



## Slow Sand Filter Bed Resanding

### PART 1 – GENERAL

This specification defines the technical criteria and supply requirements for filter sand. These improvements include placement and grading of new filter sand on one existing filter bed, approximately 0.85 acres in area.

#### 1.1 SCOPE OF SUPPLY AND SERVICES

##### A. FILTER SAND

Provide for the production and delivery to the Willamette Wellfield (WWF) of all filter sand. Filter #1 will have new sand installed on top of the existing sand for a total depth of 36 inches. The total amount of sand required is 1875 tons. Moisture content allowed is 5% (1500 cubic yards with a weight of 1.25 tons per yard). Sand shall be produced and ready for placement by the dates specified in Section 3.1 – New Filter Sand Production.

##### B. SAND PLACEMENT

The contractor will be responsible for the placement and final grading by grade-rakes of the filter sand. The acceptable methods for placement will be by conveyORIZED placement. Spreading with small tractor with tracks that have low lbs./foot weight displacement may be allowed. Calculations for displacement and equipment proposed by contractor must be approved prior to bidding if method is other than conveyORIZED placement.

#### 1.2 QUALITY ASSURANCE

- A. The filter sand is the primary treatment component for the production of potable water from the WWF. Hence, proper handling and cleanliness of the sand during production, storage, and delivery are critical. All filter sand shall be kept completely separate from other materials, sources of contamination, and hauled in clean truckbeds and/or trailers. Part 3 of this specification addresses QA/QC requirements for production, storage, hauling, testing, and acceptance of filter materials. The Owner, working with the Contractor, may develop additional quality control measures for production and handling of filter materials that are specific to the production site and haul routes.

### 1.3 REFERENCES AND STANDARDS

- A. The following references and standards apply to WWF Slow Sand filter materials:
1. AWWA Standard B100-96 Standard for Filtering Materials (includes sand and gravel)
  2. ASTM C127 – Standard Test Method for Specific Absorption of Coarse Aggregate
  3. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates
  4. ASTM C702 - Methods for Reducing Field Samples of Aggregate to Testing Size
  5. ASTM D75 - Practice for Sampling Aggregates
  6. AWWA Research Foundation Manual of Design for Slow Sand Filtration (1991)
  7. ASCE Slow Sand Filtration (1991)
  8. Willamette Wellfield Slow Sand Filtration Pilot Study Report (January 2001)
  9. Oregon Administrative Rules, Chapter 333

### 1.4 DEFINITIONS

- A. The following definitions apply to this specification:

**Effective Size (ES).** The mesh size opening that will just pass 10 percent (by weight) of a representative sample. ES is measured in millimeters (mm).

**Uniformity Coefficient (UC).** A ratio calculated as the mesh size opening that will just pass 60 percent (by weight) of a representative sample of the filter sand divided by the mesh size opening that will just pass 10 percent (by weight) of the same sample.

**Percent Fines.** The percent (by weight) of a representative filter sand sample passing through a U.S. No. 200 mesh.

**Filter Materials.** Specially processed sand and gravel that are used to remove particulate matter from water during filtration.

**New Sand.** Filter sand that is produced from raw materials that have not previously been used for any other purpose.

**Contamination.** Degradation of the filter materials by foreign substances such that the filter material does not meet all applicable criteria of Part 2 and/or, upon contact of the filter material with source water, the water becomes contaminated to such an extent that a violation of State of Oregon Drinking Water Quality Standards occurs.

## PART 2 – PRODUCTS

### 2.1 FILTER SAND PHYSICAL CHARACTERISTICS AND SIZE

- A. The filter sand shall meet all of the following requirements. Conformance with these specifications shall be determined by an independent material testing laboratory of the Owner's choosing. The cost for laboratory analyses shall be borne by the Contractor. The laboratory will invoice directly to the Contractor.
1. The sand shall be of predominantly siliceous material that will resist degradation during handling and use. It shall be visibly free of clay, dust, micaceous and organic material. The apparent specific gravity shall be equal to or greater than 2.55 and the acid solubility less than 5 percent, as defined in AWWA B100-96.
  2. The effective size ( $D_{10}$ ) shall be in the range of 0.27 to 0.33 mm based on sieve analysis as per ASTM C136 (see AWWA B100-96).
  3. The uniformity coefficient shall be less than or equal to 2.5 based on sieve analysis as per ASTM C136.
  4. The amount of fines at the point of manufacture shall not be greater than 0.3 percent by weight passing a U.S. No. 200 mesh. The amount of fines of the filter sand installed in the filter basins shall not be greater than 0.5 percent by weight passing a U.S. No. 200 mesh. Gradation tests shall use a newly-purchased U.S. No. 200 mesh.

### 2.2 WATER QUALITY TEST FOR FILTER SAND

- A. As a measure of the filter sand's initial performance for filtered water quality, new filter sand shall be tested as follows and meet the following criteria:
1. Five pounds of a representative sample of filter sand shall be added to 5 gallons of filtered water from the WWF. The turbidity of the water shall be measured before sand addition. The sand and water shall be mixed thoroughly for 1 minute, then the sand and water mixture settled for 1 minute. Using a vial, 2 samples of water from 6 inches below the water surface shall be extracted. The vials shall be agitated, and then their turbidities shall be measured on a properly calibrated Hach 2100P turbidimeter. The test shall be repeated with a second 5-pound sand sample and filtered water. The average turbidity reading from the 4 samples shall not exceed 50 NTUs.
- B. The Owner's representative shall conduct the water quality tests.

## 2.3 FILTER SAND SAMPLE SUBMITTAL

- A. **Test Run Submittal Procedures:** The Contractor shall submit a 1 cubic yard (CY) test run of filter sand. The test run shall be produced at a materials processing facility owned and/or operated by the Filter Sand supplier and shall be representative of sand that can be produced full-scale in the amounts required, as specified in Part 3. The test samples shall then be transported to a designated location at the WWF site a minimum of 10 calendar days prior to scheduled placement of materials in the filter beds. An Owner's representative shall observe and document the source pit, the location and type of processing equipment, a portion of the test run, and the shipment of the test run to WWF. One representative 10-pound sample of the 1 CY filter sand submittal shall be collected upon delivery to the WWF by the Owner's representative and tested by an independent laboratory of the Owner's choosing. The sample must meet or exceed the criteria set forth in Parts 2.1 and 2.2 above. The Contractor may request that additional samples of the test run be analyzed if there is any question of the integrity of the samples or the sampling procedures.
- B. **Payment for Test Run Submittal:** The costs for the production and hauling of the test run submittal shall be borne entirely by the Contractor. The cost for laboratory analyses of all samples of the test run shall be borne by the Owner.

## PART 3 – EXECUTION

### 3.1 NEW FILTER SAND PRODUCTION

- A. Produce and deliver new filter sand in the estimated amounts and the anticipated delivery times to the WWF during construction as follows:

<b>Construction Package</b>	<b>Estimated Sand Quantity Required (Tons)</b>	<b>Anticipated Timing</b>	
		<b>Begin Deliveries</b>	<b>End Deliveries</b>
Filter 1	1,875	Mar. 22, 2010	April 7, 2010

- B. The actual amounts and timing may vary based on design and/or project schedule changes. The bid unit cost shall be for the total quantity of filter sand required. No adjustment in the unit cost will be allowed for changes in quantities or the delivery schedule.
- C. The Contractor shall include hauling of all sand, from the point of production to the equipment doing the placement, and the placement of the sand. Storage of sand on-site will only be allowed on a very limited basis.

- D. It is anticipated that the Contractor's sand supplier will need to mobilize sand washing/processing equipment by March 1, 2010 in order to meet the delivery schedule. Assuming a sustained production rate of 150 tons/day, production of 1875 tons of filter sand could take at least 13 days.

3.2 N/A

### 3.3 SAMPLING, TESTING, AND ACCEPTANCE OF FILTER MATERIALS

#### A. GENERAL

Requirements for sampling, testing, and acceptance of filter sand and filter underdrain gravel during production and delivery, including associated specific quality control and acceptance procedures, shall generally conform to the requirements of AWWA Standard B100b-96 except as modified herein.

#### B. SAMPLING

A composite sample shall be obtained from approximately every 1000 tons of filter material produced at the point of production. The composite sample shall consist of 7 representative material samples taken each day for approximately 7 consecutive days of material production. Thus, each composite sample will represent the characteristics of the material being produced on a continual basis. The set of 7 daily lot samples shall be reduced to a composite sample with a minimum weight of 10 lb. for testing in accordance with ASTM C702. Additional samples may be taken at the direction of the Engineer or the Owner.

The Contractor shall be responsible for collecting the daily lot samples. Each sample shall be identified with the date, time, and any other appropriate identification as directed by the Engineer or the Owner. A representative of the Owner shall be responsible for compiling each set of 10 daily lot samples into a composite sample for testing.

#### C. TESTING

All composite samples shall have a sieve analysis performed in accordance with ASTM C136 to determine ES, UC, and percent fines for the sand. Sieve analyses shall be performed by an independent material testing laboratory of the Owner's choosing. This does not constrain the Contractor from performing additional sieve analyses at the production site to ensure good quality control. The Owner shall pay for testing composite samples specified herein. Retesting of material that had been previously rejected or additional QA/QC testing performed by the Contractor shall be paid for by the Contractor.

Every fifth composite sample shall also be analyzed for specific gravity in accordance with ASTM C127 and acid solubility as per AWWA B100b-96,

Section 3.3.1. These analyses shall be performed by an independent material testing laboratory of the Owner's choosing. The Owner shall pay for these tests. Retesting of material that had been previously rejected shall be paid for by the Contractor.

Every tenth composite sand sample shall be tested for initial wash water turbidity as per the method outlined in Part 2.2 of this specification. These tests shall be conducted by the Engineer or the Owner's representative and shall be paid for by the Owner.

Immediately prior to loading of filter materials for delivery to the WWF, the Contractor shall submit to the Owner's representative the results of the moisture content tests for one representative sample of materials being hauled that day. Tons of sand delivered shall be adjusted for all sand above the 5% allowance. These tests are required to determine the basis of payment for delivered materials. The Contractor shall provide for and bear all costs of the moisture content tests.

#### D. ACCEPTANCE AND REJECTION

Filter materials that have passed each and every part of the applicable requirements of Part 2, as verified by the Owner's representative, will be allowed to be hauled to the WWF construction site. No filter materials shall be hauled to the site that has not been verified as having passed all testing criteria. Should a run of material fail to meet all requirements of Parts 2.1 or 2.2 (sand), the Contractor may, upon approval from the Owner, reprocess the material in question to meet the specifications. Retesting of such material shall be required according to the requirements of Part 3.4.C.

Filter materials that have been improperly handled or stockpiled, as per Part 3.4, or hauled, as per Part 3.5, will be rejected and not paid for by the Owner.

### 3.4 STOCKPILING AND HANDLING OF FILTER MATERIALS

- A. Stockpiling of filter materials at the production site shall be in such a manner that they do not come into contact with any other materials. This includes stockpiling of new sand, used sand, and gravel. The stockpile areas shall be well drained and sloped and bermed as necessary to preclude contact with storm runoff and drainage from other material stockpiles and equipment areas. To the maximum extent practicable, stockpiles shall be placed so as to avoid contamination from vehicles, stationary equipment, and excessive dust or other airborne contaminants.
- B. The Contractor shall clearly delineate and identify all filter material production and stockpiling areas.
- C. The Owner's representative shall make periodic inspections of the stockpiles to ensure conformance with the intent of these requirements. Any material that is determined by the Owner to have been improperly handled or

stockpiled, or has been contaminated, shall be rejected and removed immediately by the supplier from the filter material stockpile areas.

### 3.5 HAULING OF FILTER MATERIALS

- A. Hauling of accepted filter materials from the point of production to the WWF construction site shall be in trucks that are being used for no other purpose than to transport filter materials. Trucks that have been hauling other rock or sand materials shall be thoroughly washed with 2 ppm or greater chlorine solution prior to loading with filter materials. Equipment used for loading filter sand in trucks shall meet the same criteria. These requirements shall apply to the hauling of both new filter materials and cleaned/reclassified sand.
- B. Under no circumstances shall loaders and trucks that have been used to haul dirt, sludge, debris, stumps, vegetative, or other organic-based materials be allowed to haul filter materials, unless approved by the Owner. The Owner may elect to allow loaders/trucks that have hauled such material to be used, provided that the truckbed is thoroughly washed and disinfected with chlorine solution of at least 5 ppm strength, or cleaned and disinfected to the Owner's satisfaction.
- C. Should a load of material be delivered to the site in a truck that does not meet the above criteria, the entire load will be rejected and shall be removed immediately by the supplier. The supplier shall bear all costs associated with removal. Any and all rejected material shall not be used for the WWF filters, even after reprocessing/washing.
- D. Trucks hauling filter materials to the filter beds shall follow specific traffic routes at the WWF site to help preclude excessive pickup of foreign materials that may contaminate the filter materials. The traffic routes will be established by the construction contractor and approved by the Engineer. In addition, as directed by the Engineer, trucks may be stopped and visibly inspected for excessive material (mud, etc.) from the truck tires and undercarriage at a designated control point near the entrance of the WWF site. Trucks with excessive amounts of mud will not be permitted to deliver materials.
- E. Temporary stockpiling of filter materials at the WWF site may be allowed on a limited basis. As explained in Part 3.1, the Contractor shall coordinate with the Owner to establish a filter materials delivery schedule. It is anticipated that the delivery or off-load point will be at or adjacent to the filter access ramps.
- F. Placement of the sand is to be accomplished by conveyORIZED methods. Prior approval by the engineer is required before the contractor may be allowed to drive equipment on the sand for the purposes of moving materials into place. Cleaning and disinfecting of all equipment entering the filter beds is required to be accomplished according to Section 3.5 B above.

### 3.6 PLACING OF SAND

- A. Sand deliveries will be scheduled by the contractor to coincide with the rate of placement achievable from the conveyORIZED delivery system, estimated to be in the order of 300 cu yds per hour.
- B. The temporary storage area for filter sand is a 65' by 30' asphalt pad with concrete barriers on three sides. No sand may be stockpiled outside of this protected area.
- C. Motorized equipment may be allowed on the filter beds for moving sand into place with the Engineers prior approval only. The preferred method of placement is by conveyORIZED delivery system with manual labor assistance for final grading.

**END OF SECTION**