Dirt Equestrian Arenas:
Why Sample for Water Quality?

By Michael DePew
SAF Member and
Consulting Soil Scientist
with Environmental Technical Services

Most arenas use water as a management tool for manipulating footing conditions and secondarily for dust control. Soil material's physical and mechanical properties change with changes in soil water content. The best soil performance characteristics are found within a narrow range of soil moisture and often referred to as the optimum soil moisture content. With so much of the soil performance properties dependent upon soil moisture, what about the quality of the applied water?

Water quality means different things dependent upon the application. For example water quality for drinking water differs from that for treated sewage effluent water, than that for irrigation. Water quality for irrigation refers to the kind and amount of salts present in the water and their effects on the arena-soil over time. Irrigation water quality considerations normally consider factors effecting plant growth. Although with an arena surface the plant growth factors are not directly applicable, many of these factors also apply to soil physical and mechanical properties. If levels of calcium, magnesium, and sodium, as well as chlorides, sulfates, and bicarbonates, as a group or alone, are too high; it can negatively impact soil characteristics and performance. Likewise the balance or ratio between these soluble salts has a tremendous influence on water quality. Primary among these is the level an ratio of sodium.

A breakdown of soil structure is a major effect of elevated sodium. Soil aggregates/micro-aggregates tend to be bonded by calcium and magnesium. High levels of dissolved sodium tend to displace these

bonding elements and disperse the soil aggregates. As sodium increases, dispersion increases and soil structure declines. Soil dispersion caused by sodium can cause soils to lose their cohesiveness, crust easier, and tend to limit water penetration.
Elevated bicarbonate levels also have a negative influence on water quality. A high level of bicarbonates (and carbonates) can create issues as they build up in the soils over time. Once applied in the irrigation water the soil will begin to dry out and will leave behind and accumulate the salts in the water. Some salts re-enter solution (dissolve) when the soil is wetted again and can move through the soil with rain or irrigation such that they leach or are removed from the soil system as drainage. On the other hand, other salts such as those formed from bicarbonates precipitate out and do not come back into solution upon rewetting. Bicarbonates precipitate out as carbonates primarily with calcium and magnesium (for calcium carbonate and magnesium carbonates) and leave behind sodium salts. As carbonates build up in the system over time the carbonates can foster such detrimental conditions such as soil crusting, cementations and clodding, development of hard pan layers, and reduces the plasticity of clay minerals.

When both carbonates accumulate in the soil and sodium levels increase (due to the loss of calcium and magnesium in the carbonate forming process) the impact on soil performance can be quite severe resulting in a soil which is massive, non-cohesive, soft/yielding when wet, crusty and hard when dry, hard to rewet and wets on surface forming a slick surface with an underlying hard-cemented layer.

Taking a water quality sample to determine the risk of your water to form these soil conditions is recommended. The table below identifies some of the key testing factors to evaluate and also the hazard levels. The same or similar factors and levels apply to grassed arenas. More

information about water quality can be found at: https://www.joe.org/joe/2014december/tt8.php

Water Quality Parameters for Arena Water

	Preferred		Problematic		High Hazard	
pH	6.0 -7.0		<6 or >7		<5.5 or >8.5	
EC (mmhos/com; dS/m)	<0.75		0.75-3.0		>3.0	
salinitty (TDS, ppm)	<375		375-1500		>1500	
SAR (sodium adsorption ratio)	<3.0		3.0-6.0		>6.0	
Total sodium (ppm)	<70		70-180		>180	
Calcium (ppm)	<75		75-150		>150	
Magnesium (ppm)	<30		30-50		>50	
Bicarbonates (ppm)	<40		40-180		>180	

How to Take Irrigation Water Quality Samples

Levels and specific makeup of dissolved substances in irrigation water influence the ground/soil performance. Water analyses can only be as accurate as the sample taken.

Guidelines for collecting water quality sample:

- Containers and Handling
  - Sample early in the week to avoid having the sample sit in a lab over the weekend.
  - Samples should be collected in clean, plastic bottles (at least 20 oz) with a screw cap. Do not use glass bottles.
  - Soda-pop bottles or the heavier-grade drinking water bottles work well. Do not use the lighter/flimsier water bottles as they may burst or leak during shipment.
  - Rinse the plastic bottle and cap 3 times using the same water which you will be sampling to eliminate any contamination from the sample bottle.

- After rinsing, fill the bottle but leaving 2” air/head space from the top and then cap tightly.
- Wipe the water bottle dry. Clearly identify each container with a simple sample identification using a permanent marker.
- Tape the bottle cap shut so that it doesn’t leak during shipment. It is a good idea to also place the sample bottle within a 1 gallon ziplock bag for extra leak protection. Or even a double-bagging.
- When mailing, place bottles in a box and pack with a loose, soft packing material to prevent crushing.
- Prepare a submittal/transmittal letter indicating what the sample represents (that it is a rodeo arena), the venue name, full contact information including email, and any other pertinent details and include that within the shipping box.
- It is best to send water samples with expedited delivery for best test results. If the sample can’t be sent immediately, refrigerate it before sending to the laboratory. Keep good records of the date and location of each sample.

- Sample collection procedure:
  - Let the water run for 15-20 minutes before collecting sample.
  - For municipal water supply, collect sample at the point/faucet of the “filling station” where water is obtained for watering the arena.
  - For well water, take the sample at the pump so that residues from the lines do not contaminate the sample.
  - For surface water sources (ponds, lakes, tanks, and reservoirs) collect water from a faucet near the pumping station.

- If not possible to collect water sample from pump station or faucet, then samples may alternatively be taken directly from the surface water source, with the sample/s taken below (2 feet below) the surface.
  obtain sample by attaching a clean bottle to a pole or extension, immerse container upside down (without lid) and then once put at desired (2') depth, then turn pole so that bottle is right side up (the air escapes and the water sample enters). Collect sub-samples from many areas and then mix the several sub-samples into a "composite" and fill a single sample bottle from it, which is sent to the laboratory.