)
Calcium Magnesium Oxide: 2 mg/m$^3$ (ACGIH, OSHA)
Magnesium Carbonate: 15 mg/m$^3$ (total dust), 5 mg/m$^3$ (respirable) (OSHA); 5 mg/m$^3$ (ACGIH, O. Reg. 833); 10 mg/m$^3$ (ACGIH, O. Reg. 833);
Calcium Hydroxide: mg/m$^3$ (total dust), 5 mg/m$^3$ (respirable) (OSHA); 5 mg/m$^3$ (ACGIH, O. Reg. 833)
Magnesium oxide: 15 mg/m$^3$ (OSHA); 10 mg/m$^3$ (ACGIH, O. Reg. 833)
Silica (crystalline quartz): 2.5 mg/m$^3$ (total dust), 0.8 mg/m$^3$ (respirable) (OSHA); 0.5 mg/m$^3$ (respirable – ACGIH); 0.1 mg/m$^3$ (O. Reg. 845)

Engineering Controls: Use ventilation and dust collection to control exposure to below applicable limits.

Respiratory Protection: Wear NIOSH N-95 Dust Mask.

Eye Protection: Eye protection (chemical goggles, safety glasses and/or face shield) should be worn where there is a risk of lime exposure. Contact lenses should not be work when working with lime products.

Hand Protection: Use clean dry gloves.

Skin Protection: Cover body with suitable clothes (long sleeves shirts and trousers). Use over the angle waterproof caustic resistant footwear.

SECTION 9. Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Solid, brown/white/tan/gray granular</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>NA</td>
</tr>
<tr>
<td>pH</td>
<td>12.4 pH graduated solution at 25º C</td>
</tr>
<tr>
<td>Melting Point</td>
<td>1410º C</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>1565º C</td>
</tr>
<tr>
<td>Flash Point</td>
<td>NA</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>NA</td>
</tr>
<tr>
<td>Flammability</td>
<td>NA</td>
</tr>
<tr>
<td>Upper/Lower Flammability</td>
<td>NA</td>
</tr>
<tr>
<td>Vapor Pressure (+tº)</td>
<td>Non volatile.</td>
</tr>
<tr>
<td>Vapor Density (air=ml)</td>
<td>Non volatile.</td>
</tr>
<tr>
<td>Relative Density</td>
<td>720-1130 kg/ m³</td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>0.100 – 1.125g/100g – reactive with water to product Ca(OH)$_2$ with large amounts of heat</td>
</tr>
<tr>
<td>Partition coefficient</td>
<td>NA</td>
</tr>
<tr>
<td>Auto-Ignition Temperature</td>
<td>NA</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>580ºC</td>
</tr>
<tr>
<td>Viscosity</td>
<td>NA</td>
</tr>
</tbody>
</table>
### SECTION 10. Stability and Reactivity

| Stability: | Stable products, not very soluble. |
| Decomposition temperature: | 580°C, forms calcium oxide (CaO) and water. |
| Reactivity: | Reacts with acids to form calcium salts while generating heat. Reacts with carbon dioxide in air to form calcium carbonate. |
| Conditions to avoid: | Vicinity of incompatible materials. |
| Incompatible materials: | Acids; reactive fluoridated, brominated or phosphorous compounds; aluminum (may form hydrogen gas), reactive powdered metals; organic acid anhydrides; nitro-organic compounds; interhalogenated compounds. |
| Hazardous decomposition products: | Calcium oxide (CaO). |

### SECTION 11. Toxicological Information

| Toxicity: | LD₅₀ oral (rat) for calcium hydroxide is 7340 mg/kg. This product is not listed by MSA, OSHA, or IARC as a carcinogen, but this product may contain crystalline silica, which has been classified by IARC as (Group 1) carcinogenic to humans when inhaled in the form of quartz or cristobalite. No reported Carcinogenicity, Reproductive Effects, Teratogenicity or Mutagenicity. |
| Exposure Limits: | Refer to Section 8. |
| Irritancy: | Can cause severe irritation of eyes, skin, respiratory tract and gastrointestinal tract. |
| Chronic Exposure: | Inhalation of silica can cause a chronic lung disorder, silicosis. |

### SECTION 12. Ecological Information

Alkaline substance that increases pH to 12.4 in a saturated water solution at 25°C. Calcium hydroxide gradually reacts with CO₂ in air to form calcium carbonate (CaCO₃). Calcium carbonate is ecologically neutral. Uncontrolled spillage in surface waters should be avoided since the increase pH could be detrimental to fish. Harmful to aquatic life in high concentration.
SECTION 13. Disposal Considerations

Dispose according to federal, provincial/state and local environmental regulations.

SECTION 14. Transportation Information

Classification:   TDG: Not listed for ground transportation
                 HMR: Not listed for ground transportation

TDG: Transportation of Dangerous Goods Regulation (Canada)
HMR: Hazardous Materials Regulation (USA)

SECTION 15. Regulatory Information

Symbol:         WHMIS Rating
                 D2A, E
                 NFPA RATING
                 HEALTH-3  SPECIFIC HAZARD – ALK  FLASH POINTS-0  REACTIVITY-1
                 HMIS RATING
                 HEALTH-2  SPECIFIC HAZARD – ALK  FLASH POINTS-0  REACTIVITY-1

SECTION 16. Other Information

Original Prepared: 05/13/13
Revision Date: 10/15/14
Revision #: 1

Calciment can be removed from vehicles using rags dampened with dilute vinegar. After applying dilute vinegar, vehicles (especially chrome surfaces) must be washed with water.

The information contained herein is believed to be accurate and reliable as of the date hereof. However, Mintek Resources, Inc. makes no representation, warranty or guarantee as to results or as to the information's accuracy, reliability or completeness. Mintek has no liability for any loss or damage that may result from use of the information. Each user is responsible to review this information, satisfy itself as to the information's suitability and completeness, and circulate the information to its employees, customers and other appropriate third parties.
ATTACHMENT C: 
Disposal Options Summary

As listed in the June 2016 Weston & Sampson memo related to dredging options, disposal alternatives were discussed. The elevated arsenic greatly limits in-state re-use options.

Weston & Sampson has evaluated the following alternative waste handling policies below and found the policies below would not provide a path for in-state re-use for the Salisbury Pond sediment:

1. The MassDEP Beneficial use determination (BUD).
3. The MassDEP policy COMM-94-007 “Interim Policy for Sampling, Analysis, Handling and Tracking Requirements for Dredged Sediment Reused or Disposed at Massachusetts Permitted Landfills”

Based on the lack of in-state disposal alternatives, out-of-state disposal is the most cost effective alternative for the dredged sediment. The Waste Management Turnkey Landfill in Rochester, New Hampshire and other landfills in New York and beyond can accept the dredged sediment. The proximity to rail may provide an alternative to transport over roadways. The transport and disposal costs to out-of-state landfills are approximately $85/ton of sediment.

As the disposal costs are high, the City of Worcester may also evaluate options for on-Site or alternate brownfield location capping. The MassDEP would require either an impermeable surface feature (asphalt, concrete, etc.) or a demarcation barrier and three-feet of cover to separate these sediments. Weston & Sampson has experience designing cover systems and limiting access to impacted materials.

The in-state re-use of these sediments would require MassDEP coordination and approval. The MassDEP may approve the on-Site re-use and capping of dredged sediment if benefits can be shown. These would include reduced carbon emissions of transport of sediment out-of-state. A similarly-impacted upland area for the placement and covering of these sediments would be required. The MassDEP may reject the proposal to relocate impacted sediments based on their contaminant concentrations.