National Dredging Quality Management Program (DQM)

ANNUAL QUALITY ASSURANCE (QA) CHECKS

This document is a guide for conducting annual National Dredge Quality Management Program (DQM) quality assurance (QA) checks on scows, hopper dredges, and pipeline dredges. It provides general guidance for the processes to be followed; however, as in all marine operations, it is important that personnel be aware of the vessel's specifics and use critical thinking to ensure that the process applied is the best way to safely and reliably collect the required data.

It is DQM's goal to provide safe, expeditious service when performing a QA check; therefore, there is no set order or procedure for the check as a whole. The QA check team is responsible for working with the dredger and system provider to ensure that all required checks are performed and that the necessary data is collected while also attempting to minimize interruptions to normal operations.

For scows the required components of the check vary with the profile required, and the profile type should be verified prior to arriving on site for the check. For hopper dredges and pipeline dredges, all checks must be performed.

Position Check

Position Check— Scows

The annual QA process for scows of all profiles includes checking the static position and heading of the scow and verifying a track of the movement to and from the dump area. Tracking data is collected by an independent handheld Global Positioning System (GPS) unit and compared to the DQM-collected data. A contractor-provided tug, which monitors the time and position of the scow, may be required to transport the scow during this check. It also verifies that the data collection intervals change as the scow enters and leaves the disposal area.

Purpose

To verify the accuracy of the position-monitoring equipment and the change in data collection intervals when the scow is in the disposal area.

Materials Required

- Handheld GPS unit
- Data stream for the testing period
- DQM QA Check spreadsheet—GPS Position Check form
- Contractor-provided tug to transport the scow if the check is performed outside of normal work

Static Position Check Procedure

1. Turn on the handheld GPS, and allow sufficient time for it to acquire the maximum number of satellites at a static location.
2. Record the GPS location as close to the DQM GPS antenna location as possible.

   Note: See the Dredge Plant Instrumentation Plan (DPIP) for the antenna location.
3. At the same time, record the position reading indicated on the DQM display.

   Note: This may require a second person.
4. Enter both readings and the calculated difference in location on the GPS Position Check form.
5. Record the number of satellites received in the remarks section on the GPS Position Check form.

   Note: The difference in position should be less than 10' if the GPS receivers are co-located.
6. Record the GPS position of the other end of the scow on the GPS Position Check form.

   Note: This is used to calculate the scow heading.

Dynamic Position Check Procedure (As Needed)

1. Attach a handheld GPS unit to the scow near the positioning system antenna.
2. Have the contractor-supplied tug take the scow out to the disposal area and back.

3. Plot the track of movement recorded by the inspector's GPS against the DQM data for that time period.

4. Compare the two tracks, noting the distance/time between positions both inside and outside the disposal area.

Position Check (Hopper/Pipeline)

The annual QA check process includes checking the latitude and longitude reported on the DQM onboard screen against the readings from a handheld GPS receiver. The two readings should differ by no more than 3 m (or 10'), depending on the number of satellites available and the location of the antenna.

Purpose

To verify the accuracy of the dredge positioning system.

Materials Required

- Handheld GPS unit
- DQM QA Check spreadsheet—GPS Position Check Form

Procedure

1. Turn on the handheld GPS, and allow sufficient time for it to acquire the maximum number of satellites at a static location.

2. Record the GPS location as close to the DQM GPS antenna location as possible.

   Note: See the Dredge Plant Instrumentation Plan (DPIP) for the antenna location.

3. At the same time, record the position reading indicated on the DQM display.

   Note: This may require a second person or a camera/screenshot.

4. Enter both readings and the calculated difference in location into the Dredge Position Check Form.

   Note: In almost all cases this data should be entered in the columns labeled GPS1.

5. Record the number of satellites received in the remarks on the form.

   Note: The difference in position should be less than 10'.

Hull Status Checks

Hull Status Check (Scow)

For all split hull or pocket scows the annual QA check process includes the contractor opening and closing the hull to verify the conditions which result in a change in the open/closed status.

Purpose

To document the hull conditions which trigger a change in the open/closed status.

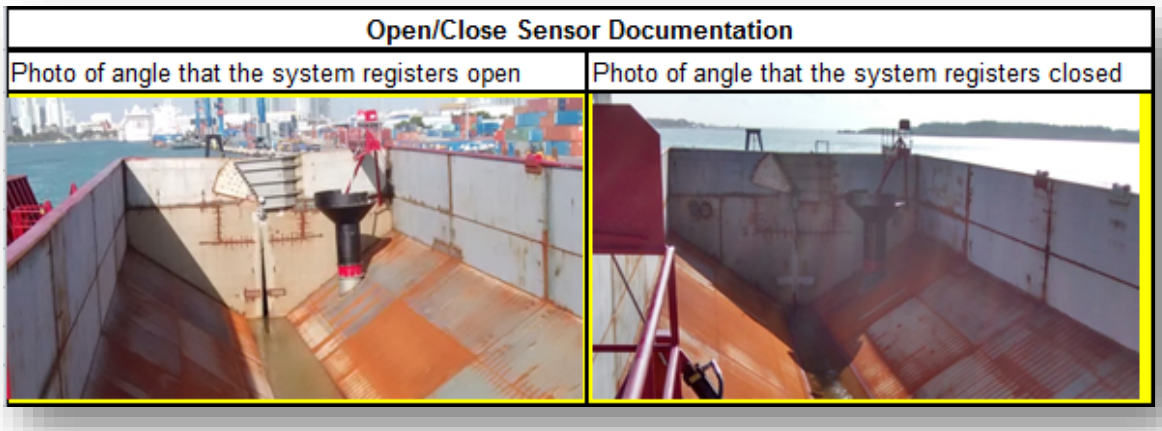
Materials Required

- Digital camera
- QA Check spreadsheet

Procedure

1. Have the Contractor open the split or bottom doors.
2. Photograph the bin as the sensor registers a change from closed to open.
3. Photograph the bin again as the sensor registers a change from open to closed.

   Note: The photographs should be taken from the centerline of the scow, looking at the far end of the bin for split hulls and the far end of the instrumented door for pocket scows.



Hull Status Check (Hopper)

For all hopper dredges the annual QA check process should, when possible, include the contractor opening and closing the hull to verify the conditions which result in a change in the open/closed status.

Purpose

To document the hull conditions which trigger a change in the open/closed status.

Materials Required

- QA Check spreadsheet

Procedure

1. If practical, have the Contractor open the split or bottom doors.
2. Observe the OBS screen, noting the change of hull status and verifying that the signal is not delayed significantly from the time of open/close.

Draft Sensor Checks

Physical Draft Sensor Check (Hopper/Scow)

For all Scow Monitoring, Scow Ullage, and Hopper Dredge profiles, the annual QA check verifies the accuracy of the forward and aft draft sensors by comparing the observed scow hull draft marks with the corresponding sensor readings from the DQM data. The QA check team reviews the difference between instrument and manually measured averaged drafts to ensure that the system is operating within acceptable accuracy (+/- 0.1' in calm seas conditions), directing the Contractor to recalibrate or repair system components as necessary.

Purpose

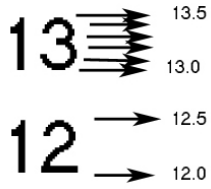
To verify the accuracy of the forward and aft draft sensors while light and loaded.

Materials Required

- QA Check spreadsheet/notebook
- Auxiliary vessel to observe hull draft marks
- Radio communication between the vessels
- Two people, one onboard the auxiliary vessel and a second onboard the hopper/scow
- Measuring tape in feet and tenths

How to Read Draft Marks

A draft mark is read by interpreting where the water crosses the draft mark. The height of the font used for drafts mark is typically equal to one half of a foot, with the bottom of the number equal to 0' and the top equal to 0.5'. The height of the blank space between the two numbers is also 0.5' for a total of 1' of change from the bottom of one number to the bottom of the next number. In this figure, the arrow above 13.0 is 13.1; the draft continues incrementing by 0.1' up to 13.5' at the top of the number.



Procedure

Note: During the check, the hopper/scow should lie in relatively calm seas to minimize wave-induced measurement errors.

Note: This check should be made both when the hopper/scow is light and when it is loaded to verify accuracy throughout the working range of the draft sensor.

Person 1 (Onboard the Auxiliary Vessel)

1. Circle the hopper/scow to observe and record the forward and aft draft markings (both port and starboard).

Person 2 (Onboard the Hopper/Scow)

1. Record the system-measured draft values on the QA check spreadsheet.
2. Calculate the difference between the instrument-measured and manually measured draft, and enter that on the QA check spreadsheet.

   Note: Under ideal sea conditions, the difference should be within +/-0.1'. As wave heights increase, measurement error also increases; therefore, record this information in the remarks accordingly.

3. If the difference in either the light or loaded measurements is outside what is deemed acceptable by the QA check team for the given conditions, have the Contractor calibrate the sensors.

Simulated Draft Sensor Check (Hopper/Scow)

For all Scow Monitoring, Scow Ullage, and Hopper Dredge profiles, the annual QA check verifies the accuracy of the draft sensors. As an alternative to the physical check method described above, the following simulated method has been developed. The QA check team should work with the dredger/system provider to determine which method is the best choice for the plant being tested. When performed properly, both methods ensure

that the system is operating within acceptable accuracy (+/- 0.1' in calm seas conditions). If it is not, the Contractor should recalibrate or repair system components as necessary.

Purpose

To verify the accuracy of draft sensors through exposure to full a simulated range.

Materials Required

- QA check spreadsheet/notebook
- Sealed pipe greater in length than the draft range of the vessel (typically, 10'-15')
- Measuring tape in feet and tenths
- Bucket of water or a water source to fill the pipe

Procedure

Note: Slight variations on this procedure may be used with different system providers to account for their calibration procedures. QA check personnel should always carefully confirm that calibrations are performed only prior to a complete test or retest and should consult a senior QA team member if there is any uncertainty.

1. Observe the current draft of the scow and record it using the same techniques as described in the physical draft sensor check.
2. From this point on, track any changes to the scow's loading, position, or motion.
3. Have the system provider mark the draft pressure sensor cable at the point it enters the onboard stilling well, and then remove it and lay it on deck for accurate measurement.
4. Mark the cable at 5' increments from the pressure sensor.
5. Hang the test pipe in a vertical position, and fill it with water.
6. Record the draft reading of the sensor in the air.
7. Lower the sensor to a measured depth in the test pipe (5',10',15'), and check the displayed draft for an equivalent increase from the open air value.
8. At this time, if the value does not change by the measured amount, have the system provider calibrate the sensor, and then retest.
9. Lower the sensor back into the scow stilling well, and verify that the displayed draft matches the physical draft reading previously recorded.

Ullage Check

For all Scow Ullage and Hopper Dredge profiles, the annual QA check includes recording the reported bin ullage using a bin ullage tape measure. The QA check team reviews the bin ullage data to ensure that the system is operating within acceptable accuracy (+/-0.1'), directing the Contractor to recalibrate or repair system components as necessary.

Purpose

To verify accuracy of the bin ullage sensors while the scow or hopper is light and loaded.

Materials Required

- QA check spreadsheet/notebook
- Bin ullage tape—A clearly readable, weighted tape, marked at intervals of 0.1', capable of measuring the full range of bin depth; the tape should weigh 2-3 lb and, whenever possible, be 6" diameter disk.

  Note: The Contractor is responsible for supplying this item.

Procedure

Note: To minimize wave-induced measurement errors, the scow or hopper should be in relatively calm waters during the ullage check.

1. Review the relevant section of the plant's Dredge Plant Instrumentation Plan (DPIP) to determine the correct reference point for ullage measurements and any plant-specific procedures.
2. Ensure that the scow or hopper is light and with just enough material so that the ullage sensors have a uniform fore and aft surface to provide a consistent measurement and so that manual soundings can be taken relative to the hopper datum (zero ullage) in the vicinity of the sensor.
3. Take three soundings, both forward and aft, at port, starboard, and centerline by lowering the weighted tap until the weight touches the fluid.

   Note: On some vessels this is not possible, and either port and starboard or centerline soundings are taken.
4. Record the distance of each sounding in the QA check spreadsheet.
5. Read the DQM system-measured ullage values from the (vendor-specific) display, and record them in the QA check spreadsheet.

6. Calculate the difference between the physically measured ullage values and the DQM system-measured ullage values, and record them in the QA check spreadsheet.

   Note: The difference between the manually measured and DQM system-measured values should not exceed +/-0.1'.

7. Fill the bin with dredge material or water to a level high enough to provide a single, continuous, horizontal fluid plane.

   Note: At the QA Team's discretion, a weighted plate lowered below the sensor may be substituted for actual dredge material.

8. Repeat steps 3-6.

Draghead Depth Check

The annual QA check for hopper dredges requires calibration checks of the reported draghead depth using a manual means, such as a tape measure, sounding line, or calibrated pressure transducer, to directly measure the draghead depth.

Where pressure sensors are used to calibrate the draghead depth sensors, there must be a record of calibration for the past 12 months, and all sources of potential interference should be avoided.

The QA Check Team reviews the draghead depth data to ensure that the system is operating within acceptable accuracy, directing the Contractor to recalibrate or repair system components as necessary. Weekly calibration of the draghead depths is recommended as these sensors are sensitive to environmental conditions.

Purpose

To verify the accuracy of the draghead depth sensors.

Materials Required

- Draghead Depth Check form/notebook
- Steel tape, chain, or wire with clearly visible flags/tags placed at 1' increments within the operational range of the dragarm; it should be capable of measuring the depth below the water surface to the lowest fixed point of each draghead (often the heel) with sufficient length to measure 5' feet over the maximum project depth

  Note: The Contractor is responsible for supplying this item.

- Handheld radio to communicate with the bridge

  Note: If a pressure sensor is being used, the radio may cause interference.

Procedure

Note: This test is highly dependent on wave heights and should be conducted in very low wave situations due to possible errors caused by reading the measuring tape incorrectly.

1. For each draghead, attach the steel tape or chain to the draghead, and note any offset to the bottom.
2. Lower the draghead, so that one of the flags is even with the water's surface.
3. Note the depth indicated by the tape or chain.
4. Call up to the bridge, and record the value displayed on the DQM screen.
5. Repeat the procedure for a minimum of three depths within the operating range of the draghead.

Note: The difference between the manually measured and system-measured averages should be ≤ 0.5'.

Suction Mouth Depth Check

The annual QA check for pipeline dredges requires calibration checks of the reported suction mouth depth using a manual means, such as a tape measure or sounding line, to directly measure the depth.

Where pressure sensors are used to calibrate the depth sensors, there must be a record of calibration for the past 12 months, and all sources of potential interference should be avoided.

The QA check team reviews the depth data to ensure that the system is operating within acceptable accuracy, directing the Contractor to recalibrate or repair system components as necessary. Weekly calibration of the depth sensor is recommended as these sensors are sensitive to environmental conditions.

Purpose

To verify the accuracy of the ladder depth sensors.

Materials Required

- Pipeline QA spreadsheet (Suction Mouth Depth Check form)/notebook

- Steel tape, chain, or wire with clearly visible flags/tags placed at 1' increments within the operational range of the ladder; it should be capable of measuring the depth below the water with sufficient length to measure 5' over the maximum project depth.

  Note: The Contractor is responsible for supplying this item.

- Handheld radio to communicate with the bridge

  Note: If a pressure sensor is being used, the radio may cause interference.

Procedure

Note: This test is highly dependent on wave heights and should be conducted in very low wave situations due to possible errors caused by reading the measuring tape incorrectly.

1. Attach the steel tape or chain to the cutterhead or ladder, and note any offset to the suction mouth.
2. Lower the ladder, so that one of the flags is even with the water's surface.
3. Note the depth indicated by the tape or chain.
4. Call up to the lever room, and record the value displayed on the DQM screen.
5. Repeat the procedure for a minimum of three depths within the operating range of the ladder.

Note: The difference between the manually measured and system-measured averages should be ≤ 0.5'.

Velocity Check

The annual QA check for pipeline dredges requires calibration checks of the reported velocity using a dye test or calibrated external meter.

Additionally, the accurate pipeline length from the point of dye injection to the outfall is required. If an external meter is used for calibration checks, the meter must be calibrated within the past year, and its installation must meet the manufacturer's instructions.

The QA check team reviews the velocity data to ensure that the system is operating within acceptable accuracy, directing the Contractor to recalibrate or repair system components as necessary.

Purpose

To verify the accuracy of the velocity instrumentation.

Materials Required

- Pipeline QA spreadsheet (Velocity Check form)/notebook
- Environmentally appropriate testing dye and an injection point/procedure (Bright Dyes by Kingscote Chemical, available at McMaster-Carr, is EPA approved)
- **Note**: The Contractor is responsible for supplying these items.
- Handheld radio to communicate
- Stopwatch

Procedure

Note: It is recommended that this test be run more than once and at more than one velocity to verify instrument accuracy.

1. Run the dredge pump in such a way as to provide a steady flow of water with no material.
2. Verify that the velocity and rpm remain constant.
3. Inject the dye in the pipeline, and start the stopwatch.
4. Monitory the velocity reading to verify that it remains constant.
5. Stop the stopwatch at the first sighting of dye from the outfall.
6. Using the pipe length and time, determine the velocity and compare it to the onboard reading.