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SECTION 02329 – PIPELINE DREDGE SILENT INSPECTOR

PART 1 GENERAL

1.0 INTRODUCTION

The Silent Inspector (SI) is a system that monitors dredges and reports and manages the data for Corps of Engineers dredging contracts. This specification defines the data collection needs of the Contracting Officer or his/her representative for managing the present and proposed future contracts. Most of the required data parameters are currently available through existing sensors on industry dredges. The collection and recording of the data in standard format will afford timely analysis of these data for dredge performance indicators.

Additionally, the data will assist the Authorized Representative of the Contracting Officer (Contracting Officer) with contract administration and add flexibility in government manpower allocations for inspection, and meet ever increasing environmental monitoring requirements established by the responsible agencies. On unit priced contracts, SI will be used to verify parameters and assist in evaluating claims.

The SI system collects and records measurements of operating parameters from contractor's sensors on hydraulic pipeline dredges. The following specifications present the data parameters, sensor performance, and data format required. The SI central database and software receives and analyzes all the various types of data.

For hydraulic pipeline dredges, the SI system collects and records measurements from contractor sensors, calculates the dredging activities and displays this information with standard reports and graphical displays. Recorded data are also automatically backed up, and later archived to allow transfer of the data to other locations. The hydraulic pipeline dredge system consists of sensors connected to a contractor's Dredge Specific System (DSS), and a dredge-based Corps data-monitoring computer (Ship Server). The DSS collects sensor data, checks these data against acceptable ranges, and computes data as needed and sends the data to the Ship Server, which inserts the data into a database. The Ship Server computer then reviews those data, computes the present dredging activity being performed, and produces reports and graphical displays of the data. Additional information concerning the dredging projects such as the dredges used, and locations of the dredging and disposal areas can also inserted into the system database.

1.1 Dredge Plant Instrumentation Plan

The contractor shall develop a Dredge Plant Instrumentation Plan (DPIP) that shows how the contractor will gather sensor data, perform quality control on those data, calibrate and repair sensors/data reporting equipment when they fail, and distribute the sensor data and (where required) computed dredge specific data to the data acquisition component via a standard interface. The contractor shall keep a log of sensor problems and repairs. This log may be appended or incorporated into the contractor's standard quality control reporting. Re-calibration may be directed at any time during contract execution as deemed necessary. No recalibration or adjustments to the calibration controls shall be performed in the absence of the Contracting Officer or his/her representative without prior written approval. Physical documentation of the calibration procedures and corresponding printed verification data shall be provided for every calibration event.

1.2 Payment – Tailored for District and type of contract

The system shall be operational within 30 days after the Notice to Proceed. The Contractor shall include all costs for this system within the Lump Sum price for “Hopper Dredge Silent Inspector”. If the system is not operational after 30 days after the Notice to Proceed, or if the system becomes inoperable for a period of time greater than allowed within this section, the hourly rate of pay for the dredge for 100% pay time will be reduced to 80% of the original bid price until the system is fully operational. Installation of the system shall not relieve the contractor of the requirements within the paragraph entitled “Delivery of Plant” located in the Special Contract Requirements Section.

Possible Alternate wording -

The system shall be operational within 30 days after the Notice to Proceed. The Contractor shall include all costs for this system within the Lump Sum price for “Pipeline Dredge Silent Inspector”.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 Sensor Specifications

The contractor will provide, operate and maintain all hardware and software to meet the following specifications. The data-reporting format of these parameters is given in section 3.4.1.

3.1.1 Slurry Density.

The slurry density of the dredge pipeline shall be recorded by a density metering device on the discharge side of the dredge pump(s) approved for use by the Contracting Officer or his/her representative and calibrated according to the manufacturer's specifications prior to commencement of work and documented in the DPIP.

3.1.2 Slurry Velocity.

A flow-metering device approved for use by the CONTRACTING OFFICER or his/her representative and calibrated according to the manufacturer’s specifications prior to commencement of work and documented in the DPIP should obtain the slurry velocity in the pipeline. A magnetic flow-metering device calibrated according to manufacturer's specifications prior to commencement of work is the preferred flow-metering device. The slurry velocity shall be obtained using the same pipeline inside diameter as the slurry density measurement. The slurry velocity should be recorded at the discharge side of the dredge pump(s) near the slurry density measurement (as noted in section 3.1.1).

3.1.3 Horizontal Positioning

Dredging equipment horizontal positioning shall typically be provided in the same State Plane coordinates that was the basis for the pre-dredge survey unless specified otherwise by the contracting officer. Horizontal positioning shall be obtained using differential Global Positioning System (DGPS) equipment operating with a minimum accuracy level of 1-3 meters horizontal Circular Error Probable (CEP).

Differential Correction broadcasts will be furnished 24 hours/day by the Government in standard RTCM SC-104 version 2.0 output. Horizontal positioning shall be recorded to the nearest whole foot when provided in State Plane coordinates.

3.1.4 Vessel Heading

Vessel headings shall be provided using industry standard equipment described in written form and approved by the Contracting Officer or his/her representative prior to dredging. Calibration will be performed according to manufacturer's specifications prior to commencement of work and documented in the DPIP. The contractor shall provide dredge compass heading (to the nearest whole degree) with values from 000 (true north) to 359 degrees referenced to a clockwise positive direction convention.

3.1.5 Tide/Riverstage

Tide and riverstage data shall be obtained using appropriate equipment to give the water level accurate to the nearest 1/10 foot. Government furnished benchmark location and water level datum information will be provided at the dredging site and given to the contractor. Above datum (positive) values shall be entered with a positive sign, and below datum values shall be entered with a negative sign.

3.1.6 Date and Time

The date and time shall be reported to the nearest second in the format shown in section 3.4.1. The time shall be referenced to universal coordinated time.

3.1.7 Cutterhead Depth

The digging depth of the cutterhead (relative to the water surface) shall be obtained with a minimum accuracy of $\pm$ 1/2 foot with values recorded to the nearest 1/10 foot (consistent with EM 1110-2-103, "Hydrographic Surveying" quality control criteria under Class 1 standards). Various measuring systems may be used to provide cutterhead depth, but the operation and accuracy must be described in detail in written form and included in the DPIP for approval prior to dredging. The Contracting Officer or his/her representative may require periodic cutterhead depth checks over a calibration point at the project site and the contractor shall calibrate and/or repair cutterhead depth measurement equipment as necessary. The Contracting Officer or his/her representative may also require depth checks over a calibration point deeper than the project depth. Cutterhead depth data will be relative to the water surface level without tidal or river stage elevation adjustments.

3.1.8 Dredge production

Dredge production data are based upon the measured slurry velocity and density.
Instantaneous production refers to the production at a given time. Integrated production is the production over a given time interval.

3.2 Performance Requirements

3.2.1 Sensor Performance Requirements

The Dredge Plant Instrumentation is a part of the dredge plant and must be functional at all times. The contractor shall be responsible for replacement or repair of sensors and other necessary data acquisition equipment needed to supply the required data. Repairs must be completed within 48 hours after a sensor failure occurs or the contractor fails to report required data within the specified time window (section 5.0) for dredge measurements. If failure to repair does not occur in that period, the particular plant affected will be considered non-responsive to the contract requirement and will either be replaced or a redundancy part added to render the plant fully operational to include the monitored data, all at no additional increased price or time to the contract.

3.2.2 System performance requirement

To meet the overall goals stated in the introduction, the contractor's DSS system is expected to provide a minimum 95 percent data return. Data return is defined as the total number of valid data strings sent by the DSS system to the data monitoring computer divided by the number of data strings that are possible to send during a given time interval. The possible number of data strings for a given time interval is defined by the data reporting interval defined in section 3.4.1. The system should consistently report correct data to have acceptable performance.

3.3 Contract Provided Equipment

3.3.1 Data Monitoring Computer

The contractor shall supply the CONTRACTING OFFICER or his/her representative a computer that will run Corp's software and receive data from the contractor's data reporting interface. The computer should contain at minimum a Pentium IV (or equivalent) microprocessor with no less than a 1.8 Gigahertz CPU. The computer must contain a hard disk no smaller than 8 Gigabytes, include at least 256 Megabytes of system memory, support the PCI system bus and support the Windows 2000 operating system. The contractor shall be responsible for obtaining component vendor software drivers if the drivers are not provided with the latest release of the Windows 2000 operating system software. The computer must also contain an Ethernet adapter that supports 10BaseT Unshielded Twisted Pair connections that shall connect to the network hub (contractor shall supply a stranded Category 5 UTP patch cable to the network hub and two spares). Also, it should have a standard 101 key keyboard, Microsoft compatible mouse, at minimum one parallel, two unoccupied serial ports, a universal serial bus port, and a CD-ROM drive (16X speed or faster). It should also have a minimum of 17-inch (viewable-size measured diagonally) video monitor capable of supporting at a minimum XVGA resolution of 1204x768 pixels, 65536 viewable colors. Also the system should include a 100Mb Zip disk mounted either internally or externally. The contractor shall make available all computer related owner's guides and instruction manuals.

The contractor is not responsible for maintaining the CONTRACTING OFFICER or his/her representative's computer software. If a CONTRACTING OFFICER or his/her representative's hardware (including printer and other hardware) fails to operate properly, the CONTRACTING OFFICER or his/her representative is responsible to determine the nature of the problem. If a hardware problem is identified, then the contractor shall be responsible for repairing it.

3.3.2 Network hub

The data monitoring computer will communicate via IEEE 802.3 Ethernet and the TCP/IP networking protocol. The contractor will provide to the Contracting Officer a network hub to allow the temporary

addition portable computers to the computer network. The hub should provide a minimum of four RJ-45 ports that support Category 5 Unshielded Twisted-Pair Network wiring.

3.3.3 Uninterruptible Power Supply (UPS)

The contractor will also supply an Un-interruptible Power Supply (UPS) for the computer and networking equipment. The UPS should provide backup power at 1kVA for a minimum of 10 minutes. The UPS should have a serial interface to the Contracting Officer computer to communicate UPS status. The contractor will ensure that sufficient power outlets are available to run all specified equipment.

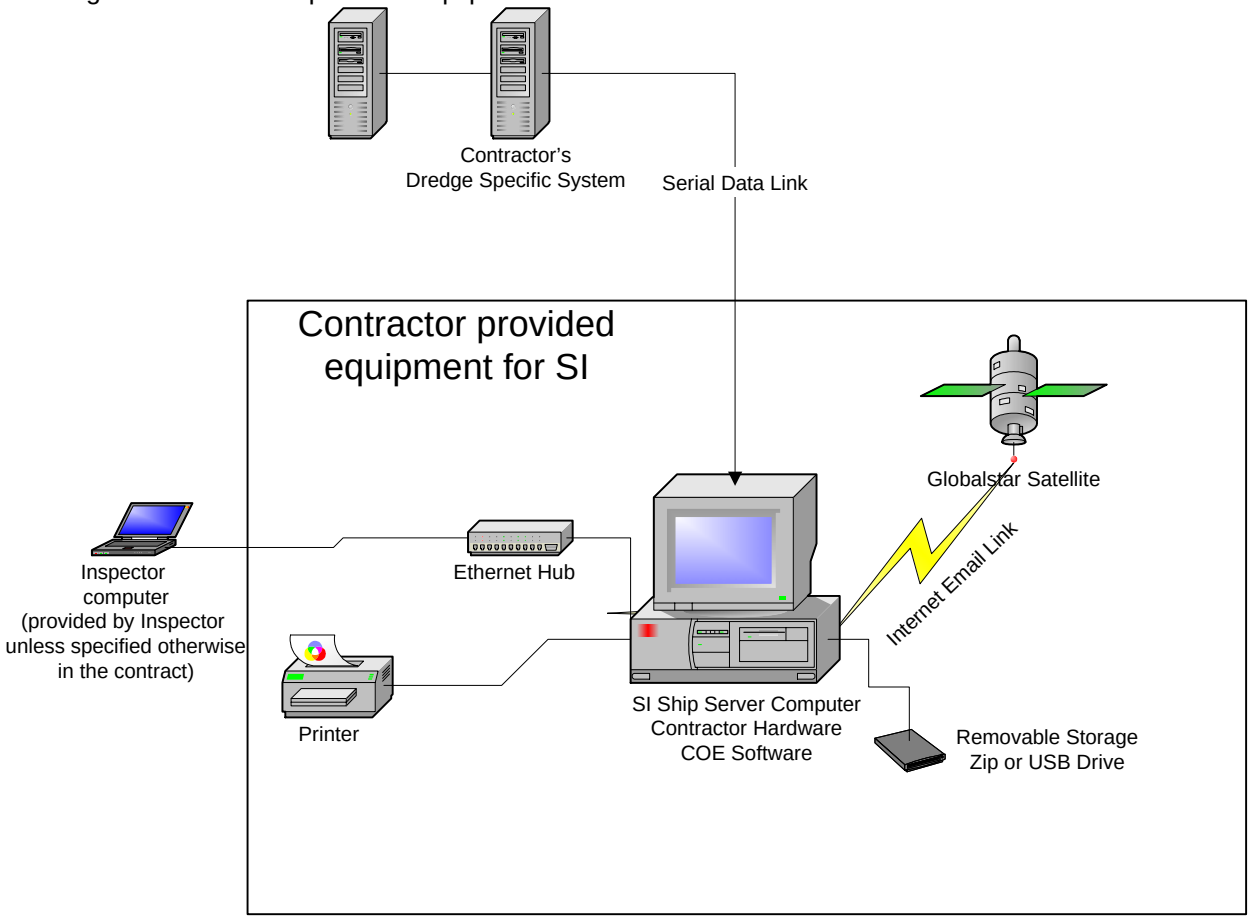
3.3.4 Printer

The contractor will supply a printer. The printer will connect to the specified Ship computer via a parallel interface (cable supplied by the contractor). The printer should support the Adobe Postscript Level 2 page description language. Also, the printer should have a minimum resolution of 300 dots per inch and have a rated print speed of 6 pages per minute or higher. Additionally, the printer should have minimum paper capacity of 100 pages of 8.5X11 inch paper. The contractor is responsible for maintaining a supply of printer paper and other consumables such as printer cartridges. Printer usage will not exceed 500 pages per month.

3.3.5 Satellite Data Modem

The contractor shall provide a satellite phone or modem, establish service and install the relevant equipment for use as a data link. The satellite data transmission device shall be equal to or equivalent to a SeaTel Wavecall 3000 or Qualcomm GSP-1620 which have the following salient characteristics: connection to externally mounted antenna, db-9 connector serial data transmission port, compatible with the Globalstar satellite system, 9.6Kbaud data transmission rate, no internet service provider required to access the Internet, and compatible with Microsoft windows dialup networking. The data transmission time required is estimated at less than five minutes per day. To avoid data interference, the satellite data modem is for the exclusive use of the ARCO computer during the length of the contract. The contractor shall make available all relevant operating and reference manuals for the satellite data phone/modem.

3.3.6 Figure of Contractor provided equipment



3.4 Data Reporting

Standard data will be sent to the Contracting Officer computer. The sensor data should be output via a RS-232 19200 baud serial interface to the data monitoring computer. The serial interface will be configured as 8 bits no parity and no control. A standard data string should be nominally sent every 10 seconds. The failure to send a data string within 60 seconds to the data monitoring computer results in a dredge down status determination by the automated monitoring system. Data strings should never be sent more frequently than one per second.

3.4.1 Reporting Format

The reported are sent as an eXtensible Markup Language (W3C standard XML 1.0) document. The format required here facilitates viewing the data in a web browser as well as automated handling of the data.

<?xml version="1.0"?>

<PIPELINE_DREDGING_DATA>
<DREDGE_NAME/>
< PIPELINE _DATA_RECORD>
<CUTTER_X_POSITION coord_type =”(SP,LL,UTM)”/>
<CUTTER_Y_POSITION coord_type =“(SP,LL,UTM)”/>
<DATE_TIME/>
<CUTTER_DEPTH/>
<VERT_CORRECTION/>
<DREDGE_HEADING/>
<SLURRY_DENSITY/>
<SLURRY_VELOCITY/>
<INST_PROD_RATE/>
<INTG_PROD_RATE/>
<TOTAL_DAILY_PROD/>
<CUTTERHEAD_DIST_FROM_CEN/> (optional)
<DREDGE_ADVANCE/> (optional)
<PUMP1_VACUUM/> (optional)
<PUMP1_DISCH_PRESS/> (optional)
<PUMP1_INLET_PRESS/> (optional)
<PUMP1_RPM/> (optional)
<SPUD_X_POSITION coord_type=”(SP,LL,UTM)”/> (optional)
<SPUD_Y_POSITION coord_type=”(SP,LL,UTM)”/> (optional)
<CUTTER_RPM/> (optional)
<BOOST_PUMP1_VACUUM/> (optional)
<BOOST_PUMP1_DISCH_PRESS/> (optional)
<BOOST_PUMP1_INLET_PRESS/> (optional)
<BOOST_PUMP1_RPM/> (optional)
</ PIPELINE _DATA_RECORD>
</ PIPELINE _DREDGING_DATA>
<cr>
<lf>

3.4.2 Reporting data metadata

Header Tag	**Tag Notes**
X_POSITION	Cutterhead X position. Latitude or Easting in state plane coordinates Latitude and Longitude values are to be reported to the hundredth of a minute. State plane coordinates may be reported to the nearest whole foot and are the preferred means of position reporting. The attribute **coord_type** has the value SP for state plane coordinates, LL for Latitude or Longitude and UTM for Universal Transverse Mercator coordinates. Only these three values are valid.
Y_POSITION	Cutterhead Y position. Longitude or Northing in state plane coordinates. The same comments for the X_POSITION tag apply.
DATE_TIME	mm/dd/yyyy hh:mm:ss defined as UTC time.
CUTTER_DEPTH	Cutterhead digging depth (referenced to water surface)
VERT_CORRECTION	Riverstage or tide value (feet)

Header Tag	Tag Notes
DREDGE_HEADING	The dredge heading reported from 0 to 359 degrees. Referenced to true north.
SLURRY_DENSITY	Slurry density (grams/cubic centimeters)
SLURRY_VELOCITY	Slurry velocity (feet/second)
INST_PROD_RATE	Instantaneous production rate (cubic yards/hr)
INTG_PROD_RATE	Integrated (over reporting interval) production rate (cubic yards/hr)
TOTAL_DAILY_PROD	Total production since midnight local time (cubic yards)

Optional Header Tag	Optional Tag Notes
SPUD_X_POSITION	Spud X position. Latitude or Easting in state plane coordinates The same comments for the X_POSITION tag apply
SPUD_Y_POSITION	Spud Y position. Longitude or Northing in state plane coordinates. The same comments for the X_POSITION tag apply.
CUTTER_RPM	Cutterhead Revolutions Per Minute
CUTTERHEAD_DIST_FROM_CEN	Cutterhead distance from cut centerline (feet)
DREDGE_ADVANCE	Dredge advance along cut centerline since midnight (feet)
LADDER_RPM	Ladder pump shaft revolutions per minute
LADDER_VACUUM	Ladder pump vacuum (mmhg)
LADDER_DISCH_PRESS	Ladder pump discharge pressure (psig)
PUMP1_DISCH_PRESS	Dredge pump discharge pressure (psig) General note - Multiple main drive pumps should be noted as PUMP1, PUMP2, PUMP3 and so on. These additional tags should be noted in the DPIP.(revision sect)
PUMP1_VACUUM	Dredge pump vacuum (mmhg)
PUMP1_INLET_PRESS	Dredge pump inlet pressure (psig)
PUMP1_RPM	Dredge pump shaft revolution rate (rev/min)
BOOST_PUMP1_DISCH_PRESS	Booster pump discharge pressure (psig)
BOOST_PUMP1_INLET_PRESS	Booster pump inlet pressure (psig)
BOOST_PUMP1_RPM	Booster pump shaft revolution rate (rev/min)
BOOST_PUMP1_VACUUM	Booster pump vacuum (mmhg)

3.4.3 Data reporting examples

```
<?xml version="1.0"?>
<PIPELINE_DREDGING_DATA>
<DREDGE_NAME>Arkansas</ DREDGE_NAME>
<PIPELINE _DATA_RECORD>
<DATE_TIME>05/14/2004 13:12:05</DATE_TIME>
<CUTTER_X_POSITION coord_type="LL">10.123345</CUTTER_X_POSITION>
<CUTTER_Y_POSITION coord_type="LL">-80.123333</CUTTER_Y_POSITION>
<CUTTER_DEPTH>16.5</CUTTER_DEPTH>
```

<VERT_CORRECTION>1.2</VERT_CORRECTION>
<DREDGE_HEADING>235.5</DREDGE_HEADING>
<SLURRY_DENSITY>1.33</SLURRY_DENSITY>
<SLURRY_VELOCITY>6.2</SLURRY_VELOCITY>
<INST_PROD_RATE>1460.85</INST_PROD_RATE >
<INTG_PROD_RATE>233.7</INTG_PROD_RATE>
<TOTAL_DAILY_PROD>128.6</TOTAL_DAILY_PROD>
<CUTTERHEAD_DIST_FROM_CEN>10.3</CUTTERHEAD_DIST_FROM_CEN> (optional)
<DREDGE_ADVANCE>28.9</DREDGE_ADVANCE> (optional)
<PUMP1_VACUUM>265.4</PUMP1_VACUUM> (optional)
<PUMP1_DISCH_PRESS>89.9</PUMP1_DISCH_PRESS> (optional)
<PUMP1_INLET_PRESS>-5.16</PUMP1_INLET_PRESS> (optional)
<PUMP1_RPM>406</PUMP1_RPM> (optional)
<SPUD_X_POSITION coord_type="LL">61.345879</SPUD_X_POSITION> (optional)
<SPUD_Y_POSITION coord_type="LL">-59.459218</SPUD_Y_POSITION> (optional)
<CUTTER_RPM>55.1</CUTTER_RPM> (optional)
<BOOST_PUMP1_VACUUM>251.5</BOOST_PUMP1_VACUUM> (optional)
<BOOST_PUMP1_DISCH_PRESS>101.6</BOOST_PUMP1_DISCH_PRESS> (optional)
<BOOST_PUMP1_INLET_PRESS>-4.86</BOOST_PUMP1_INLET_PRESS> (optional)
<BOOST_PUMP1_RPM>522</BOOST_PUMP1_RPM> (optional)
</PIPELINE _DATA_RECORD>
</PIPELINE _DREDGING_DATA>
<cr>
<lf>

3.4.4 Contractor Data Backup

The dredging contractor shall maintain an archive of the data sent to the data monitoring computer for the length of the dredging project. The Contracting Officer or his/her representative may request (at no additional cost to the contract price) that the contractor provide a copy of these data covering specified time periods. The data will be provided on PC format CD-R disks (or alternate storage medium agreeable to the Contracting Officer, such as 100Megabyte ZIP disks or USB drives) and each of the requested time periods will be identified.

3.5 Dredge Plant Instrumentation Plan (DPIP)

The contractor shall submit a Dredge Plant Instrumentation Plan. Refer to section 3.8 for the schedule of submittal. The plan shall include at a minimum:

3.5.1 Dredge computations and documentation

All computations for a particular dredge concerning deriving computed data elements as required in section 3.4 from sensor data elements will be provided to the Contracting Officer or his/her representative. The Contracting Officer or his/her representative prior to the change being applied must approve any changes to the computing methods during the dredging contract in writing.

These computations include the determination of cutterhead position and depth. The inside pipe diameter along with the location of the slurry density and slurry velocity metering system sensors shall also be provided to the Contracting Officer or his/her representative.

The contractor will also provide the Contracting Officer or his/her representative with dimensioned drawings of the dredge. The drawings should include 1) overall dredge dimensions including hull and decks 2) the locations of all sensors needed to supply required data 3) the cutter basket dimensions, 4) the distance between spuds, 5) suction ladder length (or lengths) in straight segments with any angled sections shown and labeled in degrees, 6) offset distances of the cutterhead and spuds from the DGPS antenna. Cutterhead dredge dimensions are to be certified by a licensed marine surveyor or architect. The user manuals provided by the instrumentation manufacturers should be available on the dredge for reference, but they are not necessary for inclusion in the DPIP.

3.5.2 Data reporting

Non-standard sensor data names not in section 3.4.1 shall be supplied to the Contracting Officer or his/her representative. An example ASCII format file of data to be exported to the data monitoring computer will be provided with the DPIP.

3.5.3 Computer hardware

The brand name and specifications of furnished computer hardware.

3.5.4 Calibrations

The contractor will provide certificates of calibration and/or manufacturers certificates of compliance for all required dredge information presented in section 3.5.1. These include slurry density, slurry velocity, heading, and cutterhead depths.

3.5.5 Instrumentation quality control methods

Test methods used by the contractor to provide quality control of input sensor data should be documented. These test methods shall include the checking of sensors to verify that reported values are applicable for that sensor and the particular project being dredged.

3.5.6 Sensor log

The contractor shall maintain a log of sensor performance and modifications during the length of the dredging contract. The log shall contain the time when a sensor fails (and subsequently repaired). The log shall also include the time and results of sensor calibrations, the time of sensor replacements, and the time when backup sensor systems are initiated to provide required data. It shall also contain the name of the person responsible for the sensor work. Only sensors that affect the data reported in section 5 are affected by this logging requirement. The contractor may elect to add this log to the quality control report with permission from the Contracting Officer or his/her representative.

3.5.7 Pump curves

The contractor shall provide the pump manufacturers pump performance curves for all dredge pumps and booster pumps used on the pipeline application. Pump performance curves should define the values for flow rate vs. pump head for all applicable RPM values as well as associated net positive suction head

required (NPSHR), pump efficiency, and power input. The pump performance chart should specify the fluid in which the performance is based on (*i.e.* clear water or slurry), the impeller diameter, and the maximum passable sphere diameter.

3.5.8 Summary of Pipeline dredge DPIP Deliverables

Description	Referring Section
Overall dredge dimensioned drawing with sensor locations	3.5.1
Dredge dimensions – offset distance from DGPS antenna	3.5.1
Computer system hardware documentation (documentation available on dredge)	3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.3.5, 3.3.6, 3.5.3
Proposed revisions to data reporting interface	3.4, 3.5.2
Sensor calibrations - slurry density, slurry velocity, cutterhead depth, and heading	1.1, 3.1.1, 3.1.2, 3.1.4, 3.1.7, 3.1.8, 3.5.4
Sensor Log	1.1, 3.5.6

3.6 Quality Assurance Tests

3.6.1 Pipeline dredge water test

The Contracting Officer or his/her representative will direct the contractor in performing water tests to help verify slurry velocity and slurry density reporting. A water test consists of pumping water through the pipeline.

3.6.2 Pipeline dredge cutterhead depth

The Contracting Officer or his/her representative may require periodic calibration checks of the reported cutterhead depth over a calibration point at the project site. The Contracting Officer or his/her representative may also use direct means such as tape measures, sounding lines, and pressure sensors to directly measure cutterhead depth. The Contractor shall have on the dredge a clearly readable steel tape, chain, or wire graduated in 1 and 1/2 foot increments. This tape or chain will be capable of measuring the depth below water surface of the cutterhead measuring point with sufficient length to measure 5 feet over the maximum project depth.

3.7 List of Items Provided by the Contractor

Description	Section Reference
Computer system, UPS, and printer	3.3.1, 3.3.3, 3.3.4
Network hub	3.3.2
Dredge Plant Instrumentation Plan	1.1, 3.5
Data reporting interface	3.4.1, 3.5.2
Dredge heading	3.1.4
Cutterhead horizontal position	3.1.3
Tide level / Riverstage	3.1.5
Dredge data acquisition time	3.1.6
Slurry density	3.1.1
Slurry velocity	3.1.2
Dredge production	3.1.8, 3.1.1, 3.1.2
Cutterhead depth	3.1.7
Measuring tape	3.6.2

3.8 Schedule of DPIP Submittal – Tailored by District

The Contractor DPIP submittal shall be required 15 days after the Notice to Proceed. Within 7 days after receipt of the DPIP, the CONTRACTING OFFICER or his/her representative will review and comment on its acceptability. After this DPIP is reviewed and accepted by the CONTRACTING OFFICER or his/her representative, the onboard system will be required to be inspected, approved by the CONTRACTING OFFICER or his/her representative, and operational within 30 days after the Notice to Proceed. If the system is not operational after 30 days after the Notice to Proceed, or if the system becomes inoperable for a period of time greater than allowed in the specification, the Dredging unit price, for each assignment, will each be reduced to 80% of the original bid price for the hours when the system is not fully operational.