Managing and treating the muddy drilling water and drill-cuttings during the air-rotary drilling of a water well or a closed-loop geothermal borehole can be a very challenging task, particularly when the drilling water and drill cuttings are going to flow right into a stream or flow into a storm drain pipe. A sediment filter bag is a very effective Best Management Practice (BMP) that treats the muddy drilling water and contains the drill cuttings. A sediment filter bag can be a more effective method to treat the muddy drilling water than the use of straw-bales, a silt-fence, or silt sox. When it is time to clean up the drill-cuttings from the drilling site, using a sediment filter bag can be the easiest, quickest, and most economical method of restoring the drilling site.

Drilling sites where the muddy drilling water and the drill-cuttings will flow off the site and into a stream or other water-body, or into an existing storm-drain piping system will require that the muddy water be treated by using a BMP that will also contain the cuttings on the drilling site. These sediment and erosion control requirements will vary from state-to-state, and the number and types of BMP’s will also vary with the classification of the watershed that contains the receiving stream.

The bag is made of a non-woven geotextile fabric that contains the drill cuttings while the air and treated water pass through the fabric. It is constructed by sewing together two sheets of non-woven geotextile fabric (that resembles the wool-felt fabric in a felt hat) to make a large fabric bag. A spout on the bag is secured over a pipe or a hose that is connected to a diverter bolted onto the top of the well casing or is bolted under the drill table of the rig. The 800 to 1,200 cubic feet per minute of compressed air that operates the down-the-hole hammer in air-rotary drilling also carries the drill cuttings and groundwater up to the diverter. This mixture of air/water/clay/silt/sand/and the gravel-sized chips of bedrock is blown through a hose or a pipe into the sediment filter bag.
The non-woven geotextile fabric threads filter out some clay and silt particles and contain all of the sand and gravel-sized rock chips within the bag. The air and the water flow out through the tiny opening between the threads of the geotextile fabric. The tiny openings between the geotextile fabric threads do allow some clay and silt particles to pass through, so the water discharging from the sediment filter bag is muddy in appearance because it still contains suspended clay and silt material. Because the bag fabric filters out and contains most of the sediment, a sediment filter bag is considered a Best Management Practice device to meet Sediment and Erosion Control Regulations.

A diverter, located at the top of the well or borehole, is used to send the compressed air, drilling water, groundwater, and drill cuttings out through a pipe or a hose connected to the spout of the sediment filter bag. A pneumatic diverter is bolted onto brackets under the drill table, and its bellows are operated by the compressed air from the deck compressor on the drill rig. The air causes the bellows ring to expand down to the ground to provide a seal. See photo 1. The drill-rod wipers are opened and closed by a lever, making it quick and easy to move a roller-cone bit or a down-the-hole hammer and button bit into and out of the bore hole through the pneumatic diverter. See photo 2.

A casing-top diverter mounts or threads onto the top of the casing, and may need to be removed in order to change out the drill bit during drilling. Some models of casing-top diverters have drill-rod wipers that can be split open, and so it is easy to move the bit into and out of the bore-hole. See photo 3. The major advantage of using a pneumatic diverter is that it will work during the drilling of the borehole for the casing, while a casing-top diverter will only work after the casing has

3. To install this casing-top diverter, the adapter flange on the left is placed on the top of the casing and the diverter in bolted onto the adapter flange.

4. The 6-inch diameter hose connects the diverter to the bag. The rod-wiper is closed and the bellows have been inflated to extend down to the ground surface.

5. A ratchet binder-strap was used to secure the spout of the bag onto the hose. Note that the end of the curved hose is aiming into the center of the bag.
been installed. The pressure of the compressed air causes the bellows to extend down to the ground surface and make a tight seal so that all of the drill cuttings, water, and drilling air are directed into the 6-inch diameter hose. See photo 4.

Using a flexible hose, rather than a rigid pipe, to connect the diverter to the spout of the sediment filter bag makes it much easier to position the bag and to aim the discharge of the hose into the center of the bag. See photo 5. If the discharge from the pipe or the hose is aimed right at the wall of the bag, the air-stream of the cuttings will erode a hole in the fabric wall of the bag, through a process similar to sand-blasting. The sediment filter bag has been placed in a hydraulic dump trailer to make it quick and very easy to clean up the drilling site. The trailer-dumping hydraulic system has been used to raise the trailer bed so that the filtered water flows out of the back end of the trailer.

The diameter of the pipe or hose is also an important factor in preventing the erosion and failure of the fabric wall of the bag. At 1,200 cfm of air flow from the rig compressor, the velocity of the air/water/cuttings mix flowing into the bag through a 6-inch hose or pipe is 6,000 feet per minute. If a 4-inch hose or pipe were used, the velocity would be more than 13,300 feet per minute, more than twice the velocity from a 6-inch pipe or hose. The 4-inch diameter is two-thirds the diameter of a 6-inch diameter pipe or hose, and yet it will create more than double the flow velocity that can erode a hole in the fabric wall of the bag. So using a 6-inch diameter hose or pipe and carefully aiming the hose or pipe into the center of the bag are the two factors that will keep the flow of cuttings from causing the bag to fail by eroding a hole in the fabric wall of the bag. See photo 6.

The drilling site location may require the use of a second BMP such as compost filter socks. In Pennsylvania, if the watershed is classified as a high-quality watershed, the second BMP must be compost filter socks. Compost filter socks contain wood chips and organic material that have first been composted and then placed within a mesh tube to form the sock. Multiple compost filter socks are staked down using an X-pattern of stakes to hold the socks down onto the ground surface. See photo 7.

The geotextile fabric walls of the sediment filter bag contained most of the silt and clay material and all of the sand and gravel-sized drill cuttings within the bag. The water flowing out of the bag was still muddy, and the compost filter socks removed almost all

6. The 1,200 cubic feet per minute of compressed air have inflated the bag and are flowing out through the fabric. The yellow-brown area on the bag surface shows that the flow from the hose is hitting the inside wall of the bag because the hose angle shifted.

7. The compost filter socks were installed as a second BMP to further treat the muddy water flowing out the back end of the trailer.
of the remaining sediment as the muddy water seeped slowly through the socks. See photo 8.

The sediment filter bag was placed within the hydraulic dump trailer to make the drilling site cleanup fast and easy. After the drilling was completed, the tailgates on the trailer were closed, and the bed was tilted about 10 degrees to drain the water out of the cuttings in the bag. The bag of cuttings was then towed away and disposed of as clean-earth material. See photo 9.

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8. The large-diameter compost filter sock caught the yellow, muddy water in a puddle. After treatment by the composted material inside the sock, the water became clear.

9. The hydraulic dump trailer made it very easy to haul away the drilling cuttings in the sediment filter bag for disposal at another location.

Photos by Todd Giddings