geotech

DH-81 Depth-Integrating Suspended-Sediment Sampler

Installation and Operation Manual

Rev 08/25/2025 Part # 11000001

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Credits and Acknowledgments:

Portions of this manual were adapted from the "Operator's Manual for the US DH-81 Depth-Integrating Suspended-Sediment Sampler." This content was written by the staff of the Federal Interagency Sedimentation Project (FISP) and is used with the permission of the Chief. We gratefully acknowledge their contribution and expertise.

Documentation Conventions

This uses the following conventions to present information:

WARNING

An exclamation point icon indicates a **WARNING** of a situation or condition that could lead to personal injury or death. You should not proceed until you read and thoroughly understand the **WARNING** message.

CAUTION

A raised hand icon indicates **CAUTION** information that relates to a situation or condition that could lead to equipment malfunction or damage. You should not proceed until you read and thoroughly understand the **CAUTION** message.

NOTE

A note icon indicates **NOTE** information. Notes provide additional or supplementary information about an activity or concept.

Section 1: System Description

Function and Theory

The US DH-81 is a modular, hand-held depth-integrating suspended-sediment sampler developed by the Federal Interagency Sedimentation Project (FISP). It comprises an adapter (US DH-81A) that attaches to a 1/2-inch wading rod and supports a variety of caps, nozzles, and sample containers.

The system is used for collecting flow-weighted, depth-integrated water-sediment samples in streams or rivers that can be waded in and is compatible with multiple configurations to suit various sampling requirements.

System Components

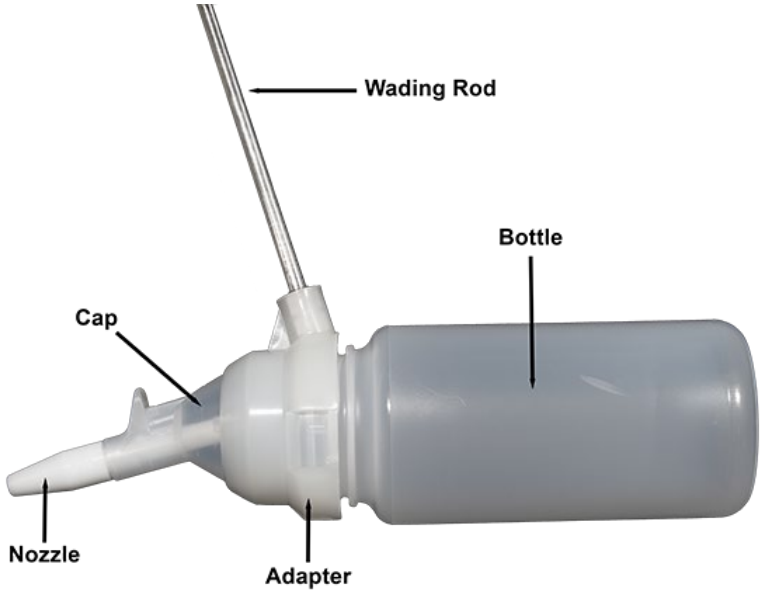

Figure 1-1: *Composition of a DH-81A Sampler*

DH-81A Adapter

The US DH-81A serves as a central adapter, providing critical support for the sampler. It features a threaded insert that securely mounts to the wading rod, offering a stable and balanced suspension point. This adapter's versatile design allows it to support various caps and bottles. This flexibility makes the US DH-81A an essential component for US DH-81 samplers.

US D-77 Caps

The D-77 cap is a versatile piece of equipment that connects the sample bottle to the nozzle, ensuring a secure and leak-proof seal. The cap features two threaded ends: one to directly attach to the sample bottle and the other to connect to the nozzle, which facilitates the transfer of sample from the surface water source to the bottle. This dual-threaded design makes it easy to switch between bottles and nozzles, streamlining the sampling process.

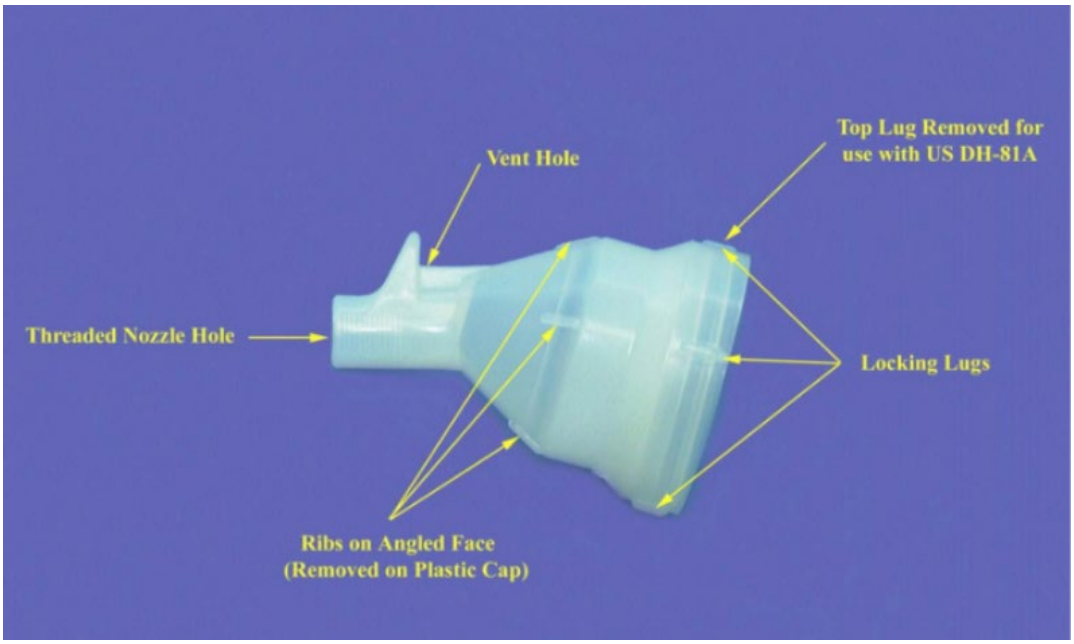

Figure 1-2

Nozzle

The nozzle threads directly into the US D-77 Cap, offering a secure and simple connection. The influent end of the nozzle comes in various sizes, which can be selected based on the anticipated flow rate of the surface water to be sampled. This adaptability ensures accurate sample collection across different water bodies.

Following are the recommended nozzle based on anticipated flow:

- 3/16” Nozzle - 2.0 - 6.2 ft / sec
- 1 / 4” Nozzle - 1.5 - 7.6 ft / sec
- 5/16” Nozzle - 2.0 - 7.0 ft / sec

Wading Rod & Handle

The wading rod is designed to securely suspend and gradually lower the US DH-81 sampler into surface water. It threads directly into the US DH-81A Adapter and is available in 1-foot lengths, which allows for a customizable setup. A handle is connected to the top of the rod for added stability and control during the sampling process.

Bottles

The US DH-81 sampler is designed for use with a variety of containers, including both **HDPE** and **FEP 1 liter bottles**.

- The **HDPE 1 liter bottle** (part #4107020 / 7100003) is a durable, general-purpose choice for many sampling applications.

- For high-purity water-quality sampling, particularly for trace metal analysis, the **FEP 1 liter bottle** (part #4107021 / 7100007) is recommended.

When using an FEP bottle with a **US D-77 PFA Cap**, a **Bottle Adapter** (part #4107002 / 5750011) is required to ensure a proper seal.

WARNING

The US DH-81 is typically used with 1 liter plastic or fluorinated ethylene propylene (FEP) bottles. Although larger bottles can be used, they are not recommended due to buoyancy challenges and sampling inaccuracies. **Glass containers are not recommended** due to their fragility. If used, extreme caution must be taken during deployment.

Section 2: System Installation

Insert the selected cap into the US DH-81A using the three locking lugs. Rotate clockwise to lock. Align the vent hole with the rod receptacle. Hand-tighten the nozzle into the cap (do not use tools). Attach the wading rod and extensions, then screw the sample container into the cap.

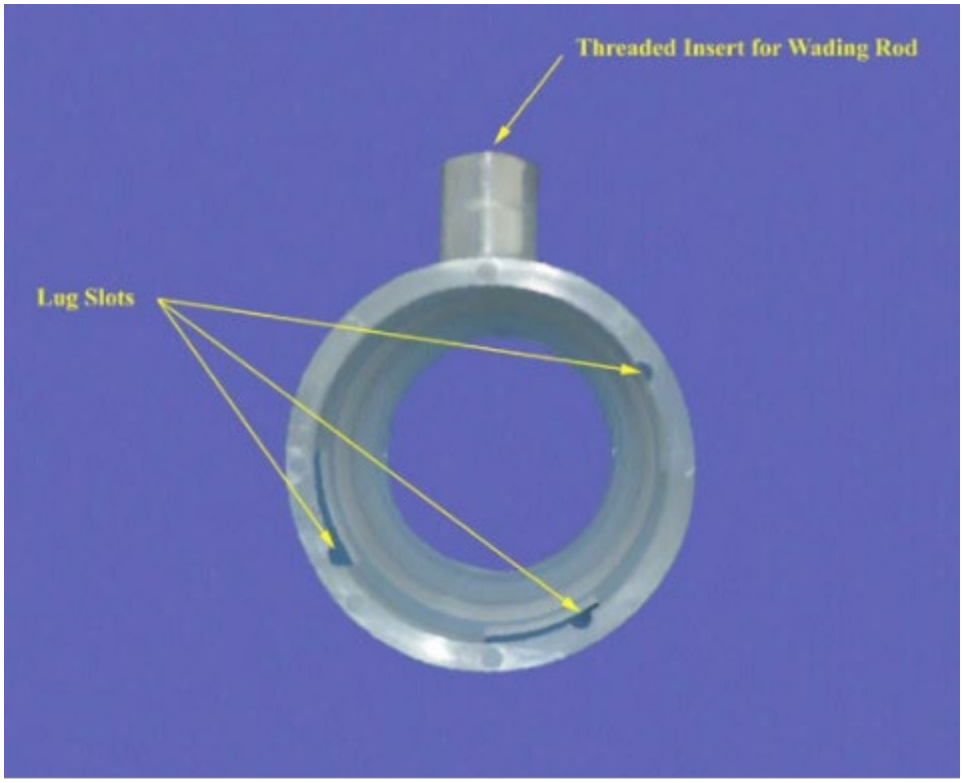

Figure 2-1: *Lug Slots on the DH-81A Adapter*

Section 3: System Operation

Figure 3-1

When wading in a stream to collect a sample, your goal is to minimize the force of the water against your body and maximize stability:

- **Positioning:** Stand sideways to the current to reduce water resistance. Slightly bend your upstream knee and lean into the flow to increase your stability.

- **Holding the Sampler:** Keep the sampler held away from your body and as far upstream as possible. Hold the wading rod vertically, with the sampler nozzle pointing upstream and horizontal.

Figure 3-1 shows an example of proper position for sampling using proper wading and sampling technique.

Sampling Process

NOTE

Sample Volume: Do not exceed 800 mL sample volume to prevent nozzle submergence inside the bottle. Overfilling reduces inflow velocity and may bias sediment concentration.
Maximum Sampling Depth: Maximum recommended depth: 12 ft at sea level (for 800 mL). Sampling up to 15 ft is possible with a 1 L bottle. For deeper or non-wadable depths, 1 ft rod extensions can be used.
Unsampled Zone: This is the gap between the nozzle and streambed. For a 1 L bottle, it is approximately 4 inches. This must be accounted for in shallow water sampling.

1. **Lowering the Sampler:** Begin with the sampler above the water's surface. Use your pre-determined transit rate (ref *Section 3: System Operation*, Transit Rates) to lower it into the stream.

2. **Maintaining the Rate:** Continue the transit at a steady pace until the sampler touches the bottom.

3. **Reversing Direction:** Immediately reverse direction and maintain the same transit rate until the sampler clears the surface of the water.

NOTE

Be careful not to disturb any loose sediment at the bottom of the stream, as this could contaminate your sample.

4. **Handling the Sample:** Once the sampler is out of the water, do not tilt it forward. If the container is nearly full, tilting could cause water to spill out through the nozzle and bias your sample.

Post-Sampling and Labeling

- **Removing the Container:** After a sample is collected, firmly hold the cap with one hand and remove the container with the other. You can secure the wading rod under your arm or on your shoulder to free up your hands.

- **Water-Quality Samples:** When collecting water-quality samples, use the "2-person, clean-hands/dirty-hands" technique. For detailed instructions, refer to the *National Field Manual for the Collection of Water-Quality Data*, Chapter A4, pages 17-18.

- **Labeling:** After capping the container, apply a clear, informative label.

Essential Label Information for Sediment Samples

Ensure your label includes the following details:

- Stream Name
- Cross-Section and Vertical Location
- Sample Stream Depth
- Stream Stage
- Date and Time of Sampling
- Personnel Identification
- Water Temperature
- Coordination with Sample Groups
- Sample Serial Number

Guidance Resources & Methods Summary

For detailed sampling instructions, please refer to the following U.S. Geological Survey (USGS) publications:

- **Suspended-Sediment Sampling:**
  - *Field Methods for Measurement of Fluvial Sediment* by Edwards and Glysson.
  - Find the relevant information in Chapter C2, pages 35-70.

- **Water-Quality Sampling:**
  - *National Field Manual for the Collection of Water-Quality Data*.
  - The specific instructions are in Book 9, Chapter A4, pages 25-48.

<u>Equal-Discharge-Increment (EDI) Method Summary</u>

Before you begin sampling, you must measure or estimate the mean velocity at each stream vertical. When using the **equal-discharge-increment (EDI) technique**, you should collect an approximately equal volume of sample at each stream vertical if you plan to composite the samples for analysis. To determine the correct transit rate, follow these steps:

1. Refer to Table 1 in the referenced guide to find the mean velocity of the stream.

2. Locate the corresponding time required to collect an 800 mL sample with your specific nozzle size.

3. Calculate the transit rate (in ft/sec) using this formula:
    a. (Stream depth at the sampling vertical x 2) ÷ Sampling time

Example:
Mean velocity in the sampling vertical = 4.0 ft/sec
Sampling time for 3/16-in nozzle = 37 (sec Table 3)
Depth at sampling vertical = 3.0 ft
Transit rate = 2 x (3 ft) ÷ (37 sec) = 0.16 ft/sec

Equal-Width-Increment (EWI) Method Summary

The **Equal-Width-Increment (EWI)** method requires you to use a **consistent transit rate** in every vertical across the stream's cross-section.
To determine the correct transit rate, follow these steps:

1. Measure the stream's **mean velocity** and the **deepest sampling depth**.

2. Find the correct **transit rate diagram** for the specific container and nozzle you are using.

3. Use the depth and velocity information to find the proper transit rate on the diagram.

Transit Rate Example Calculation

Here is an example of how to calculate the transit rate:

Given Information:
- Mean stream velocity: **3 ft/sec**
- Maximum depth: **2.5 ft**
- Container: **1 liter plastic**
- Nozzle: **3/16 inch diameter plastic**

Instructions:
1. Locate **2.5 ft** on the Y-axis (depth).
2. Move horizontally from that point to the middle of the "Recommended" zone on the diagram.
3. From there, move vertically down to the X-axis to find the "Transit Rate Divided by Mean Velocity" value. For this example, that value is **0.1**.
4. Multiply this value by the mean velocity: **0.1 x 3 ft/sec = 0.3 ft/sec**.

The resulting **transit rate is 0.3 ft/sec**, and this is the rate you must maintain at **every vertical**.

Transit Rates

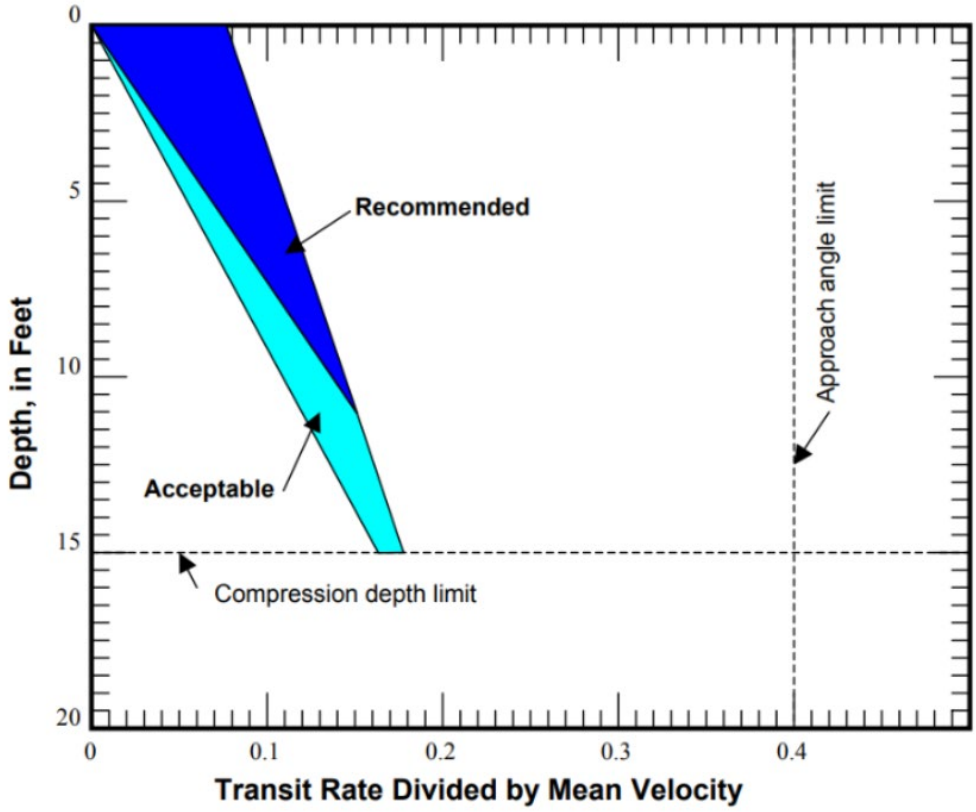

Figure 3-2: *Transit rate diagram for the US DH-81 sampler with a US D-77 plastic cap, 1 L plastic bottle and a 3/16-in plastic nozzle*

NOTE

The following volumes were used to produce this diagram. The total volume of the sampler container is 1215 ml. The maximum recommended volume is 800 ml. The maximum acceptable volume is 1000 ml.

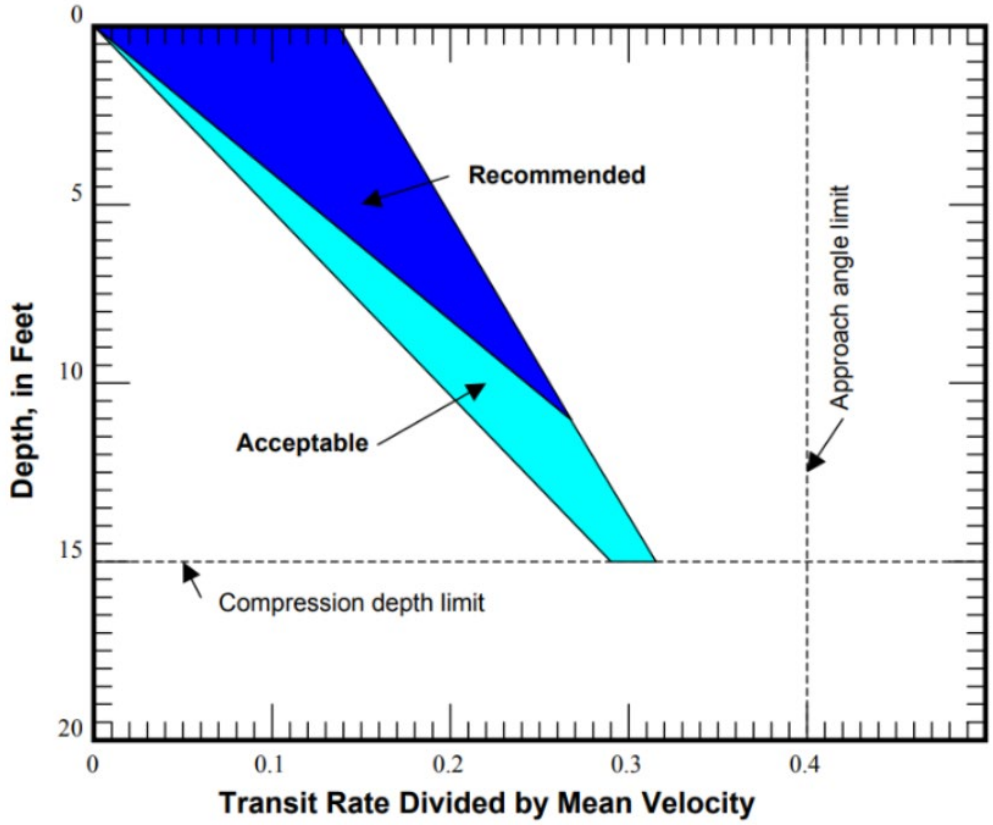

Figure 3-3: *Transit rate diagram for the US DH-81 sampler with a US D-77 plastic cap, 1 L plastic bottle and a 1/4-in plastic nozzle*

NOTE

The following volumes were used to produce this diagram. The total volume of the sampler container is 1215 ml. The maximum recommended volume is 800 ml. The maximum acceptable volume is 1000 ml.

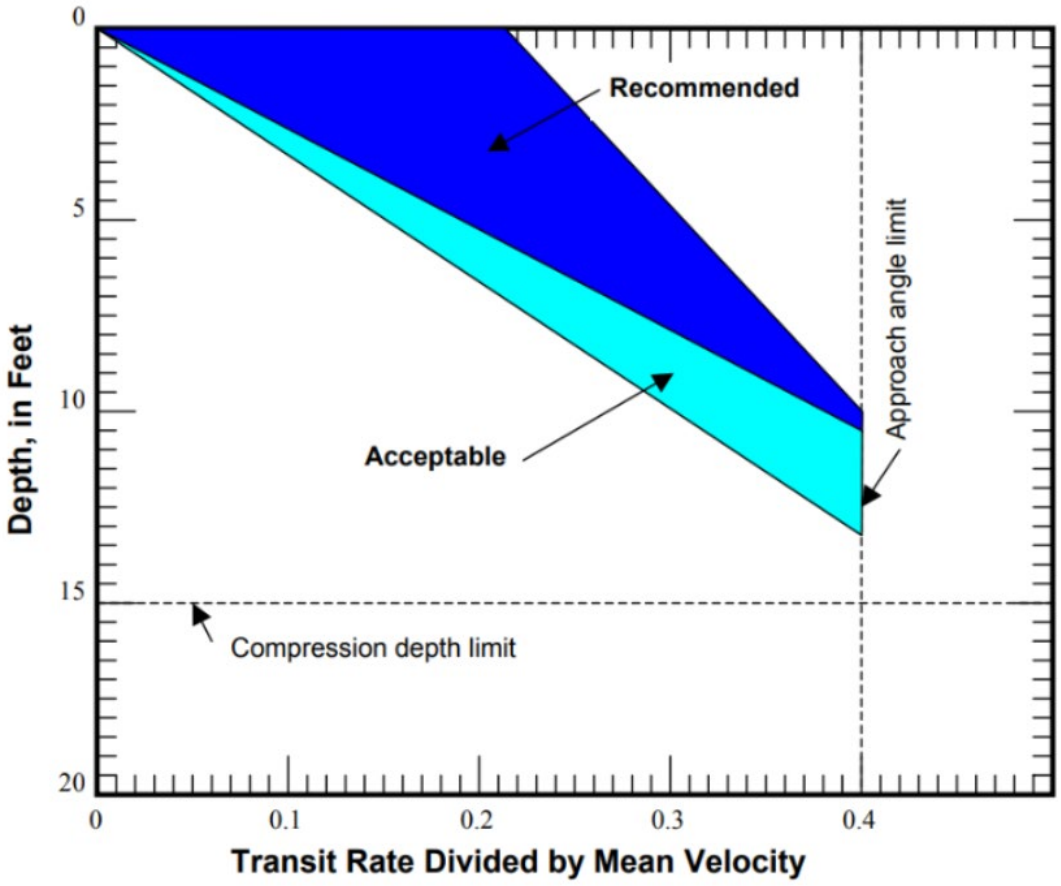

Figure 3-4: *Transit rate diagram for the US DH-81 sampler with a US D-77 plastic cap, 1 L plastic bottle and a 5/16-in plastic nozzle*

NOTE

The following volumes were used to produce this diagram. The total volume of the sampler container is 1215 ml. The maximum recommended volume is 800 ml. The maximum acceptable volume is 1000 ml.

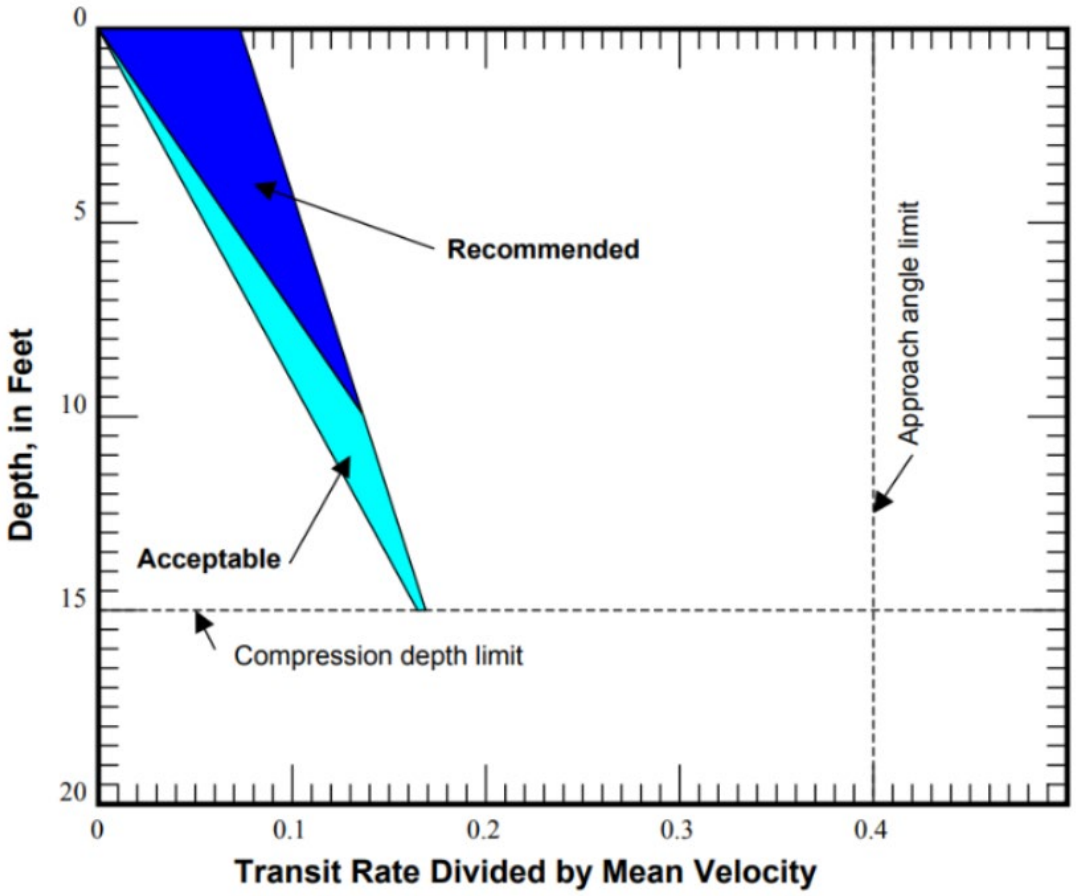

Figure 3-5: *Transit rate diagram for the US DH-81 sampler with a US D-77 PFA cap, TFE bottle adapter, 1 L FEP bottle and a 3/16-in TFE nozzle*

NOTE

The following volumes were used to produce this diagram. The total volume of the sampler container is 1265 ml. The maximum recommended volume is 800 ml. The maximum acceptable volume is 1000 ml.

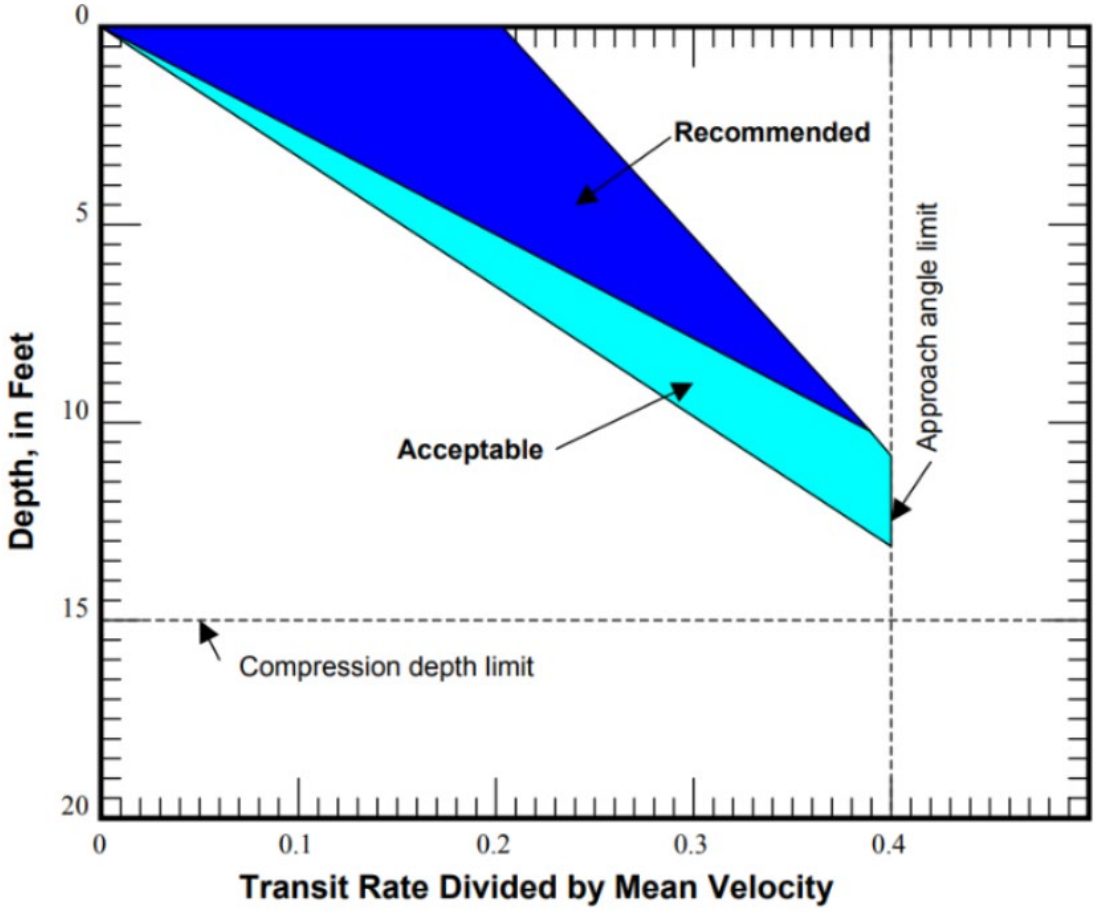

Figure 3-6: *Transit rate diagram for the US DH-81 sampler with a US D-77 PFA cap, TFE bottle adapter, 1 L FEP bottle and a 1/4-in TFE nozzle.*

NOTE

The following volumes were used to produce this diagram. The total volume of the sampler container is 1265 ml. The maximum recommended volume is 800 ml. The maximum acceptable volume is 1000 ml.

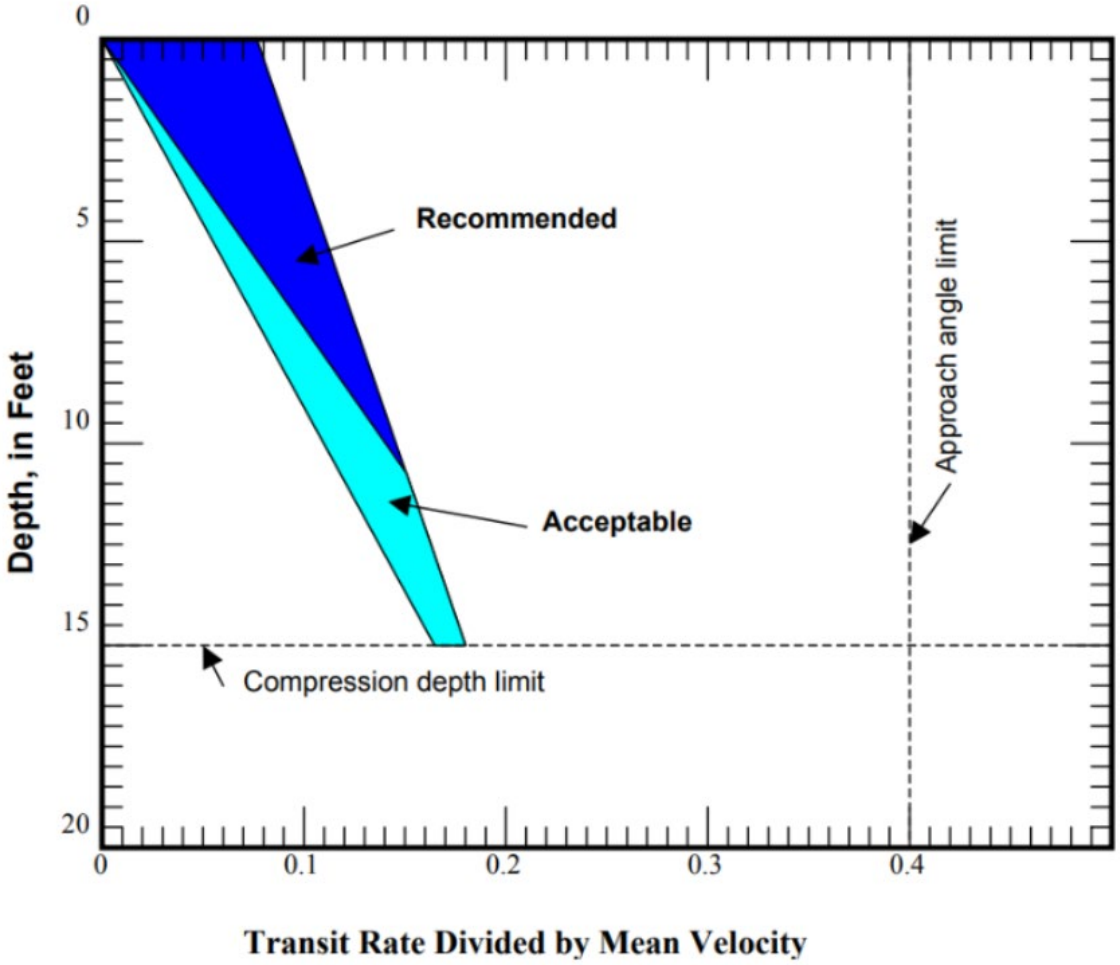

Figure 3-7: *Transit rate diagram for the US DH-81 sampler with a US D-77 PFA cap, TFE bottle adapter, 1 L FEP bottle and a 5/16-in TFE nozzle.*

NOTE

The following volumes were used to produce this diagram. The total volume of the sampler container is 1265 ml. The maximum recommended volume is 800 ml. The maximum acceptable volume is 1000 ml.

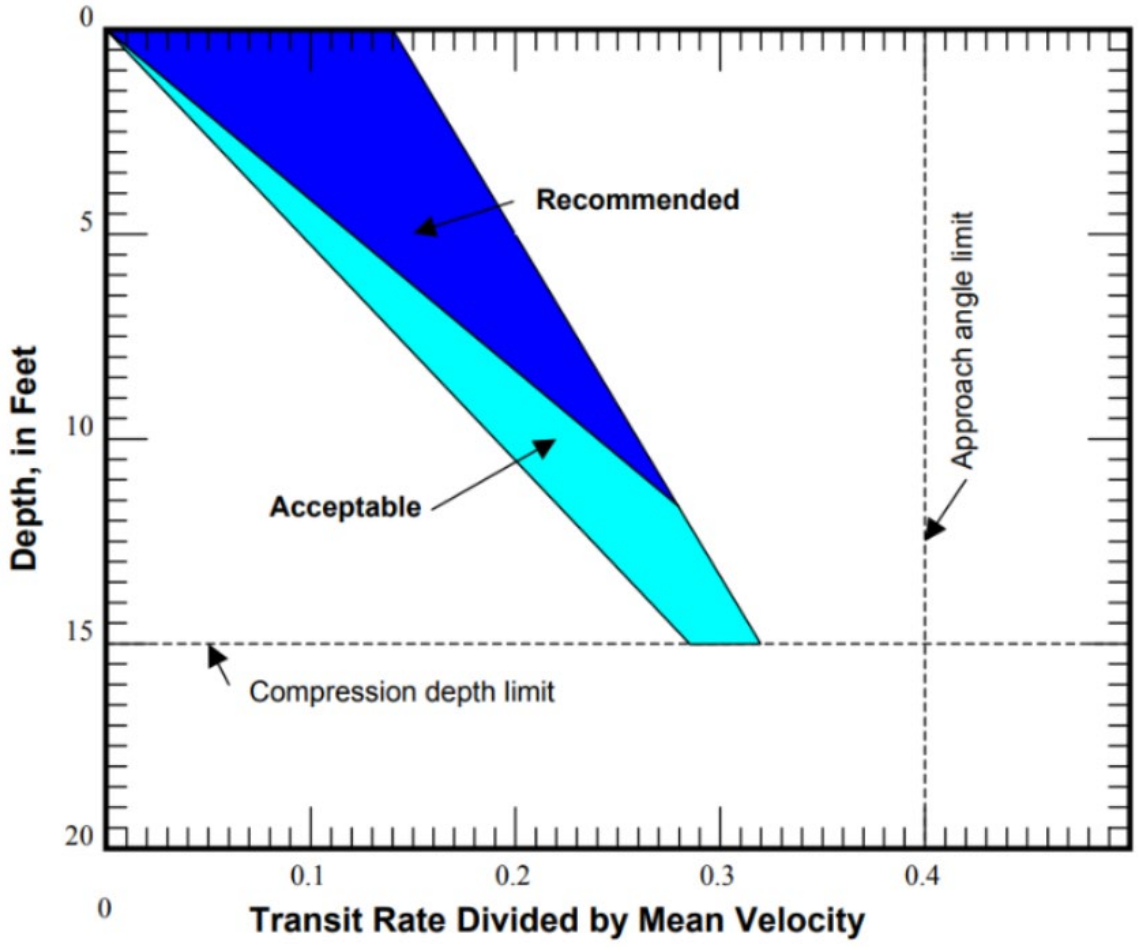

Figure 3-8: *Transit rate diagram for the US DH-81 sampler with a US D-95™ PFA cap, FEP bottle, and a 3/16-in TFE nozzle.*

NOTE

The following volumes were used to produce this diagram. The total volume of the sampler container is 1265 ml. The maximum recommended volume is 800 ml. The maximum acceptable volume is 1000 ml.

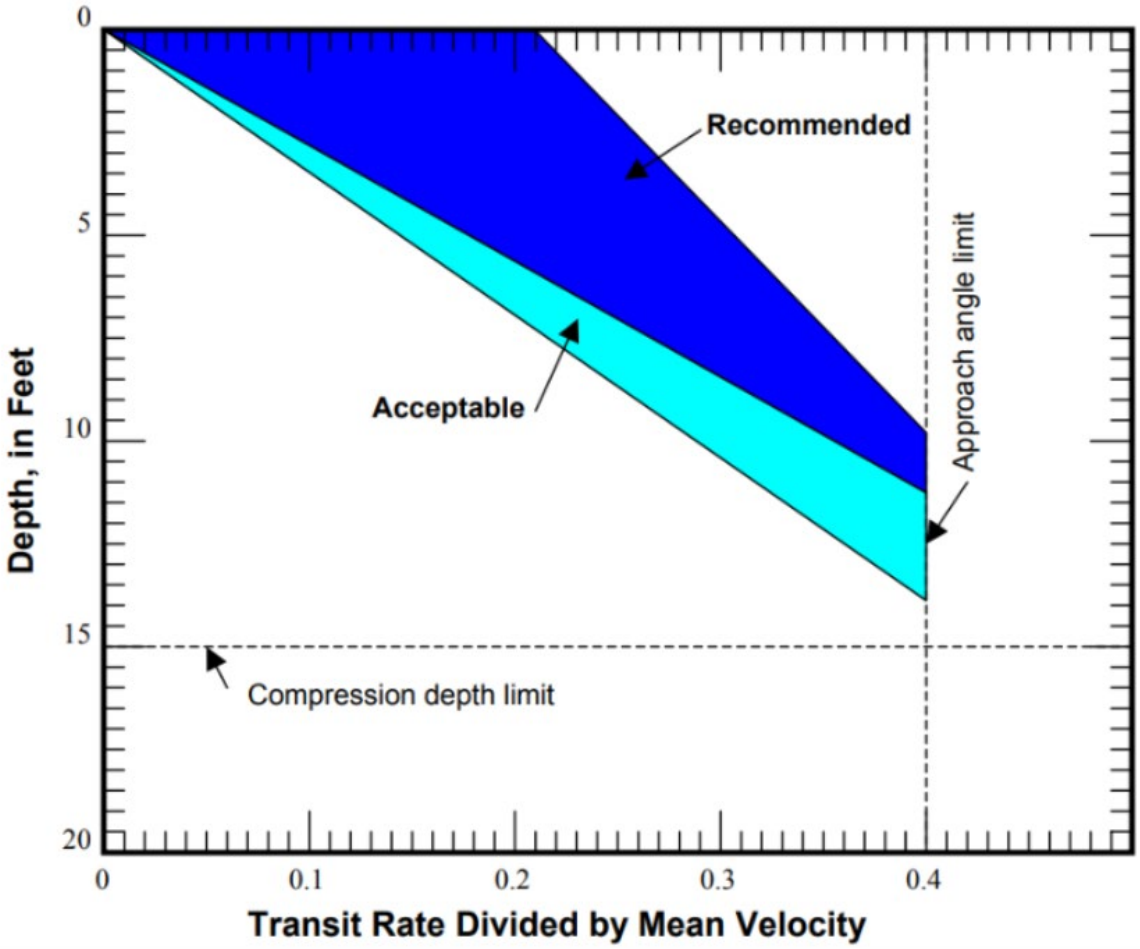

Figure 3-9: *Transit rate diagram for the US DH-81 sampler with a US D-95™ PFA cap, 1 L FEP bottle, and a US D-77 5/16-in TFE nozzle.*

NOTE

The following volumes were used to produce this diagram. The total volume of the sampler container is 1265 ml. The maximum recommended volume is 800 ml. The maximum acceptable volume is 1000 ml.

NOTE

Isokinetic conditions (inflow efficiency of 1.0) are optimal. Acceptable range: 0.9–1.1.

Section 4: System Maintenance

Cap Inspection and Modification

Inspect US D-77 caps for presence of locking lugs and ribs. Plastic caps must have the top lug and all four longitudinal ribs removed before use in the US DH-81. PFA caps should retain the ribs. DO NOT modify vent holes.
Check for stripped or obstructed threads and cracks. Use a 9/16-18 NF threading tap if needed. Discard any cracked or damaged caps.

US DH-81A Adapter

Inspect for cracks or damage. Ensure the aluminum insert threads are not stripped. Never acid-rinse the US DH-81A due to potential corrosion of the metal insert. Use a 3/8-20 NS threading tap for repairs.

Nozzles

Check for deformations, burrs, or damaged threads. Discard damaged nozzles. Use only TFE nozzles when acid rinsing is part of the sampling protocol.

Wading Rods and Extensions

Inspect for thread damage and wear to heat-shrink coverings. Repair threads using a 3/8-20 NS threading die. Replace damaged plastic coatings with 1/2-in heat-shrink tubing.

Section 5: System Troubleshooting

Getting Help

Geotech service personnel are trained on all aspects of the US DH-81 equipment line and are dedicated to helping you maximize the efficiency and cost effectiveness of your US DH-81 system. For further technical support, replacement parts, or custom sampler configurations, contact Geotech Sales.

Geotech Environmental Equipment, Inc.
2650 E 40th Ave, Denver, CO 80205
Phone: 1-800-833-7958
Email: sales@geotechenv.com
Website: www.geotechenv.com

Section 6: System Specifications

Table 5-1: Cap/Bottle Combinations

Cap	Bottle	Bottle Adapter Required
US D-77 Plastic	Plastic/MJT	No
US D-77 PFA	Plastic/MJT	No
US D-77 PFA	FEP	Yes
US D-95TM (TFE)	FEP	N

Table 5-2: Filling Time for US DH-81 Sampler Using a 1 L Bottle (in Seconds)

Velocity (ft/s)	Volume (mL)	3/16-in Nozzle	1/4-in Nozzle / 5/16-in Nozzle
1.4	800	59	
1.6	800	52	
1.8	800	46	
2.0	800	74	41 / 27
2.2	800	67	38 / 24
2.4	800	61	35 / 22
2.6	800	57	32 / 20
2.8	800	53	30 / 19
3.0	800	49	28 / 18
3.2	800	46	26 / 17
3.4	800	43	24 / 16
3.6	800	41	23 / 15
3.8	800	39	22 / 14
4.0	800	37	21 / 13
4.2	800	35	20 / 13
4.4	800	33	19 / 12
4.6	800	32	18 / 12
4.8	800	31	17 / 11
5.0	800	29	17 / 11

5.2	800	28	16 / 10
5.4	800	27	15 / 10
5.6	800	26	15 / 9
5.8	800	25	14 / 9
6.0	800	25	14 / 9
6.2	800	24	13 / 9
6.4	800		13 / 8
6.6	800		13 / 8
6.8	800		12 / 8
7.0	800		12 / 8
7.2	800		12 /
7.4	800		11 /
7.6	800		11 /

Section 7: Parts and Accessories

QTY	USGS/HIFF Part Number	Geotech Part Number	Description
	4101024	71000056	Kit, US DH-81A Adapter, Handle, Wading Rod, 3 ea 1ft Extension
	4107034	71000013	US D-77 Cap, Delrin
	4107084	71000028	US D-77 Nozzle, Delrin, 3/16”, 2.0-6.2 ft/sec
	4107085	71000029	US D-77 Nozzle, Delrin, ¼", 1.5–7.6 ft/sec
	4107086	71000030	US D-77 Nozzle, Delrin, 5/16”, 2.0-7.0 ft/sec
	4107020	71000003	HDPE, Bottle, 1 Liter
	4107036	71000002	US D-95 Cap, Nozzle, PTFE
	4107087	71000032	Nozzle, PTFE, 3/16”, 2.0-6.2 ft/sec
	4107088	71000031	Nozzle, PTFE, ¼", 1.5-7.6 ft/sec
	4107089	71000020	Nozzle, PTFE, 5/16”, 2.0-7.0 ft/sec
	4107021	71000007	FEP, Bottle, 1 Liter
	4107002	57500011	Adapter DH-81A
	4107125	71000050	Wading Rod Section, SS4 12”
	4107130	71000055	Handle, HDPE, Wading Rod, DH-81A

Appendix A: References and Resources

USGS National Field Manual for the Collection of Water-Quality Data:

- U.S. Geological Survey. (1999). *National field manual for the collection of water-quality data*. U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, Chapter A4.

Abt, S.R., et al., 1989, Human Stability in a High Flood Hazard Zone:

- Abt, S. R., Wittler, R. J., Taylor, A., & Love, D. J. (1989). Human stability in a high flood hazard zone. *Water Resources Bulletin*, *25*(4), 881–890.

- Edwards, T. K., & Glysson, G. D. (1999). *Field methods for measurement of fluvial sediment*. U.S. Geological Survey Techniques of Water-Resources Investigations

Revision History		
Project #	**Description**	**Date**
M2490	Created Manual – AL, AH, and GR	8/25/2025

NOTES

NOTES

The Warranty

For a period of one (1) year from date of first sale, product is warranted to be free from defects in materials and workmanship. Geotech agrees to repair or replace, at Geotech's option, the portion proving defective, or at our option to refund the purchase price thereof. Geotech will have no warranty obligation if the product is subjected to abnormal operating conditions, accident, abuse, misuse, unauthorized modification, alteration, repair, or replacement of wear parts. User assumes all other risk, if any, including the risk of injury, loss, or damage, direct or consequential, arising out of the use, misuse, or inability to use this product. User agrees to use, maintain and install product in accordance with recommendations and instructions. User is responsible for transportation charges connected to the repair or replacement of product under this warranty.

Equipment Return Policy

A Return Material Authorization number (RMA #) is required prior to return of any equipment to our facilities, please call our 800 number for appropriate location. An RMA # will be issued upon receipt of your request to return equipment, which should include reasons for the return. Your return shipment to us must have this RMA # clearly marked on the outside of the package. Proof of date of purchase is required for processing of all warranty requests.

This policy applies to both equipment sales and repair orders.

FOR A RETURN MATERIAL AUTHORIZATION, PLEASE CALL OUR SERVICE DEPARTMENT AT 1-800-833-7958.

Model Number: _____

Serial Number: _____

Date of Purchase: _____

Equipment Decontamination

Prior to return, all equipment must be thoroughly cleaned and decontaminated. Please make note on RMA form, the use of equipment, contaminants equipment was exposed to, and decontamination solutions/methods used. Geotech reserves the right to refuse any equipment not properly decontaminated. Geotech may also choose to decontaminate the equipment for a fee, which will be applied to the repair order invoice.

Geotech Environmental Equipment, Inc.
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