List of Tables

NOTES applicable to Tables 1 through 6:
1) Reportable Concentration: Any amount above MDL
2) Other EPA approved comparable methods, which target the same constituents and have equivalent or lower detection limits may be used if analyses are conducted by a NC DWR certified laboratory that is certified for the method.
4) Submit copies of original laboratory reports.
5) Method Detection Limits and Reporting Limits: For target analytes with Maximum Soil Contaminant Concentrations below laboratory reporting limits, the MDL concentration must be indicated with the analytical result and results reported down to the MDL. Results above the MDL, but below the laboratory reporting limit, must be reported and qualified as estimated. The reporting limit concentration must be indicated for all target analytes and must be supported by the inclusion of a calibration standard at this concentration in the calibration curve.
6) Laboratories must be certified by the North Carolina DWR to perform the listed methods

Table 1
Approved Methods for Soil Analyses at Petroleum UST Closures and Over-Excavation and at Site Checks and for Non-UST Releases of Petroleum

Suspected Contaminant	Analytical Methods for Closure, Site Check, or Other Preliminary Investigation Samples	Analytical Methods for Samples from Over-Excavation Following a Release
1a. Low Boiling Point Fuels: gasoline, aviation gasoline, etc.[a]	EPA 8015C for TPH-GRO **(or** UVF for TPH)[b]	EPA 8260B **and** MADEP VPH
1b. Ethanol-Gasoline Blends	EPA 8015C for TPH-GRO **(or** UVF for TPH)[b] **and** EPA 8260B	
2. Medium/High Boiling Point Fuels: jet fuels, kerosene, diesel, fuel oil #2, biodiesel (containing diesel), etc. Varsol, mineral spirits, naphtha.	EPA 8015C for TPH-GRO **and** EPA 8015C for TPH-DRO **(or** UVF for TPH)[b]	EPA 8260B, EPA 8270D, MADEP VPH, **and** MADEP EPH
3. Heavy Fuels: #4, #5, #6 fuel oils, motor oil, hydraulic fluid, etc. Mineral oil[c]	EPA 8015C for TPH-DRO **(or** UVF for TPH)[b]	EPA 8270D **and** MADEP EPH
4. Used/ Waste Oil	EPA 8260B, EPA 8270D, MADEP VPH, MADEP EPH, **(or** UVF for TPH and PAH)[b] **and** EPA 3050B or 3051A Prep: Total Metals (Cr and Pb), EPA 8081B (pesticides)**, and** EPA 8082A (PCBs)[d]	EPA 8260B, EPA 8270D, MADEP VPH, MADEP EPH, EPA 3050B or 3051A Prep: Total Metals (Cr and Pb), EPA 8081B (pesticides) **, and** EPA 8082A (PCBs)[d]

a Analyze for Pb, EPA 3050B or 3051A Prep: Total Metals (Pb). Rev. 0412

b Only UVF technology with product (fuel) identification and calibration approved by DWM is allowed. (Other methods for TPH analysis may be approved by DWM for the initial investigation if determined to meet all requirements.)

c Carbon chains in mineral oils range from approximately C_{12}-C_{45}.

d Analyses for PCBs and pesticides are not required for service station/garage waste oil investigations.

Table 2
Approved Methods for Soil Analyses during Advanced Phases of Petroleum UST Release Investigations

Suspected Contaminant	LSA 1 Soil Sampling [a]	Comprehensive Site Assessment and Monitoring Soil Sampling [b f]	Final Site Closure Soil Sampling
1. Low Boiling Point Fuels: gasoline, aviation gasoline, ethanol-gasoline blends, etc.	For the first sample collected below land/excavation surface and the last sample prior to saturated zone use: EPA 8260B with IPE & MTBE **and** MADEP VPH For all other samples, analyze only by: MADEP VPH	Analyze all samples from each vertical boring by EPA 8260B with IPE & MTBE **and** EPA 8015C (TPH GRO) Then analyze the sample from each boring with the highest TPH-GRO value by MADEP VPH [d]	EPA 8260B with IPE & MTBE **and** MADEP VPH
2. Medium/High Boiling Point Fuels: jet fuels, kerosene, diesel, naphtha, fuel oil #2, etc. Varsol, mineral spirits, naphtha,	For the first sample collected below land/excavation surface and the last sample prior to saturated zone use: EPA 8260B, EPA 8270D, MADEP VPH, **and** MADEP EPH For all other samples, analyze only by: MADEP VPH, **and** MADEP EPH	Analyze all samples from each vertical boring by EPA 8260B, EPA 8270D, EPA 8015C (TPH GRO) **and** EPA 8015C (TPH DRO) Then analyze the sample from each boring with the highest TPH-GRO value by MADEP VPH [d] **and** Then analyze the sample from each boring with the highest TPH-DRO value by MADEP VPH **and** MADEP EPH [d]	EPA 8260B, EPA 8270D, MADEP VPH, **and** MADEP EPH
3. Heavy Fuels: #4, #5, #6 fuel oils; motor oil; hydraulic fluid; etc. Mineral oil [e]	For the first sample collected below land/excavation surface and the last sample prior to saturated zone use: EPA 8270D **and** MADEP EPH For all other samples, analyze only by: MADEP EPH	Analyze all samples from each vertical boring by EPA 8270D **and** EPA 8015C (TPH DRO) Then analyze the sample from each boring with the highest TPH-DRO value by MADEP EPH [d]	EPA 8270D **and** MADEP EPH
4. Used / Waste Oil	For the first sample collected below land/excavation surface and the last sample prior to saturated zone use: EPA 8260B, EPA 8270D, MADEP VPH, MADEP EPH, EPA 3050B or 3051A Prep: Total Metals (Cr and Pb), EPA 8081B (pesticides), **and** EPA 8082A (PCBs)[c] For all other samples, analyze only by: MADEP VPH, **and** MADEP EPH	Analyze all samples from each vertical boring by EPA 8260B, EPA 8270D, EPA 3050B or 3051A Prep: Total Metals (Cr and Pb), EPA 8081B (pesticides), **and** EPA 8082A (PCBs), Then analyze the sample from each boring with the highest TPH-GRO value by MADEP VPH **and** Then analyze the sample from each boring with the highest TPH-DRO value by MADEP VPH **and** MADEP EPH [d]	EPA 8260B, EPA 8270D, MADEP VPH, MADEP EPH, EPA 3050B or 3051A Prep: Total Metals (Cr and Pb), EPA 8081B (pesticides), **and** EPA 8082A (PCBs)[c]

a 2 full analysis samples are required per well boring.

b Sample analysis for monitoring will be limited to constituents previously detected

c Analyses for PCBs and pesticides are not required for service station/garage waste oil investigations.

d Avoid sampling the smear zone. If the samples with the highest EPA 8015C values appear to represent the smear zone, do not analyze them using MADEP. If all samples from a boring are non-detect for the 8000 series and 8015C, the additional analyses by MADEP should not be performed on the sample.

e Carbon chains in mineral oils range from approximately C_{12}-$C_{45.}$

f Use of UVF technology with product (fuel) identification and calibration approved by DWM is allowed for initial field assessment to facilitate intensive semi-quantitative assessment of contamination prior to collection at optimal locations of a minimum number of samples for laboratory analysis by the approved methods.

Table 3
Approved Methods for Groundwater Analyses at Petroleum UST Release Investigations (All Phases)

Suspected Contaminant	Analytical Methods (See Notes)
1. Low Boiling Point Fuels: gasoline, aviation gasoline, ethanol-gasoline blends, etc.	SM 6200B[a, b], MADEP VPH, **and** Metals (Pb)[d]
2. Medium/High Boiling Point Fuels: jet fuels, kerosene, diesel, fuel oil#2, biodiesel (containing diesel), etc. Varsol, mineral spirits, naphtha.	EPA 602 with Xylenes, EPA 625 Base/ Neutrals and Acids plus 10 largest non-target peaks, MADEP VPH, **and** MADEP EPH
3. Heavy Fuels: #4, #5, #6 fuel oil; motor oil; hydraulic fluid, etc. Mineral oil[c].	EPA 625 Base/ Neutrals and Acids plus 10 largest non-target peaks, **and** MADEP EPH
4. Used/ Waste Oil	SM 6200B, EPA 625 Base/ Neutrals and Acids plus 10 largest non-target peaks, MADEP VPH, MADEP EPH, **and** Metals (Cr and Pb)[d]

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a For EDB, also use EPA Method 504.1, initially and at closure.

b Only analyze for full list of target analytes for SM 6200B (presented in the *Guidelines for Sampling*, App. B) at the initial groundwater investigation (e.g., IAA/ IAR or LSA) unless DWM directs otherwise.

c Carbon chains in mineral oils range from approximately C_{12}-$C_{45.}$

d Use methods for metals from sources listed in 15A NCAC 2L .0112 and .0413.

Table 4
Approved Methods for Soil Analyses at Non-Petroleum UST Closures and Release Investigations

Suspected Contaminant	Analytical Methods (See Notes)
1. Halogenated Solvents 2. Non-Halogenated Solvents	EPA 8260B
3. Non-Petroleum - Unknown	Contact NC DENR/ UST Section/Corrective Action Branch (919) 707-8171
4. Pesticides	Contact NC Dept. of Agriculture and Consumer Services/ Pesticide Section (919) 733-3556 **and** NC DENR/ UST Section at (919) 707-8171
5. For substances not covered in 1 through 5	Contact NC DENR/ UST Section/Corrective Action Branch (919) 707-8171

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Table 5
Approved Methods for Groundwater Analyses at Non-Petroleum UST Closures and Non-Petroleum UST Release Investigations

Suspected Contaminant	Analytical Methods
1. Solvents: a. Halogenated/Non-Halogenated b. Ethanol c. Ethylene Glycol d. Formaldehyde	 a. EPA 8260B b. EPA 8260B c. EPA 8260B d. EPA 8315A
2. Non-Petroleum - Unknown	Contact NC DENR/ UST Section/Corrective Action Branch at (919) 707-8171.
3. Pesticides	Contact NC Dept. of Agriculture and Consumer Services/ Pesticide Section at (919) 733-3556 **and** NC DENR/ UST Section at (919) 707-8171.
4. For substances not covered in 1 - 4	Contact NC DENR2341/ UST Section/Corrective Action Branch at (919) 707-8171.

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Table 6
Approved Methods for Soil Analyses for a Permit

(See permit for required methods

Contaminant	Methods (See Notes)	Reportable Concentration
1. Low Boiling Point Fuels: gasoline, aviation gasoline, ethanol-gasoline blends, etc.	1. EPA 8015C for TPH-GRO, 2. EPA 8260B, 3. EPA 9045C (pH), and EPA 1311 (TCLP) Metals* Methods required for sampling purposes: (routine monitoring 1) , (permit completion 1 &2), (initial characterization1,2 &3)	Any amount above MDL
2. Medium/High Boiling Point Fuels: jet fuels, kerosene, diesel, fuel oil #2, biodiesel (containing diesel), etc. Varsol, mineral spirits, naphtha	1. EPA 8015C for TPH-GRO and EPA 8015C for TPH-DRO 2. EPA 8260B and EPA 8270D, 3. EPA 9045C (pH) and EPA 1311 (TCLP) Metals* Methods required for sampling purposes: (routine monitoring 1), (permit completion 1 &2), (initial characterization 1,2 &3)	Any amount above MDL
3. Heavy Fuels: #4, #5 and #6 fuel oils; motor oil; hydraulic fluid; etc. Mineral oil	1. EPA 8015C DRO, 2. EPA 8270D, 3. EPA 9045C (pH), and EPA 1311 (TCLP) Metals* Methods required for sampling purposes: (routine monitoring 1) (permit completion 1 &2) (initial characterization 1,2 &3)	Any amount above MDL
4. Used / Waste Oil	1.EPA Method 9071B, 2. EPA 8260B and EPA 8270D, 3. EPA 9045C (pH), and EPA 1311 (TCLP) Metals Methods required for sampling purposes: (routine monitoring 1) (permit completion 1 &2) (initial characterization 1, 2 &3)	Any amount above MDL
5. For substances not covered in 1 through 4	Contact NC DENR / UST Section (919) 707-8171	Contact the UST Section

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* In lieu of TCLP analysis, a total analysis of the TCLP constituents to document that individual analytes are not present at levels which could exceed TCLP regulatory levels.

NOTES: *1) If TCLP metals exceed TCLP limits, contact the DWM-Hazardous Waste Section at (919) 707-8200 for disposal information. 2) For permit completion sampling, the MDL concentration must be indicated with the analytical result and results reported down to the MDL. Results above the MDL, but below the laboratory reporting limit, must be reported and qualified as estimated. Blank results for these target analytes must also be reported down to MDL in order to evaluate the low level reporting. See the Guidelines for Sampling, current edition, for tables of volatile and semi-volatile target analytes, groundwater quality standard, and routine laboratory reporting limits.*

Table 7
Sample Containers and Preservatives for Soil Analyses

Method	Number and Type of Containers	Preservation	Holding Times
EPA 8015C GRO MADEP VPH	Duplicate pre-weighed VOA vials with methanol and Teflon-lined screw caps Extra VOA vial w/o preservative[a]	Cool to 4±2°C	28 days
	Duplicate EnCore samplers or equivalent **or** Duplicate pre-weighed empty VOA vials with Teflon-lined screw caps Extra VOA vial w/o preservative[a]	Cool to 4±2°C **and** Complete laboratory preservation[b] or analyze within 48 hours	
EPA 8260B[c]	Triplicate EnCore samplers or equivalent **or** Duplicate pre-weighed VOA vials w/ de-ionized water, sodium bisulfate, and stir bar, and duplicate pre-weighed VOA vials with methanol. Extra VOA vial w/o preservative[a]	Cool to 4±2°C **and** complete laboratory preservation[b] or analyze within 48 hours	14 days
EPA 8015C DRO EPA 8270D EPA 8081B EPA 8082A	8-oz glass jar with Teflon-lined screw cap	Cool to 4±2°C	Extract within 14 days and analyze extracts within 40 days of extraction.
MADEP EPH	4-oz (120-ml) wide-mouth amber glass jar with Teflon-lined screw cap	Cool to 4±2°C	Extract within 14 days and analyzed extracts within 40 days of extraction.
Total Metals	500-ml polyethylene or glass jar	Cool to 4±2°C	6 months

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a Use for dry weight determination and for soil characterization (i.e., laboratory effervescence check) of low-concentration samples suspected to contain carbonate minerals.

b See the *Guidelines for Sampling*, current version, for details on preservation options. Consult with the laboratory when selecting the preservation option and ensure option is documented with analytical results. If low level sodium bisulfate or equivalent preservation is required, check with the laboratory that will be doing the analysis for any other requirements. Sample size should be limited to 5 to 10 grams, depending on soil type. See the *Guidelines for Sampling*, current version, for additional information.

c Soil Samples collected for the analysis of ethanol and ethanol-gasoline blend releases must be analyzed with no delay.

Table 8
Sample Containers and Preservatives for Groundwater Analyses

Method	Number and Type of Containers	Preservative[a]	Holding Times
EPA 8260B SM 6200B MADEP VPH	Triplicate 40-ml VOA vials with Teflon-lined septa screw cap	Add 3 to 4 drops of 1:1 HCl Cool to 4±2°C	14 days
MADEP EPH	1-L amber glass with Teflon-lined screw cap	Add 5 ml of 1:1 HCl (to pH<2) Cool to 4±2°C	Samples must be extracted within 14 days and extracts analyzed within 40 days.
EPA 625	1-L amber glass with Teflon-lined screw cap	Cool to 4±2°C	Samples must be extracted within 7 days and extracts analyzed within 40 days.
Metals (Cr and Pb)	500-ml polyethylene or glass jar	Add 5 ml of 1:1 HNO_3 (to pH<2) Cool to 4±2°C	Samples must be analyzed within 6 months.
EPA 504.1	40-ml VOA vials with Teflon-lined septa screw cap	Add 3mg sodium thiosulphate Cool to 4±2°C	Samples must be extracted and analyzed within 14 days.

a Check with the laboratory that will be doing the analysis for any other requirements. Rev. 1113

Table 9 Worksheet for Calculating MADEP Soil Sample Results

Contaminant	Analytical Method	Hydrocarbon Fraction Ranges	Analytical Hydrocarbon Fractions		Laboratory Results Concentration	Final VPH and/or EPH Concentrations (mg/kg)	Residential MSCC (mg/kg)	Industrial/ Commercial MSCC (mg/kg)	Soil-to-Groundwater MSCC (mg/kg)
Low Boiling Point Fuels: gasoline, aviation gasoline, gasohol, etc.	MADEP VPH	C5-C8 Aliphatics	C5-C8 Aliphatics	VPH	x mg/kg	x	939	24528	68
		C9-C18 Aliphatics	C9-C12 Aliphatics	VPH	a mg/kg	a	1500	40000	540
		C9-C22 Aromatics	C9-C10 Aromatics	VPH	c mg/kg	c	469	12264	31
Medium/ High Boiling Point Fuels: jet fuels, kerosene, diesel, fuel oil #2, etc. Varsol, mineral spirits, naphtha,	MADEP VPH and MADEP EPH	C5-C8 Aliphatics	C5-C8 Aliphatics	VPH	x mg/kg	x	939	24528	68
		C9-C18 Aliphatics	C9-C12 Aliphatics	VPH	a mg/kg	a + b	1500	40000	540
			C9-C18 Aliphatics	EPH	b mg/kg				
		C19-C36 Aliphatics	C19-C36 Aliphatics	EPH	y mg/kg	y	31000	810000	Considered immobile
		C9-C22 Aromatics	C9-C10 Aromatics	VPH	c mg/kg	c + d	469	12264	31
			C11-C22 Aromatics	EPH	d mg/kg				
Heavy Fuels: #4, #5, #6 fuel oils; motor oils; hydraulic fluid; etc. Mineral oil*.	MADEP EPH	C9-C18 Aliphatics	C9-C18 Aliphatics	EPH	b mg/kg	b	1500	40000	540
		C19-C36 Aliphatics	C19-C36 Aliphatics	EPH	y mg/kg	y	31000	810000	Considered immobile
		C9-C22 Aromatics	C11-C22 Aromatics	EPH	d mg/kg	d	469	12264	31
Used/ Waste Oil	MADEP VPH and MADEP EPH	C5-C8 Aliphatics	C5-C8 Aliphatics	VPH	x mg/kg	x	939	24528	68
		C9-C18 Aliphatics	C9-C12 Aliphatics	VPH	a mg/kg	a + b	1500	40000	540
			C9-C18 Aliphatics	EPH	b mg/kg				
		C19-C36 Aliphatics	C19-C36 Aliphatics	EPH	y mg/kg	y	31000	810000	Considered immobile
		C9-C22 Aromatics	C9-C10 Aromatics	VPH	c mg/kg	c + d	469	12264	31
			C11-C22 Aromatics	EPH	d mg/kg				

* Carbon chains in mineral oils range from approximately C_{12}-C_{45}.

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Table 10 Worksheet for Calculating MADEP Groundwater Sample Results

Contaminant	Analytical Method	Hydrocarbon Fraction Standard Ranges	Analytical Hydrocarbon Fractions		Laboratory Results Concentration	Final VPH and/or EPH Concentrations (ug/L)	Final and Interim Groundwater Quality Standards (ug/L)
Low Boiling Point Fuels: gasoline, aviation gasoline, gasohol, etc.	MADEP VPH	C5-C8 Aliphatics	C5-C8 Aliphatics	VPH	x ug/L	x	400
		C9-C18 Aliphatics	C9-C12 Aliphatics	VPH	a ug/L	a	700
		C9-C22 Aromatics	C9-C10 Aromatics	VPH	c ug/L	c	200
Medium/ High Boiling Point Fuels: jet fuels, kerosene, diesel, fuel oil #2, etc. Varsol, mineral spirits, naphtha.	MADEP VPH and MADEP EPH	C5-C8 Aliphatics	C5-C8 Aliphatics	VPH	x ug/L	x	400
		C9-C18 Aliphatics	C9-C12 Aliphatics	VPH	a ug/L	a + b	700
			C9-C18 Aliphatics	EPH	b ug/L		
		C19-C36 Aliphatics	C19-C36 Aliphatics	EPH	y ug/L	y	10000
		C9-C22 Aromatics	C9-C10 Aromatics	VPH	c ug/L	c + d	200
			C11-C22 Aromatics	EPH	d ug/L		
Heavy Fuels: #4, #5, #6 fuel oils; motor oils; hydraulic fluid; etc. Mineral oil*.	MADEP EPH	C9-C18 Aliphatics	C9-C18 Aliphatics	EPH	b ug/L	b	700
		C19-C36 Aliphatics	C19-C36 Aliphatics	EPH	y ug/L	y	10000
		C9-C22 Aromatics	C11-C22 Aromatics	EPH	d ug/L	d	200
Used/ Waste Oil	MADEP VPH and MADEP EPH	C5-C8 Aliphatics	C5-C8 Aliphatics	VPH	x ug/L	x	400
		C9-C18 Aliphatics	C9-C12 Aliphatics	VPH	a ug/L	a + b	700
			C9-C18 Aliphatics	EPH	b ug/L		
		C19-C36 Aliphatics	C19-C36 Aliphatics	EPH	y ug/L	y	10000
		C9-C22 Aromatics	C9-C10 Aromatics	VPH	c ug/L	c + d	200
			C11-C22 Aromatics	EPH	d ug/L		

* Carbon chains in mineral oils range from approximately C_{12}-C_{45}.

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Table 11
Equipment Construction Materials

Construction Material[1]	Acceptable Analyte Groups	Precautions
Metals		
316 Stainless Steel	All analyte groups. Recommended for inorganic nonmetallics, metals, volatile and extractable organics.	Do not use if weathered, corroded or pitted.[2]
300-Series Stainless Steel (304, 303, 302)	Suitable for all analyte groups (if used, check for corrosion before use). Recommended for inorganic nonmetallics, metals, volatile and extractable organics.	Do not use if weathered, corroded or pitted.[2] If corroded, samples may be contaminated with iron, chromium, copper or nickel. Check for compatibility with water chemistry for dedicated applications. Do not use in low pH, high chloride or high TDS waters.
Low Carbon Steel Galvanized Steel Carbon Steel	Inorganic nonmetallics only.	Appropriate liners must be used. Teflon liners for organics. Plastic or Teflon liners for metals. Galvanized equipment will also contaminate with zinc and cadmium. If used to collect large samples (e.g., dredges), samples may be collected from portions of the interior of the collected material.
Brass	Inorganic nonmetallics only.	Do not use if weathered, corroded or pitted.[2]
Plastics [3]		
Teflon and other fluorocarbon polymers	All analyte groups. Especially recommended for trace metals and organics.	Easily scratched. Do not use if scratched or discolored.
Polypropylene Polyethylene	All analyte groups.	Easily scratched. Do not use if scratched or discolored.
Polyvinyl chloride (PVC)	All analyte groups except extractable and volatile organics	Do not use when collecting extractable or volatile organic samples.
Tygon, Silicone, Neoprene	All analyte groups except extractable and volatile organics.	Do not use when collecting extractable or volatile organic samples. Do not use silicone if sampling for silica.
Viton	All analyte groups except extractable and volatile organics.	Minimize contact with sample. Use only if no alternative material exists.
Glass		
Glass, borosilicate	All analyte groups except silica and boron.	None

[1] Refers to construction material of the portions of the sampling equipment that come in contact with the sample (e.g., housing of variable speed submersible pump must be stainless steel if extractable organics are samples; the housing of a variable speed submersible pump used to sample metals may be plastic.

[2] Corroded/weathered surfaces are active sorption sites for organic compounds.

[3] Plastics used in connections with inorganic trace element samples (including metals) must be uncolored or white. Rev. 0908

Table 12
Construction Material Selection for Sample Collection Equipment

Analyte Group	Acceptable Materials
Extractable Organics	Teflon Stainless steel Glass Polypropylene Polyethylene All parts of the system, including connectors and gaskets, must be considered. Viton may be used if no other material is acceptable.
Volatile Organics	Teflon Stainless steel Glass Polypropylene Polyethylene All parts of the system, including connectors and gaskets, must be considered. Viton may be used if no other material is acceptable.
Metals	Teflon Stainless steel Polyethylene, including high density (HDPE) Polypropylene Tygon, Viton, Silicone, Neoprene PVC Glass (except silica and boron)
Ultratrace Metals	Teflon Polyethylene, including high density (HDPE) Polypropylene Polycarbonate Mercury must be in glass or Teflon
Inorganic Nonmetallics	Teflon Stainless steel Low carbon, galvanized or carbon steel Polyethylene, including high density (HDPE) Polypropylene Tygon, Viton, Silicone, Neoprene PVC Glass Brass

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Table 13
Equipment for Collecting Groundwater Samples

Activity	Equipment Type
Well Purging	Variable speed centrifugal pump Variable speed submersible pump Variable speed bladder pump Variable speed peristaltic pump Bailer with lanyard
Well Stabilization	pH meter DO meter Conductivity meter Thermometer/Thermistor Turbidimeter Flow-through cell Multi-function meters
Sample Collection	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Bailer with lanyard (See Appendix F for cautions when using bailers for sample collection.)
Groundwater Level	Electronic sensor Chalked tape

Rev. 0908

Table 14
Water Sampling Equipment Use and Construction

EQUIPMENT	CONSTRUCTION HOUSING [1]	TUBING [1]	USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
			WATER SAMPLING		
			GROUNDWATER		
1. Positive displacement pumps [2]					
a. Submersible (turbine, helical rotor, gear driven)	SS, Teflon	SS, Teflon, PE, PP	Purging	All analyte groups	See notes [3,4,5], must be variable speed
			Sampling	All analyte groups	See notes [3,4,5], must be variable speed
	SS, Teflon	Non-inert[6]	Purging	All analyte groups	See notes [3,4,5], must be variable speed; polishing required[7]
			Sampling	All analyte groups except volatile and extractable organics	Must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
	Non-inert[6]	Non-inert[6]	Purging	All analyte groups	See notes [3,4,5], must be variable speed; polishing required[7]
			Sampling	All analyte groups except volatile and extractable organics	Must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
b. Bladder pump (no gas contact)	SS, Teflon, PE, PP or PVC if permanently installed	SS, Teflon, PE, PP	Purging	All analyte groups	See notes [3,4,5], must be variable speed
			Sampling	All analyte groups	See notes [3,4], must be variable speed Bladder must be Teflon if sampling for volatile or extractable organics or PE if used in portable pumps
	SS, Teflon, PE, PP	Non-inert[6]	Purging	All analyte groups	See notes [3,4], must be variable speed; polishing required[7] **This configuration is not recommended**
			Sampling	All analyte groups except volatile and extractable organics	See notes [3,4], must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
	Non-inert[6]	Non-inert[6]	Purging	All analyte groups	See notes [3,4], must be variable speed; polishing required[7]
			Sampling	All analyte groups except volatile and extractable organics	See notes [3,4], must be variable speed; polishing required[7] If sampling for metals, the tubing must be

EQUIPMENT	CONSTRUCTION HOUSING [1]	TUBING [1]	USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
					non-metallic if not SS
2. Suction lift pumps					
a. Centrifugal	N/A	SS, Teflon, PE, PP	Purging	All analyte groups	See note [4], foot-valve required Must be variable speed
	N/A	Non-inert[6]	Purging	All analyte groups	See note [4], foot-valve required; polishing required[7] Must be variable speed
b. Peristaltic	N/A	SS, Teflon, PE, PP	Purging	All analyte groups	See note [4],foot-valve required; polishing required[7] or continuous pumping required Must be variable speed
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	See note [4], medical grade silicone tubing in pump head Must be variable speed
				Extractable organics	See note [4], configured with trap as specified in Appendix F or use Teflon-lined tubing in the pump head
	N/A	Non-inert[6]	Purging	All analyte groups	See note [4], foot-valve required Must be variable speed
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	See note [4], medical grade silicone tubing in pump head Must be variable speed
3. Bailers	SS, Teflon, PE or PP	N/A	Purging	All analyte groups	None, **<u>see Appendix F</u>**
		N/A	Sampling	All analyte groups	None, **<u>see Appendix F</u>**
	Non-inert[6]	N/A	Purging	All analyte groups <u>except</u> volatile and extractable organics	None, **<u>see Appendix F</u>** If sampling for metals, the tubing must be non-metallic if not SS
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	None, **<u>see Appendix F</u>** If sampling for metals, the tubing must be non-metallic if not SS
				<u>SURFACE WATER</u>	
1. Intermediate containers such as pond sampler, scoops, beakers, buckets, and dippers	SS, Teflon, Teflon-coated, HDPE, PP	N/A	Grab sampling	All analyte groups	None
	Glass	N/A		All analyte groups except boron and fluoride	None
	Non-inert[6]	N/A		All analyte groups <u>except</u> volatile and	None

EQUIPMENT	CONSTRUCTION HOUSING [1]	TUBING [1]	USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
				extractable organics	
2. Nansen, Kemmerer, Van Dorn, Alpha and Beta Samplers, Niskin (or equivalent)	SS, Teflon, Teflon-coated, HDPE, PP	N/A	Specific depth grab sampling	All analyte groups	None
	Non-inert[6]	N/A		All analyte groups except volatile and extractable organics	None
3. DO Dunker	SS, Teflon, glass, HDPE, PP	N/A	Water column composite sampling	All analyte groups	None
4 Bailers – double valve	SS, Teflon, HDPE, PP	N/A	Grab sampling	All analyte groups	None
	Non-inert[6]	N/A	Grab sampling	All analyte groups except volatile and extractable organics	None If sampling for metals, the tubing must be non-metallic if not SS
5. Peristaltic pump	N/A	SS, Teflon, PE, PP	Specific depth sampling	All analyte groups except volatile and extractable organics Extractable organics	Medical grade silicone tubing in pump head Must be variable speed See note [4], configured as specified in Figure 4, or use Teflon-lined tubing in the pump head
	N/A	Non-inert[6]		All analyte groups except volatile and extractable organics	Medical grade silicone tubing in pump head Must be variable speed

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Acronyms:

N/A	not applicable	SS	stainless steel	HDPE	high density polyethylene
PE	polyethylene	PP	polypropylene	PVC	polyvinyl chloride

[1] Refers to tubing and pump housings/internal parts that are in contact with purged or sampled water (interior and exterior of delivery tube, inner lining of the discharge tube, etc.).

[2] If used to collect volatile or extractable organics, all power cords and other tubing must be encased in Teflon , PE or PP.

[3] If used as a non-dedicated system, pump must be completely disassembled, if practical, and cleaned between wells.

[4] Delivery tubing must be pre-cleaned and precut at the base of operations or laboratory. If the same tubing is used during the sampling event, it must be cleaned and decontaminated between uses.

[5] In-line check valve required.

[6] "Non-inert" pertains to materials that are reactive (adsorb, absorb, etc.) to the analytes being sampled. For organics, materials include rubber and plastics (except PE and PP) and PVC. For metals, materials include brass, galvanized, and carbon steel.

[7] "Polishing": When purging for volatile or extractable organics, the entire length of tubing or the portion which comes in contact with the formation water must be constructed of Teflon, SS, PE or PP. If other materials (e.g., PVC, garden hoses, etc.) are used, the following protocols must be followed: 1) slowly withdraw the pump from the water column during the last phase of purging, 2) to remove any water from the well that may have contacted the exterior of the pump and/or tubing, remove a single well volume with the sampling device before sampling begins. **Do not use Tygon** for purging if purgeable or extractable organics are of interest. Polishing **is not recommended;** use of sampling equipment constructed of appropriate materials is preferred.

Table 15
Soil Sampling Equipment Use and Construction

	EQUIPMENT	CONSTRUCTION HOUSING[1]	USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
			SOIL SAMPLING		
	SOILS				
1.	Core barrel (or liner)	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	Sampling	All analyte groups.[2]	See notes [3, 4, 5]
		Non-inert[6] nonmetallics	Sampling	All analyte groups	See note [7]
		Non-inert[6] metals	Sampling	All analyte groups	See note [7]
2.	Trowel, scoop, spoon or spatula	SS, Teflon, Teflon-coated, HDPE, PP	Sampling Compositing	All analyte groups[2] All analyte groups except volatile organics	 Samples for volatile organics must grab samples
		Plastic	Sampling and compositing	All analyte groups except volatile and extractable organics	None Must be nonmetallic if not SS
3.	Mixing tray (pan)	SS, Teflon, glass, Teflon-coated, aluminum , HDPE, PP	Sampling Compositing or homogenizing	All analyte groups[2] All analyte groups except volatile organics	See note [5] See note [5]
		Non-inert[6]	Compositing or homogenizing	All analyte groups	See notes [4, 5, 7];must be nonmetallic if not SS
4.	Shovel, hand/bucket auger	SS	Sampling	All analyte groups[2]	None
		Non-SS	Sampling	All analyte groups[2]	See notes [4, 5, 7]
5.	Split spoon	SS or carbon steel w/ Teflon insert	Sampling	All analyte groups[2]	See notes [4, 5, 7]
6.	Shelby tube	SS	Sampling	All analyte groups[2]	See note [3]
		Carbon steel	Sampling	All analyte groups	See notes [3, 4, 7]
	SEDIMENT				
1.	Coring devices	SS, Teflon, glass, Teflon-coated, aluminum, HDPE, PP	Sampling	All analyte groups[2]	See notes [3, 4, 5]
		Non-inert[6] nonmetallics	Sampling	All analyte groups	See note [7]
		Non-inert[6] metals			See notes [4, 5, 7]

	EQUIPMENT	CONSTRUCTION HOUSING[1]	USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
2.	Grab – Young, Petersen, Shipek	Teflon, Teflon-lined, SS	Sampling	All analyte groups[2]	None
		Carbon steel	Sampling	All analyte groups	See notes [4, 5]
3.	Dredges – Eckman, Ponar, Petit Ponar, Van Veen	SS	Sampling	All analyte groups[2]	None
		Carbon steel, brass	Sampling	All analyte groups	See notes [4, 5]
4.	Trowel, scoop, spoon or spatula	SS, Teflon, Teflon-coated, HDPE, PP	Sampling Compositing	All analyte groups[2] All analyte groups except volatile organics	 Samples for volatile organics be grab samples
		Plastic	Sampling and compositing	All analyte groups except volatile and extractable organics	None must be nonmetallic if not SS
5.	Mixing tray (pan)	SS, Teflon, glass, Teflon-coated, aluminum, HDPE, PP	Sampling Compositing or homogenizing	All analyte groups[2] All analyte groups except volatile organics	See note [5] See note [5]
		Non-inert[6]	Compositing or homogenizing	All analyte groups except volatile and extractable organics	none See note [5]; must be nonmetallic if not SS
			WASTE[8]		
1.	Scoop	SS	Liquids, solids & sludges	All analyte groups[2]	Cannot collect deeper phases
2.	Spoon	SS	Solids, sludges	All analyte groups[2]	Cannot collect deeper phases
3.	Push tube	SS	Solids, sludges	All analyte groups[2]	Cannot collect deeper phases
4.	Auger	SS	Solids	All analyte groups[2]	None
5.	Sediment sampler	SS	stockpiles	All analyte groups[2]	None
6.	Backhoe bucket	Steel	Solids, Sludges	All analyte groups[2]	Difficult to clean Volatiles and metals must be taken from the interior part of the sample
7.	Split spoon	SS	Solids	All analyte groups[2]	

CommandButton1

[1] Refers to tubing and pump housings/internal parts that are in contact with purged or sampled water (interior and exterior of delivery tube, inner lining of the discharge tube, etc.).

[2] Do not use if collecting for hexavalent chromium (Chromium^{+6})

[3] If samples are sealed in the liner for transport to the laboratory, the sample for VOC analysis must be taken from the interior part of the core.

[4] If a non-stainless steel (carbon steel, aluminum) liner, core barrel or implement is used, take the samples for metals, purgeable organics and organics from the interior part of the core sample.

[5] Aluminum foil, trays or liners may be used only if aluminum is not an analyte of interest.

[6] "Non-inert" pertains to materials that are reactive (adsorb, absorb, etc.) to the analytes being sampled. For organics, materials include rubber, plastics (except PE and PP), and PVC. For metals, materials include brass, galvanized, and carbon steel.

[7] If non-inert-liner, core barrel or implement is used, take samples from the interior part of the collected sample.

[8] If disposable equipment of alternative construction materials is used, the construction material must be compatible with the chemical composition of the waste, cannot alter the characteristics of the waste sample in any way, and cannot contribute analytes of interest or any interfering components.

[9] Peristaltic pump may be used without vacuum trap assembly if the flexible, Teflon-lined tubing is used in the pump head.