APPENDIX B - Operation and Control of Grit Pumping and Dewatering Process

The grit pumping cycle is automatically initiated based on a 24 hour adjustable timer. Each pumping cycle consists of the following sequence of events: air scour starts and stops; grit pumps start in conjunction with a water scour and the dewatering screw conveyors; grit pumps and water flush stops; and dewatering screw conveyors stop.

At the initiation of each pumping cycle, prior to the start of the pumps, an automatic air scour agitates the grit to remove organics that are trapped within the grit at the bottom of the Vortex Grit Chambers. Service air lines with flow control valves (H520-FCV for train 1 and H525-FCV for train 2) are provided for this purpose. The duration and pressure of the air scour is adjustable and should be long enough at sufficient pressure to thoroughly agitate the grit to remove most of the larger organic material. The effectiveness of the air scour can be monitored by sampling the grit prior to the cyclone and watching for organic material. The duration of air is adjustable through the distributed control system (DCS) as described below. The air pressure can be changed by adjusting the set point of pressure relief valves H520-HV1 for train 1 and H525-HV1 for train 2. Block valves (H520-HV2 for train 1 and H525-HV2 for train 2) must be open to allow the air into the chambers.

A water scour system is started in conjunction with the grit pumps, which fluidizes the grit and enables it to be pumped. Flushing water lines with flow control valves (H521-FCV for train 1 and H526-FCV for train 2) are provided for this purpose. The pressure of the water scour is adjustable at pressure reducing valves (H520-HV1 for train 1 and H525-HV1 for train 2). Block valves immediately downstream of the pressure reducing valves must be open to allow the flushing water into the chambers.

The fluidized grit is pumped from the grit chamber to the cyclones and dewatering equipment. Grit pumps 1 (H310-GRP) and 2 (H315-GRP) and lines H310, H315 and H316-100-GR-DI1 are provided for train 1, and pumps 1 (H320-GRP) and 2 (H325-GRP) and lines H320, H325 and H326-100-GR-DI1 are provided for train 2. Each grit chamber has one duty and one standby pump. The pumps are aligned in parallel with suction and discharge isolation valves for each pump as follows:

- H310-HV1 and H310-HV2 for pump 1
- H315-HV1 and H315-HV2 for pump 2
- H320-HV1 and H320-HV2 for pump 3
- H325-HV1 and H325-HV2 for pump 4.

There are no check valves on the pump discharge lines, so the isolation valves on the standby pumps must be closed to prevent the grit slurry from recirculating back through the standby pump. Switching duty of the two pumps is manual. When alternating the duty of pumps, the status of the isolation valves for the two pumps must also be changed. Suction and discharge pressure of each pump is locally displayed. Seal water is provided for each pump. On the discharge line, block valves H316-HV1 and H326-HV1 should normally be open and block valves H319-HV1 and H329-HV1 should normally be closed. Grit from either chamber can be bypassed back to the inlet chamber via line H329-100-GR-DI1 by opening block valves H319-HV1, or H329-HV1 and closing block valves H316-HV1, or H326-HV1, respectively.

Grit slurry enters the respective cyclone separator tangentially where it is concentrated. The liquid portion exits the cyclones through the vortex finder and flows by gravity in line H329-100-GR-DI1 to the screen bypass channel. The concentrated grit exits the cyclone into the dewatering screw conveyor.

The dewatering screw conveyors start simultaneously with the respective grit pumps. The concentrated grit slurry enters the hopper where the grit settles to the bottom and the lighter organic material floats to the surface and exits the hopper with the supernatant liquid via an overflow. The overflow from each conveyor drains by gravity to the screen bypass channel in line H327-150-GR-DI1. The screw conveyor transports the grit which settles in the bottom of the hopper up to where it is discharged for ultimate disposal. As the grit is conveyed up by the screw, it is washed with a high pressure spray. Flushing water lines with flow control valves H335-FCV and H345-FCV are provided for this purpose. The dewatering

screw conveyors can be drained for maintenance. A bottom valve is provided on each conveyor hopper for this purpose.

The pumping cycles should be frequent enough to prevent excessive build-up of grit in the chamber. The pumping frequency will likely vary throughout the different seasons of year.
The duration of the pumping cycles is adjustable, and should be long enough to ensure all settled grit is removed from the chamber and the discharge piping each cycle.

The grit pumping and dewatering system may be operated in one of three modes: Hand, Computer-Manual, and Computer-Automatic.

Hand Control
To operate the air or water scour valves manually, select Hand using the local COH selector switch. The valve is then operated using the local Open/Close selector switch.

To operate the grit pumps manually, select Hand using the local COH selector switch (ensure that the appropriate isolating valve has been opened prior to operating the pump). The pump will start and run continuously while Hand is selected. To stop the pump, return the selector switch to Off or press and latch the LOS push-button.

To operate the dewatering screws manually, select Hand using the local COH selector switch. The dewatering screw will start and run continuously while hand is selected. To stop the screw, return the selector switch to Off or press and latch the LOS push-button.

To operate the screw flushing water valves manually, select Hand using the local COH selector switch. The valve is then operated using the local Open/Close selector switch.

Computer-Manual Control
To operate the grit removal system on Computer-Manual control, select Computer for each of the air scour valves, water scour valves, grit pumps, dewatering screws, and flushing water valves using their respective COH switches.

At the operator workstation, select Graphic (or Group) display 1C to control the grit removal system for Vortex Grit Chamber Number 1. Select Graphic (or Group) display 1D to control the grit removal system for Vortex Grit Chamber Number 2. Using the pop-up device control boxes, switch each valve, pump, and screw conveyor to manual and select the desired state, Open-Close for valves and Start-Stop for pumps and dewatering screws.

Computer-Automatic Control
To operate the grit removal systems on Computer-Automatic control, select Computer for each of the air scour valves, water scour valves, grit pumps, dewatering screws, and flushing water valves, using their respective COH switches.

At the operator workstation, select Graphic (or Group) display 1C to control the grit removal system for Vortex Grit Chamber Number 1. Select Graphic (or Group) display 1D to control the grit removal system for Vortex Grit Chamber Number 2. Using the pop-up device control boxes, switch each piece of equipment to Automatic control.

To configure the grit removal sequence, the following parameters must be set:

- **Auto Start:** "Enable" to run the automatic sequence, "Disable" to stop the automatic sequence.
- **Cycle Off Time:** Set this adjustment to the desired Off time (in minutes) between cycles.
- **Air Scour On Time:** Set this adjustment to the desired air scour duration (in minutes).
- **Rest Time:** This adjustment sets the duration (in minutes) between air scour and grit pumping/water scour.
- **Grit Pump Run Time:** This adjustment sets the duration (in minutes) for grit pumping and water scour.

• **Dewatering Conveyor Delay:** Set this adjustment to the required time (in minutes that the dewatering screw should run after the grit pump stops.
• **Duty Select:** Selects the desired duty pump (ensure that the appropriate isolation valves have been opened).

Once the control parameters are set and the sequence is enabled, the cycle will repeat automatically based on the selected control parameters.

Safety
Each grit pump is fitted with a seal water pressure switch that will shut down the pump and initiate an alarm if seal water pressure is inadequate. Once the condition has been corrected, the software alarm must be manually reset from Graphic (or Group) display 1C or 1D (depending on which pump has failed).

Each of the dewatering screw grit hoppers are fitted with high level switches that interrupt the grit pumping sequence and initiate an alarm when a high level is detected.
The alarm must be manually reset on Graphic displays 1C and 1D when the level returns to normal.