

MATERIALS TEST REPORT FOR
Nakheel Golf

REPORT TO:

Steve Beck
Western Pozzolan Corp.
1748 Senecio Drive
Larkspur, CO 80118

DATE RECEIVED: October 13, 2005
TEST DATE: January 3 - 9
REPORT DATE: January 17, 2006
Condition of sample: Normal

PARTICLE SIZE ANALYSIS (ASTM F-1632)

| Lab ID No. | Sample | Soil Separate % | | | Sieve Size/Sand Fraction Sand Particle Diameter % Retained | | | | | | |
|----------------------|--------------------------------|-----------------|------|------|--|-----------------------|----------------------|-----------------------|----------------------|-------------------------|-------------------------|
| | | Sand | Silt | Clay | No. 10 Gravel 2 mm | No. 18 V. coarse 1 mm | No. 35 Coarse 0.5 mm | No. 60 Medium 0.25 mm | No. 100 Fine 0.15 mm | No. 140 V. fine 0.10 mm | No. 270 V. fine 0.05 mm |
| 19857-1 | Saudi Sand | 99.3 | 0.0 | 0.7 | 0.0 | 0.0 | 30.1 | 62.6 | 6.1 | 0.4 | 0.1 |
| 19857-1d | 90-10 Western Pozzolan (18/16) | 98.0 | 0.8 | 1.2 | 0.0 | 0.0 | 30.8 | 61.5 | 5.4 | 0.3 | 0.0 |
| USGA Recommendations | | | ≤ 5% | ≤ 3% | ≤ 3% gravel ≤ 10% combined | ≥ 60% | | ≤ 20% | | ≤ 5% | |

PARTICLE SHAPE/PARTICLE SIZE PARAMETERS/pH

| Lab ID No. | Sample | Sphericity/Angularity | pH* | D85 | Cu | Grad. Index |
|------------|--------------------------------|---|-----|------|------|-------------|
| 19857-1 | Saudi Sand | Low to high/sub-rounded to well rounded | 7.9 | 0.63 | 1.71 | 2.7 |
| 19857-1d | 90-10 Western Pozzolan (18/16) | Low to high/sub-angular to well rounded | 6.5 | 0.64 | 1.73 | 2.8 |

*ASTM D4972

PHYSICAL PROPERTIES (ASTM F-1815-97)

| Lab ID No. | Sample | Particle Density (g/cc) | Bulk Density (g/cc) | K _{sat} Infiltration Rate (in/hr) | Total Porosity % | Aeration Porosity % | Capillary Porosity* | Loose Density* (g/cc) |
|------------|--------------------------------|-------------------------|---------------------|--|------------------|---------------------|---------------------|-----------------------|
| | | | | In a simulated 30 cm profile | | | | |
| 19857-1 | Saudi Sand | 2.65 | 1.65 | 46.3 | 37.6 | 31.5 | 6.1 | -- |
| 19857-1d | 90-10 Western Pozzolan (18/16) | 2.64 | 1.58 | 44.0 | 40.3 | 30.8 | 9.5 | -- |
| | | | | In a Simulated 25 cm profile | | | | |
| 19857-1 | Saudi Sand | 2.65 | 1.65 | 46.3 | 37.6 | 28.2 | 9.4 | -- |
| 19857-1d | 90-10 Western Pozzolan (18/16) | 2.64 | 1.58 | 44.0 | 40.3 | 27.3 | 13.0 | -- |
| | USGA Values | | | > 6 | 35 - 55 | 15 - 30 | 15 - 25 | |

* Determined at 25 and 30 cm tension

+ For quality control purposes

Comments: The Saudi sand sample (Lab ID No. 19857-1) was tested as received and in a 90-10 blend with the Western Pozzolan 18/16 product provided. The mix was tested and the results were compared to USGA Guidelines for greens construction.

The sand and mix were clean in that there was little silt and clay. The sand fraction was uniform in particle size, most of the sand falling into the medium and coarse size fractions. The uniformity in particle size is illustrated by the uniformity coefficients (Cu), these values falling below the optimum range of 2 to 3 for construction mixes. The lower the Cu and gradation index, the more uniform the particle size and the greater the compaction resistance. Sands with Cu values much below 2 may lack sufficient particle packing to form a stable surface during grow-in and sometimes beyond. The rounded shape of the sand may compound this. The sand and mix have particle size distributions that meet USGA guidelines.

The pH was high in the sand and acceptable in the 90-10 mix.

The physical properties of the sand and 90-10 mix, as determined on compacted cores, are found in the table on page 2. The samples had saturated hydraulic conductivity (infiltration) rates that were high but within USGA Guidelines. The rate was reduced slightly with the addition of Western Pozzolan 18/16.

The total porosity was acceptable in both samples, this increasing with the addition of the inorganic amendment to the sand. The aeration porosity is made up of relatively large pores that conduct water under saturated conditions. When drained, they are filled with air providing the oxygen that is necessary for root growth. The capillary porosity is made up of small pores that hold water against the force of gravity, retaining much of it for plant use. In a USGA profile we determine this at 30 cm suction, simulating a 30 cm deep profile. We also looked at this simulating a 25 cm deep profile since there is some interest in doing so.

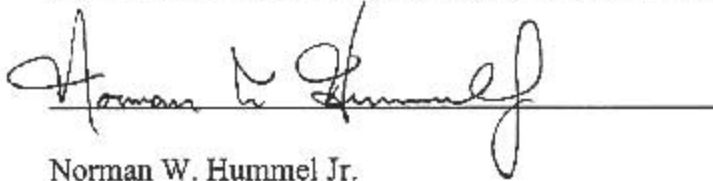
You can see from the results that the aeration porosity was slightly high in both the sand and mix in a 30 cm deep profile. The water retention, as reflected in the capillary porosity was low in both samples in the 30 inch deep profile. The capillary porosity increased as the profile depth decreased, and with the addition of the inorganic amendment. Still, the mix had a capillary porosity that fails to meet USGA Guidelines. From the standpoint of water retention, the data suggests that there could be some benefit to decreasing the profile depth to 25 cm and adding the WP 18/15 at 10% by volume. It will take more inorganic amendment, however, to increase the water retention to within USGA Guidelines.

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The results also suggest that greens built with either the sand or mix would have good drainage, and after free drainage would have good aeration and low water retention in either a 25 or 30 cm deep profile.

A quality control program is suggested during construction to make sure that the mix selected is consistent with that reported here. We can provide rapid turnaround with our quality control service.

Please let me know if you have any questions on the results. Thank you.

A handwritten signature in cursive script, reading "Norman W. Hummel Jr.", is written over a horizontal line. The signature is fluid and stylized, with a prominent loop at the end of the last name.

Norman W. Hummel Jr.
President