Water Test
(Hydro)

Each water test shall consist of pumping the bin out to its lowest level and then filling the bin to capacity with water, taking ullage and draft measurements at both levels to determine bin volume and displacement. The objective of the water test is to assure data consistency by comparing the system-calculated water specific gravity to the value determined by analyzing a water sample retrieved from the bin.

If the results of the water test indicate that the system is not operating within acceptable accuracy, the Contractor shall be required to correct the deficiencies causing the error and repeat the water test until the results are acceptable.

Purpose: The objective of the water test is to assure accuracy of the scow's reported displacement and bin volume. In order to conduct this test successfully, proper operation of ullage and draft sensors is necessary. By filling the bin with water, the calculated density of the water can be compared to that of the water sampled from the bin, and the value of Tons Dry Solids can be calculated and should equal zero.

Material Required:

1) A copy of the SCIF spreadsheet and portable computer
2) Auxiliary vessel to observe vessel hull draft markings
3) Handheld radio to communicate with auxiliary vessel (if needed)
4) Water sampling device to retrieve a water sample from the bin
5) A refractometer with automatic temperature compensation to determine the specific gravity of the bin water sample. The refractometer shall be capable of measuring the bin water's specific gravity with a resolution of 0.001 and minimum accuracy of $\pm$ 0.001. Distilled water should be available for calibration of the refractometer.

Procedure:

Note: Its is strongly recommended that all instrumentation is in calibration prior to this test being conducted by a COR.

With the scow light and washed clean of dredge material, the bin is filled with just enough water so that the ullage sensors have a uniform fore and aft surface to provide a consistent measurement, and manual soundings can be taken relative to the bin datum (zero ullage) in the vicinity of the sensor. Three soundings are taken forward and aft, at port, starboard and centerline. On some scows this is not possible and either port/starboard or centerline soundings will be taken by a representative of the DQM support team and a crew member familiar with sounding the bin record the soundings.

While these measurements are being taken, the launch will read the draft marks in feet and tenths of feet. These manual draft measurements are communicated to the inspector on the scow. These measurements are taken simultaneously to insure that the readings are reflective of a steady state ship. The inspector also records the corresponding electronic readings from the DQM system. The bin is then filled with water and the above steps are repeated. While the bin is full, a small water sample from the bin is collected to calculate the specific gravity of water. Use the refractometer to determine its density. Record this value in the spreadsheet. From the DPIP enter the horizontal offsets between the ullage sensors and the horizontal offsets between the draft sensors.

After all values are entered into the spreadsheet, observe the calculated value of Tons Dry Solids. The difference between the bin measured water density and the spreadsheet calculated water density should be within (plus or minus) 5.0%.

If the calculated water density is outside the acceptable range look at the draft and ullage sensor difference. If either of these differences is outside the acceptable range for the corresponding sensors then the long hand calculation should be completed by someone experienced with stability and trim calculations, contact the DQM support center if you need assistance. If the draft and ullage values are within acceptable ranges, both light and loaded, then discretion should be taken and numbers should be re-checked. If the water test results still don't agree then the validity of the tables will come into question and other redundant methods of calculation should be attempted though use of the stability and trim booklets on the vessel and/or its hydrostatic tables.

Draft, Ullage, Water Tests, and Trim Trim Tests

Light Drafts

	Port	Stbd	Average (ft)	Instruments	Difference (ft)
Fwd			0		0
Aft			0		0

Linear Interpellation Light Draft

	Table		Disp	Draft	Disp
	Draft	Displacemen	Delta	Increment	Delta
Lesser Draft from table					
Larger Draft from table					
Inspector	0	#DIV/0!	0	#DIV/0!	#DIV/0!
DQM System	0	#DIV/0!	0	#DIV/0!	#DIV/0!
Or Displacement Equation					
Inspector Light Ship Displacement (Long Tons)			#DIV/0!		
DQM Light Ship Displacement (Long Tons)					
Inspector calculated displacement with system drafts			#DIV/0!		
DQM System interpellation delta			#DIV/0!		

Light (residual/almost empty) Ullage-Level Check

	Manually Measured				DQM Ullage	
	Port	Stbd	Center	Average (ft)	Instrument	Difference (ft)
Fwd				0		0
Aft				0		0

Linear Interpellation Light Ullage

	Table		Volume	Ullage	Volume
	Ullage	Volume	Delta	Increment	Delta
Lesser ullage from table					
Larger ullage from table					
Inspector	0	#DIV/0!	0	#DIV/0!	#DIV/0!
DQM System	0	#DIV/0!	0	#DIV/0!	#DIV/0!
Or Volume Equation					
Inspector Light Ship Volume (yrds^3)			#DIV/0!		
DQM Light Ship Volume (yrds^3)					
Inspector calculated volume with system drafts			#DIV/0!		
DQM System interpellation delta			#DIV/0!		

Loaded Drafts

	Manually Measured			DQM Drafts	
	Port	Stbd	Average (ft)	Instruments	Difference (ft)
Fwd			0		0
Aft			0		0

Linear Interpellation Loaded Draft

	Table		Disp	Draft	Disp
	Draft	Displacemen	Delta	Increment	Delta
Lesser Draft from table					
Larger Draft from table					
Inspector	0	#DIV/0!	0	#DIV/0!	#DIV/0!
DQM System	0	#DIV/0!	0	#DIV/0!	#DIV/0!
Or Displacement Equation					
Inspector Loaded Ship Displacement (Long Tons)			#DIV/0!		
DQM Loaded Ship Displacement (Long Tons)					
Inspector calculated displacement with system drafts			#DIV/0!		
DQM System interpellation delta			#DIV/0!		

Loaded (Full) Ullage-Level Check

	Manually Measured				DQM Ullage	
	Port	Stbd	Center	Average (ft)	Instrument	Difference (ft)
Fwd				0		0
Aft				0		0

Linear Interpellation Loaded Ullage

	Table		Volume	Ullage	Volume
	Ullage	Volume	Delta	Increment	Delta
Lesser Ullage from table					
Larger ullage from table					
Inspector	0	#DIV/0!	0	#DIV/0!	#DIV/0!
DQM System	0	#DIV/0!	0	#DIV/0!	#DIV/0!
Or Bin Volume Equation					
Inspector Loaded Ship Volume (yrds^3)			#DIV/0!		
DQM Loaded Ship Volume (yrds^3)					
Inspector calculated volume with system drafts			#DIV/0!		
DQM System interpellation delta			#DIV/0!		

Water Test and TrimTrim Results

Water Specific Gravity in Hopper		(kg/cubic meter)
Longitudinal separation of ullage sensors		(ft)
Longitudinal separation of draft sensors		(ft)
mark any one with X		**Chose one**
Use DQM System reported Displacement and Volume		
Use inspector Displacement and Volume Based on inspector Drafts and Ullage		
Use inspector Displacement and Volume Based on DQM Drafts and Ullage		
Use equation (DQM Drafts or System Drafts)		

Loaded Ship Weight- Light Ship	FALSE	Loaded hopper weight/Weight of dredged material (LT)
Mass of Dredged material (kg)	0	Mass of Dredged material (kg)
Hopper volume - Residual	FALSE	Volume Delta (yrds^3)
*0.7646	0	Volume (cubic meters)
Density of Solids (kg/cubic meter)		BASELINE COULD BE 2750 KG/CUBIC METERS
Density of Water * 1000	0	
Calculated water density	#DIV/0!	Calculated water density
% difference	#DIV/0!	Percent water density error
mass/volume equals density	#DIV/0!	TDS calculation (kg)
Calculated Tons Dry Solids	#DIV/0!	TDS calculation (LT)
Ullage Angle (DQM data)	#DIV/0!	
Draft Angle (DQM data)	#DIV/0!	
TrimTrim Angle (Delta)	#DIV/0!	

	Fresh	Salt	institute
delta volume (lbs)	0	0	0
Delta Volume (Long Tons)	0.0	0	0
Delta Disp (Long Tons)	FALSE	0	0
Delta density vs volume (Long Tons)	0.0	0	0

Check Results: ______ **pass** ______ **fail**

Remarks: