Cover Sheet
Standard Operating Procedure

Operation Title: **Temporary Groundwater Monitoring Point Installation**

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1. Applicability

This Standard Operating Procedure (SOP) applies to all programs in the Maine Department of Environmental Protection's (MEDEP) Division of Remediation (DR). It may be utilized by other Divisions within MEDEP, as determined by the respective Division Directors or their designees.

This SOP is not a rule and is not intended to have the force of law, nor does it create or affect any legal rights of any individual, all of which are determined by applicable statutes and law. This SOP does not supersede statutes or rules.

2. Purpose

The purpose of this document is to describe the MEDEP/DR procedure for the installation of temporary groundwater monitoring points via direct-push methodology. These installations are often referred to as microwells or direct-push monitoring points (DPMPs) and generally consist of small-diameter monitoring points with an isolated, slotted-screen intake interval surrounded by filter pack. They are usually drilled to relatively shallow depths in overburden or shallow, fractured bedrock and therefore have minimal or no permanent casing and are installed as temporary monitoring points for the collection of groundwater samples or hydraulic head measurements.

Temporary groundwater monitoring points are most often used as a screening tool to evaluate the presence or absence of groundwater contamination or to better understand site-specific hydraulic conditions. In some cases, these monitoring points can be used for additional evaluation when site conditions warrant. Permanent monitoring wells have additional design considerations that are not covered in this SOP.

3. Key Definitions

Temporary Groundwater Monitoring Point: A small-diameter groundwater monitoring point installed using direct-push technology, consisting of a discrete slotted-screen interval and minimal casing. These are alternately called direct push monitoring points (DPMPs) or microwells and are typically used for screening-level groundwater sampling and evaluation of hydraulic conditions. Depending on site conditions, construction, and protection measures, they may be used for limited long-term monitoring, but they are not equivalent to conventionally installed monitoring wells such as though installed using hollow-stem auger, sonic, or rotary drilling methods.

Direct Push Monitoring Point: An alternate term for a temporary groundwater monitoring point or microwell.

Microwell: An informal term used to describe a temporary groundwater monitoring point or direct push monitoring point.

Geoprobe®: A method of obtaining soil borings utilizing Geoprobe Systems direct push technology.

Borehole: The hole created in the ground after using the Large Bore Soil Sampler for collecting soil borings, or the Large Bore Pre – Probe designed specifically for creating a hole for installation of a direct-push monitoring point or for continued soil sampling at depth.

Annulus: Space in the borehole between the well screen or casing and the borehole wall.

Riser – The portion of pipe which extends from the well screen to or above the ground surface. Typically consists of threaded 3/4 or 1-inch inner diameter (ID) polyvinyl chloride (PVC) plastic pipe.

Slotted Screen: Threaded PVC casing with the same diameter as the riser, constructed with slots to allow water to enter the microwell from the surrounding formation.

Flush mount: A surface casing completion in which the casing is installed approximately level with the ground surface and secured with a concrete pad to limit surface water infiltration. In flushmount construction, the riser measuring point is located below ground surface.

Stick Up: A surface casing completion in which the casing extends above the ground surface to protect the riser. In stick-up construction, the riser measuring point is located above ground surface.

Filter Pack: Clean, well rounded screened material (typically sand) placed in the annulus between the borehole wall and the well screen to prevent formation material from entering the completed monitoring point. Filter pack material should be selected based on observed subsurface conditions and sized to effectively retain native fine material while not being drawn into/through the screen.

Bentonite: A hydrous aluminum silicate available in powder, chip, granular, or pellet form, that is used to provide a tight seal between the borehole wall and the well casing.

Soil Cuttings: Soil/unconsolidated material generated and brought to the ground surface during subsurface investigation activities.

4. Responsibilities

All MEDEP/DR Staff must follow this procedure when performing this task. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this SOP. MEDEP/DR staff reviewing data by outside parties should ensure that this SOP (or an equivalent) was followed, depending on the specific Data Quality Objectives (DQOs) of the task.

Other MEDEP SOPs may also apply when performing this task, including, but not limited to MEDEP/DR SOP *RWM-DR-014 - Development of a Sampling and Analysis Plan* (SAP). The SAP should consider quality assurance and quality control (QA/QC) samples and measures, the specifics of which will depend on the DQOs for the task. Types of QA/QC samples are discussed in more detail in the DR Quality Assurance Plan (QAP). SAP development includes provisions for creating a Health and Safety Plan (HASP) associated with the activity, including compliance with Dig Safe notifications when disturbing soil with powered equipment or tools (i.e., not hand tools). Dig Safe notification does not include public utility clearance requests which must be completed separately (e.g., sewer and water lines). These utility marking requests typically do not extend onto marking private property (i.e., they may only mark lines in the public right of way), so hiring a private utility marking company may be necessary, depending on site specifics. Fieldwork and data collection tasks must be properly documented in accordance with applicable MEDEP SOPs and policies.

5. Guidelines and Procedures

Temporary groundwater monitoring points installed via direct-push technology (microwells) provide an inexpensive, yet effective method for obtaining overburden groundwater samples.

Additional precautions beyond those described in this document may be necessary when installing monitoring wells intended for permanent long-term monitoring, deeper borings, or monitoring points installed using methods other than direct-push (e.g., hollow-stem auger, sonic, or rotary drilling). Such installations should follow applicable guidance, industry standards, and site-specific requirements to ensure proper

construction, development, and the reliability of data collection needed for long-term assessment.

If using a soil sampler rod as part of the installation, microwell installation can provide an opportunity to observe and record the encountered lithology, as well as to collect deeper soil samples if needed for the investigation. For guidance on the collection of soil samples, see SOP RWM-DR-006, Soil Sampling.

5.1. Equipment

Equipment required for the installation and development of a microwell includes:

- Direct push type boring system, such as Geoprobe Systems soil boring system, including all necessary probe rods, center rods, outer casing, drive caps, cutting shoe, and sleeves required
- Appropriate diameter PVC Riser (commonly 0.75-inch nominal)
- Appropriate diameter PVC machine- slotted screen (typically 0.75-inch nominal with 0.010-inch slots)
- PVC threaded end caps to fit screen
- Geoprobe expendable point sized to fit the selected PVC riser/screen (typically 1.1-inch outer diameter [OD])
- Filter sand
- Granular bentonite
- Monitoring well cap plug capable of providing a vapor and watertight seal
- Flush mount road box or stick-up casing (site-dependent)
- Portland Cement (if finishing with flush-mount road box or stickup casing or utilizing bentonite grout)
- Water-level meter
- 5-gallon buckets
- Peristaltic pump and tubing
- Surge block (if needed)
- Containerization equipment (if needed)
- Site-specific health and safety equipment (minimum OSHA D level) and monitoring equipment (e.g. photo-ionization detector, four-gas meter)

Nominal well diameter determines the exact equipment and installation approach required, as borehole width should be wide enough to ensure that filter pack can be uniformly deposited around the screen and riser. Microwells are most commonly installed with nominal diameters of 0.5 to 1.0-inch. These smaller sizes are the most reliable and easiest to properly seal, cost effective, and the PVC is usually easily obtained. Installations with a nominal well diameter of 0.75-inch, installed

with a 2.25 inch outer diameter/ 1.5 inch ID drive-casing are the most common within MEDEP practice.

Typical direct-push systems are capable of installing monitoring wells up to 2-inches in nominal diameter, but such installations require higher powered direct push drill rigs and specific site conditions. These larger diameter monitoring well installations may not always be successful and may be better suited for an alternate installation methodology.

Slotted-screen size and filter pack material should be selected based on the anticipated grain size of the formation at the intended screened interval, with the goal of minimizing movement of native fine material into the well while preventing filter pack material from entering the well screen. Typically, a #1 sand and 0.01-inch slotted screen are appropriate for most overburden and shallow, fractured bedrock wells, especially those in finer-grained formations (e.g., silty sand or fine sand). They may not be the best option in certain formations. For example, a #2 sand and wider slot screen are more appropriate for coarser-grained formations (e.g., medium to coarse sand or gravelly sand). A #0 sand filter pack and finer slot screen are most appropriate for very fine-grained formations (e.g., silts, sandy silts, or very fine sands) where control of fines is needed, though its use may reduce well recharge rates/flow.

Materials chosen for installation, well construction, and development should be appropriate to ensure that cross-contamination will not occur when sampling contaminants-of-concern (COCs) on a Site. For example, coated bentonite pellets, Teflon-lined tubing, and some drilling rod lubricants are not considered PFAS-free.

5.2. Considerations Prior to Installation

5.2.1. Health and Safety

Well-installation, even to shallow depths, can pose health and safety risks. Ensure that the health and safety plan is followed and an activity hazard assessment/ analysis is complete if required. All work should be conducted following the applicable Health and Safety Plan (HASP).

Before any intrusive subsurface work happens, Dig Safe must be contacted, in accordance with state requirements, to identify and mark underground utilities. Markings should be reviewed in the field prior to beginning work, and boring locations should be adjusted if necessary to maintain required clearance distances.

If utilities are encountered or suspected, or they cannot be cleared, intrusive work should not occur until the conflict is resolved. Dig Safe notifications must be valid during the timeframe of work and consideration should always be given to private utility mapping, as Dig Safe only covers public utilities.

Site-specific condition assessment should occur prior to well installation, and conditions should be continuously monitored during well installation. Examples of hazards to consider include, but are not limited to:

- Maintaining an exclusion zone with safety cones or barriers, especially in populated areas
- Dependent on the previous use of the Site, screening for subsurface gas and vapor may be appropriate, especially during rod withdrawal and well development/sampling
- Rods should be treated as stored-energy systems, and the operator should be familiar with the drill rig and aware of potential hazards (e.g. pinch-points, rod rebound, water or gas under pressure)
- All personnel on Site should be aware of where the emergency stop button for the drill rig and fire extinguisher are located
- Closely monitor the ground and any surrounding structures for potential heaving or structural cracking, especially if there is significant water or artesian conditions
- Additional precautions when working near the road or high traffic areas

Always refer to the manufacturer's operations manual for use of the specific boring system.

5.2.2. Containerization

Containerization requirements should be clearly stated in the work plan or quality assurance project plan dictating work, but it is important to note that conditions may change. When site conditions, expected contaminants, or regulatory requirements indicate that ground surface discharge is not appropriate, cuttings and groundwater should be containerized to minimize release into the environment and potential further contamination. Appropriate containers include drums, buckets, totes, or other suitable vessels that are structurally sound, compatible with the material being stored, and capable of being securely closed and labeled.

Always clearly label containerized material and stage it securely away from surface water, storm drains, public access, and any site traffic. Management may be necessary to prevent spills, leaks, or exposure. Dispose of cuttings and groundwater following applicable MEDEP guidance, site-specific requirements, and any other applicable regulations.

For management of petroleum contaminated groundwater from drilling activities, see SOP No. RWM-PP-012 Managing Non-Hazardous Petroleum Contaminated Ground Water and Soil at UST Sites.

5.3. Microwell Installation Procedure

Boring and well construction information should be logged using the field data record in Attachment A or an approved equivalent.

1. **Confirm Clearing:** Ensure that the boring has been appropriately cleared for public and private utilities. Consider pre-clearing the boring with hand tools to the depth of utilities in the area.

2. **Decontaminate:** Decontaminate non-dedicated equipment (e.g. rods, samplers) per MEDEP/DR SOP# RWM-DR-017 Equipment Decontamination Protocol. Specialty decontamination procedures like powered high-pressure wash, PFAS-free water rinse, or equipment blank detection should be detailed in a work plan and recorded on appropriate field logs.

3. **Drill Borehole:** Using the boring system, construct a borehole to the depth desired for the microwell (refer to the manufacturer's operations manual for use of the boring system). It is prudent to bore one or two feet deeper than desired in case of borehole collapse, especially in borings deeper than 15 feet. After reaching the depth desired, leave the soil borer or probe in the borehole to prevent premature borehole collapse. If rig is capable, push temporary casing to keep the borehole open. Observations such as soil lithology, PID readings, and depth to groundwater should be recorded on the appropriate field log (Attachment A or equivalent) or in a field notebook.

4. **Construct the Microwell on the Surface**: Construct the microwell using the PVC riser, slotted screen, and end cap or disposal tip. The length of the screen and riser will vary depending on data quality objectives (DQOs), the formation to be sampled and depth of the individual well. Additionally, screen length may be influenced by the COC(s) being investigated and whether samples will be collected. For shallow wells (less than 15 feet), a blunt end cap will usually suffice.

In deeper wells or easily collapsible formations, construct a "modified screen" by sawing off the threads at the bottom of the screen with a hacksaw (take approximately one inch off of the tip), and hammer a Geoprobe Expendable Point into the end of the screen by banging the riser and tip on a truck tailgate or other sturdy object. Deeper wells may also require the construction of the well in sections while installing the well in the borehole; use best field judgement to determine the technique.

5. **Remove Sampler and Install Microwell**: Remove the soil borer or pre-probe from the borehole, which should remain open, especially if outer casing is present. Confirm the depth to bottom of the borehole and depth to water, if applicable. If collapsed material remains in borehole, clean it out with the sampler. If needed, use material to raise the bottom of the borehole to the intended screened interval. If a seal is required (i.e. formation exposed at bottom of borehole is different than intended screened formation), utilize bentonite chips, otherwise consider sand or backfill. Install the microwell, ideally while utilizing a centralizer or level to ensure it is straight and centered. If the well does not finish into the borehole to the required depth, utilize a hammer to provide extra force in pushing the well into the borehole. Be careful not to apply enough force to crush the slotted screen.

   If the well still does not advance to the appropriate depth, remove the well and re-drill the borehole with the soil borer or blunt probe. It is sometimes helpful to clean out collapsed material from the borehole by "resampling" with the soil borer several times. Reinstall the microwell when redrilling is completed.

6. **Place Filter Pack:** Seal the top of the monitoring well with a cap or tape to ensure that material does not enter the well, then carefully pour filter sand into the annulus around the microwell to ensure that the screen is surrounded by the filter material. The level of filter material should rise above the top of the screen by a minimum of 1 foot.

   Slowly remove the outer casing until casing is at the intended depth where the top of the seal will sit. Monitor filter pack settling to determine if additional material needs to be added to maintain correct depth.

7. **Place Seal:** Slowly pour bentonite into the annulus to seal the well against infiltration from surface water or contaminant migration from other lithologies. A minimum of two feet of bentonite is needed to seal a microwell. Bentonite may need to be hydrated with potable water if sufficient formation water is not present in the borehole. It is recommended that bentonite hydrate for at least thirty

minutes prior to adding additional backfill materials to limit bridging. Filter sand, native fill, or bentonite grout should be used to fill to at least the top foot of the annulus. If utilizing bentonite grout, care should be taken to ensure proper hydration and bentonite to Portland cement ratio. It is recommended that grout is allowed to set for at least 24 hours prior to pumping the well.

8. **Install Protective Materials:** Install the stick-up casing or flush mount road box, if utilizing.

9. **Record Measurements:** Ensure final measurements are recorded on a well installation field data record (see Attachment A).

10. **Decontaminate, as necessary:** If installing additional microwells, decontaminate non-dedicated equipment between borings as required in MEDEP/DR SOP# RWM-DR-017 or the appropriate work plan or quality assurance program plan.

Once the microwell has been installed, it should be properly surveyed (if it will be used for water level information), capped with an appropriate end cap, and permanently marked with the correct well designation as well as date of installation and estimated screened interval below ground surface. The appropriate security measures (such as a road box, or locking outer casing), if required, can then be installed over the microwell. The well should then be developed (see Section 5.5).

5.4 Well Installation Evaluation

If the microwell does not install into the borehole after repeated attempts to clean out collapsed material, the formation may not allow for installation of a microwell with this method. It may be necessary to utilize a temporary well point system, or installation of a monitoring well with a rotary drilling rig.

5.5 Microwell Development

Development is required to remove fines introduced during installation and to properly seat the filter pack surrounding the well screen. This process helps limit the migration of fine native material into the screened interval. Fine particles are drawn into the pore spaces of the sand pack to block other fine material from entering. Microwells can be developed by over-pumping, or a combination of surging and over-pumping.

Development of temporary microwells is generally less extensive than development of monitoring wells intended for long term use. Development goals should be established

by a quality assurance program plan or the work plan and may include target turbidity values, visual clarity, or a specified number of well evacuations.

5.5.1. Development Procedure

Collect an initial depth to water and depth to bottom of the newly installed well and record it in a field notebook or on an applicable field data record. Because microwells have a small diameter, traditional development pumps do not generally fit.

Using a peristaltic pump and tubing (material and diameter appropriate for site specific COCs), pump the well while agitating the well with the tubing to stir up fine sand and silt, and allow this material to flow out with the purged water. It is recommended that purge water is containerized even if site-specific regulations do not require it, as documentation of volume removed vs. depth to water is helpful in determining if the monitoring well is connected to the aquifer. While pumping, the intake should be moved throughout the screened interval during pumping operations. Allow the tubing to reach the bottom of the well to remove as much settled material as possible. It may be necessary to completely evacuate the well several times in order to fully remove all of the fines and settled material.

If water from the microwell is still turbid, it may be necessary to surge the well with a surge block (A device which works very well for this is a chimney brush extension rod with threaded ends.) to remove sediment. After surging the well to flush water in and out of the well through the slots and the sand pack, continue pumping the well as described above until the water is generally silt free or the site-specific DQOs for development have been met.

While developing the well, records regarding flow rates and recharge rates should be kept to fully evaluate the well and the formation in which it is screened. This information will also be used in developing purge rates for future sampling. It can also be helpful to collect additional water quality parameters such as turbidity. The final depth to water and depth to bottom of the well should be recorded in the field notebook and on the well installation form (Attachment A).

After development and recharge to at least 80% of the initial static water level, the microwell can be sampled. Review DQOs to determine if the newly installed well should sit and equilibrate with the aquifer for a certain period. Sampling the microwell should be conducted following MEDEP/DR SOP#

RWM-DR-002 – Groundwater Sample Collection for Site Investigation and Assessment Monitoring.

5.5.2. Monitoring Well Abandonment

When a temporary monitoring point is no longer needed or useful, it should be hydraulically sealed (abandoned) to prevent the boring from serving as a conduit for contaminant migration. For more information, see SOP No. RWM-PP-020 Well and Boring Abandonment.

6 References

None

ATTACHMENT A
Microwell Installation Form

MICROWELL INSTALLATION FORM		WELL ID:	INSTALL DATE:	LOGGED BY:
PROJECT NAME:		EGAD NUMBER:	INSTALL PURPOSE:	
DRILL TYPE:	OPERATOR:	LATITUDE AND LONGITUDE:		SOURCE:

SOIL DESCRIPTION AND DRILLING COMMENTS - NOT TO SCALE

DEPTH REFERENCE POINT:

FINAL DEPTH OF BORING:

DEPTH WATER TABLE:

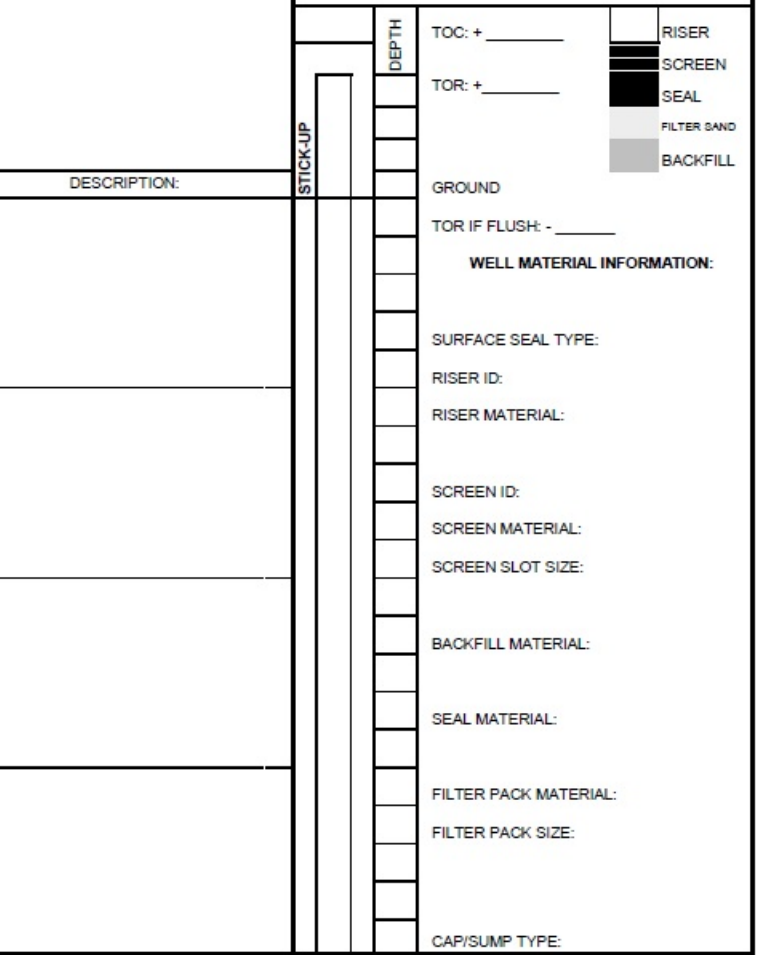
NOTES/ SAMPLE INFORMATION:

DEPTH	PENETRATION	RECOVERY	PID	OTHER: _____	CHECK IF SAMPLED	USCS	DESCRIPTION:

MONITORING WELL INSTALL INFORMATION - NOT TO SCALE

SCREENED INTERVAL:

BOTTOM OF WELL:



WELL MATERIAL INFORMATION:

SURFACE SEAL TYPE:

RISER ID:

RISER MATERIAL:

SCREEN ID:

SCREEN MATERIAL:

SCREEN SLOT SIZE:

BACKFILL MATERIAL:

SEAL MATERIAL:

FILTER PACK MATERIAL:

FILTER PACK SIZE:

CAP/SUMP TYPE:

DEVELOPMENT INFORMATION

INITIAL DEPTH TO WATER:	FINAL DEPTH TO WATER:	TOTAL GALLONS REMOVED:
INITIAL DEPTH TO BOTTOM:	FINAL DEPTH TO BOTTOM:	OTHER:

TOR = TOP OF RISER
TOC = TOP OF CASING
ID = INNER DIAMETER
BGS = BELOW GROUND SURFACE
THIS FORM IS INTENDED FOR TEMPORARY INSTALLATION ONLY

SIGNATURE: _____