Guide and Standard Operating Procedure for HydraSleeve™

Site-Specific Passive Sampling Evaluation

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Passive groundwater sampling methods can provide time and cost savings, elimination of contaminated purge water, and easier, safer access to high traffic or remote sites, when compared to active sampling methods such as bailing and pumping, including. Before transitioning from an active to a passive sampling method it may be requested that a study be performed to show that the passive method provides reliable, representative results that in some way compare favorably to the active method being replaced.

This guide is provided as an aid for designing and executing a study to compare the results of sampling with a HydraSleeve™ passive groundwater sampler to results from active sampling methods.

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Introduction

Groundwater monitoring protocols have undergone a transition during the past 25 years with expanded lists of compounds being monitored, lower contaminant concentration thresholds, and the shift from volume purge sampling to low-flow and passive sampling methods. These changes are forcing a re-evaluation of legacy methods employed for groundwater sampling processes, devices, and lab methods to better meet requirements and to gain cost-efficiencies. Passive groundwater sampling offers benefits in the key areas of, reduction in sampling cost, elimination of contaminated purge water, and easier / faster sampling, resulting in safer site mobility.

The key concerns when changing site sampling methods are whether the results acquired using the new method will be substantially the same as those acquired by the previously used and accepted method, and whether the regulators will accept results acquired by the passive sampling method. There is a significant amount of published information that indicates properly implemented passive sampling produces results that have a close correlation with results from active sampling systems across a wide range of contaminants. It should be noted up-front however, that occasionally there can be differences in results between the methods that are related to the source of the water being collected by each method.

On the occasions where results between two methods differ, and the sampling protocols were carefully followed, neither method will produce a “wrong” result. Instead, the evaluation may require consideration of well-specific information to understand the dynamics that lead to different results, and therefore better understand the groundwater flow and contaminant transport occurring in the local groundwater.

- Passive samplers provide results representing an interval, while active samplers provide results that represent a flow-weighted average across the entire screen (USGS 2020), therefore the sampling intervals may not be the same for both methods in long screens or fractured bedrock.

- In wells prone to turbidity, the active sampling method may produce a sample with more turbidity than the passive method and the turbidity may affect lab reporting limit and/or results.

This guideline is provided to assist site owners, their consultants, and regulators in implementing an objective, fact-based, comparison and results evaluation between active sampling methods and passive sampling.

Setting Site Data Objectives

Before undertaking an evaluation of the results between sampling methods, the site data objectives should be reviewed to determine how the sampling results are used in site decision making, what are the key points of comparison between the existing and new method, and what do the regulators want to see that will interest them in allowing a change in sampling methods. A holistic approach, that considers the over-arching goals and how new information enables a better understanding of the site, is often preferred. In most cases it is a simple process to discuss the evaluation objectives with the regulators up-front so that acceptance-criteria can be developed prior to beginning an evaluation.

Site-Specific Criteria

- If the groundwater sample data is being used determine whether, or to what extent a site has specific contaminants, the comparison may be focused on whether both techniques report similar concentrations at very low levels, across a wide range of constituents.

- If the data are part of a long-term monitoring program, the comparison may be geared more toward whether the different sampling methods lead to the same decision, based on exceedance of specific concentration thresholds or MCLs for a known set of contaminants.

- A comparison of monitoring data at an active remediation site may be more directed toward the general changes and trends in the concentration of a limited number of contaminants within a treatment environment, rather than having agreement on lowest level concentrations.

Results Comparison Methods

There are three techniques for comparing results that can be effective when considering changing sampling methods.

1. **Historical Comparison:** Sample using the proposed (passive) technique and compare the results to historical data. This is the least costly method of comparison and may be suitable when there is long-term, consistent, and stable data available.

2. **Bracketed Comparison:** Alternately sampling some of the wells with the proposed (passive) technique and the current (active) sampling method for three or more rounds of sampling. This technique provides results from the passive method that are "bracketed" between two active sampling results occurring before and after the passive result. While samples are not taken contemporaneously, shifts in contaminant /concentration trends over time may be noted and evaluated. This method takes longer but is less costly than side-by-side evaluations.

3. **Side-by-side Comparison:** The proposed technique (passive) and the current technique (active) are performed one immediately after the other at a single sampling event so that all well conditions are as close to the same as possible. The passive sampler is deployed in advance of a scheduled sampling event so that the sampler has sufficient residence time that it is ready for recovery at the time of the scheduled event. On the sampling date, the passive sampler is recovered and immediately after, the active method is deployed, and the sample collected. This method is more costly because two samples are collected at the same time for each well and sent to the lab for analysis, however the results represent a point-in-time comparison. Because of time and cost considerations, side-by-side evaluations are usually employed at a representative set of wells on a site, rather than all the wells.

Results Comparison Considerations & Statistics

- Are there threshold-based decision points such as state or federal MCL's or other criteria? If so, are the two methods equivalent if the data from both methods lead to the same decision?

- In cases of long saturated screens (>10ft) is there information suggesting that aquifer contributions and contaminant concentrations are similar along the entire screen? If not, is there a plan to deploy passive samplers at two or more intervals for a one-time concentration profile?

- If vertical concentration differences are noted using passive samplers, how will the results be reconciled with the blended sample from the active method?

- How will comparison be made when there are differences in turbidity in the samples acquired by the two methods? Turbidity can cause elevated lab Reporting Limits and elevated concentrations of some CoC including metals and PFAS.
    - Is the turbidity increased when pumping?
    - Will turbid samples be filtered?

- What statistical measures will be employed to compare each pair of data points?
    - The USGS provides guidance on how to evaluate the data from a side-by-side sampling event in chapter 10, of their publication. "Passive sampling of groundwater wells for determination of water Chemistry" (No. 1-D8). US Geological Survey. Imbrigiotta, T. E., & Harte, P. T. 2020. In that chapter the authors suggest the following general guidelines for acceptable Relative Percent Differences between sample concentrations.
        - RPD up to +/- 25% VOCs & trace metal concentrations >=10ug/L
        - RPD up to +/- 50% for VOC & trace metal concentrations < 10ug/L
        - RPD up to +/-15% major cations & anions concentrations mg/L range
    - Relative Percent Difference (RPD) is a common statistical tool used to compare two data points in side-by-side sampling evaluations. Lower RPDs mean the two data points are similar. RPDs begin to fail as a practical comparison when concentrations are low. For example, comparing 2 ug/L to 5 ug/L is only a difference in 3 ug/L, which for many regulated contaminants would not be a significant difference that lead to different site decisions. However, the RPD calculates to an unacceptable 86%. In these cases, other statistical methods or techniques are suggested.
    - The USGS suggests that "one of the more effective ways to compare concentration results is to plot the data on a 1:1 correspondence on an X-Y plot with the passive results on one axis and the active results on the other axis. If the two sampling methods collect the same concentrations, the points will plot on or close to the 1:1 correspondence line."

Understanding the Site

Background Conditions

There are localized environmental conditions that may affect sample results independent of the sampling method. For a valid comparison these conditions should be understood and considered prior to making comparisons. These conditions include,

- Geologic conditions where the monitor well is located.
- Well Design: Screened sediment or open borehole? Well construction Materials?
- Well Configuration: Well depth, diameter, screen location & length. If the wells are 2-inch diameter, is the casing Schedule 40 (standard) or schedule 80 (smaller inside diameter)?
- Static or piezometric water level & range of annual fluctuation
- Local groundwater flow conditions such as, recovery time, hydraulic conductivity, or drawdown test results.

Historical Sampling Regiment

Understanding the historical sampling routine helps to ensure that all sampling requirements are considered and better enables a holistic comparison between different sampling techniques.

- Are there certain regulatory requirements regarding sample methods or procedures?
- Sampling method and how long in use?

- Is historical data available?
- How many wells are on the site?
- Sampling frequency?
- Are all CoCs sampled at every event? If not when?
- Dedicated sampling equipment? What is dedicated and what is not?
- Water Quality Parameters: Which ones are collected for aquifer /contaminant definition and which for low-flow stabilization?
- Waste-water disposal: Required or not? What is the process and cost?
- Decontamination of sampling equipment, Are there special requirements such as for PFAS?
- Field Blanks: Equipment rinsate blank requirements (PFAS)?, Other requirements?

Contaminant Considerations

The list of Contaminants of Concern (CoCs) should be reviewed to confirm that the appropriate passive sampler is being used and that the sampler can provide the sample volume required to meet laboratory method(s).

- What are the CoCs?
- Are the samples to be unfiltered, "whole" water samples or dissolved fraction only?
- Are there minimum sample turbidity requirements? If so, what are they and what is the process when turbidity is over the limit?
- Historic concentration ranges : Min, Max, Mode ?
- Lab Method(s)
- Sample volume requirements (Check with lab for minimum sample volume requirements)

Planning for Adequate Sample Volume

Because passive sampling collects a sample of the water under natural flow conditions, the amount of water that can be collected without causing changing or affecting natural flow, is limited to the water within the saturated screen. The diameter and length of saturated screen dictate the size and number of passive samplers that can be deployed in a well.

It is always desirable to contact the lab that will perform the analysis and ask for the Minimum Sample Volume Requirements that meet the site objectives. Most labs are familiar with passive sampling and are able to accommodate lower volume requests.

The maximum volume that can be acquired from a 5-foot-long saturated screen is slightly over 1-liter. Using a HydraSleeve sampler, more than two liters can be collected in a 9-foot saturated screen. (Table 1)

Table 1. SATURATED SCREEN LENGTH TO MEET SAMPLE VOLUMED REQUIREMENTS

Table 1. Standard HydraSleeve Dimensions, Sample Volume and Saturated Screen Requirements*.					**Minimum Saturated Screen Required****		**Minimum Saturated Screen Required Above each Additional HydraSleeve****
Item ID	**Sampler Type**	**Maximum Sampler Volume**	**Sampler Dimensions (Diameter When Filled with Sample)**	**Minimum Well Diameter**	**WITH Top Weight in 2-inch Diameter Sch 40 Well. (FEET)**	**WITHOUT Top Weight in 2-inch Diameter Sch 40 Well. (FEET)**	**2-inch Diameter Sch 40 Well (FEET)**
GSH110	HydraSleeve	600mL	1.5" Diameter x 30" Length	1.5" Sch 40 Wells	4.0	5.5	3.0
GSH130	HydraSleeve	1.1L	1.75" Diameter x 37" Length	2" Sch 80 Wells	5.0	6.5	3.5
GSH430	HydraSleeve SuperSleeve	1.1L	1.75" Diameter x 37" Length	2" Sched 80; (50mm) Wells	5.0	7.0	3.5
GSH435	HydraSleeve SuperSleeve	1.5L	1.75" Diameter x 52" Length	2" Sched 80; (50mm) Wells	7.0	9.5	5.0
GSH440	HydraSleeve SuperSleeve	2.1L	1.75" Diameter x 66" Length	2" Sched 80; (50mm) Wells	8.5	12.0	6.5
GSH470	HDPE HydraSleeve SuperSleeve (For PFAS Sampling)	1.1L	1.75" Diameter x 37" Length	2" Sched 80; (50mm) Wells	5.0	7.5	4.0
GSH475	HDPE HydraSleeve SuperSleeve (For PFAS Sampling)	2.0L	1.75" Diameter x 67" Length	2" Sched 80; (50mm) Wells	9.0	12.5	7.0
GSH515	HydraSleeve SpeedBag	500mL	1.5" Diameter x 30" Length	1.5" Sch 40 Wells	Do Not Use Top Weight	6.5 with Oscillation 7.5 without Oscillation	4.0 with Oscillation 5.0 without Oscillation
GSH510	HydraSleeve SpeedBag	900mL	1.75" Diameter x 37" Length	2" Sched 80; (50mm) Wells	Do Not Use Top Weight	7.5 with Oscillation 9.0 without Oscillation	4.5 with Oscillation 6.25 without Oscillation
					4-inch Diameter Sch 40 Well. (FEET)	**4-inch Diameter Sch 40 Well. (FEET)**	**4-inch Diameter Sch 40 Well (FEET)**
GSH230	HydraSleeve	3L	2.9" Diameter x 37" Length	4" Sch 80 Wells	4.0	6.4	3.3

* Custom Length HydraSleeves, Custom "TurboSleeves" and "Armored HydraSleeves" are available for special applications.** All Saturated Screen Lengths are approximate.

Field Data Collection, Minimum Requirements

Once sampling begins, collecting well-specific sampling details will provide information that can be used for quality assurance and will document factors separate from the sampling method, that could affect results, aiding in the overall comparison and better understanding of site characteristics. At a minimum the following should be collected,

1. Depth to pump intake and depth to midpoint of passive sample interval.
2. Water level prior to installing and recovering samplers.
3. Turbidity of the acquired samples.
4. Volume of purge water generated.
5. Sample volume collected.
6. Specific issues/events that occurred during sampling that add information to the overall sampling picture.
7. Number of people on-site for sampling and total time per sample method.

Conducting a Side-By-Side Sampling Event

A side-by-side test involves some complexity and therefore planning. The intention is to collect samples from a well by two different sampling methods, one immediately after the other, to eliminate temporal variations, and in a way that the samples best represent the same water interval.

Pre-Deployment Preparation

1. Establish agreement with stakeholders and regulators on the evaluation process and what results allow for the use of passive samplers on the site.
2. Have a safety plan in place that reflects site conditions, contaminants, and equipment.
3. When sampling for PFAS, review the need and frequency for equipment rinsate blanks and the selection of materials used in the sampling devices and accessory supplies.
4. Determine the number of wells that will best fulfill the evaluation objectives and choose those that best represent the site conditions. Make note of wells that historically are pumped dry during sampling, are highly turbid, or wells that have wide-ranging or inconsistent historical results.
5. Review the CoCs and select the passive sampling device(s) that are appropriate for sampling the specific COCs.
6. Review the minimum lab sample volume requirements for the CoCs and the sample volume capability of the passive sampler.
7. Review the individual well configurations to confirm that there is adequate saturated screen interval to obtain the required sample volume using the selected passive sampler(s). Determine the pump intake depth and configure the placement of the passive sampler(s) within the saturated screen to acquire the sample(s) as close as possible to the pump intake interval. **It is recommended that factory-built suspension tethers are used to help ensure all components are accounted for and that samplers will be effectively placed in the available saturated screen. See Appendix A for Tether Information Worksheet.*
8. When planning an event to compare a passive sampling method to an active sampling method (bailing, volume pumping or low-flow pumping), the passive sampler should be sampled first and installed far enough in advance of the intended sampling date to allow the passive sampler it's minimum residence time. This means that dedicated sampling equipment must be removed from the wells to allow for the installation of the passive samplers. The active method should begin as soon as practical after the passive sample has been taken from the well.
9. Some passive samplers require a Minimum Residence Time in the well before the sample can be acquired. The minimum residence time includes the time it takes for the well to return to natural flow conditions after being disturbed by the placement of the sampler and, in the case of diffusion sampling, to allow adequate time for molecules to diffuse through a membrane to equilibrium in the sampler. HydraSleeve passive grab-samplers

need only a short residence time because there is little displacement, drag-down of stagnant water, and flow disturbance when the sampler is installed. Active sampling methods can commence immediately upon installation of the devices because the action of pumping/purging draws water from the casing and screen into the pump where the blended water is removed from the well until it is determined that continued pumping represents aquifer quality water. Therefore, pumping can be performed immediately after passive samplers are removed, but not the other way around.

10. To reduce the number of site-trips the passive sampler(s) may be installed after sampling during a current event and left in place until the test event, as long as the minimum residence time is met. There is no maximum residence time, and the samplers will always represent the conditions at the recovery date. Follow the installation process according to the manufacturer's instructions.

On-Site Installation Plan

1. Before going to the site, check all equipment and parts to be sure everything has arrived and in good condition.
2. Once on site and prior to installing or removing any equipment from the well, a water level measurement should be taken and recorded.
3. Field-check the well depth using a weighted tape or weighted rope that can be measured when it is retrieved and check the depth against the tether configuration details to be sure samplers will be properly placed.
4. Remove all dedicated equipment from the well and store in a suitable manner for re-installation after the passive samplers are removed from the well.
5. Install the passive sampler(s) per the manufacturer's SOP. Select from the list below to link to detailed deployment and recovery instructions for various passive samplers .
    a. HydraSleeves / SuperSleeves / SpeedBags
    b. Dual Membrane PDBs (DMPDBs)
    c. Standard PDBs (PDBs)

General Guidance for Installing HydraSleeves & SuperSleeves. **Consult the manufacturer's SOP or Manual for details. (SuperSleeve guidance is shown after the HydraSleeve section)**

General Guidance for Installing HydraSleeves

1. If a factory constructed tether is being used, review the well configuration document that arrived with the project tether quotation emails.
2. Select the tether with the ID tag that matches the well ID. (If a factory suspension tether is not being used see the manufacturer's SOP for constructing a suspension tether.)
3. Open the zip-top package holding the designated HydraSleeve, remove the HydraSleeve from the package, unfold it and hold it so the two white reinforcing strips are at the top. Save the discharge straw for use when the HydraSleeve is recovered from the well.
4. Using a thumb and forefinger, squeeze the two ends of the white strips toward each other so the top of the HydraSleeve begins to open and the strips bend outward near the holes. Squeeze tightly so the white strips are crimped in the open position.
5. *If the configuration calls for a Top Weight continue here otherwise skip to #7 below*. Identify the Top Weight and hold it so the two small holes are at the top. Slide the top of the HydraSleeve through the bottom of the Top Weight and push upward until the holes in the Top Weight align with the holes in the white strips at the top of the HydraSleeve.
6. One end of the tether will have a "U"-shaped Spring Clip attached to the rope. Place the wide end of the "U"-shaped Spring clip into the top of the HydraSleeve so that the "ears" of the clip are located in the holes in the white strips AND in the holes of the Top Weight so that the HydraSleeve is inside the Top Weight, and both are suspended by the Spring Clip. The narrow end of the "U" is above the HydraSleeve.
7. *If the configuration does NOT call for a Top Weight continue here*. One end of the tether will have a "U"-shaped Spring Clip attached to the rope. Place the wide end of the "U"-shaped Spring clip into the top of the HydraSleeve so that the "ears" of the clip are located in the holes in the white strips and the narrow end of the "U" is above the HydraSleeve. The clip should hold the top of the HydraSleeve open.
8. Locate the bottom of the HydraSleeve and fold the bottom in half length-wise so the two holes align. Place a zip-tie or bottom clip through the holes and connect the zip-tie or clip to the stainless-steel bottom weight.
9. Be sure the other end of the tether is connected to the reel or frame on which it was delivered. Connect the Well Cap provided with the tether, to the Black Snap-connector near the well ID tag.
10. Place the weight and bottom of the HydraSleeve in the well and start to lower*. Once the HydraSleeve is in the water DO NOT PULL UPWARD BECAUSE THE UPWARD ACTION WILL CAUSE WATER TO MOVE PREMATURELY INTO THE SAMPLER.
11. *If there are to be multiple HydraSleeves on one tether, as the tether is lowered, watch for small stainless-steel rings embedded in the rope. They will usually be located approximately a distance of approximately the length of the HydraSleeve from the bottom of the tether. There will be two rings per sampler, and they are spaced the length of a HydraSleeve apart.
12. Find the upper ring of the two-ring pair and fasten a Spring Clip to the ring.
13. Open the package with the HydraSleeve for the second position and attach the top of the HydraSleeve to the Spring Clip. Unfold the HydraSleeve downward along the rope. The bottom of the sleeve should be near another ring. Use a zip-tie through the two holes in the bottom of the HydraSleeve and zip tie the bottom of the HydraSleeve to the ring. If there is not another ring near the bottom of the sleeve look upward on the rope and see if there is a ring above the one with the clip. If so, relocate the Spring Clip to the upper ring and zip tie the bottom of the sleeve to the lower ring.

14. If there are additional HydraSleeves to install in the same well repeat 3 through 4 and skip to 11 and continue until all sleeves are attached to the tether for this well.
15. Continue lowering the tether with HydraSleeves until the Well Cap can be installed at the top of the casing. Disconnect the Reel or frame from the tether to install the Well Cap on the casing. DO NOT PULL UPWARD ON THE TETHER BECAUSE THE UPWARD ACTION WILL CAUSE WATER TO MOVE PREMATURELY INTO THE SAMPLER.

General Guidance for Installing SuperSleeves. **Consult the manufacturer's SOP or Manual for details. (HydraSleeve guidance is shown before the SuperSleeve section)**

1. If a factory constructed tether is being used, review the well configuration document that arrived with the project tether quotation emails.
2. Select the tether with the ID tag that matches the well ID. (If a factory suspension tether is not being used see the manufacturer's SOP for constructing a suspension tether.)
3. Locate the Standard Top Collar (STC) assembly or the Weighted Top Collar (WTC) assembly designated for the specific well. Separate the two parts by unscrewing them. One part is male threaded and the other is female threaded. There will be a "U"-shaped Spring clip packaged in with the Top Collar Assembly.
    a. The STC will be a two-piece gray PVC cylinder, between 1.6-in and 1.9-inch diameter and about 4-in long, that is made from two PVC parts threaded together.
    b. The WTC will be a two-piece gray PVC and silver stainless-steel cylinder, between 1.6-in and 1.9-inch diameter Between 8 in and 18-inches long, that is made from the stainless-steel and PVC parts threaded together. WTCs are ONLY used on the SuperSleeve that is at the bottom of the tether. If there are multiple SuperSleeves on a tether only the bottom sleeve may be Top Weighted.

4. Open the zip-top package holding the designated SuperSleeve, remove the SuperSleeve from the package, unfold it, and hold it with the plain end at the top. This is the end that DOES NOT have the two ¼-inch holes (or, in some models a tied knot). This is the top of the SuperSleeve which can be opened like a plastic bag. There is a discharge straw in the package. Save the discharge straw for use when the SuperSleeve is recovered from the well.
5. Slide the female threaded part from the Top Collar assembly upward over the top of the SuperSleeve so that the female threads are upward. If this is a weighted Top collar assembly the female part will be stainless-steel, otherwise the female part will be gray PVC.
6. Open the top few inches of the SuperSleeve and slide the narrow end of the PVC male threaded Top Collar into the top of the SuperSleeve until the top of the SuperSleeve is ~1/4-in to ~1/2-in above the threads. The top of the sleeve should not be more than 1/8-in above the smooth tapered portion above the male threads.
7. Slide the female threaded part over the male threaded part and gently screw the parts together, trapping the top of the SuperSleeve between the two parts. Tighten only finger-tight, sufficient so that a tug on the lower portion of the sleeve doesn't pull the sleeve out of the Top Collar Assembly, but not so tight as to slice the top of the SuperSleeve by over-tightening the threads.
8. One end of the tether will have a "U"-shaped Spring Clip attached to the rope. Place the wide end of the "U"-shaped Spring clip into the top of the Top Collar Assembly so that the "ears" of the clip are located in the holes in the gray PVC Top Collar. The narrow end of the Spring Clip is attached to the tether, above the SuperSleeve.
9. Locate the bottom of the SuperSleeve and fold the bottom in half length-wise so the two holes align. Place a zip-tie or bottom clip through the holes and connect the zip-tie or clip to the stainless-steel bottom weight. Only the bottom SuperSleeve will have a bottom weight.
10. Be sure the other end of the tether is connected to the reel or frame on which it was delivered. Connect the Well Cap provided with the tether to the Black Snap-connector near the well ID tag.

11. Place the weight and bottom of the SuperSleeve in the well and start to lower*. Once the SuperSleeve is in the water DO NOT PULL UPWARD BECAUSE THE UPWARD ACTION WILL CAUSE WATER TO MOVE PREMATURELY INTO THE SAMPLER.
    a. *If there are to be multiple SuperSleeves on one tether, watch for small stainless-steel rings embedded in the rope as the tether is lowered. The rings will usually be located a distance of approximately the length of the SuperSleeve from the bottom of the tether.
    b. There will be two rings per sampler, and they are spaced the length of a SuperSleeve apart.
12. Find the upper ring of the two-ring pair and fasten a Spring Clip to the ring.
13. Open the package with the SuperSleeve for the second position(upward from the first SuperSleeve) and attach the top of the SuperSleeve to the Spring Clip. Unfold the SuperSleeve downward along the rope. The bottom of the sleeve should be near another ring. Use a zip-tie through the two holes in the bottom of the SuperSleeve and zip tie the bottom of the SuperSleeve to the ring. If there is not another ring near the bottom of the sleeve look upward on the rope and see if there is a ring above the one with the clip. If so, relocate the Spring Clip to the upper ring and zip tie the bottom of the sleeve to the lower ring.
14. If there are additional SuperSleeves to install in the same well repeat 4 through 7 and skip to 12 above until all sleeves are attached to the tether for this well.
15. Continue lowering the tether with SuperSleeves until the Well Cap can be installed at the top of the casing. Disconnect the Reel or frame from the tether to install the Well Cap on the casing. DO NOT PULL UPWARD ON THE TETHER BECAUSE THE UPWARD ACTION WILL CAUSE WATER TO MOVE PREMATURELY INTO THE SAMPLER.

Passive Sample Collection

Recovering a HydraSleeve / SuperSleeve sample

1. Review the tether configuration to see how many and what size samplers are in the well.
2. Locate the discharge-straws packaged with the HydraSleeve / SuperSleeve and prepare the appropriate sample bottles for the well samples.
3. Carefully remove the Well Cap without lifting it more than a few inches above the well casing and take a water level reading.
4. *Collect a sample by grasping the top of the tether rope and pulling upward rapidly (about 1 ft per second) for a distance about 1-1/4 to 1-1/2 times the length of the longest sleeve in the well. For example, if the sleeve is ~3-feet long, pull upward rapidly 4 to 5 feet, after which a slower rate is okay. A 1-ft per second rate is approximately equal to the fastest speed a person can move a straight arm in an arc from alongside their leg to straight over their head.
    a. *Look for special instructions for oscillating the tether when saturated screen length is short or when SpeedBag HydraSleeves are used. In these cases, the sleeve is pulled up about ½ to 2/3 it's length and then allow to settle back to its original position. The action is repeated 3-4 times, and on the final pull, the sleeve is pulled all the way through the sample zone as described in #4 above.
5. When the HydraSleeve is removed from the well, pinch the top of the sleeve an inch below the white strips and fold the top of the sleeve over so that any water above the valve is removed. When the SuperSleeve is removed from the well fold the sleeve slightly at the Top Collar to remove any water above the valve.
6. Keep the HydraSleeve/ SuperSleeve vertical and bring the sleeve and sample bottles near each other. (A lightweight tripod is useful for suspending full HydraSleeves for one-person sampling).
7. Pierce the side of the sleeve* with the pointed end of the discharge straw and manipulate the straw and sleeve to control the flow into the sample bottles. Samples should be discharged into bottles immediately after removal from the well.

a. *The HydraSleeve / SuperSleeve will collect a sample representing any stratification that may occur withing the sample interval. Therefore with 1.5L and 2L Sleeves it is possible that the bottom portion of the sleeve may reflect higher concentrations of "sinkers" if that is how they occur in the sample interval, and the upper part of the Sleeve may reflect higher concentrations of "floaters" if they occur that way in the sample interval.
b. Practice discharging the HydraSleeves as needed to optimize the process.
c. Plan for retaining a small amount of water after sampling for CoCs to fill a turbidity vial for analysis as part of the evaluation.
d. Log the amount of time elapsed from opening the well until the sample bottles are filled after sampling.
e. Dispose of the samplers according to the solid waste requirements. Tethers and other re-usable components may be stored on plastic bags, labeled with the well ID for future use in the same well.

8. Handle, preserve, package, and ship samples according to site protocols.

Collecting Water Quality (WQ) / Stabilization Parameters

In many cases Water Quality stabilization parameters do not need to be collected when using a passive sampler because the well isn't being purged and has been in a stable, equilibrium environment after the minimum residence time is met.

If field indicator parameter measurement is required to meet a specific non-purging regulatory requirement, the water remaining in the HydraSleeve after the lab sample for CoCs is collected may be used. If, during the planning phase, it is anticipated that there will not be enough water remaining after lab samples are collected, a second HydraSleeve may be installed at the same time as the first sampler, to acquire field WQ parameters. Alternate strategies for acquiring field WQ parameters may also be considered, including, using a downhole WQ sensor lowered on a cable or collecting a one-shot sample using a small bailer after the passive sampler is removed.

Sampling with the Active Method

1. Have the active sampling equipment (pump or bailer) ready to install before removing the passive samplers from the well.
2. Be sure all passive sampling equipment (samplers, tethers, weights, etc.) are removed from the well.
3. Insert pumps and tubing (or bailers) into the well slowly to minimize agitation. Avoid moving the equipment up and down unnecessarily.
4. Place the pump intake in the pre-designated sample location and confirm that it is at the planned depth.
5. Follow the standard sampling procedures, including purging and/or stabilization, normally followed at the site.
6. Collect samples in lab bottles according to standard procedures for the site. Handle, preserve, package and ship samples according to site protocols.
7. Collect a small sample and fill a turbidity vial for turbidity analysis as part of the evaluation.
8. Determine and log the amount of water pumped for purging or stabilization.
9. Log the amount of time from beginning of pump installation until the well is closed after sampling.
10. Dispose of purge water and disposable accessories according to site requirements.

Contact EON with questions or for assistance with a specific project at:

800-474-2490 or **Info@EONPro.com**

APPENDIX A

Well Information Worksheet (Example)

PPS

EON PRODUCTS CUSTOM TETHER CONSTRUCTION SHEET

The information you supply in this worksheet is the basis for pricing and construction of your Passive Sampling installation.

- ⇨ Please fill in White Blanks with your Company, Site, Well Detail, & Sampler Depth information.
- ⇨ If Pasting from another sheet be sure to Paste Values, NOT formula. (Paste Special>>Value & Number Format)
- ⇨ Most installations use only one type of sampler. If using different sampler types in the same well,
- ⇨ list each sampler type in a separate row. (One type per Row). EON will assist with the Green areas as needed.

Components (EON Can Assist)

Item	Quantity
Prefill Y/N	N
ASTM Type	
Zip Ties-25pk	1
Blank T1-130	

Co. Name		Site Name	
Co. Location		Site Location	
Contact Name		Your PO#	
EON Project #		Sampling for PFAS?	no
		Requested Receipt Date	

Sampler Location Details -Type or Paste the Information Below

More Info:	*IS MEASUREMENT REFERENCE POINT =TOP OF CASING ? (Yes/No)	y	Feet or Meters ?	Feet	Type	Select
	*FOR PDBS, INDICATE WHETHER PLACEMENT DEPTH IS MEASURED TO THE "TOP" OR "MID"-POINT OF SAMPLER. *FOR HYDRASLEEVES, INDICATE "TOP" OF SAMPLER OR CENTER-"C" OF THE SAMPLE ZONE? (For Hydrasleeves the sample zone is above the top of sampler placement)	Top	Bottom of Screen = Well Depth? (Yes/No)	Yes	Tether Type	Poly 3/16
	PVC Casing? Y / Schedule 40 Casing? Y				Cap Type	Tcap/Ring
	ENTER THE PLACEMENT DEPTH FOR EACH SAMPLER IN THE CELLS BELOW			Enter # of ft above well bottom to place weight if needed		
IF DEPTHS ENTERED BELOW ARE NOT MEASURED FROM TOC ENTER "NO" in CELL M14	Deepest → Shallowest		EON Can Assist with the Entries Below			

	Well I.D.	Well Depth*	Well Dia	Depth to Water	Top of Screen	Depth* S-1	Depth* S-2	Depth* S-3	Depth* S-4	Depth* S-5	Depth* S-6	Depth* S-7	Sampler Type	# of Samplers	Weight Type	Reel Type
	Example	60	2	13.39	50	57	52						1.7x18DS	2	1.5 Std	H-Frame
1														0		
2														0		
3														0		
4														0		
5														0		
6														0		
7														0		
8														0		
9														0		
10														0		
11														0		

The Well Information Worksheet is completed prior to the selection and purchase of passive groundwater samplers. The information is used to confirm the size and placement of Passive Diffusion Samplers and HydraSleeves within the saturated well screen and for placement of sampler connection points on the tether. The worksheet is provided in Excel format.