5. COMPLETING FILTER-ASSESSMENT REPORTS

ATTENTION SWMOR2 USERS
Since you are monitoring CFE turbidity levels instead of IFE turbidity levels, we require you to conduct a Filter Assessment based on your CFE readings instead of based on the IFE readings.

In addition, you will be unable to document which of your two filters is causing the problem since you do not have a turbidimeter on each filter. Consequently, we also require you to prepare a filter-assessment report for each of your two filters whenever your CFE turbidity levels exceed 1.0 NTU on three separate occasions.

Because the monitoring location for your plant would be the principle difference between the two sets of instructions for SWMOR and SWMOR2 users, this chapter applies to all surface water treatment plants.

If you have a filter that consistently produces water with an elevated turbidity level, you will need to conduct a special filter study called the Filter Assessment. It is important to note that you only have to complete the filter-assessment report if two consecutive 15-minute turbidity readings are above 1.0 NTU at the outlet of an individual filter on three separate occasions during any consecutive three months. For example, you would have to submit a completed FAR if *any* of the following situations has occurred:

- The IFE turbidity level at the outlet of Filter No. 3 was above 1.0 NTU on August 3, August 9, and August 20.
- The IFE turbidity level at the outlet of Filter No. 1 was above 1.0 NTU on September 20, October 3, and November 30.
- The IFE turbidity level at the outlet of Filter No. 6 was above 1.0 NTU on January 5, March 20, and March 22.

As our examples above suggest, there are several different combinations of events that can trigger a filter assessment. In order to help you comply with the rules, the SWMOR and SWMOR2 spreadsheets automatically determine if you need to conduct a filter assessment.

IMPORTANT
When you conduct a filter assessment, you will need to actually get down into the filter and make some physical measurements and excavate some of the media. Any time that you do these kinds of studies, be very careful to avoid injuring yourself or damaging the filter media. Therefore, you need to develop and document the procedures you will use before you actually begin the filter assessment. Appendix H contains an example of a standard operating procedure that was developed by plant operators during one of our technical-assistance pilot projects. Although your procedures may be significantly different from those developed for that plant, step-by-step procedures for conducting a filter assessment are essential.

The filter-assessment report, or FAR, shares many features with the SWMOR. For example:

- The FAR is an Excel spreadsheet that contains many comment boxes and drop-down menus. If you are unfamiliar with these spreadsheet features, you can learn more about them in Section 1.5.
- You must complete the FAR electronically.
- You can download a copy of the FAR at our website or we can send you a copy on the SWMOR CD-ROM.

The FAR contains several major sections. Except for the sections on the plant and operator information, each of these sections is titled and inside a box that is bordered with a thick, dark line. For example, page 1 of the FAR contains the **Design Specification** and the **Operating Procedures** sections, and page 2 contains the sections on **Current Conditions**, **Media Surface Conditions**, and **Backwash Conditions**.

General Instructions

You will need to make several measurements during the filter assessment and record the results on the FAR spreadsheet. All of this data must be entered in a decimal format. For example, if one of the measurements results in a reading of 12 feet 6 inches, you will need to enter <12.5> on the FAR spreadsheet. Similarly, 6 feet 8 inches must be recorded as <6.67> feet.

5.1 PLANT AND OPERATOR INFORMATION

You will only need to complete the blanks for plant and operator information on page 1 of the FAR. Once you fill in this information, it is copied into the corresponding cells on pages 2, 3, and 4.

Public Water System Name

Enter the name of your public water system. The water-system name shown on the SWMOR and the one you enter on the FAR must be identical.

Plant Name or Number

If your water system has more than one treatment plant, enter the name of the plant that collected the data contained in this specific report. You do not have to complete this blank if your water system has only one treatment plant. Again, to avoid

confusion, please make sure that the plant name shown on the SWMOR matches the one you enter here.

PWS ID No.
Enter your water system's seven-digit PWS ID number.

Filter Number
Enter the number of the filter that you are evaluating. You must enter the number of the filter as it appears on page 3 of the SWMOR, for example, Filter No. 6. We realize that this filter number may not correspond with the numbering system you use at your plant, so we have left enough space for you to add some information if you need to. For example, if Filter No. 6 corresponds to your Filter 3-West, the completed form might look like this:

Operator's Signature
After the completed FAR form has been printed, the operator who was in charge of conducting the filter assessment must sign the bottom of page 1. This operator may or may not be the same person who is responsible for the daily operation of the plant. Consequently, the individual who signs the FAR form may not be the same person who signs the SWMOR. The signature must be handwritten in ink. Stamped signatures and typewritten names are not acceptable.

Operator's Name (printed)
Enter the name of the operator who is signing the FAR.

License No. and Class
Enter the license number and the type of license held by the operator who is signing the FAR.

Date
Enter the date that the FAR was signed.

5.2 DESIGN SPECIFICATIONS
This portion of the FAR contains design information on the filter that you are evaluating. In order to complete this portion, you will need the following:

- Design information from a variety of sources including engineering drawings for the plant
- Specifications for the filter, its media, and its appurtenances
- Information from pump curves and other plant documentation

Filter Type
Select the type of filter that you are evaluating from the drop-down list. Table 5.1 contains a general description of each type of filter contained in the drop-down list.

Table 5.1. Filter Type drop-down list.

Item	Description
Gravity	If the top of the filter is open to the atmosphere, it is probably a gravity filter. In these filters, settled water usually flows by gravity from the clarifier or sedimentation basin into the filter.
Pressure	If the filter is completely enclosed, it is probably a pressure filter. A transfer pump is usually used to pump settled water into the filter.
Permutit	A proprietary gravity filter that is fully enclosed. The filter discharges to a backwash tank immediately above the filter bed.
Other	If you are not sure what kind of filter you have, select "Other" and then describe the filter in the Additional Remarks area or include a copy of the filter's engineering drawings.

Operating Mode

Select the operating mode for the filter that you are evaluating from the drop-down list. Table 5.2 contains a general description of each operating mode contained in the drop-down list.

Table 5.2. Operating Mode drop-down list.

Item	Description
Constant Rate/ Constant Level	The outlet of these filters is typically equipped with a mechanical rate-of-flow controller or a SCADA-controlled motorized flow control valve. As the head loss through the filter increases, the flow controller automatically opens more to maintain the preset flow rate. Typically the inlet to these filters is completely submerged, and the water level is essentially the same in all of the filters during the entire filter run.
Constant Rate/ Variable Level	The flow rate in these filters is typically controlled by a weir, a telescoping valve, or some other device located at the inlet of the filter rather than at its outlet. As the water passes though the flow-control device, it falls through an air gap into the filter inlet pipe. Once the water passes through the air gap, there is no way for it to be redirected to another filter. Consequently, as the head loss increases, the water level in the filter rises. The rising water level provides the additional head needed to maintain the desired flow rate.
Declining Rate	In this operating mode, the inlet piping to the filters is completely common and no attempt is made to maintain a uniform flow rate through the filter. At the beginning of filter run, the flow rate is limited by an orifice plate (or flow-control valve and flowmeter) located at the filter outlet. As the head loss in a filter increases, the flow rate decreases and water tends to be redirected to other, cleaner filters.
Other	If you are not sure what kind of filter you have, select <Other> and then describe the filter's operating mode in the Additional Remarks area or on a separate page.

Media Bed Dimensions

Diameter (ft), Length (ft), and Width (ft)

If you are conducting an assessment on a round filter, enter the diameter of the filter bed but leave the length and width boxes empty. If the filter has a rectangular bed, enter the length and width of the media bed, but leave the diameter box empty.

Surface Area (ft^2) *CALC*

The spreadsheet will automatically calculate the surface area of the media bed if you entered the filter-bed dimensions correctly. However, if you have made a mistake entering the dimensions, the word "ERROR" will appear in the surface area cell.

Freeboard (ft)

Measure the distance from the top of the filter bed to the upper edge of the backwash water trough.

Max Head Loss (ft)

Enter the maximum available head loss for the filter, that is, the maximum head loss that can be achieved during a filter run. This information can often be obtained from engineering drawings or filter specifications. However, if these sources do not provide you with the information, you can use the method shown in Figure 5.1. When using this method, the maximum water level in the filter can be based on whichever design feature controls the maximum water level in the filter. For example, the controlling feature could be any one of the following:

- the overflow elevation of the filter wall
- the bottom of the filter overflow pipe
- the maximum water level that can be achieved in the clarifier

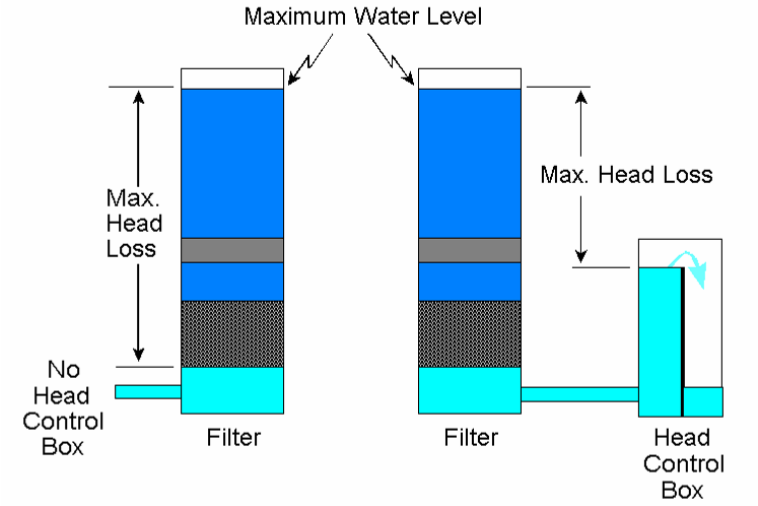

Figure 5.1. Determining maximum available head loss.

Media Type

Using the drop-down list, select the type of media bed in the filter that you are evaluating based on the original filter design. This information should be based on information you obtain from the engineering drawings or filter specifications. *Do **not** answer this question based on information you obtain during a filter excavation.* Table 5.3 contains a general description of each media type contained in the drop-down list.

Table 5.3. Media Type drop-down list.

Item	Description
Multiple Media	These filters contain at least three different media materials. The most common design uses garnet, sand, and anthracite media.
Dual Media	These filters contain exactly two different types of media. The most common design incorporates sand and anthracite.
Rapid Sand	This design utilizes only sand media.
Deep-bed Mono Media	This filter contains at least 48 inches of a single type of media. These filters commonly contain either anthracite or granular activated carbon.
Other	If this filter contains a media bed or material that is not adequately described by the other options in the drop-down list, select "Other" and then describe the filter's media bed in the Additional Remarks area or on a separate page.
Unknown	Select this option if you cannot find any engineering drawings or media specifications describing the type of media used in the filter.

Media Specs

If you do not have the specifications for the media that was installed in the filter being evaluated, select <Unknown> for the material used in Layer 1 and leave the rest of this section blank.

Material

Using the drop-down list, select the type of filter material in each layer in the filter bed. If the filter contains fewer than four layers, select the materials used in each layer that the filter does have and leave the other layers blank.

Depth (inches)

Record the thickness of each media layer in inches.

Min. Size (mm) and Max. Size (mm)

Look at the media specifications. If the specifications give a range of acceptable sizes for each layer, enter the minimum and maximum values for the size range. On the other hand, if the specifications give only a single size, enter that value in both the minimum and maximum spots.

UC

Enter the uniformity coefficient for each of the media materials used in the filter. If the specifications do not include a uniformity coefficient value for one or more of the materials, enter <Unknown> in the appropriate boxes.

Specific Gravity
If the media specifications include a specific gravity for the filter media, record the value in the appropriate box. If no specific-gravity specification is available, enter <Unknown>.

Total Depth (inches) *CALC*
If you have entered the depth of each media layer, the spreadsheet will automatically calculate the total depth. However, if you do not have the media specifications and selected <Unknown>for the material in Layer 1, the spreadsheet will automatically enter <Unknown> in this spot.

L/D Ratio *CALC*
The spreadsheet will use the information that you entered about media depth and size to automatically calculate the L/d ratio for the filter.

Underdrain System

Underdrain Type
Select the type of underdrain system that is being used in the filter that you are evaluating from the drop-down list.

Support Gravel

No. of Grades
If your filter contains one or more layers of support gravel, enter the number of different sizes that are specified in the filter specs. If you are using one of the gravel-less underdrain systems and have no support gravel, enter <None> in the **No. of Grades** cell but leave the rest of the boxes in this area blank.

Min. Size (in) and Max. Size (in)
If your filter contains support gravel, record the maximum and minimum gravel sizes in the appropriate box.

Total Depth
Record the total thickness of the gravel support layer.

Troughs

Number
Record the number of backwash troughs in the filter that you are evaluating.

Separation (inches)
Enter the distance (in inches) between the edges of two adjacent troughs. If the troughs are not the same distance apart, enter <Variable> in this spot and describe the arrangement in the **Additional Remarks** area of the form. Also, if the edge of the last trough is further from the filter wall than the distance between adjacent troughs, include this measurement in the **Additional Remarks** area.

Suppl. Backwash

Using the drop-down list, select the type of supplemental backwash system used in the filter. Table 5.4 contains a general description of the items in the list.

Table 5.4. Supplemental Backwash drop-down list.

Item	Description
None	If the filter contains no supplemental backwash equipment, select “None” from the list. Select “None” only if the filter does not contain any supplemental backwash facilities. Make other selections if the filter contains supplemental backwash equipment that is not used or if the equipment is broken.
Surface Wash	The filter has a supplemental backwash system with fixed or rotating arms that are designed to wash the surface of the media at the beginning of the filter backwash cycle.
Subsurface Wash	The filter has a fixed or rotating arm system that is designed to operate beneath the surface of the media when the bed has been expanded during the backwash cycle.
Air Scour	The filter was equipped with an integral air-scour backwash system during its initial construction or a major renovation. Usually, this choice applies whenever the air-scour system is incorporated into the design of the underdrain.
Air Scour (retrofit)	Select this choice if an air scour system has been installed in a filter after construction. Usually, these air scour systems are not an integral part of the underdrain design and utilize a network of laterals that are installed on top of the support gravel layers.
Other	If you are sure that you have a supplemental backwash system but do not know what kind it is, select “Other” and then describe the system in the Additional Remarks area or on a separate page.

Filter-to-Waste

Using the drop-down list, record whether the filter has the ability to filter to waste.

Flow and Loading Rates

Filter Flow Rate (gpm)

Regulatory Std *CALC*

The spreadsheet will automatically record the filter flow rate allowed by the TCEQ rules based on the surface area of the filter bed, the data you have entered in the **Filter Type** and **Operating Mode** boxes, and the maximum allowable filter loading rate.

Design

Enter the flow rate at which the filter is designed to operate.

Typical

Enter the typical flow rate through the filter when it is operating under normal conditions.

During Backwash
Enter the typical flow rate through the filter when one of the other filters is being backwashed.

Maximum
Enter the maximum flow rate that routinely occurs during a typical filter run.

App'd Exception
If your plant has received our written permission to operate a flow rate that is above the normal regulatory limit, enter the filtration rate that we have approved for the filter, and enter the date that we sent you the letter approving the higher flow rate in the **Additional Remarks** box. If you have not received written permission to operate at higher flow rates, leave this box empty.

Loading Rate (gpm/ft^2)
Regulatory Std *CALC*
The spreadsheet will automatically record the maximum filter loading rate allowed by our rules based on the data you have entered in the **Filter Type** and **Operating Mode** boxes.

Design, Typical, During Backwash, and Maximum *CALC*
The spreadsheet will automatically calculate the filter loading rate for each of the operating conditions based on the size of the filter bed and the flow rate information you provided.

App'd Exception
If your plant has received our written permission to operate at a filter-loading rate that is above the normal regulatory limit, enter the rate we have approved for the filter, and enter the date that we sent you the letter approving the higher flow rate in the **Additional Remarks** box. If you have not received written permission to operate at higher flow rates, leave this box empty.

BW Flow Rate (gpm)
Regulatory Std *CALC*
The spreadsheet will automatically record the minimum backwash-water flow rate allowed by our rules and the maximum backwash water flow rate that we typically recommend. Both of these values are based on the reported surface area of the filter bed.

Design
Enter the maximum backwash-water flow rate that can be achieved during a backwash cycle. The "design" backwash rate can be limited by factors such as:

- the design capacity of the backwash pump
- the maximum flow rate that can be achieved through the remaining filters
- the hydraulic capacity of the backwash supply header

In some cases, it may not be possible to determine a "design" capacity of the backwash system. If you cannot determine the designed backwash water flow rate, enter <Unknown> in this cell.

Typical

Enter the typical backwash-water flow rate that occurs during a backwash cycle. If the backwash rate changes during a routine cycle, enter the rate that is maintained during the main part of the cycle. Do not enter the backwash rate during the surface wash or air-scour cycle unless that rate is maintained throughout the entire backwash cycle. If the backwash cycle includes "ramp up" and "ramp down" periods, do not record those values.

Maximum

Enter the maximum backwash water flow rate that routinely occurs during a typical filter backwash cycle.

BW Loading Rate (gpm/ft^2)

Regulatory Std *CALC*

The spreadsheet will automatically record the minimum backwash-water loading rate allowed by our rules and the maximum rate we typically recommend.

Design, Typical, and Maximum *CALC*

The spreadsheet will automatically calculate the filter-loading rate for each of the operating conditions based on the size of the filter bed and the flow rate you provided.

Filter Control and Monitoring Equipment

Filter Influent

Controller

Select the type of flow rate controller used to control the rate of flow *into* the filter from the options shown in the drop-down list. When you answer this question, only consider those devices that are used to proportion or otherwise regulate the flow rate into the filter. Do not include the valves if they are only used to isolate the filter (that is, stop the settled water flowing into the filter) during a backwash cycle. Table 5.5 contains a general description of the items in the drop-down list.

Meter

Using the drop-down list, select the type of meter that is used to monitor the flow rate *into* the filter. Table 5.6 contains a general description of each meter contained in the drop-down list.

Table 5.5. Rate-of-Flow Controller drop-down list.

Item	Description
None	Select this option if the inlet piping of the filter does not have a rate-of-flow control device. Also select this option if the filter inlet has a flow control valve that is only used to isolate the filter during backwash or one that is only used in the fully open or fully closed positions.
Fix. Weir Splitter	The flow rate into the filter inlet is controlled by a splitter box with a fixed weir or gate that was not designed to be raised or lowered. You should also select this option if the splitter box has drop pipes that control the distribution of water to the filters.
Var. Weir Splitter	This option applies if the flow rate to the filter inlet is controlled by a splitter box with a weir or gate that was designed to be raised or lowered.
Man. Telescoping	Select the manual telescoping valve option if the filter is supplied by a trough containing an adjustable telescoping valve.
Man. Butterfly	Choose this only if a manual butterfly valve is used to regulate the flow rate into the filter. Choose "None" if the valve is only used in the fully open or fully closed position.
Mechanical ROFC	This option applies if there is a mechanical rate-of-flow controller on the inlet piping to the filter.
Mot. Valve (Auto.)	Select this option if the filter has a motorized valve on its inlet pipe that automatically maintains the desired flow rate.
Siphon Pipe	Select this option if the feed rate into the filter is controlled by the size of a siphon pipe. This control mechanism is used in a proprietary design in the Greenleaf filter.
Orifice Plate	This option applies if the flow rate into the filter is limited by an orifice plate.
Other	If you are sure that you have a flow control valve on the inlet piping to the filter but you do not know what kind it is, select "Other" and then describe the device in the "Additional Remarks" area or on a separate page.

Turbidimeter

If the inlet of the filter is equipped with an online turbidimeter, enter its make and model number. If there is no online turbidimeter at the filter inlet, enter <None> in this box.

Filter Effluent

Controller

Select the type of flow-rate controller used to control the rate of flow *at the outlet* of the filter from the options shown in the drop-down list. When you answer this question, only consider those devices that are used to proportion or otherwise regulate the flow rate as it leaves the filter. Do not include the valves if they are only used to isolate the filter (that is, stop the flow of filtered water) during a backwash cycle. You can use Table 5.5 for a general description of the items in the drop-down list, but remember that this box applies to the flow-control devices at the outlet of the filter, rather than the one at its inlet.

Table 5.6. Meter drop-down list.

Item	Description
None	This selection applies only if you have no way to determine the flow rate into the filter.
Proportional	Select this option only if both of these conditions apply: The filter is equipped with a non-adjustable rate-of-flow controller such as a fixed weir, siphon tube, or orifice plate The overall flow rate to the filter battery is metered at some point upstream of the filters
Venturi **Orifice** **Propeller** **Nunating Disk** **Paddle** **V-notch Weir** **Flat Weir** **Parshall Flume**	If the inlet of the filter is equipped with a rate-of-flow indicator, select the appropriate type of device.
Other	If you are sure that you have a way of determining the flow rate into the filter but none of the other options adequately describe the method, select <Other> and then describe the method in the **Additional Remarks** area or on a separate page.

Meter

Using the drop-down list, select the type of meter that is used to monitor the flow rate *at the outlet* of the filter. You can use Table 5.6 for a general description of the items in the drop-down list; just remember that this box applies to the metering device located at the outlet of the filter rather than the one located at its inlet.

Turbidimeter

If the outlet of the filter is equipped with an online turbidimeter, enter the make and model number of the unit. If there is no online turbidimeter at the filter outlet, enter <None> in this box.

LOHG

Select the type of loss-of-head gauge used in the filter that you are evaluating from the drop-down list. Table 5.7 contains a general description of each item contained in the drop-down list.

Turbidimeter

If the inlet of the filter is equipped with an online turbidimeter, enter its make and model number. If there is no online turbidimeter at the filter inlet, enter <None> in this box.

Filter Effluent

Controller

Select the type of flow-rate controller used to control the rate of flow *at the outlet*

of the filter from the options shown in the drop-down list. When you answer this question, only consider those devices that are used to proportion or otherwise regulate the flow rate as it leaves the filter. Do not include the valves if they are only used to isolate the filter (that is, stop the flow of filtered water) during a backwash cycle. You can use Table 5.5 for a general description of the items in the drop-down list, but remember that this box applies to the flow-control devices at the outlet of the filter, rather than the one at its inlet.

Table 5.7. Loss-of-Head Gauge (LOHG) drop-down list.

Item	Description
None	Select this option if you do not have any way to determine the head loss in the filter.
Differential Gauge	Your filter has a single gauge or indicator that gives a direct loss-of-head reading. This type of device is commonly incorporated into SCADA systems.
Two Gauges	Choose this option if you determine the head loss within your filter by manually subtracting the readings from two separate gauges.
Water Lvl Indicator	This option applies if filter head loss is determined using a ruled water level indicator. This type of device is commonly used on constant-rate, variable-level filters.
Other	If you are sure that you have a way of determining the head loss but none of the other options adequately describe the method, select <Other> and then describe the method in **Additional Remarks** or on a separate page.

Backwash Water Source

Using the drop-down list, describe the method used to deliver backwash water to the filter. Table 5.8 contains a general description of each item.

Table 5.8. Backwash Water Source drop-down list.

Item	Description
Filter Effluent	Select this option if the only source of backwash water is the output of the other filters. This means that a filter cannot be backwashed unless the other filters are in operation. In some designs, the backwash water is supplied directly by the other filters. In other designs, the water enters a head control box, which then supplies the backwash water.
Filters & Pump	Select this option only if both of these conditions apply: • The principal source of backwash water is the other filters • The plant can augment the filter output with additional water from the clearwell or distribution system Again, the filter cannot be backwashed unless the other filters are in operation. The clearwell/distribution system is only used to ensure an adequate backwash rate when the other filters are not producing enough water.
Dedicated BW Pump	The filter is backwashed using a dedicated backwash pump that draws water from a clearwell or filtered water sump. In this design, the other filters do not have to be in operation during a backwash cycle. The backwash pump has enough capacity to adequately backwash the filters whether or not the plant is treating water.
Elevated BW Tank	The plant has an elevated storage tank that it uses to supply backwash water for the filters. In this design, the elevated tank serves no other purpose than to backwash the filters; it is not connected to the distribution system.
Service Pump	This option applies if the backwash water is supplied by the same pumps that discharge to the distribution system.
Distribution	The plant uses the distribution system as the principal source of its backwash water.
Other	If none of the other options adequately describe the source of the backwash water, select <Other> and then describe the method in the **Additional Remarks** area or on a separate page.

Controller

Select the type of rate-of-flow controller used to regulate the backwash water flow rate from the choices shown in the drop-down list. When you answer this question, only consider those devices that are used to regulate the flow rate of the backwash water. Do not include the valves if they are only used to isolate the filter—that is, to start and stop the flow of backwash water. You can use Table 5.5 for a general description of the items in the drop-down list, but you have to remember that this box applies to the flow-control devices on the backwash-water supply line rather than the one at the filter inlet.

Meter

Using the drop-down list, select the type of meter that is used to monitor the backwash water flow rate. Use Table 5.6 for a general description of the items in the drop-down list; just remember that this box applies to the metering device located on the backwash water supply line rather than the one located at the filter inlet.

Turbidimeter

If the filter is equipped with an online turbidimeter to measure the turbidity of the spent (dirty) backwash water, enter the make and model number of the unit. If the turbidity of the spent backwash water is not monitored using an online turbidimeter, enter <None> in this box.

Additional Remarks

If you need to explain or clarify any of the information that you supplied in the **Filter Design** portion of the FAR, enter that information here. If you need more space, you can enter <See attached sheet.> in this box and include your remarks on a separate page.

5.3 OPERATING PROCEDURES

This portion of the FAR contains information about the way the filter is operated and maintained. Most of the information can be obtained from the plant's standard operating and maintenance procedures.

Calibration

Method, Flowmeter
Method, Backwash Meter
Method, Mech. ROFC

Enter data in each of these boxes by selecting the appropriate item from the drop-down list. Table 5.9 contains a general description of the more common methods used to calibrate flowmeters and mechanical rate-of-flow controllers.

Table 5.9. Flowmeter and Other Calibration Methods drop-down list.

Item	Description
Unknown	Select this option if you do not know what method was used to calibrate the flowmeters and rate-of-flow controllers the last time that they were calibrated. Only use this option when the calibration was checked or adjusted by a third-party contractor and you don't know what method was used. If you choose this option, enter the name of the company that performed the service in the **Additional Remarks** box.
Weirs	Select <Weirs> if you calibrated the device using a weir.
Flume	Select <Flume> if you calibrated the device using a flume.
Ultrasonic	This option applies if the device was calibrated using an ultrasonic meter.
Time & Volume	The flowmeter or ROFC was calibrated by measuring the volume of water that was discharged within a given period of time.
Other	If you or your third-party contractor used some other method to calibrate the flowmeter or rate-of-flow controller, select <Other> and then describe the method in the **Additional Remarks** area or on a separate page.

Method, NTU (primary)
Method, NTU (secondary)
Use the drop-down list to select the type of primary and secondary standards used when calibrating the online turbidimeters. We are using the *primary standard* to mean the method used when conducting a full calibration of the turbidimeter, and s*econdary standard* to mean the method used when you are only checking the calibration of the online turbidimeter.

Table 5.10 contains a general description of the methods commonly used to calibrate online turbidimeters.

Frequency (each device)
Record how often you calibrate each of the filter devices using the drop-down list.

Date (each device)
Record the date that you calibrated each device the last time.

Backwash

Criteria
For each of the parameters listed in this area, enter the reading that would trigger a backwash cycle at your plant.

Table 5.10. Turbidimeter Calibration Methods drop-down list.

Item	Description
Formazin	Select this option if you are preparing a calibration solution using a 4000 NTU formazin solution. This method requires you to make one or more dilute solutions, which are then used to calibrate the instrument.
Stablized formazin	You are using a prepared stabilized formazin product such as Hach's StablCal to calibrate the online turbidimeter.
Polymer beads	You use a polymer-bead product such as the AEPA's standard polystyrene to calibrate the turbidimeter.
Gel	You are using a prepared-gelatin standard such as Hach's Gelex to calibrate the turbidimeter.
Comparison	The online turbidimeter is calibrated based on the results from another turbidimeter.
Proprietary device	You are calibrating the online monitor with a manufacturer's proprietary device such as GLI's turbid glass calibration cube or Hach's ICE cube.
Other	If none of the typical methods describes the one that you are using to calibrate your online turbidimeter, select <Other> and then describe the method in the **Additional Remarks** area or on a separate page.

Monitoring Interval

Enter the frequency that you monitor each of the parameters. For example, if you monitor the turbidity every six minutes, enter <6 min.> in the **Turbidity (NTU)** space; and if you monitor the head loss once each 12-hour shift, enter <12 hrs> in the **LOH (ft)** space.

Written Standard Operating Procedures (SOPs)

Select the item from the drop-down list that best describes the condition of each of the listed standard operating procedures. Table 5.11 contains a general description of each item contained in the drop-down list.

Table 5.11. Drop-down list for the status of standard operating procedures.

Item	Description
Complete	This option applies only if the written SOP lists all of the steps and equipment needed to complete the specific task and is up-to-date.
Partial	The specific SOP is up to date but does not include all of the required steps or does not identify all of the equipment required to complete the listed task.
Out-of-date	The SOP is complete but does not accurately describe the procedures currently used by all of the operators.
None	Select this option only if the plant has no written procedures for completing the tasks or if none of the operators is following the SOP.

Additional Remarks

If you need to explain or clarify any of the information that you entered in the **Operating Procedures** portion of the FAR, enter that information here. If you need more space, you can enter <See attached sheet.> in this box and include your remarks on a separate page.

5.4 CURRENT CONDITIONS

In this portion of the FAR, you will describe the point in the filter run when you are conducting the filter assessment. You will also describe the condition of the filter and its appurtenances. In order to complete this portion of the report, you will need to physically inspect the filter and evaluate the performance of its monitoring and control devices.

Operating Conditions

Date and **Time**

Enter the date and time that you begin the filter assessment.

Turbidity (NTU)

Enter the turbidity of the water leaving the filter at the beginning of the assessment.

LOH (ft)

Record the head loss (loss of head, or LOH) immediately before taking the filter offline to begin the filter assessment.

Flow Rate (gpm)

Record the flow rate through the filter immediately before beginning the assessment. If you cannot determine the flow rate through the individual filter, you should enter <Unknown> in this box.

Run Time (hr)

If you monitor the length of time that the filter is in service between backwash cycles, record the number of hours that the filter has been in operation since the last backwash cycle. If you don't routinely keep track of this piece of information, just enter <Unknown> in the **RUN TIME (hr)** box.

Run Volume (gal)

If you keep track of the amount of water produced during each filter run, record the volume of water that has been filtered since the last backwash cycle. If you don't routinely monitor this piece of information, just enter <Unknown> in the box.

Physical Condition of Filter

Walls and Troughs

Describe the physical condition of the filter walls and backwash troughs in the filters using the respective drop-down lists. Table 5.12 contains a general description of each item contained in the drop-down lists for the physical condition of the walls and troughs.

Table 5.12. Drop-down list for Condition of Walls and Troughs.

Item	Description
Excellent	No rust or corrosion. Coating materials in "like new" condition.
Good	Slight corrosion or coating material damage that has no impact on filter performance or filter life.
Minor Damage	Minor corrosion or filter-wall damage that does not impair filter performance but requires repair during next scheduled filter renovation or repair.
Moderate Damage	Small leaks or other damage in troughs, walls, or other internal structural components that require immediate repair in order to ensure proper filter performance and avoid catastrophic filter failure. Describe the nature of this damage in the **Additional Remarks** area or on a separate page.
Severe Damage	Severe leaks. The filter is at or near the point of catastrophic failure and needs major renovation or replacement. Describe the nature of this damage in the **Additional Remarks** area or on a separate page.
Other	We have no idea why one of the previous options would not adequately describe the condition of the filter. However, you may select <Other> and then describe the situation in the **Additional Remarks** area or on a separate page.

Suppl. Backwash, Flowmeter, ROFC, etc.

Describe the operational condition of the filter appurtenances (equipment and attached devices) using the respective drop-down lists. Table 5.13 contains a general description of each item contained in the drop-down lists for the mechanical condition of the filter appurtenances.

Additional Remarks

If you need to explain or clarify any of the information that you provided in the **CURRENT CONDITIONS** portion of the FAR, enter that information here. If you need more space, you can enter <See attached sheet.> in this box and include your remarks on a separate page.

Table 5.13. Drop-down list for Condition of Filter Appurtenances.

Item	Description
Fully Operational	No apparent or detectable malfunction of any sort.
Slight Malfunction	The device has a slight malfunction that does not affect your ability to control or monitor filter performance. That is, the problem is detectable but does not apparently impair filter performance. Examples of slight malfunctions include: • A surface wash arm that has one or two damaged or missing nozzles. • A rate-of-flow contoller (ROFC) or flow control valve that butterflies slightly. That is, the device does not hold the desired setting for at least 10 minutes but only slight flow rate changes are produced and no apparent changes in the turbidity level result. • A turbidimeter body contains a little sediment or precipitate.
Moderate Malfunction	The device is malfunctioning to the point that your ability to monitor or control the filter is impaired. Moderate malfunctions include: • A rotating surface wash arm that has several damaged or missing nozzles but that will still rotate. • An ROFC or flow control valve that butterflies consistently. That is, the device will not hold the desired setting for at least five minutes, and the resulting flow rate changes are severe enough to cause frequent fluctuations in turbidity levels. • The turbidimeter is subject to intermittent air bubbles that compromise your confidence in the accuracy of the turbidity readings. Describe the nature of this damage in the **Additional Remarks** area or on a separate page.
Severe Malfunction	The device is malfunctioning to the point that you are almost completely unable to monitor or control the filter. Severe malfunctions include: • A rotating surface wash arm that will not rotate no matter whether there are any damaged or missing nozzles. • An ROFC or flow control valve that butterflies continuously. That is, the device will not hold the desired setting for at least two minutes, and the flow changes are severe enough to produce continuous changes in the filtered water turbidity levels. • The turbidimeter light bulb is burned out or the sampling line has stopped flowing, Describe the nature of this damage in the **Additional Remarks** area or on a separate page.
Other	If the previous options would not adequately describe the condition of the appurtenances, you may select <Other> and then describe the situation in the **Additional Remarks** area or on a separate page.

5.5 MEDIA SURFACE CONDITIONS

In this portion of the FAR, you will describe the appearance and condition of the media surface when you begin the assessment and after you backwash the filter. To complete this portion, you will need to get down into the filter and inspect the surface of the media. You must complete this portion of the filter assessment before you probe or excavate the filter.

IMPORTANT
When you get down into the filter to collect the data required by this section, you need to be very careful to avoid injuring yourself or damaging the filter. Therefore, you need to develop and document the procedures you will use before you actually begin the filter assessment. Appendix H contains an example of a standard operating procedure that was developed by plant operators during one of our technical assistance pilot projects. Although your procedures may be significantly different from those developed for that plant, step-by-step procedures for conducting a filter assessment are essential.

You will need to collect the **Before BW** data before you backwash the filters or conduct any other media measurements. The **After BW** information needs to be collected after you backwash the filter but before you begin probing or excavating the filter media. Consequently, the **Before BW** spaces will be completed before you complete the **BACKWASH CONDITIONS** portion of the FAR, while the **After BW** spaces will be completed after you collect the **BACKWASH CONDITIONS** data.

Mounds

Number

Enter the number of mounds that you observe before and after backwashing the filter. Do not include mounds that rise less than one inch above the height of the surrounding media. If there are no mounds in the filter, you can enter <0> or <None> in the appropriate spot.

Length (inches)
Width (inches)
Height (inches)

Describe the size of the mounds. If none of the mounds were higher than 1 inch, you may either leave these spaces blank or enter <NA> in them.

Example 5.1: Describing Mounds on the Filter Surface

As you drain the filter, you identify seven mounds that are at least 1 inch higher than the other media in the filter. The largest mound is 36 inches long and 8 inches wide, and the smallest mound is 8 inches long and 8 inches wide. The mounds range in height from a minimum of 1.5 inches to a maximum of 3.5 inches.

As you prepare to excavate the filter (that is, after backwashing the filter and recording the information required in the **Backwash Conditions** portion of the FAR), you observe that only two mounds remain. Although both of the mounds are rather large (about 3.5 feet, or 42 inches, in diameter), neither is more than one inch high.

The report should look like this:

	Before BW	After BW
MOUNDS		
Number	7	0
Length (inches)	8 - 36	
Width (inches)	8 - 8	
Height (inches)	1.5 - 3.5	

Depressions

Number

Enter the number of depressions that you observe before and after backwashing the filter. Do not include the depressions unless they extend more than one inch below the level of the surrounding media. If there are no depressions in the filter bed, enter <0> or <None> in the appropriate spot.

Length (inches)
Width (inches)
Depth (inches)

Describe the size of the depressions. If none of the depressions were deeper than 1 inch, you may either leave these spaces blank or enter <NA> in them.

Accumulated Floc

Thickness

Enter the thickness of the floc mat before and after backwashing the filter. You may enter the information in either a decimal format or fraction. For example, if the floc mat is ⅜ inch thick, enter the value as either <0.375> or <3/8>. If the floc mat varies in thickness, enter the range of results. For example, if the floc mat ranges in depth from 0 inches to ¼ inch, enter <0–1/4> or <0–0.25>.

Distribution

Select the item in the drop-down list that best describes how extensively the floc mat covers the surface of the filter media. Table 5.14 contains a general description of each item contained in the drop-down list. If there is no floc accumulation on the surface of the media, you may leave the space blank.

Table 5.14. Floc Accumulation drop-down list.

Item	Description
Uniform	The floc mat seems to be evenly dispersed on the top of the filter (that is, it covers most of the media surface) and there is no area that seems unusually free of floc.
Localized	Most of the filter appears to have no accumulation of floc and whatever floc mat that is present seems to be isolated to a few areas within the filter.
Other	The floc mat seems to be relatively uniform but there are isolated, well-defined areas where there is an unusual absence of surface floc. Describe the condition in the **Additional Remarks** area or on a separate page.

Retraction

Number

Enter the number of areas where the filter media has separated from the filter wall. Do not count the area unless the retraction is more than any of the following:

- 12 inches long
- ¼ inch wide
- ½ inch deep

If there are no areas where the filter media has retracted from the filter wall, enter <0> or <None> in the appropriate spot.

Length (inches)
Width (inches)
Depth (inches)

Describe the size of the retractions. You may either leave these spaces blank or enter <NA> if none of the areas are more than any of the following:

- 12 inches long
- ¼ inch wide
- ½ inch deep

Cracks

Number

Enter the number of cracks in the filter media. Do not count the area unless the crack is more than any of the following:

- 12 inches long
- ¼ inch wide
- ½ inch deep

If there are no cracks in the media, enter <0> or <None> in the appropriate spot.

Length (inches)

Width (inches)

Depth (inches)

Describe the size of the cracks. You may either leave these spaces blank or enter <NA> if none of the areas are more than any of the following:

- 12 inches long
- ¼ inch wide
- ½ inch deep

Mudballs

No. per ft^2

Enter the number of mudballs that are present on each square foot of media surface.

- If there are no mudballs on the surface of the media bed, enter <0> or <None> in the appropriate spot.
- If there are too many mudballs to count in one or more areas of the filter, enter <TNTC> which stands for "Too Numerous To Count."
- If the distribution of mudballs is not uniform across the media bed, enter the minimum and maximum number that you observe. For example, <0–4>, <2–15>, and so forth.

Size (inches)

Describe the size of the surface mudballs as follows:

- If there are no mudballs on the surface of the media bed, you may either leave the spaces blank or enter <NA> in each one
- If the mudballs are all less than ½ inch in diameter, you can enter < <½ >, which stands for "less than ½ inch," in the appropriate space
- If the size of the mudballs exceeds 6 inches in diameter, you may enter < 6+ > or < >6 > in the appropriate space
- If the size of the mudballs varies, enter the maximum and minimum sizes. For example, < 0.25–1.5 >, or < <¼–6+ >, < 0.5–9.0 >, and so forth

Distribution

Select the item in the drop-down list that best describes how the mudballs are spread across the surface of the filter media. Use the general descriptions contained in Table 5.14 to decide which item in the drop-down list best describes the mudball distribution in the filter.

Additional Remarks

If you need to explain or clarify any of the information that you provided in the **MEDIA SURFACE CONDITIONS** portion of the FAR, enter that information here. If you need more space, enter <See attached sheet.> in this box and include your remarks on a separate page.

5.6 BACKWASH CONDITIONS

This portion of the FAR contains information about the backwash process used at the plant. Most of the information you need to complete this portion of the report will be based on observations that you make during the backwash process. Consequently, you *must not* begin collecting this data until you have collected the **Before BW** data needed to complete the **Media Surface Conditions** section of the FAR.

IMPORTANT
If you need to enter the filter to collect the required data, you must be very careful to avoid injuring yourself or damaging the filter media. Therefore, you need to develop and document the procedures you will use before you actually begin the filter assessment. Appendix H contains an example of a standard operating procedure that was developed by plant operators during one of our technical-assistance pilot projects. Although your procedures may differ significantly from those developed for that plant, step-by-step procedures for conducting a filter assessment are essential.

Rate and Duration

BW Flow Rate (gpm)

Enter the backwash-water flow rate that was maintained during the main part of this backwash cycle. Do not enter the initial backwash rate, the final backwash rate, or the flow rate that was maintained during a simultaneous air-water backwash cycle unless this was also the flow rate used during the main part of the water-only backwash cycle.

Rise Rate (inches/minute) *CALC*

The spreadsheet will automatically calculate the rise rate that was achieved during **this** backwash cycle. This calculation will be based on the surface area of the filter and the backwash water flow rate you entered above.

Loading Rate (gpm/ft^2) *CALC*

The spreadsheet will also automatically calculate the backwash loading rate. This calculation will be based on the backwash water flow rate you entered above and the surface area of the filter bed.

Duration (minutes)

Record the length of time that you backwashed the filter **at the flow rate you entered in the BW FLOW RATE (gpm) space above**.

Total Volume (gallons)

Record the total volume of backwash water used during the backwash cycle. When entering this number, include water used during any “ramp up” and “ramp down” periods and any water used by supplemental backwash facilities.

Troughs

Levelness

Select the item in the drop-down list that best describes how level the filter troughs are. Table 5.15 contains a description of each item.

Table 5.15. Drop-down list for Trough Levelness.

Item	Description
Level	The backwash water comes over the top of all the weirs at about the same time.
Slightly Unlevel	The backwash water comes over the top of one weir or over one end of the weirs before it comes over the rest of the weirs. However, the water ultimately comes over the entire top of all of the weirs before the maximum backwash water flow rate is achieved.
Moderately Unlevel	The backwash water comes over one weir or the ends of the weirs and the problem persists until the maximum backwash-water flow rate is achieved.
Severely Unlevel	Even at the maximum backwash-water flow rate, water is not flowing over the entire length of all of the weirs. For example, water doesn't flow over both sides of one or more weirs, or water doesn't flow over one end of one or more weirs.

Flooding

Select the item in the drop-down list that best describes any flooding that occurs during the backwash cycle. Table 5.16 contains a general description of each item.

Table 5.16. Drop-down list for Trough Flooding.

Item	Description
None	There is no flooding in any of the weirs.
Slight	There is some flooding on one end of weirs but the weirs are not completely flooded, and the flow of spent backwash water does not appear to be obstructed.
Moderate	There is significant flooding on one or more weirs, and the flow of spent backwash water appears to be affected. However, no part of any weir is completely submerged, and the velocity and direction of the floc particles in the area of the flooding appear to be unaffected.
Severe	One or more weirs are almost completely submerged. The flow of spent backwash water is clearly obstructed. Floc particles in the area of the flooding are not moving at the same velocity and in the same direction as the floc particles throughout the filter.
Complete	All of the weirs are completely submerged. The backwash water flow rate is restricted and floc particles are not being effectively removed from the filter.

Suppl. Backwash

Duration (minutes)

Record how long the supplemental backwash facilities were operated during the backwash cycle.

Effectiveness

Select the item in the drop-down list that best describes how effective you think the supplemental backwash facilities are. Table 5.17 contains a general description of each item contained in the drop-down list.

Table 5.17. Supplemental Backwash Effectiveness drop-down list.

Item	Description
Excellent	The supplemental backwash facilities are completely effective in breaking up the floc throughout the entire filter bed.
Adequate	The supplemental backwash facilities are very effective but do not affect all of the filter bed. Most of the large floc particles are broken into smaller ones that can be removed during the main part of the backwash cycle. However, the supplemental facilities appear to be less effective in the corners of the filter or on one side of the filter.
Poor	The supplemental backwash facilities are only somewhat effective. Large floc particles remain in the filter even after the completion of the supplemental backwash cycle. Even in the area where the supplemental backwash facilities appear to be fully operational, large floc is not broken into smaller particles that can be efficiently removed during the main backwash cycle.
Ineffective	The supplemental backwash process seems to have minimal effect on the size of the floc particles. It just seems a waste of time and effort.

Jetting

No. of Sites

Enter the number of areas where significant jets are noted during the main part of the backwash cycle. During the initial phases of the cycle, some jetting may occur as the filter bed is expanded. Do not count these sites *unless* they continue to be noticeable during the main part of the backwash cycle *or* appear in the same spot each time that a backwash cycle is initiated.

Severity

Select the item in the drop-down list that best describes how severe you think that the jetting problem is. Table 5.18 contains a general description of each item contained in the drop-down list.

Table 5.18. Drop-down list for Backwash Jetting.

Item	Description
Slight	You can see jets in the media during the backwash cycle, but they are small and do not seem to be affecting the overall effectiveness of the backwash cycle.
Moderate	The jets are rather large and you can see the media in the jetting area rising above the media in the adjacent areas. However, the media in the other areas of the filter is being effectively aggitated, the filter grains are still moving well in all areas of the filter, and the floc particles are being effectively removed from all areas of the filter.
Severe	The jets are large, and the filter media in the jet is clearly rising above the rest of the media surface. The jet appears to be causing lower media layers to reach the surface of the expanded bed, or the jetting has reached a point where the media in other areas of the filter is not being agitated sufficiently, and the floc particles in the other areas of the filter are not being removed effectively.

BW Water Distribution

Select the item in the drop-down list that best describes how effective you think the supplemental backwash facilities are. Table 5.19 contains a general description of each item contained in the drop-down list.

Table 5.19. Drop-down list for Backwash Water Distribution.

Item	Description
Uniform/Even	The backwash water appears to be evenly distributed throughout the filter. The turbulence in the expanded filter bed appears to be relatively uniform everywhere in the filter.
Uneven	Some areas of the expanded filter bed appear significantly more turbulent than others. Still, there is some media motion in all areas of the filter and floc is rising in all areas.
Inadequate	Some areas of the filter bed appear to have adequate turbulence while other areas have no motion at all. The floc in some areas of the filter is being effectively removed while the floc in other areas remains virtually motionless.
Other	Describe the condition in the Additional Remarks area or on a separate page.

Spent BWW Turbidity

Collect a water sample from above the filter media after you finish the backwash cycle. Measure the turbidity level of this spent backwash water sample, and record the result (in NTU) in the **SPENT BWW TURBIDITY** space.

Expansion and Yield

Expansion (inches)

You must make two measurements to determine the inches of expansion that was obtained during the backwash cycle. The first number is the distance from a fixed reference point (such as the top of the filter wall) to the top of the expanded filter bed. This first measurement must be made when backwashing at the maximum backwash water flow rate. The second measurement is made after the backwash cycle is over and is the distance from that same reference point to the top of the unexpanded (settled media) filter bed. The expansion is then calculated by subtracting the first reading from the second, that is:

expansion (inches) = distance to unexpanded bed (inches) – distance to expanded bed (inches)

Expansion (percent) *CALC*

The spreadsheet will automatically calculate the percentage of bed expansion based on the inches of expansion that you achieved during the backwash cycle and the average media depth that you measured as you probed the backwashed filter.

Yield (percent) *CALC*

The spreadsheet will automatically calculate the percentage of filtered water that was sent to the distribution system during this filter run. This value is calculated based on the volume of filtered water you produced during the filter run (**RUN VOLUME**) and the total amount of water that you used to backwash the filter (**TOTAL VOLUME**).

Additional Remarks

If you need to explain or clarify any of the information that you provided in the **BACKWASH CONDITIONS** portion of the FAR, enter that information here. If you need more space, enter <See attached sheet>in this box and include your remarks on a separate page.

5.7 FILTER PROBE

This portion of the FAR contains information that you will obtain as you probe the filter to measure the thickness of the media layer and the levelness of the media support system. Before conducting this portion of the filter assessment, you must have already collected the data required to complete the **Media Surface Conditions** and the **Backwash Conditions** sections of the FAR.

IMPORTANT
When you conduct a filter assessment, you will need to actually get down into the filter and make some physical measurements. Any time that you do these kinds of studies, you need to be very careful to avoid injuring yourself or damaging the filter media. Therefore, you need to develop and document the procedures you will use before you actually begin the filter assessment. Appendix H contains an example of a standard operating procedure that was developed by plant operators during one of our technical assistance projects. Although your procedures may significantly differ from those developed for that plant, step-by-step procedures for conducting a filter assessment are essential.

Number of Sites

Enter the number of sites where you probed the filter to measure the thickness of the filter bed and to assess the levelness of the support gravel or underdrain.

The space between the measurements may not exceed 2 feet, and you must reduce the spacing between measurements if significant differences are detected between adjacent measurements for either (1) the distance to the support gravel or (2) the media depth. If the distance or depth:

- Between adjacent measurements varies by more than 2 inches, make an additional set of measurements at the midpoint between the points
- Continues to vary by more than two inches, continue to measure at midpoints until the distance between the measurements is only 3 inches

Media
Max. Thickness (inches)
Min. Thickness (inches)

Enter the maximum and minimum readings that you got when probing the filter to determine the thickness of the filter media.

Typ. Thickness (inches)

Enter the typical thickness of the media layer. You may determine this value by averaging the results of all of the thickness measurements. If most of the readings you got by probing the filter were the same, you can also use this value to avoid having to calculate the average thickness. For example, if you probed the filter at 60 sites and 46 of the readings were the same, and the other readings varied by as much as several inches, you may enter the value that you got 46 times without calculating the average thickness.

Support Material

To determine the elevation of the support gravel (or underdrain), you must determine the distance from the top of the backwash troughs (or some other fixed reference point) to the top of the support gravel. You can determine this distance by either of the following two methods.

1. You can measure the distance (C) from the top of the backwash trough to the top of the support gravel directly. This method may require a probe that is at least 7 or 8 feet long.
2. You can measure from the top of the backwash trough to the surface of the media (A), measure the thickness of the media (B), then add the two readings to determine the total distance to the top of the support gravel.

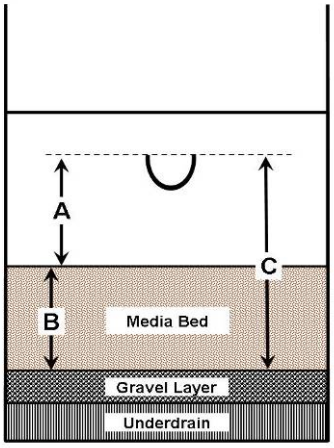

Figure 5.2. Filter media cross-section.

Max. Elevation (inches)
Min. Elevation (inches)
Enter the maximum and minimum readings that you got when probing the filter to determine the distance to the top of the support gravel.

Typ. Elevation (inches)
Enter the typical distance to the top of the support gravel. You may determine this value by averaging the results of all of the measurements. If most of the readings you got by probing the filter were the same, you may also use this value to avoid having to calculate the average thickness. For example, if you probed the filter at 60 sites and 46 of the readings were the same, you may enter the value that you got 46 times without calculating the "true" average distance—even if the other readings varied by as much as several inches.

Additional Remarks
If you need to explain or clarify any of the information that you gave in the **FILTER PROBE** portion of the FAR, enter that information here. If you need more space, you can enter <See attached sheet.> in this box and include your remarks on a separate page.

5.8 FILTER EXCAVATION
This portion of the FAR is where you will summarize the results of filter excavations.

- **You must complete at least one excavation for each 100 square feet of filter surface**. For example, a filter bed that is 20 feet long and 30 feet wide has 600 square feet of surface area and you must excavate the media in at least six locations.
- **You must excavate the media at every site where you observe a significant filter problem**. Table 5-20 describes the criteria for determining whether a site should be excavated based on a filter problem.

The FAR spreadsheet provides space for you to enter data for up to 12 excavation sites. If you need to excavate fewer sites, you only have to enter data for sites you excavated. For example, if you excavate eight sites, you should leave the spaces for sites 9 though 12 empty. If you need to excavate more than 12 sites, include a comment in the **ADDITIONAL REMARKS** box and attach a separate page showing the additional data.

Site Characteristics
You must excavate the media in at least one site where no filter problems were observed. This first site is termed the **reference** site. The number and location of the remaining sites depends on the number, severity, and location of any filter or backwash problems that you identified during previous steps in the filter assessment.

For each excavation site, use the drop-down list to describe the reason that you chose the site. Table 5.20 contains a general description of each item contained in the drop-down list.

Table 5.20. Drop-down list for Excavation Site Characteristics.

Item	Explanation **You MUST excavate . . .**
Normal	No filter problems were observed at the excavation site.
	Excavate *at least one site* where no filter problems were observed. If no such site exists, you must excavate a site where the filter media appears to be in the best possible condition.
Media Mound	A media mound was present on the surface of the filter *after* the backwash cycle.
	Excavate *each site* where the mound is *at least 2 inches* above the surface of the rest of the filter.
Media Depression	A depression was present on the surface of the media *before or after* the backwash cycle.
	Excavate *each site* where the depression is *at least 2 inches* below the surface of the rest of the filter.
Crack	A crack was observed in the surface of the filter *after* the backwash cycle.
	Excavate *each site* where you observe a crack that is at least *12 inches long, at least ½ inch wide, or at least 1 inch deep*.
Retraction	The filter media retracted from the filter wall *after* the backwash cycle.
	Excavate *each site* where the retraction is *at least 12 inches long, at least ½ inch wide, or at least 1 inch deep*.
Floc. Accumul.	There was an excessive floc accumulation on the surface of the media *before* the backwash cycle.
	Excavate *the site* where you observed *the heaviest accumulation* of floc.
Gravel Mound	The filter probe indicated a possible gravel mound under the media.
	Excavate *each site* where the mound rises *at least 2 inches above* the rest of the support gravel.
Gravel Depression	The filter probe indicated a possible depression in the gravel layer beneath the media.
	Excavate *each site* where the gravel layer drops *at least 2 inches lower* than the rest of the support gravel.
Poor Suppl. BW	The supplemental backwash facilities seemed significantly less effective in the area of the excavation site.
	If you characterized the effectiveness of the supplemental backwash facilities as "poor" or "ineffective," you must excavate *at least one site* where the supplemental backwash system seemed particularly ineffective.
Jetting	A jet was observed during the backwash procedure.
	Excavate *every site* where you identified *"severe" jetting* during the backwash cycle. If there were no severe jets identified, you must excavate *at least one site* where *"moderate" jetting* was observed.

Poor BW Distr.	There was little if any media movement at the excavation site during the backwash cycle.
	If you characterized the backwash water distribution as "inadequate," you must excavate the *each area* where there was *no media movement and the floc was not being removed* from the filter.
Other	None of the other items adequately describe the reason that you excavated the site. For example, you excavated the site because there was no floc accumulation at the site while the rest of the filter had a ⅜-inch accumulation. Whatever the "other" reason, describe the condition in the **Additional Remarks** area or on a separate page.
	Excavate *each site* where you think that some other observation suggests that a *severe filter problem* exists.

Media Layers and Interfaces

Layer 1
Interface 1
Layer 2 and so on

Starting at the surface of the filter, enter the depth and material in each of the media layers you identify during the excavation. For example:

	REFERENCE
CONDITION	**Normal**
LAYER 1 (Top Layer)	18 in. anthracite
INTERFACE 1	4 inches
LAYER 2	10 in. sand
INTERFACE 2	1 inch
LAYER 3	3 in. garnet
INTERFACE 3	
LAYER 4	

18 inches of anthracite
4 inches of mixed anthracite and sand
10 inches of sand
1 inch of sand-garnet mixture
3 inches of garnet
No fourth layer so no interface 3

Mudballs

Using the drop-down list, select the item that most accurately describes how many mudballs you found when excavating the site.

Max. Size (inches)
Min. Size (inches)

Record the maximum and minimum sizes of any mudballs that you found during the filter excavation.

Max. Depth (inches)

Enter the maximum depth to which the mudballs have penetrated into the filter bed. Measure the distance from the surface of the media.

Media Condition

Sharpness

Using the drop-down list, select the item that best describes the sharpness of the filter grains. Table 5.21 contains a general description of each item in the list.

Table 5.21. Media Sharpness drop-down list.

Item	Description
Excellent	The media in each of the layers is irregularly-shaped and has sharp edges. Its size, shape, and feel are very much like those of new media.
Good	The media grains in one or more layers have begun to lose their sharp edges but continue to have irregular shapes. The material is still about the same size and shape as new media but no longer looks and feels that way.
Worn	The media in one or more of the layers has worn to the point that it no longer has sharp edges. The grains have worn to the point where they have essentially the same shape. The grains no longer have the size and shape of new media.
Other	Different media materials frequently wear out at different rates. For example, one of the materials (for example, the anthracite) may be "Worn" while another material (for example, the sand) is still in "Good" shape. If you believe that a single media layer is contributing to poor filter performance, select the <Other> item and describe the condition of each media layer in the Additional **Remarks** area or on a separate page.

Encrustation

Select the item from the drop-down list that best describes the degree to which the filter grains are coated with precipitate. Table 5.22 contains a general description of each item contained in the drop-down list.

Table 5.22. Media Encrustation drop-down list.

Item	Description
None	There is no apparent precipitate coating on the filter grains. The media looks and feels like new media.
Slight	There is visible coating on the filter grains in the upper layers of the filter. However, the shape of the media in the upper layers is not changed. There is little, if any, coating on the media in the lower levels.
Moderate	There is significant coating on the media throughout the filter. Some of the media has begun to be so encrusted that the filter grains are beginning to change shape due to the encrustation. However, most of the media is still in pretty good shape.
Heavy	The problem has become so severe that the different media materials have begun to have a common color and shape.

Uniformity

When evaluating the uniformity of the filter grains, you should compare the size of larger and smaller grains with the size of typical grains. However, you should not pick the absolutely largest and smallest grains to make this comparison.

Select the item from the drop-down list that best describes how uniform the size of the media grains is in each filter layer. Table 5.23 contains a general description of each item contained in the drop-down list.

Table 5.23. Media Uniformity drop-down list.

Item	Description
Good	The media grains in each layer of the filter are almost the same size as each other.
Marginal	There is a significant range in the size of the media grains in one or more layers. The size of the larger (and smaller) grains is noticeably different from the size of the typical grain. However, there are few fine grains in the layer.
Poor	The sizes of the media grains in one or more layers vary so much that it is difficult to select a typical grain size for the layer.
Other	Different media materials frequently wear out at different rates. For example, harder materials (such as garnet) may have "Good" uniformity while softer materials (such as GAC) have "Poor" uniformity. If you believe that a single media layer is contributing to poor filter performance, you may select <Other> and describe the condition of each media layer in the **Additional Remarks** area or on a separate page.

Additional Remarks

If you need to clarify any of the information that you gave in the **FILTER EXCAVATION** portion of the FAR, enter that clarification here. If you need more space, enter <See attached sheet> in this box and include your remarks on a separate page.

5.9 ADDITIONAL STUDIES

Filter Profile Attached?

Select <Yes> or <No> from the drop-down list. We have included this item on the FAR just to remind you you must include a filter profile when you submit this report.

Percent Mudballs

You must determine and report the percentage of mudballs in the filter if one or more of the excavation sites contained "Several" or "Many" mudballs. If you only found a "Few" mudballs when excavating the media, the study is optional. If you found no mudballs at any of the excavation sites, the study is unnecessary.

If several of the excavation sites contained more than a few mudballs, you should mix the media from several of the sites before determining the mudball concentration in the composite sample. On the other hand, if the mudballs seem to be concentrated in one area of the filter, you may want to focus on that area of the filter when you prepare your composite sample.

If you are measuring the mudball concentration, you must separate the mudballs from the media. Then you must measure the volume of the mudballs and the volume of the (mudball-free) media.

Media Volume (ml)

Enter the volume of the mubdall-free media that you recovered from the excavation site (or sites) in this space.

Mudball Volume (ml)

Enter the volume of the mudballs that you recovered from the excavation site (or sites) in this space.

% Mudballs *CALC*

Once you have entered the **Mudball Volume** and the **Media Volume** in the appropriate spaces, the spreadsheet will automatically calculate the percentage of mudballs present in the sample.

Additional Remarks

If you need to explain or clarify any of the information that you provided in the **ADDITIONAL STUDIES** portion of the FAR, enter that information here. If you need more space, you can enter <See attached sheet > in this box and include your remarks on a separate page.

Also, if you conduct any other special studies such as a media solubility test or a media sieve analysis, you can enter the results here. If you need more space, you can enter <See attached sheet> in this box and include your results on a separate page.

5.10 CONCLUSIONS

If you were able to determine what caused the filter performance problems in the past, you **must** explain your conclusions. If you have developed a plan to prevent the problems from occurring in the future, you *may* also give us that information although we do not require it. If you need more space, enter <See attached sheet> in this box and include your findings on a separate page.

Corrective Action Plan Attached?

If you have developed a corrective-action plan that you would like to share with us, select <Yes> from the drop-down list and attach a copy of the plan to the report. You should select <No> from the drop-down list if either one of the following applies:

- you have not developed a plan
- you have developed a plan but would prefer to keep it confidential

If you have decided what corrective actions you are going to take and have developed a schedule for making the changes, we encourage you to give us the information. If we agree with your proposal, we will prepare a bilateral agreement. Once you and we both have signed the agreement, we will waive additional assessments on this filter for as long as you fulfill your part of the agreement.

Would You Like Some Technical Assistance from the TCEQ?

If you have been unable to determine why the filter is malfunctioning and would like some technical assistance from the TCEQ, select <Yes> from the drop-down list. If you would prefer to deal with this performance problem using other technical resources, select <No>.

Please be aware that our availability to give technical assistance is very limited. Nevertheless, if you would like our help, please indicate so on the FAR. We will be happy to assist you if we are able.

5.11 FILTER SCHEMATIC

You must include a simple filter schematic with your FAR. On the schematic, you must show the following information:

- the location of backwash troughs and supplemental backwash facilities
- the location of any filter-media anomalies such as mounds, depressions, cracks, retraction, excessive or unusually light floc accumulation, or large accumulations of surface mudballs
- the location of any significant backwash anomalies such as jetting or unusually low media movement
- the sites where you probed the filter and the measurements you collected at each site
- the sites where you excavated the filter

Page 4 of the FAR provides space for you to prepare the schematic. We realize that this is not much room to record all of the data we require if the filter is very large. If you need more room, you may prepare the filter schematic on another (larger) sheet of paper or you may make a copy of page 4, and put part of the information on each page. If you decide to use a separate piece of paper to draw the filter diagram, be sure to enter <See attached page> in the box on page 4.

5.12 SUBMITTING THE REPORT

The completed and signed FAR (including the annotated filter-profile graph) must be included when you mail your SWMOR to the TCEQ.