# Chapman Beach Sand Committee Report

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**Sand Committee Members:**


Marlena Pappas

Janet O'Donnell

Ed Gales

Michael Zubretsky


5-10-18

1) **<u>Mission Statement of the Sand Committee</u>**:

The sand committee was formed by the Board of Directors of Chapman Beach to help respond to issues which were raised in a sand petition to the Board of Directors from last summer. The Board of Directors subsequently asked the Sand Committee to obtain additional information that would help facilitate the Board's decision as to sand renourishment in the future, best practices of sand, sources of sand, health concerns of sand, and any other information that might be relevant on the subject of whether sand on our beaches should be replenished out not.

2) **<u>Pros and Cons of Beach ReNourishment</u>**- https://www.quora.com/What-are-the-pros-and-cons-of-beach-renourishment

The Pros of Beach ReNourishment

1. Beaches are able to stay intact.
Enough erosion can cause a beach to eventually collapse. This collapse means the local ecosystem collapses with it and create destruction throughout the chain of life. By renourishing the beach, the ecosystem can be saved and therefore preserve the chain of life that exists locally. In return, the costs of repairing the beach can be made up over time with various usage fees.

2. It creates a safer beach environment.
Once enough sand erodes from a beach, there can be numerous hazards that could find the feet of visitors or the bellies of sea life. Replacing the sand helps to provide a safer experience for the entire ecosystem. By giving sea life a place to burrow, the possibility of toxins spreading throughout the local chain of life is reduced and ultimately provides the ecosystem with better sustainability.

3. Beaches are better buffers.
Waves that don't have a beach to buffer their impact can be a violent force of nature. The waves crash mightily against whatever barrier they do encounter and this added force actually increases the potential for erosion. Beach renourishment helps to keep the gentle buffer in place and provide a better level of protection for nearby properties.

4. It protects inland properties.
Many beaches have a steep incline that leads up from the water. These inclines are very susceptible to erosion and any moisture may impact them in a negative way. With enough instability present, mudslides and other dangerous situations may occur that could affect lives.

Beach renourishment helps to protect inland properties by providing better stability to these inclines.

5. It can secure the environment for future generations.
A properly engineered beach renourishment project can create a permanent beach that will be around for everyone to enjoy for years to come.

The Cons of Beach Renourishment

1. It is a temporary measure to fix a permanent problem.
Ultimately beach renourishment is only a bandage for an ongoing problem. Beach erosion has a core problem that is not addressed by this process. Without a plan to address the erosion issue, eventually beach renourishment will need to occur again and again to preserve the ecosystem.

2. It alters the natural course of nature.
Natural sand compacts over time as a way to prevent itself from being eroded away. When the tide is out, walk out on the sand that exists between the moist, soft sand that a foot sinks into and the powdery sand that rarely experiences waves. The middle zone is firm and protective, which is why wild beaches tend to be more durable. Much of the replacement sand ultimately just floats away with the first waves.

3. It is incredibly expensive.
It is not uncommon for a beach renourishment project to be a $100 million investment. Although some projects have private financing and backing, many of these projects wind up being funded by taxpayers. That's $100 million which could also go to bridge repair, infrastructure development, or social programs.

4. The process of renourishment can interrupt natural life cycles.
The process of repairing a beach can be very extensive. Beaches are often extended vertically and horizontally during the repair. Sand is often imported for this process, creating grain variations that can be problematic for local sea life. Even after the repair is completed, the natural life cycle may still be interrupted by changes to wave patterns, the shape of the beach, and other unforeseen factors that occur locally.

5. It may reduce light availability.
Changes in beach size and shape can affect the way sunlight reaches the shallow tidal zones. In return, plant and sea life can be affected in positive and negative ways. The biggest negative is that lower or higher levels of sunlight can cause species growth to overwhelm the system or species death.

Beach renourishment can effectively protect a local ecosystem, but it comes at a sometimes steep price. It is up to each local community to determine if they are willing to pay the required

price to repair a beach. By weighing all of the pros and cons of this process, the correct decision can be made at the local level.

3) **Practices of Other Beaches** –

Grove Beach Improvement Assoc. - No beach to maintain. All beach areas are privately owned in front of private homes.

Grove Beach Point Assoc. - Concerned about cost, so last sand purchased was 15 years ago. However, each year they do move sand from West to East side of their beach, moving a few thousand yards per year.

Island View Beach Assoc. - More than enough is deposited by Mother Nature each year; a jetty, built over 30 years ago, is almost completely covered by the tidal/wave action!! Lucky them!!

Little Stannard - No - Lets Mother Nature do her job.

Middle Beach - No

Old Kelsey Point Assoc. and O.K. Hill Assoc. - Have not replenished in 25 years; however, last year they sifted the sand themselves (by members); they would be interested in partnering with another association/district to buy sand, share cost of sifting, etc.
Note: might be a good idea to inquire about this partnering; might be some cost-savings here since they are contiguous to our beach.

Pointina - No. They keep their groins in repair; one was broken by a huge log two winters ago, and they lost one (1) foot of sand on their beach. After repair of the groin, they are now regaining sand.

West Beach - No. Let Mother Nature take care of it. Gain some, lose some.

Indiantown, Old Saybrook (OS) - Yes, but not sure of frequency. (I will continue to check to find out the person who can give me that answer).

Great Hammock, OS - Yes. Every year. President mentioned that their BOD believes that sand replenishment is the best thing that the Assoc can do for their members....all the members are there for the water, boating, and sand.

Cornfield Point Assoc., OS - Yes. Every year.

Old Colony Assoc., East Lyme - Have abundance of sand washed up onto their beach, parking lot, and member's yards. Must move sand from parking lots, roadways each year with bulldozers!! (Lucky beach!!)

Crescent Beach Assoc., Niantic - Yes. Every year. Beach is a focus of the members and they want sand; Assoc. complies. Wow!!

Note: At the time of the survey, there was no question concerning what type of sand, or where they purchase it from.

4) **Health and Safety –**

a) **Bacteria in Sand**

From Beachapedia

As explained further in our article on Epidemiological Studies, certain "indicator bacteria" (total coliform, fecal coliform, E. coli and enterococcus) are measured in recreational waters and compared against federal and state standards to determine whether the water is safe to swim in. At many locations where bacteria levels frequently exceed standards, investigations have been conducted to try to identify and eliminate the pollution source(s) (see article Bacterial Pollution, Tracking the Sources). All too often, however, it has been difficult to locate a source of the pollution. At some beaches, scientists have noticed a correlation between bacteria levels in the water and extreme ("spring") tides. In particular, the highest bacteria levels are often associated with ebb (outgoing) tides under spring tide conditions. Could the sand be acting as a "reservoir" for bacteria and therefore a source of bacteria found in the ocean? Trying to answer this question has led to studies that measure indicator bacteria in beach sand.

Conventional wisdom has been that fecal indicator bacteria such as enterococcus and E. coli do not survive for very long in the environment once they are disassociated from a human or animal host and their waste material. It was also believed that these bacteria could not replicate and maintain colonies in the environment. So, it was somewhat of a surprise when beach sand was tested for indicator bacteria and the bacteria were pretty much found – everywhere. In Hawaii, California, Florida (1, 2), Great Lakes Beaches (1, 2) - seemingly everywhere researchers collected sand samples - bacteria such as enterococcus or E. coli (enterococcus is generally measured at salt water beaches while E. coli is generally measured at fresh water beaches) were detected in the beach sand.

**So far, the results of sand testing have raised more questions than they have provided answers.** The pattern of bacteria distribution appears to be different at different beaches. In general, researchers in California found the highest levels in wet sand and/or near storm drain outlets. **They also found higher levels at "enclosed" beaches than at open ocean beaches. Researchers in Florida found the highest levels in dry sand.** Some researchers noted higher concentrations at beaches with the highest human usage, while other researchers at different locations did not observe this pattern.

This has led to a lot of confusion and differing theories. Do the bacteria in sand indicate a human health threat? If so, what is a safe level? Are the bacteria in sand a significant source of the bacteria that are detected in water samples? If beach sand is a significant source of bacteria in

the water, do these bacteria detected in water indicate a real health threat from a recent pollution event or do they represent a resident population of sand bacteria that pose no harm?

**The answer to all these questions is the same – no one knows.**

There are several challenges to making sense of all this. First, a standard method does not yet exist to measure bacteria in sand. Sampling procedures vary amongst researchers, but, in general, a sand sample is collected and weighed. Then the sample is mixed with a specified volume of either distilled water or phosphate buffered water. After allowing the mixture to settle, the water is poured (decanted) off and the water is then measured for bacteria using either a membrane filtration method or a "defined substrate" (IDEXX) method. The many potential variables (relative amounts of sand and water, type of water, mixing method, settling time, analytical method) need to be standardized to allow comparison between test results from different researchers. Scientists at Southern California Coastal Water Research Project recently completed a method comparison study which developed a recommended standard method.

Even after there is a standard method, the results (for the water extracted from sand-water mixing) can not be directly compared to any existing health standard, because no such standard exists. To develop such a standard, sand testing would have to be combined with health surveys of thousands of beach-goers to evaluate if any sand exposure-related illnesses are occurring and if these correlate with levels of measured bacteria in the beach sand. An obvious difference between water and sand exposure is that people are less likely to ingest sand, with the notable exception of small children. Some recent epidemiological studies have started to incorporate sand testing, but consensus results and a health standard, if warranted, are probably years away.

There continues to be a lot of research in this area, including several presentations at technical conferences (1, 2) devoted to this subject, so stay tuned for further developments.

In the meantime, an article on the discovery of bacteria in the sand in South Florida recommends:

"If the beach is closed due to contaminated water, stay off the sand. Keep in mind the "swell area" where crashing waves meet the beach can potentially carry the highest risk exposure. Always use a towel. Rigorously wash your hands and the hands of your children before eating. Report any illness following a visit to the beach to your local department of health."

References

Article on Clean Beaches Council 2005 Report:

Beach Bacteria Warning: That Sand May Be Contaminated

Articles on Southern California Beach Sand Studies by Dr. Jennifer Jay (UCLA):

High Levels of Unhealthy Bacteria Found in Sand at L.A. Area Beaches
Study shows unhealthy bacteria in Southern California beach sand

Article on California Beach Sand Studies by Dr. Alexandria Boehm (Stanford)

Human Waste On Beach: Sticking To The Sand Might Not Be Such Good, Clean Fun For Beachgoers

Article on Florida Beach Sand Studies by Dr. Andrew Rogerson:

Fun in the Sand Now Hindered by Fecal Bacteria

Research Paper and Articles on Beach Sand Testing in Hawaii

Sand, soil, and pigeon droppings: sources of indicator bacteria in the waters of Hanauma Bay, Oahu, Hawaii
Group testing Waikiki sand for bacteria
After Spill, Waikiki Sand Is Clean, Health Group Says

Article and Research Paper on Sand Testing on Great Lakes Beaches

Beach Sand May Harbor Disease-causing E. coli Bacteria
Foreshore Sand as a Source of Escherichia coli in Nearshore Water of a Lake Michigan Beach

January 2012 EPA Study

Digging in beach sand linked to increased risk of gastrointestinal illness

Information on Development of a Standard Method for Sand Testing

Evaluating Methods to Measure Fecal Indicator Bacteria (FIB) in Sand

Information on California Epidemiological Studies (Avalon, Doheny, Malibu)

California Epidemiological Studies

Article and Conference Program on Sessions on Contaminated Sand

Beach Sand Often More Contaminated than Water

Contact with Beach Sand, Concentrations of Fecal Indicators, and Enteric Illness Risk (2009 National Beaches Conference, Session XI)

Continuation of Health and Safety:

**b)** **Other articles –** See above list

**c)** **Testing -** Phoenix Labs – Results, Cost – Test Sand for $50 per sample ( See attached test results for Chapman Beach – Negative Results from last summer)

**d)** **Chemicals from Lawns –** Rules and Regulations from Deep - **(Waiting on clarification from DEEP)**

**e)** **No Standard Method for Measuring Bacteria in Sand**

**f)** **Sand Not tested –** Water tested normally for Health & Safety Issues

**5) Measurement of Sand Levels –**

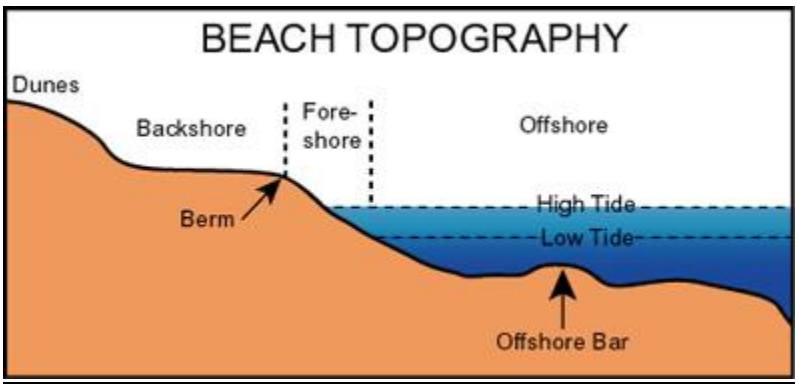
To better evaluate the levels of sand on our beaches that has been lost or deposited due to storms and title effects, we thought it would be helpful to have a "Base" from which objective comparisons could be made year to year.

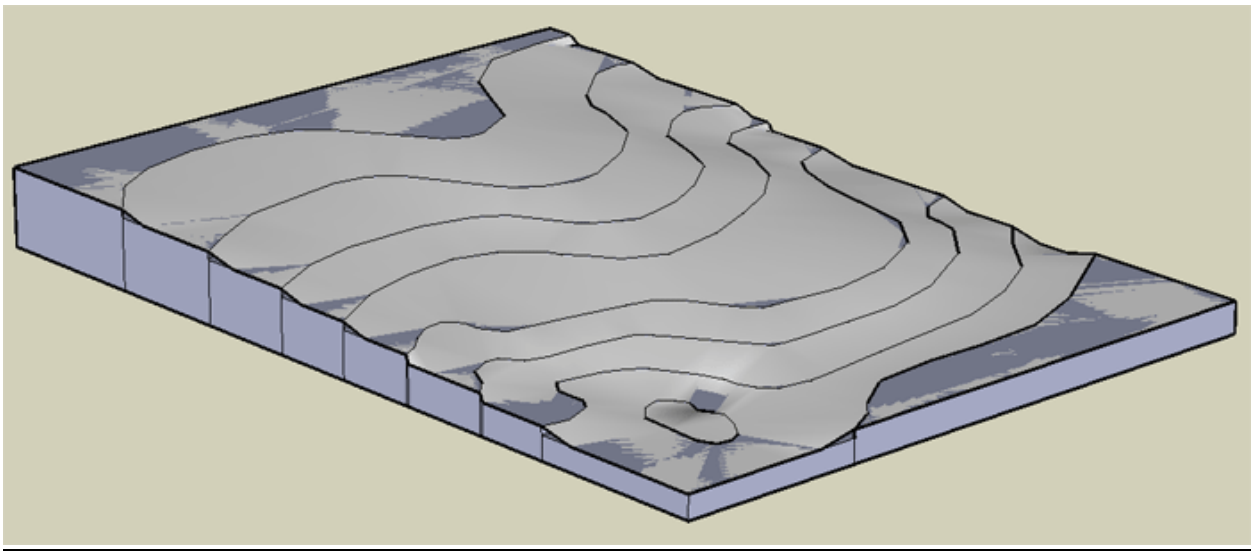
After studying a number of methods to measure ( GPS, Laser Level, Computer Simulation, etc.), we decided that a combination of a topographical survey (base line) and photography would be the most useful, economical, and repeatable method for a year to year comparison.

The topographical survey would encompass the area from low water (low tide) to the upland boundary (grass area sea wall). This mapping would serve as a snapshot in time from which either future surveys could be compared against the base line survey or photographs would be taken each year to be used as a more economical reference for comparison. A 3-D graphic may also be used to help visualize the base line conditions. Permanent elevation benchmarks would be established (example: jetty, big rocks etc.) for future reference.

All work should be complete in current working datum's, for Horizontal NA83 and for Vertical NAVD88 to coincide with State and Federal mapping systems.

Cost $750 (Richard O'Donnell has graciously provided us with a very low price in addition to helping with the technical aspects of our research)


BEACH TOPOGRAPHY
Dunes
Backshore
Fore-
shore
Offshore
Berm
High Tide
Low Tide
Offshore Bar



**6) <u>Rating System – Sand – What Makes Good Sand?</u>**

Some qualities that generally are used to describe beach sand from a technical point of view are: coarseness, particle, size, color,% Organics, %Fine Ground Shells/ Rocks, shape ( angled vs round).

We feel that since there may be many varying opinions on what sand qualities are needed, our committee recommended course of action would be to conduct a survey of the residents of Chapman Beach to find out what qualities they view as important to their overall enjoyment of the sand as well as some other related topics on the subject.

Some examples of Questions that could be used:

1. Do you or a member of your household enjoy sitting on the beach?
2. How often do you sit on the beach? Which beach? (Main, Dibble, 2nd,3rd)
3. Is your home used as a rental property?
5. Do you have any concerns about the sand on the beach? If yes – What are your concerns?
6. Questions to determine what sand qualities are important to the residents of Chapman Beach
7. Are you satisfied with the quality of the existing sand on the beach?
8. How often would you like to see our District replenish sand on our beach?
9. Do you feel that a quality beach would increase / impact your property values?
10. Do you feel that our District should include beach nourishment as a line item in the budget for consideration each year?

We believe we can accomplish this at minimum cost using email and snail mail with a service like Survey Monkey, Zoho at minimum cost. Some of these services are free, others cost $50-$100.

Budget $100 – The survey to be completed in July.

**7) <u>Supply Sources –</u>**

- **a.** Reliable and Reputable
- **b.** Costs? Co-ops? Co-ops not currently being used locally
- **c.** Vendors in CT –

  Gateway Terminal – New Haven
  Ed's Garage – Canterbury
  Cooper Corp – Chester ($22 per ton/ 23 tons per truck load)

**d.** Certificate of Quality – Specs - TBD

**e.** Island View Beach –

Island View Beach has excess sand that may be available to other beaches from time to time. We have been told from a DEEP Official that beach sand can be moved from beach to beach if it is "clean material and has compatible grain size". We are getting the clarification if permits are needed if sand is above the high water mark and meets the criteria of cleanliness and grain size. We have researched sources for grain size testing and cleanliness and for $20 such testing can be done. See Attachment.

**8) <u>Alternative Methods of Sand Conservation and ReNourishment</u>**

**a)** Mounding

**b)** Move from one beach to another at Chapman

**c)** Use tarps for protection from wind

**d)** Move from beach in close proximity to Chapman ( See Island View Beach)

**e)** Dredging (Very Expensive)

**9) <u>Timing –</u>**

The Committee has determine that there are a number of Go/No Go timing issues that may need to be addressed by the BOD if in any year they have made the decision that sand is needed on the beaches.

a) When would a decision have to be made that the storm season us over and the sand is stabilized for the summer and whether or not sand is needed? April 15th? April 30th?

b) What would be the availability and cost be for the sand that has been profiled? How long would it take to complete the purchase?

c) Where would the funding come from? Budget meetings are generally held in late May and any approval of funds cannot be spent until July 1. Could the emergency funds be used? Could the Common Area Improvements line item be used?

**10) <u>Recommendation's</u>**

**a)** Fund Topographical Survey to establish benchmarks for measurement and needs. $750 for both Main Beach and Dibble Beach is a very good price

**b)** Sand Committee would like to proceed with a survey this summer of the Beach Members to understand what the Members preference is to sand quality, questions etc.,
Survey Monkey – 10 questions, 100 answers – Free
Zoho – 15 questions, 150 answers, - Free
Survey Sparrow- $49

See sample questions from page 10

Budget $100 which would include any mailing that might be needed as well as email.

c) Committee recommends that BOD perfect a protocol for decision making on sand needs, budgets, and funding so that in any year that the BOD has decided that there is a need for sand (the quality has been decided in advance)that there is ample time to order it and have the funds available to pay for it. We ask that the BOD recognize and acknowledge that the present system in place does not accommodate these practical issues due to budget meetings held generally in late May and any approved funding cannot be spent until July 1 – which would be well into the summer season. Any ReNourishment at this time (July) would be inconvenient, unsafe, and not practical. Should Sand be a separate budget line item? Could the need for sand funding be categorized as an "emergency" which the BOD could then approve up to $5,000 in "emergency funds" for sand renourishment?

## 11) Website – Research – References

**Beach nourishment Articles:**


http://www.beachapedia.org/Bacteria_in_Sand

http://i95rock.com/how-much-will-connecticut-pay-to-replace-sand-at-hammonasset-state-park/

https://www.theverge.com/2016/11/17/13660014/miami-beach-sand-erosion-nourishment-climate-change

https://www.quora.com/What-are-the-pros-and-cons-of-beach-renourishment

http://www.nj.com/atlantic/index.ssf/2015/07/as_nj_closes_beaches_watch_the_sand_as_much_as_the.html

http://www.safebee.com/outdoors/poop-beach-sand-how-clean-is

https://www.aol.com/article/2015/07/24/another-danger-at-the-ocean-dirty-beach-sand/21213727/

http://www.nytimes.com/2009/07/21/health/research/21haza.html

http://myria.com/worried-the-beach-water-isnt-clean-worry-about-the-sand

https://www.epa.gov/npdes/combined-sewer-overflows-csos

http://www.hbarber.com/Articles/PDF-Articles/Beach-sand-bacteria.pdf

http://www.baylakerpc.org/media/95317/beach%20bmp_crescent_algoma_final.pdf

PHOENIX

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587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

# Analysis Report

June 09, 2017

FOR: Lea Duchette
24 Julia Court
Broad Brook CT 06016

| Sample Information | | Custody Information | | Date | Time |
|---|---|---|---|---|---|
| Matrix: | SOIL | Collected by: | | 06/06/17 | 6:30 |
| Location Code: | SPECIAL2 | Received by: | SW | 06/07/17 | 11:46 |
| Rush Request: | Standard | Analyzed by: | see "By" below | | |
| P.O.#: | | | | | |

## Laboratory Data

SDG ID: GBY34326
Phoenix ID: BY34327

Project ID:
Client ID: LITTLE BEACH

| Parameter | Result | RL/ PQL | Units | Dilution | Date/Time | By | Reference |
|---|---|---|---|---|---|---|---|
| Escherichia Coli | <10 | 10 | cfu/g | 10 | 06/07/17 14:50 | CB/CB | SM9222G-94,97 |
| Total Coliform | 230 | 10 | cfu/g | 10 | 06/07/17 14:50 | CB/CB | SM9222B-06 |

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

**Comments:**

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.


**Phyllis Shiller, Laboratory Director**
**June 09, 2017**
**Reviewed and Released by: Deb Lawrie, Project Manager**

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

# Analysis Report

June 09, 2017

FOR: Lea Duchette
24 Julia Court
Broad Brook CT 06016

| Sample Information | | Custody Information | | Date | Time |
|---|---|---|---|---|---|
| Matrix: | SOIL | Collected by: | | 06/06/17 | 6:30 |
| Location Code: | SPECIAL2 | Received by: | SW | 06/07/17 | 11:46 |
| Rush Request: | Standard | Analyzed by: | see "By" below | | |
| P.O.#: | | | | | |

## Laboratory Data

SDG ID: GBY34326
Phoenix ID: BY34326

Project ID:
Client ID: BIG-BEACH

| Parameter | Result | RL/ PQL | Units | Dilution | Date/Time | By | Reference |
|---|---|---|---|---|---|---|---|
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| Total Coliform | 10 | 10 | cfu/g | 10 | 06/07/17 14:50 | CB/CB | SM9222B-06 |

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

**Comments:**

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**Phyllis Shiller, Laboratory Director**
**June 09, 2017**
**Reviewed and Released by: Deb Lawrie, Project Manager**

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# Analysis Report

June 09, 2017

FOR: Lea Duchette
24 Julia Court
Broad Brook CT 06016

| Sample Information | | Custody Information | | Date | Time |
|---|---|---|---|---|---|
| Matrix: | SOIL | Collected by: | | 06/07/17 | 9:00 |
| Location Code: | SPECIAL2 | Received by: | SW | 06/07/17 | 11:46 |
| Rush Request: | Standard | Analyzed by: | see "By" below | | |
| P.O.#: | | | | | |

## Laboratory Data

SDG ID: GBY34326
Phoenix ID: BY34328

Project ID:
Client ID: CONTROL BEACH

| Parameter | Result | RL/ PQL | Units | Dilution | Date/Time | By | Reference |
|---|---|---|---|---|---|---|---|
| Escherichia Coli | <10 | 10 | cfu/g | 10 | 06/07/17 14:50 | CB/CB | SM9222G-94,97 |
| Total Coliform | 80 | 10 | cfu/g | 10 | 06/07/17 14:50 | CB/CB | SM9222B-06 |

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

**Comments:**

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**Phyllis Shiller, Laboratory Director**
**June 09, 2017**
**Reviewed and Released by: Deb Lawrie, Project Manager**

PennState
College of Agricultural Sciences

Agricultural Analytical Services Lab

# Particle Size and Sand Sieve Test

These tests are designed for landscape architects, golf course superintendents, municipal park managers, and those who supply sand, soil, and other mixtures used by these professionals in maintenance and construction activities.

The Particle Size test includes determinations of sand, silt, and clay along with the USDA soil textural class as determined by the relative percentages of the three soil fractions.

Sand Sieve test includes seven separations: gravel, very coarse sand, coarse sand, medium sand, fine sand, very fine sand, and fines (US Standard Sieve No. 10, 18, 35, 60, 140, and 270).

## Service Fees

| Service | Fee |
|---|---|
| Particle Size Test | $20.00 |
| Sand Sieve Test | $20.00 |

Fees effective 7/01/2012

## Submitting Your Sample

If submitting a sample for particle size/sand sieve tests in addition to the soil fertility test, indicate on the soil fertility information form the additional test(s) requested and include a check or money order with your sample to cover the costs of the additional analyses.

Particle Size and Sand Sieve Submission Form
PDF, 20.0 KB

Particle Size and Sand Sieve Sample Report
PDF, 29.2 KB

**Tifton Physical Soil Testing Laboratory, Inc.**
1412 MURRAY AVENUE
TIFTON, GEORGIA 31794
Phone: (229) 382-7292
Fax: (229) 382-7992
www.tiftonsoillab.com

ACCREDITED
1014.01



Date Received: April 6, 2010
Date Reported: April 8, 2010
Sample Number: L81-10
Test Report For: Alliance Sand and Aggregates, LLC
P.O. Box 1945
Decatur, AL 35602
Attn: Rodney Terry

## PHYSICAL ANALYSIS[1]

| MIXES ANALYZED (% by Volume) | | | SATURATED HYDRAULIC CONDUCTIVITY in/hr | POROSITY (%) | | | BULK DENSITY g/cm³ | WATER RETENTION AT FIELD CAPACITY % | CHEMICAL | |
|---|---|---|---|---|---|---|---|---|---|---|
| SOIL | SAND | AMENDMENT | | NON-CAPILLARY (air-filled) | CAPILLARY (water-filled) | TOTAL | | | pH[2] | EC[3] mmhos/cm |
| 104 Bama Premium Bunker Sand | | | 25.2 | 29.4 | 12.7 | 42.1 | 1.54 | 8.2 | 6.3 | |
| USGA Recommendations for Root Zone Mix: | | | Minimum of 6 in/hr. | 15 - 30 | 15 - 25 | 35 - 55 | | | | |

PARTICLE DENSITY[4] 2.65 g/cm³

## PARTICLE SIZE ANALYSIS

| SAMPLES | GRAVEL 2 mm % | SAND FRACTIONS (% Retained)[5] | | | | | SAND[6] 0.05-2 mm % | SILT[6] .002-.05 mm % | CLAY[6] <.002 mm % | ORGANIC MATTER[7] % by wt. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | VERY COARSE 1 mm | COARSE 0.5 mm | MEDIUM 0.25 mm | FINE 0.15 mm | VERY FINE 0.05 mm | | | | |
| 104 Bunker Sand | 0.0 | 2.0 | 11.9 | 64.8 | 15.5 | 3.6 | 97.8 | 1.5 | 0.7 | |
| | | | ← Bunker Sand → | | | | | | | |
| USGA Recommendations for Root Zone Mix | ≤ 10% (≤3% gravel) | | 60% minimum | | ≤ 20% | ≤ 5% | | ≤ 5% | ≤ 3% | |

Note: Total 'fines' (very fine sand, silt, and clay) in a root zone mix should be less than (<) 10%.
1. Determined at 30 cm tension by USGA testing protocol (ASTM F1815) 2. ASTM D4972 3. SSSA Soluble Salts 4. SSSA Particle Density
5. ASTM C136 and F1632 6. Bouyoucos, 1962 7. ASTM F1647 7th Revision 11/12/07

## Tifton Physical Soil Testing Laboratory, Inc.

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www.tiftonsoillab.com

ACCREDITED
1014.01

Date Received: April 6, 2010
Date Reported: April 8, 2010
Sample Number: L81-10

Test Report For: Alliance Sand and Aggregates, LLC
P.O. Box 1945
Decatur, AL 35602
Attn: Rodney Terry

Revised 11/11/03

Recommendations:

The 104 Bama Premium Bunker Sand from Alliance Sand and Aggregates, LLC was evaluated on April 7, 2010, to determine if it meets USGA recommendations as described in the enclosed USGA guidelines for selecting a bunker sand. The condition of the sample as received was normal.

The Sand is a medium sand with 76.7% particles within the USGA recommended range of 1.0 to 0.25mm for a bunker sand. The USGA recommends a minimum of 65% particles within this range. Therefore, this sand meets the USGA particle size recommendation for selecting a bunker sand.

The Sand has a minimal amount (≤3%) of silt and clay at 2.2%, so crusting of the surface layer should not be a problem.

The Sand is a mix of sub-angular and sub-rounded particles, medium sphericity in particle shape.

The Sand has a very white color, and a penetrometer reading of 2.8 kg/cm$^2$ which means it has a very low tendency to bury based on this fried-egg lie potential test.

The Sand is a silica sand and not a calcareous sand with a pH of 6.3.

The Sand had a water permeability rate of 25.2 in/hr. when compacted by the USGA procedure ASTM F1815 to simulate a compacted golf green. This is a very adequate rate for a bunker sand. The USGA recommends >20 in/hr. for a bunker sand.

**Conclusion:** According to USGA guidelines for selecting a bunker sand, this Sand is an excellent bunker sand. This Sand is outstanding in the seven guidelines the USGA recommends for selecting a bunker sand. This Sand is about as good as a bunker sand gets.

Powell Haines

## Tifton Physical Soil Testing Laboratory, Inc.

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ACCREDITED 1614.01

Date Received: April 6, 2010
Date Reported: April 8, 2010
Sample Number: L81-10

Test Report For: Alliance Sand and Aggregates, LLC
P.O. Box 1945
Decatur, AL 35602
Attn: Rodney Terry

Revised 11/11/03

Recommendations:

The USGA offers the following seven guidelines when selecting a bunker sand.

1. Minimum of 65% sand particle size between 0.25mm and 1.0mm.
2. Sharp, angular sand preferred to round particle shape to reduce fried-egg lie potential.
3. Minimal amount (≤3%) of silt and clay to prevent crusting of the surface layer.
4. Silica sand preferred over calcareous sand.
5. A minimum infiltration rate of 20 in/hr.
6. Lighter colored sands are preferred for aesthetics.
7. Playability consisting of consistency and good management.

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