

## SECTION 01014

### WORK SEQUENCE

#### PART 1 - GENERAL

##### 1.01 CONTINUITY OF PLANT OPERATIONS

###### A. Definitions:

1. Shutdown – The shutdown or cessation of operation of one particular process unit, a particular piece of mechanical equipment, a particular electrical subsystem, or electrical equipment in order to proceed with a construction modification to the plant facilities as shown and specified. Under no circumstances will this be construed to mean shutting down the entire plant or jeopardizing the reliability of the plant in its performance.
2. Bypass – Creating a shunt, diversion, or otherwise a temporary pathway for continuity between hydraulic, electrical, control, or process elements so that a particular process unit a particular piece of mechanical equipment, a particular electrical subsystem, or electrical equipment can be removed from service without disrupting the overall continuity of the Wastewater Treatment Plant (WWTP) or any of it required systems. In no way will a bypass be authorized by the City of Arlington (City) or Operator, which will impede the plants ability to process the plant design capacity except as specified otherwise.

###### B. General: The existing wastewater treatment plant is currently and continuously receiving and treating wastewater. Functions necessary to maintain operations of the facility shall not be interrupted except as specified herein. The Contractor shall coordinate the work with the Resident Engineer and Operator to avoid any interference with effective operation of plant equipment and processes. The existing electrical power distribution system includes equipment, duct, conduit, wiring, panels, and instruments that have been installed throughout a period since 1997.

1. Related Work: Requirements of this section include, but are not limited to, requirements specified in the following sections:
  - a. General Conditions
  - b. Section 01010: Summary of the Work and Contract Considerations
  - c. Section 01040: Coordination and Project Requirements
  - d. Section 01311: CPM Construction Schedule
  - e. Section 01650: Facility Startup
  - f. Section 02050: Demolition
2. Information: The information provided in this section includes provisions that are binding, however, are not all-inclusive of specified requirements herein. The purpose of this section is to guide and restrict the construction sequence of demolition and modification tasks.

###### C. Bypassing: Bypassing of untreated or partially treated wastewater to surface waters or drainage courses, and the emission of objectionable, hazardous, noxious, or otherwise prohibited substances from the treatment processes, is prohibited during construction. In the event that accidental or threatened bypassing is caused by the operations of the Contractor, the Operator shall immediately be entitled to employ others, including their own forces, to stop or prevent bypassing without giving

written notice to the Contractor. Costs incurred to stop or prevent the bypass shall be paid by the Contractor.

1. Penalties imposed on the City of Arlington or Operator as a result of any bypass or violation of the discharge permit requirements caused by the actions or due to negligence of the Contractor, his employees, subcontractors, or agents shall be borne fully by the Contractor, including legal fees and other expenses to the City of Arlington or Operator resulting directly or indirectly from the bypass or permit violation.

- D. Shutdown Plan Submittals: The Contractor shall provide a detailed Shutdown Plan and bar chart time schedule for operations which will require the removal from service of a basin, tank, pipeline, channel, electrical circuit, instrument, control circuit, equipment item, or structure. An initial Shutdown Plan shall be coordinated with and submitted at the same time as the Construction Schedule submittals specified in Section 01311 and shall meet the restrictions and conditions specified in this Section 01014 and the submittal requirements of Section 01300. The initial Shutdown Plan shall describe any variances from the Work Item and Shutdown Details in paragraph 01014-3.01 D.

The submittal covering the first 6 months of construction will be returned to the Contractor within 30 days, and the second Shutdown Plan submittal covering the remainder of the work will be returned to the Contractor within 90 days. Any subsequent proposed changes to the initial Shutdown Plan shall be submitted 4 weeks in advance of the applicable shutdown period and on a monthly basis to coincide with updating of the Construction Schedule.

The detailed Shutdown Plan shall describe, as a minimum, the Contractor's proposed method for accomplishing acceptable shutdown of equipment items, piping, unit processes or portions of unit processes; the length of time required to complete the Contractor's work; crew size, major equipment, major parts and supplies necessary to complete the Contractor's work within the stipulated shutdown time period; and any unusual safety precautions and equipment necessary to accomplish the work. The detailed Shutdown Plan shall also describe any variance from the Work Item and Shutdown details in paragraph 01014-3.01 D. An acceptable shutdown is one in which the upset of processes is avoided, odors are controlled, spills are prevented, and bypassing is prevented. Each shutdown shall be safely accomplished within the allowable time period. The Shutdown Plan shall note any activities which the Contractor expects the City or Operator to perform and shall indicate each Access Request to be submitted. The Shutdown Plan shall be submitted in accordance with Section 01300. Failure to obtain acceptance of a detailed shutdown plan shall be cause for the City to withhold payments in accordance with Article 12 – paragraphs, City to Withhold Payments.

- E. General Requirements: The Contractor shall observe the following general requirements:
1. The initial and detailed Shutdown Plan shall be updated by the Contractor on a monthly basis to coincide with updating of the Construction Schedule.
  2. The Shutdown Plan submitted by the Contractor for approval by the City shall contain provisions for preventing the release of odors during work affecting areas of existing operations.
  3. The Contractor shall not perform any work in any area of existing operations or make any connection to any existing pipeline, channel, structure, or equipment without advanced written approval by the City as specified in Section 01040.
  4. Existing systems or individual equipment items shall be isolated, dewatered, decommissioned, de-energized, or depressurized only by Operator unless

- otherwise specified in the contract documents. This work will be done in accordance with the detailed Shutdown Plan to be submitted by the Contractor and the conditions specified in this Section 01014 and in Section 01040.
5. The Operator will perform any required draining of existing basins, tanks, piping, channels, equipment, or structures to the level of the lowest existing drain line. The existing drain valves in the existing tanks and channels will carry any leakage which may occur through existing isolation valves and gates. The depth of water remaining in the basins, tanks, or channels will vary depending on the distance of the drain from the leakage source and the accuracy of the floor of the chamber. The Operator will remove any large deposits of solids; however, there may be solids residue remaining on any surface. Any subsequent cleaning or further draining and/or dewatering shall be provided by the Contractor.
  6. The Contractor shall provide all necessary temporary pumps, piping, electrical wiring, controls, and labor during and subsequent to all shutdown activities as required. Pumps and upstream water levels shall be continuously monitored by the Contractor during all temporary pumping operations to insure against process upsets, flooding, and bypassing.
  7. The Contractor shall maintain adequate access to the plant facilities, utilities, and equipment during construction to allow continued operation and maintenance by plant personnel to take place.
  8. The Contractor shall prepare a Safety Plan, which shall comply with State and Federal safety requirements as a minimum, when working in process areas. The Contractor shall be responsible for and shall provide additional safety features necessary to protect his employees and Operator employees during the conduct of the work. In addition, the Contractor shall comply with all applicable OSHA and City safety procedures for work in any potential confined space, including all tanks, channels, pipes, etc., which have or do carry process fluids and/or chemicals and are not designed for normal occupancy.
  9. Some shutdowns will have to take place during other than normal working hours, such as early mornings, nights, holidays, and weekends. Where these are foreseen, they have been identified in this Section.
  10. The Contractor shall limit shutdowns of existing substations, feeders, and motor control centers to periods when workers are actually performing work on the affected equipment. Only one-half of a double-ended substation may be shut down at any time, unless otherwise approved by the City. All electrical shutdowns shall be returned to serve on nights, weekends, and holidays, unless approved by the City.
  11. The Contractor shall coordinate all crafts and subcontractors to minimize the number and duration of shutdowns. Non-coordinated shutdowns that result in a cost of manpower or materials shall be back charged to the Contractor and will be deducted from progress payments.
  12. The Contractor shall note that all slide gates leak, and some valves leak. The Contractor is required to remove leakage of any liquids including wastewater and sludge from work areas and operating areas.
  13. The discharge point and rate of drainage and/or dewatering operations is to be submitted to City for approval. All existing equipment and processes shall remain under control of the City. New equipment which has been connected to existing processes may be operated by the Contractor only with prior approval of the City.
  14. The Contractor shall design and provide all necessary bulkheads, cofferdams, and support structures to allow isolation from work areas of basins, tanks, basins, and/or channels which are in service. Bulkheads, cofferdams, and

support structures shall conform to applicable OSHA requirements, and shall be submitted in accordance with General Conditions (Article 10, paragraph 1, Safety Practices).

## PART 2 - PRODUCTS (DELETED)

## PART 3 - EXECUTION

### 3.01 SEQUENCE AND SCHEDULE OF CONSTRUCTION

- A. General: To permit continuous treatment of wastewater and compliance with discharge permit and air emissions requirements, the initial and detailed Shutdown Plan shall provide for the specific conditions listed in Section 01014 unless otherwise approved in writing by the Resident Engineer. These conditions provide at least one method of scheduling shutdowns to allow the work to be completed without disrupting adequate treatment. The Contractor may propose in the required initial Shutdown Plan submittal other methods or modifications of the methods described herein. Any alternate methods proposed by the Contractor are subject to approval by the Resident Engineer. All shutdown activities shall be conducted only upon written approval by Resident Engineer.
- B. Shutdown Limitations: Shutdowns shall be completed within the limitations listed in the shutdown details of paragraph 01014-3.01 D and as specified herein. The shutdown constraints for each item are the total time periods from Contractor access to when the work shall be complete and the system is ready for return to service. If the Contractor undertakes a connection to an existing system which results in a shutdown, and then finds that the work will not be completed within the allowed time, he shall notify the Resident Engineer immediately. If the City does not approve an extension of the allowed time, then the Contractor shall cause the work to be completed or closed so that the process can be placed back in operation. Such extra work to close up and allow the process unit to return to service shall be at no cost to the City or Operator. If the Contractor does not continue to proceed to close up the work during a shutdown, the City may complete the work or employ others to complete the work. Costs to close the work to restore the required service and other actual damages incurred by the City or Operator due to shutdowns exceeding the allowed time shall be borne by the Contractor. The City or Operator will not be responsible for damage to work by the Contractor as a result. Should the Contractor find it necessary to incur extra expense to complete the work within the duration and periods specified herein, said extra expense shall be the burden of the Contractor.
- C. General Conditions: Major process units are identified in the following paragraphs. Time of completion, liquidated damages, main contract drawings, major items, work by others, shutdown constraints, access requests, specialized testing requirements, and sequence discussion are summarized. All other work not specified in this Section shall be completed within the Contract Times specified in Section 01011.
1. All system isolations will be performed by Operator.
  2. Several work items listed require early completion. Where new equipment is needed for these early completion work items, the Contractor shall coordinate with the equipment suppliers and shall submit shop drawings in sufficient time to ensure early completion of these work items. In the event that early

completion is impossible, as when there is insufficient time to prepare submittal or delivery, the Contractor shall identify these occurrences and propose a new time of completion in the initial and detailed Shutdown Plan.

D. Work Item and Shutdown Details:

General Sequence: Installation of the membrane equipment should be completed first to allow the membranes to be used to maintain effluent quality and meet NPDES permit requirements during construction of the remaining improvements. The headworks improvements should be constructed in parallel with the MBR system to be available for protection of the membranes when the MBR system is placed into operation. Improvements to the UV disinfection system should also be constructed in parallel with the MBR system, because hydraulics downstream of the MBR system will be significantly altered and it will be simplest to incorporate the UV disinfection improvements when the MBR system is constructed.

Following installation of the MBR system and improvements to the headworks and UV disinfection: First, the northern SBR basin will be converted to aeration basins. During that period, the southern SBR basin will receive flow continuously and discharge mixed liquor to the MBR system. After completion of the improvements to the northern SBR, the southern SBR basin will be retrofitted into new aerobic digesters, to increase sludge storage capacity, such that interruptions to thickening and dewatering of sludge during expansion of the Solids Handling Building will not adversely affect WWTP performance.

Other improvements to be completed, which include construction of the new Lab/Office and Equipment Buildings, can be done in parallel or following the previously described improvements. The work sequence outlined herein assumes that work is accomplished following the previously described improvements. The preliminary construction phasing for the WWTP is outlined below.

1. Construction Preliminaries

- a. City will relocate water service to the existing Administration Building prior to start of construction.
- b. Begin procurement process for standby generator due to long lead time and need for generator during middle of project.
- c. Install new electrical, gas and water services, while maintaining existing services until they are completely replaced.
- d. Onsite relocation of yard piping and electrical.
- e. Install new fiber optic communication lines from Public Works Building to existing Administration Building, stub-out for new Lab/Office Building and sub-outs for temporary office trailer and existing Lab Building.
- f. Provide temporary office trailer with space suitable for 5 persons.

2. Headworks

- a. Isolate the existing bypass screen channel using the existing slide gate (GT-1) and existing stop gate (GT-3).
- b. Construct the new screening channel for Fine Screen No. 3 at the Headworks.
- c. Install and test Fine Screen No 3.
- d. Construct the new wastewater inlet, install new influent sanitary sewer piping up to the point of connection to the existing influent sanitary sewer pipe, and install the new trash rack.
- e. Bypass influent wastewater from the manhole directly upstream of the Headworks into the channel for the existing mechanical screen (SCN-101).
- f. Construct tie-in of new influent sanitary sewer piping to the existing influent sanitary sewer pipe.

- g. Construct temporary bulkhead in the influent channel upstream of the screens and west of the new inlet to isolate newly installed Fine Screen No. 3 from the remaining new screening channels yet to be constructed.
  - h. Move bypass discharge to downstream of the Parshall flume.
  - i. Replace existing stop gate (GT-5) with a new slide gate (SG-105).
  - j. Construct a second temporary bulkhead to isolate the existing mechanical screen (SCN-101) channel from the newly active discharge channel.
  - k. Remove temporary bypass pumping.
  - l. Startup Fine Screen No. 3.
  - m. Install plug in the existing influent sanitary sewer pipeline.
  - n. Demolish the existing mechanical screen (SCN-101) and manual bar screen.
  - o. Construct channels for Fine Screen Nos. 1 and 2.
  - p. Install and test Fine Screen Nos. 1 and 2.
  - q. If required, perform additional bypass pumping from the upstream manhole to downstream of the Parshall flume to remove the temporary bulk heads and complete any remaining structural work where the bulkheads had been placed.
  - r. Remove temporary bypass pumping.
  - s. Reconnect existing foul air piping until new biofilter is constructed.
  - t. Isolate the grit removal system by closing existing slide gates GT-6 and GT-7.
  - u. Remove and replace the existing grit removal system.
3. Membrane Bioreactor System
- a. Demolish existing Office Building and Old Chlorination Building.
  - b. Construct MBR tanks and surrounding retaining walls.
  - c. Install gas service line from MBR Support Building to meter.
  - d. Install equipment in the MBR tanks.
  - e. Construct MBR Support Building and install permeate pumps, blowers, and other MBR system equipment. Note: Construction of the MBR tanks and MBR Support Building and associated equipment installation may proceed concurrently to the extent possible.
  - f. Perform clean water testing as required by Section 13030.
  - g. Construct 36-inch RAS pipeline and 48-inch ML pipeline from the MBR tank up to the northern SBR tank.
  - h. Construct new WAS suction piping to existing WAS pumps in existing SBR Support Building.
  - i. Construct 24-inch PER to the existing SBR Support Building.
  - j. Install covers and bridge crane over MBR tanks.
  - k. Extend temporary RAS and ML pipelines from the MBR system to the southern SBR tank.
4. Lab/Office and Equipment Buildings
- a. Construct new Lab/Office Building in new location.
  - b. Connect services to new Lab/Office Building.
  - c. Extend gas service to the new service locations, including the new Lab/Office Building.
  - d. City will move lab and office operations to new building.
  - e. Remove temporary office trailer.
  - f. Demolish existing Lab Building.
  - g. Construct new Equipment Building following demolition of existing Lab Building.
  - h. City will move operations to new Equipment Building.
  - i. Install new standby generator.

- j. Connect the new standby generator to the new electrical service.
- 5. UV Disinfection System
  - a. Temporarily route PER discharge to a temporary UV disinfection installation as shown on the Drawings.
  - b. From the temporary UV disinfection installation, PER will be routed temporarily to the first manhole downstream of the existing headbox.
  - c. The temporary UV disinfection installation will include two of the three new UV reactors. One UV reactor will serve as a backup. The other UV reactor will operate continuously at full power while improvements for the new UV disinfection system are being made. The temporary UV installation shall be protected from weather and sunlight by being housed in a temporary tent or shed, or being installed in the MBR Support Building. Temporary power shall come from the new electrical service.
  - d. Install new spray system in southern SBR tank.
  - e. Operate southern SBR continuously in aerated fill mode with continuous discharge. Fix decanter at high water level with discharge weir fully open.
  - f. Operate MBRs in normal mode, but with RAS recycle back to the southern SBR (Note: It will take some time for the MBR process to build sufficient biomass, so sludge wasting will be minimal or non-existent during initial operation).
  - g. Take northern SBR offline.
  - h. The temporary UV disinfection installation will require temporary relocation of the existing effluent sampler.
  - i. The temporary UV disinfection installation will require temporary connection of the existing 3W pumps to the temporary PER discharge pipe.
  - j. Remove existing effluent and overflow/bypass piping and UV reactors from the lower level of the existing Secondary Support Building.
  - k. Install the new PER piping in the lower level of the existing Secondary Support Building and make the penetrations through the north wall to the existing headbox and wet well.
  - l. Raise the walls of the existing headbox.
  - m. Install east train of UV reactors (UV Reactor No. 3 and blank for future UV Reactor No. 4).
  - n. Provide temporary power service to aeration blowers, WAS pumps, existing Local Control Panel No. 1 for the existing sump pumps and 3W pumps equipment in the southern SBR tank, and other items powered by the existing MCC in the Secondary Support Building. Provide temporary power through either temporary connections from the new electrical service or use of the existing standby generator. Wire power to existing local disconnect switches, where provided, or provide a temporary disconnect switch. All equipment wired with temporary power shall also be wired with a temporary on/off switch.
  - o. Remove the existing MCC, UV power modules, UV control panel, SBR control panel, and other electrical devices and panels that are to be demolished.
  - p. Install the new MCC, transformer, control panels, UV power modules, and UV control panels.
  - q. Connect permanent power from the new electrical service to the MCC and wire new UV equipment and existing equipment to remain to the MCC.
  - r. Startup UV Reactor No. 3 and place it in operation.
  - s. Transfer effluent disinfection to new UV reactors and remove temporary UV disinfection installation and temporary PER discharge piping. This will require a temporary shutdown.

- t. Install west train of UV reactors (UV Reactor No. 1 and 2).
  - u. Startup UV Reactor No. 1 and 2 and place them in operation.
  - v. Conduct performance testing on UV reactors.
  - w. Reconnect the existing 3W pumping system. This will require a short-term shutdown or hot-tap.
  - x. Remove the temporary connection for 3W pumps.
  - y. Make improvements to the 3W pumping system, replacing one pump at a time so that one pump will always be operational.
  - z. The new 3W pumps will be run from the PLC, so once the 3W pumping improvements are made, rewire control of the sump pumps to the PLC and then demolish existing Local Control Panel No. 1.
6. Biological Process
- a. Remove piping/equipment from northern SBR tank, including WAS suction line from northern SBR tank.
  - b. Demolish existing Post Equalization Basin.
  - c. Reconfigure northern SBR into new aeration basins with anaerobic, anoxic, swing, and aerobic zones.
  - d. Install mixing, aeration, and pumping equipment, as well as all electrical and instrumentation equipment.
  - e. Complete ML and RAS piping within the new aeration basins, without making a connection.
  - f. Wire new equipment to the MCC.
  - g. Perform clean water testing of equipment.
  - h. Seed and startup new aeration basins.
  - i. Provide temporary bypass pumping to the southern SBR tank to reconfigure the influent wastewater piping to the new aeration basins inside the existing SBR Support Building.
  - j. Connect RAS and ML to the new aeration basins and remove temporary RAS and ML piping. This will require one or more short-term shutdowns.
  - k. Begin feeding influent wastewater to the new aeration basins and feeding mixed liquor from the aeration basins to the MBR process.
  - l. Disconnect temporary power from those items that are to be demolished or relocated and take the southern SBR offline and remove piping/equipment.
  - m. Disconnect WAS pump suction from southern SBR tank and connect new WAS suction piping from new RAS pipeline. This will require a short-term shutdown.
7. Solids Handling System and Odor Control
- a. Construct biofilters and install odor control equipment.
  - b. Connect foul air piping to aeration basins and headworks.
  - c. Construct aerobic digesters in southern SBR tank.
  - d. Provide temporary installation of one blower at the digesters. The blower shall receive temporary power from the new electrical service or the new standby generator. The blower will operate continuously at full power while improvements for the expanded Solids Handling Building are being made. The temporary blower installation shall be protected from weather and sunlight by being housed in a temporary tent or shed.
  - e. Modify WAS discharge piping to direct WAS to new digesters and install temporary piping to existing sludge dewatering, if required. Temporarily cease wasting while these modifications are made.
  - f. Modify the digested sludge piping between the aerobic digesters and digested sludge pumps. Use storage capacity in the aerobic digesters to hold digested sludge while these modifications are made.



- g. Pump out the contents of the existing sludge storage tanks to the digesters and demolish them.
- h. Install the aluminum covers over the digesters and aeration basins.
- i. Connect foul air piping to the digesters.
- j. Demolish the existing biofilter and salvage the existing standby generator, fuel tank and membrane thickener.
- k. Construct expanded Solids Handling Building.
- l. Install one of two new blowers and connect new blower discharge to digesters.
- m. Remove temporary digester blower installation and relocate blower to expanded Solids Handling Building.
- n. Install new sludge dewatering system, sludge conveyors, and complete necessary piping modifications.
- o. Install new MCC and electrical equipment.
- p. Startup and test new dewatering system, then reroute electrical and instrumentation wiring from the existing belt filter press, polymer system and digested sludge pumps (one at a time) from the existing MCC in the existing Equipment Building to the new MCC in the expanded Solids Handling Building.
- q. Demolish existing Equipment Building.
- r. Remove the existing lime conveyance system and install the new system. While this work is being done, the City's Biosolids Compost Facility must have availability to receive dewatered sludge.
- s. Connect foul air piping to the Solids Handling Building.

END OF SECTION