FORMER HUSKY SERVICE STATION
CORNER OF HIGHWAY 44 AND MONTANA STREET
VALIER, MONTANA
REMEDIAL INVESTIGATION WORK PLAN

Facility:

Former Husky Service Station
Corner of Highway 44 and Montana Street
Valier, MT
DEQ Facility ID #56-13802, Release #3197, Work Plan #34092

Prepared for:

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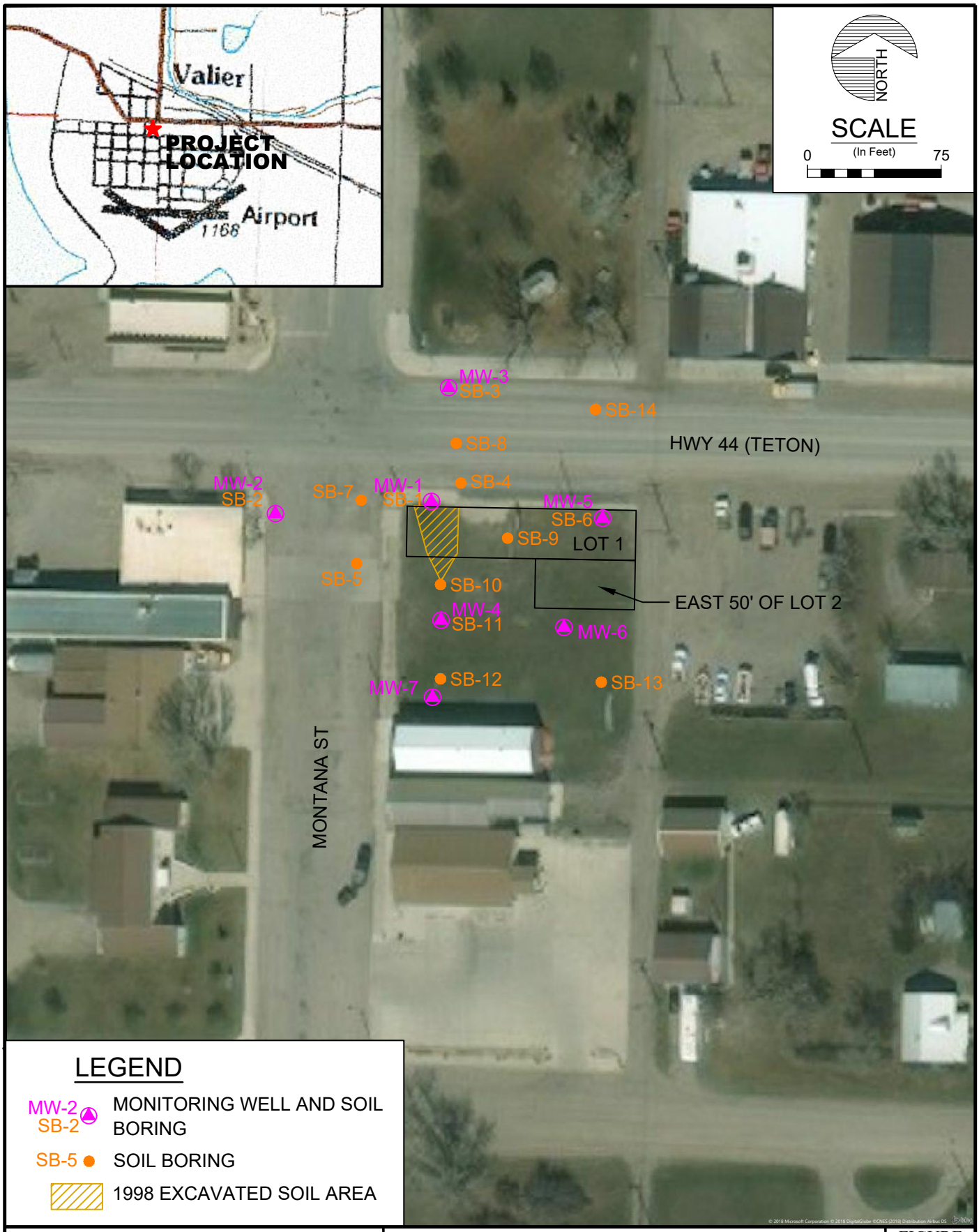
FORMER HUSKY SERVICE STATION
CORNER OF HIGHWAY 44 AND MONTANA STREET
VALIER, MONTANA
REMEDIAL INVESTIGATION WORK PLAN

1.0 SUMMARY OF SITE CONDITIONS AND BACKGROUND

The former Husky Service Station Site, located on the southeast corner of the Montana Street and Highway 44 (Teton Avenue) intersection in Valier, Montana was leased to several operators until it was closed in 1965. The property is Lot 1 and the East 50 feet of Lot 2 in the Valier original Townsite Subdivision in Pondera County. August Habets bought the property from Husky Oil Company in 1971, and apparently paid property taxes on the Site after the 1971 transfer. However, the deed was apparently not recorded and the property remained in Husky Oil Company's name. Figure 1-1 shows the vicinity map of the Site and the existing Site conditions.

Two underground storage tanks (USTs) on site, one 1,000 gallon and one 500 gallon, which both at one point in time contained gasoline, were removed as directed by August Habets on July 14, 1997 (documentation is not clear and indicates that in fact two tanks were removed; however, the reported sizes of the tanks range from a 400 or 500 gallon tank to a 500 or 1,000 gallon tank). During removal of the USTs, the party hired to excavate the tanks, Douglas Miller, discovered contamination in the adjacent soils and reported the release to the Montana Department of Environmental Quality (MDEQ) on July 17, 1997.



FORMER HUSKY SERVICE STATION FACILITY ID 56-13802, RELEASE 3197 VALIER, PONDERA COUNTY, MONTANA	**VICINITY & SITE MAP**	FIGURE **1-1**

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1.1 HISTORIC SITE INVESTIGATIONS AND REMEDIAL ACTION

The MDEQ requested that additional investigation and soil removal activities be conducted in 1998. Cleanup efforts were continued by August Habets in April 1998 and included removal of approximately 310 cubic yards of contaminated soil from the site. Soil samples taken from the excavation indicated that there may still be contamination beyond the excavation boundaries. Gasoline Range Organics (GRO) were still present in the soils on the excavation boundaries, ranging from 920 parts per million (ppm) to 2470 ppm in the excavation sidewalls and from 170 ppm to 380 ppm in the excavation bottom. The excavation was backfilled with clean fill and no further investigation was conducted until an initial remedial investigation was initiated in 2006. Refer to Figure 1-1 for the approximate excavation boundaries.

In 2006 and 2008, remedial investigations were conducted at the request of MDEQ and under the direction of Husky Energy. Hydrometrics, Inc. prepared work plans (Hydrometrics, 2006 and 2008) for MDEQ approval, conducted investigations, and submitted a Remedial Investigation Report (Hydrometrics, 2007) and Standardized Initial Remedial Investigation Report RIR-01 (Hydrometrics, 2009) summarizing Site activities.

In 2006, five soil borings (SB-1 through SB-5) and three monitoring wells (MW-1, MW-2, and MW-3) were installed to assess soil and groundwater conditions around the former service station. A survey of potential receptors was also conducted to assess drinking water and vapors (using a PID) in nearby structures. In 2008, field activities included completion of nine new soil borings (SB-6 though SB-14) and installation of two additional monitoring wells (MW-4 and MW-5) for soil and groundwater investigation activities. The 2008 investigation also included a survey of wellhead measuring points; a round of groundwater sampling to identify the extent and magnitude of contamination and direction of groundwater flow; collection of data regarding potential petroleum vapors in subgrade structures; and analysis of a tap water sample from the nearest potential receptor (Wells Fargo Bank).

In 2006, petroleum constituents above MDEQ Risk Based Screening Levels (RBSLs) were present in two soil borings: SB-1 adjacent to the former tank basin, and SB-4 just north of the former tank basin and groundwater from one well: MW-1 adjacent to the former tank basin (located at SB-1).

The 2008 investigation showed petroleum constituents above MDEQ RBSLs in four soil borings, (SB-8, SB-10, SB-11, and SB-14), located to the north and south of the former tank basin. Petroleum constituents were above RBSLs in the samples obtained from wells MW-1 and MW-4 (adjacent to the former tank basin at location of SB-11). Investigation results (2006 and 2008) indicated that petroleum constituents in soil and groundwater were limited to the area within and directly adjacent to the former tank basin and widespread migration of petroleum constituents had not occurred.

A receptor survey was conducted in 2006 (Hydrometrics, 2007) and supplemented during the 2008 investigation (Hydrometrics, 2009) to identify potential receptors of contamination in the area and to determine possible pathways for migration of contaminants. Drinking water mains and service connections in close proximity to the former tank basin were identified as potential receptors because water line connections can potentially be permeable to petroleum contamination. Utilities within a two city block area of the site were located by the Utilities Underground Locations Center and through discussions with the town shop manager during 2006 site activities. Further information regarding utilities can be found in the 2009 Annual Groundwater Monitoring Report (Hydrometrics, 2010).

No significant levels of organic vapors were detected at neighboring sites or a sewer manhole in 2006 or 2008. Results of tap water sampling at Wells Fargo Bank in 2006 and 2008 indicated there were no volatile organic compounds (VOCs) present above the practical quantitation limits in the drinking water. The primary potential threat to human health appears to be during future work by city staff on nearby sewer lines (Hydrometrics, 2013b).

On October 16, 2009, Hydrometrics conducted groundwater sampling of the five wells located on and around the Former Husky Service Station in Valier, and a sample was again collected from the Wells Fargo Bank tap water to further evaluate potential receptors. Results of tap water analysis in 2009 and again in 2012 indicated there were still no VOCs present above the practical quantitation limits in the drinking water.

In 2012, the five existing monitoring wells were sampled (Hydrometrics, 2012a and 2012b) and analyzed for Volatile Petroleum Hydrocarbons (VPH). During the following year, two additional monitoring wells (MW-6 and MW-7) were installed to update the monitoring well network in order to adequately assess the current overall extent of the groundwater contaminant plume in the southern and southeastern directions (Hydrometrics, 2013a and 2013b). Refer to Figure 1-1 for monitoring well locations. Following installation of the new wells, all seven monitoring wells (MW-1 through MW-7) were sampled in October 2013 and samples were analyzed for VPH.

Activities conducted at the Site in 2014 included the sampling (in October) and analyses of seven monitoring wells (Hydrometrics, 2014a and 2014b). All groundwater samples were submitted for analysis of VPH and intrinsic biodegradation indicators (IBIs) including: dissolved manganese, ferrous iron, nitrates and nitrites, sulfate, and dissolved methane. Both monitoring wells MW-4 and MW-1 continued to contain VPH constituents. Of the IBI measured, sulfate had the largest spatial gradient from the surrounding wells to well MW-1, located in the tank removal backfill area. The results suggested that bacterial sulfate reduction may have been driving hydrocarbon biodegradation in the vicinity of the former tanks.

In 2015, 2016, and 2017, monitoring activities conducted as voluntary follow-up to prior activities included sampling of seven monitoring wells (MW-1 through MW-7). Groundwater samples were submitted for analysis of VPH and IBIs. Groundwater results indicated VPH constituents were still present at monitoring wells MW-4 and MW-1 (Hydrometrics, 2016a, 2016b, 2018).

In 2018, the sanitary sewer manhole nearest the Site was monitored for VOCs, and a tap water sample was collected from the facility closest to where contaminated groundwater is in contact with the city water line (Wells Fargo Bank). The receptor survey did not identify any potential threat to human health from the Site conditions. Groundwater samples were also collected from the seven existing monitoring wells during annual events in 2018 and 2019 in order to document current conditions for final site closure.

Based on analytical data and site conditions (potentiometric maps, lithology, etc.), it is apparent that petroleum impact at this site is still limited to the vicinity immediately surrounding MW-1 and MW-4, which coincides with the vicinity of the former tank basin. Clayey native soils surrounding the source area restrict the movement of petroleum hydrocarbon constituents away from this area. Groundwater concentrations at all other monitoring wells have remained well below RBSLs and typically at levels below detection.

Benzene has been detected in both monitoring wells (MW-1 and MW-4) at concentrations above the RBSL since 2006. Both wells have also exceeded the RBSL for C5-C8 aliphatics, C9-C12 aliphatics, C9-C10 aromatics, and total purgeable hydrocarbons (TPH) periodically from 2006 to 2015. Groundwater trends show most contaminant levels are gradually declining at the site and IBIs indicate biodegradation has been occurring at varying rates. Groundwater results from 2018 showed RBSL exceedances of benzene and C5–C8 aliphatics at MW-1 and MW-4, consistent with past monitoring events. Results from 2019 show only one analyte (benzene) at MW-1 and MW-4 above RBSLs.

Groundwater flow direction based on regional topography and groundwater elevations in the seven wells suggest groundwater flow is to the north-northwest and south away from the former tank basin area. The groundwater elevations create an apparent mound in the former tank area.

Groundwater depth at the seven monitoring wells has been observed at approximately four to ten feet below ground surface. As has been noted in previous reports, groundwater concentrations of petroleum analytes at MW-1 and MW-4 may fluctuate with water level

trends. Fluctuations in groundwater levels appear to have periodically introduced hydrocarbons remaining on the perimeter of the former excavation back into the groundwater. This process could have led to historically observed periodic increases in VPH concentrations at MW-1 and MW-4.

2.0 PURPOSE AND OBJECTIVES OF REMEDIAL INVESTIGATION

The objective of the 2020/2021 remedial investigation is to further define the extent and magnitude of petroleum contamination of soil remaining in the vicinity (west, east, and south) of monitoring wells MW-1 and MW-4. This data will be used to determine the next steps toward closure of this Site.

3.0 PROPOSED FIELD WORK

Hydrometrics has completed this Remedial Investigation Work Plan (Work Plan) in accordance with MDEQ's Montana Remedial Investigation Guidance for Petroleum Releases (RI Guidance). Hydrometrics will perform project management duties including Client and DEQ consultation, prepare reports, collect and submit soil samples for analyses, and provide site reports and recommendations. This section discusses individual soil investigation tasks and methodology.

Standard Operating Procedures (SOPs) relevant to this project are collected in Appendix A and summarized in Table 3-1. It should be emphasized that SOPs are necessarily written to be general guidelines, and that the detailed procedures specified in this SAP supersede those specified in the SOPs. Sample documentation forms to be used during field sampling are in Appendix B.

3.1 REMEDIAL SOIL INVESTIGATION AND METHODOLOGY

The scope of work for remedial soil investigation in the vicinity of monitoring wells MW-1 and MW-4 will include the following tasks.

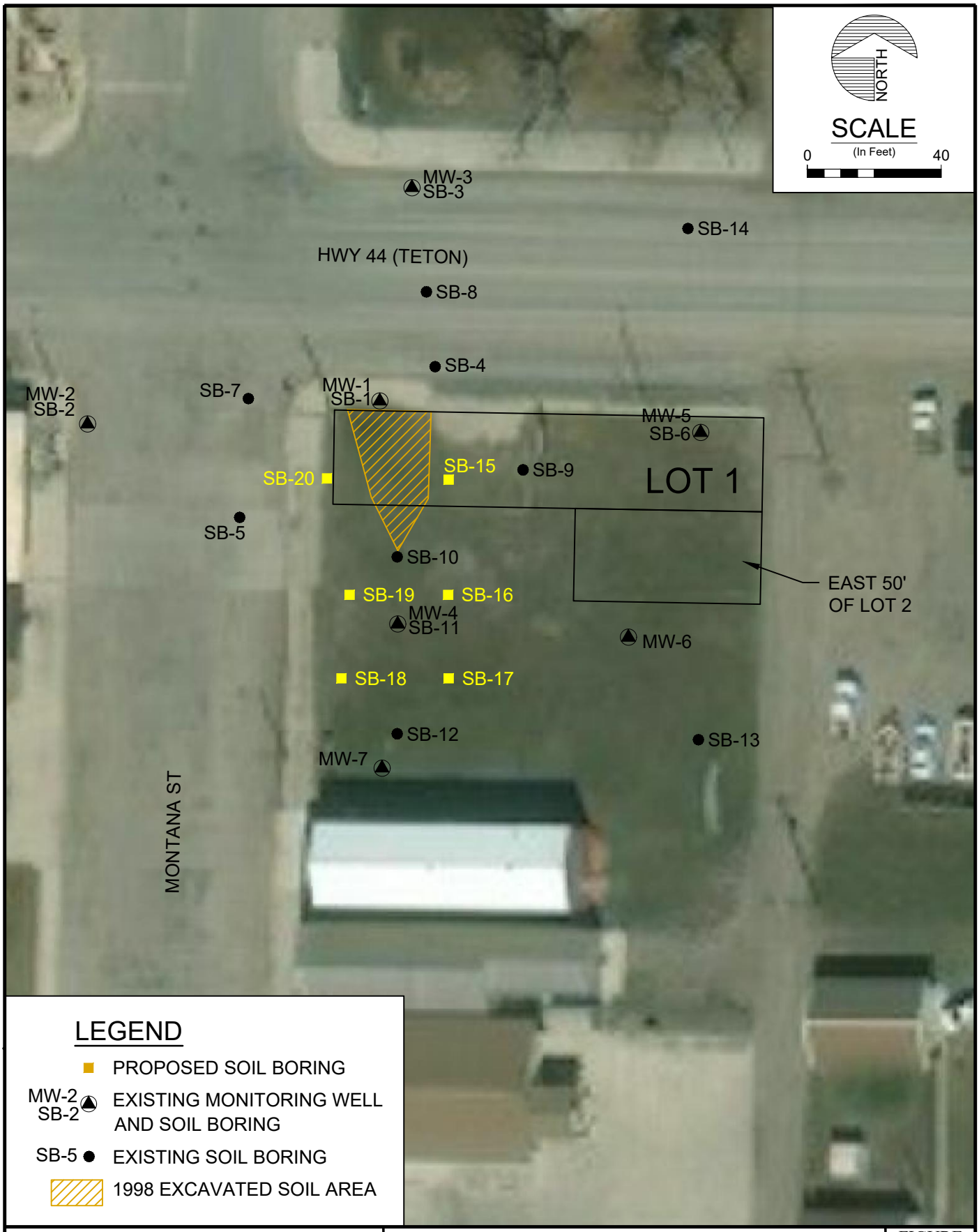
Prior to installation of the soil borings, buried and overhead utilities will be located by Montana 811 one-call service contractors, which will locate utilities coming into or adjacent to the Facility. Hydrometrics may also hire a private utility locate company to conduct locates before on-site field work begins. Hydrometrics will coordinate with utility locators, site contacts, and the City of Valier, as required.

Hydrometrics will travel to Valier to install six soil borings to the west, east, and south of the former tank basin. Proposed soil boring locations are shown on Figure 3-1. Based on site screening (see below), additional boring locations may be selected to define the extent of petroleum impacted soils.

TABLE 3-1. SUMMARY LIST OF STANDARD OPERATING PROCEDURES FOR SAMPLING SOIL

Standard Operating Procedure	Date Revised	Title of Standard Operating Procedure
HSOP-4	10/10	Chain-Of-Custody Procedures, Packaging, and Shipping Samples
HSOP-5	1/12	Global Positioning System (GPS) Equipment Operation
HSOP-7	1/14	Decontamination of Sampling Equipment
HSOP-29	6/04	Labeling and Documentation of Samples
HSOP-31	6/04	Field Notebooks
HS-SOP-34	5/10	Procedure For Collecting Direct-Push Soil Samples©
HS-SOP-45	7/02	Headspace Gas Analytical Screening Procedure For Soils
HSOP-58	1/12	Guideline For Quality Assurance of Environmental Data Collection Activities, Data Quality Planning, Review, and Management

A Power Probe direct-push sampler (2¼-inch outer diameter bit) will be used to advance soil borings at the Facility to a depth of approximately 24 feet below ground surface, unless 1) refusal is encountered at a shallower depth, or 2) obvious or significant petroleum contamination (based on visual, odor, or field screening) is encountered. If refusal is encountered, several additional attempts will be made within a few feet of the proposed borehole location, in an attempt to reach the target depth. If obvious or significant petroleum contamination is encountered, the borehole location will be moved further downgradient of the potential source (former tank basin) with the intent to identify the margin or extent of impacted soil at the Site. No laboratory samples will be submitted from the abandoned borehole in this situation. All boring locations and findings will be documented. The depth of borings may be modified based on the results of site conditions, screening activities, and any additional site information. Procedures for collection of direct-push soil samples are



FORMER HUSKY SERVICE STATION FACILITY ID 56-13802, RELEASE 3197 VALIER, PONDERA COUNTY, MONTANA	**PROPOSED SOIL BORING LOCATION MAP**	FIGURE **3-1**

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discussed in HS-SOP-34 (Appendix A). Cuttings will be disposed of by dispersing along the ground surface. Granulated bentonite will be used to backfill each boring to ground surface, if dirt or grass surface. Bentonite will be used to backfill borings to 4 inches of surface, and the surface patched with similar material to the original surface, if concrete or asphalt surface.

Continuous soil samples will be collected from each boring and screened for heated headspace using a Photoionization Detector (PID). As standard procedure, soil samples will be collected at 2-foot depth intervals (0-2 feet, 2-4 feet, etc.), with each sample a composite of the corresponding 2-foot section of core. Sampling intervals will be adjusted based on the location of clean soil/contaminated soil contacts, to ensure that contaminated soils and clean soils are not mixed within a single sample. When blockage or plugging occurs in the macro core, soil samples will be taken as a 4-foot composite sample.

Immediately after collection, a portion of the sample will be placed in a plastic Ziploc bag for subsequent headspace analysis (HS-SOP-45), and a second portion will be placed in two 4-ounce (oz.) glass sample jar(s) with minimal headspace. The Ziploc bag will be labeled with the sample information (borehole name, depth interval, date, and time). The glass jars will be stored in coolers on ice immediately for potential submittal to the laboratory. The plastic bags containing soil samples from various depths within a given borehole will be screened for headspace gases using a calibrated PID, following the procedures outlined in HS-SOP-45 (Appendix A). The typical procedure for analysis of headspace gases involves allowing headspace gases to develop in the bag with the sample for a minimum of ten minutes, heating the bag in a building or vehicle if necessary due to cold ambient air temperature. A reading is then obtained with the PID by puncturing the bag with the PID intake tube and inserting the tube into the airspace above the soil sample or inserting the tube into the airspace above the soil sample through the seal of the bag. PID readings for each sample will be recorded on the project field form (Appendix B).

After obtaining PID readings for all depth intervals sampled at a particular soil boring, three soil samples per boring will be selected for submittal to an analytical laboratory for analyses. The selected soil samples will include:

- Two samples exhibiting the highest PID headspace readings; and
- One sample from the bottom of the boring.

Additional samples for laboratory analysis may be collected by field personnel as warranted. If a boring was relocated due to obvious or significant petroleum contamination (based on visual, odor, or field screening), no samples will be submitted from the abandoned borehole location.

The samples submitted to the laboratory for analysis will be the sample portions initially stored in amber glass jars on ice. Two sample jars will provide sufficient sample for laboratory analyses (one sample jar is minimum required), unless the sample contains a large percentage of coarse-grained (gravel or larger) material, in which case three jars will be used. Laboratory analyses are discussed in Section 3.3 below.

In order to provide information on data reproducibility, one field duplicate sample will be collected during the remedial soil investigation. The field duplicate sample will be collected by splitting equal portions of sample into two sets of sample jars, assigning unique sample numbers to the two samples, and submitting both samples to the laboratory for analysis as a check on field and analytical precision.

Soil borings will be logged in the field by an experienced geologist or soil scientist. Logging will include lithologic descriptions (soil stratigraphy, color, texture, and moisture), presence of fill material, evidence of hydrocarbon contamination, and depths of water-bearing zones. A log form to be used to record soil and sample information during soil boring activities is

included in Appendix B. Labeling and documentation of soil samples, as well as general guidance for keeping field notebooks, are described in HSOP-29 and HSOP-31 (Appendix A).

3.2 SAMPLING LOCATION DESIGNATIONS

Individual boring locations will be designated using the following labeling scheme:

SB-XX

where XX is a two-digit code incremented sequentially for each successive sample. Soil borings drilled in 2021 will start with SB-15 to integrate with previous activities at this Site.

Individual samples will be assigned unique sample numbers according to the following sample numbering scheme:

AAA[A]-YYMM-XXX

where AAA[A] is a three- or four-character code denoting the project (HVAL for Husky Valier), YYMM is a four-digit code denoting the year and month (e.g., 2103 for March 2021), and XXX is a three-digit code incremented sequentially for each successive sample.

3.3 LABORATORY ANALYSES

Soil samples from the borings will be submitted to Energy Laboratories for analysis for VPH by method MA-VPH to determine the presence of residual gasoline compounds in the soil, in accordance with the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases, Table B (DEQ, 2018). Samples will be delivered to the laboratory using standard chain-of-custody procedures. Procedures for Chain-Of-Custody, packaging, and shipping of samples are described in HSOP-4.

The laboratory will analyze and provide results for standard laboratory QC samples as part of the analytical results package, to ensure that the data obtained are of sufficient quality to support the site investigation and any subsequent remedial activities, if any.

3.4 DECONTAMINATION OF EQUIPMENT

Drilling equipment will be decontaminated between soil borings or clean equipment will be used so that clean drill tools are employed for each boring. Decontamination of drilling equipment is described in HSOP-7 (Appendix A), and will consist of washing, along with hand scrubbing with Non-phosphate detergent and water, as necessary.

3.5 MANAGEMENT OF INVESTIGATION DERIVED WASTE

Minimal cuttings will be generated from the borings. Cuttings will be disposed of by dispersing along the ground surface. Decontamination water will be dispersed along paved surfaces away from storm water inlets, unless free product is evident in the rinse water. Decontamination water will be captured and disposed properly, if free product is observed. No drilling or purge water is anticipated to be generated.

3.6 QUALITY CONTROL/QUALITY ASSURANCE PLAN (QA/QC) AND DATA EVALUATION

The Quality Assurance/Quality Control Plan (QA/QC) describes sample documentation, handling requirements, analytical parameters, and data evaluation for this event in more detail. This plan is included in Appendix C.

Data collected through the investigation will be validated. The results of this validation will be summarized on the DEQ Data Validation Summary Form (see Appendix C) and included as an appendix to the final project report.

Data evaluation for the Husky Valier remedial investigation will be conducted using the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases (DEQ, 2018) and screening levels as described in the QA/QC Report (Appendix C).

4.0 PROJECT REPORTING

Following the completion of activities described in this Work Plan, Hydrometrics will discuss ongoing Work Plan tasks and results with DEQ's project manager and will submit written agreed-upon Work Plan modifications as required to complete the objectives of this Work Plan.

Hydrometrics will prepare a Remedial Investigation Report following MDEQ RI Guidance, following the completion of activities described in this Work Plan. The report will provide a summary of field activities related to the remedial soil investigation, figures, data validation, data summary tables, data analysis as appropriate, and conclusions and recommendations. Field sampling data sheets, laboratory analytical data and a complete Release Closure Plan (RCP) will be appended to the report. Hydrometrics will transmit the report to MDEQ electronically and coordinate with DEQ to determine the next appropriate steps to move the site toward closure.

5.0 SCHEDULE AND BUDGET

The following schedule lists the estimated completion dates for each Work Plan task.

Task 1.	Contact DEQ to Discuss Work Plan Approach	**Completed: July 15, 2020**
Task 2.	Prepare and submit Remedial Investigation Work Plan.	**September 30, 2020**
Task 3.	Conduct Soil Boring Investigation.	**March/April 2021**
Task 4.	Analyze soil samples for Volatile Petroleum Hydrocarbons.	**April/May 2021**
Task 5.	Discuss Work Plan tasks and monitoring results with DEQ's project manager.	**As needed; March 2021 to July 2021**
Task 6.	Prepare and submit a Release Closure Plan (RCP) and Remedial Investigation Report.	**July 15, 2021**

A budget has not been prepared for this Work Plan, since this site is not eligible for PTRCB reimbursement. Implementation of this Work Plan will begin after receiving written notification that the scope of the Work Plan has been approved by DEQ.

6.0 REFERENCES

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Hydrometrics, Inc., 2016b. Abbreviated Groundwater Corrective Action Activities Report for Petroleum Release At Former Husky Service Station, Corner of Highway 44 and Montana Street Valier, Pondera County, MT; DEQ Facility ID #56-13802, Release #3197. December 2016.

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Montana Department of Environmental Quality, 2018. Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases, May 2018.

APPENDIX A

HYDROMETRICS' STANDARD OPERATING PROCEDURES (HSOPs)

STANDARD OPERATING PROCEDURE

HSOP-4

CHAIN-OF-CUSTODY PROCEDURES, PACKING, AND SHIPPING SAMPLES

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Helena, MT 59601

Author: Mark Walker
Title: Senior Chemist/Sciences Manager

Signature: _____ Date: 6/2004

Reviewer: Walter Crane
Title: Technical Services Manager

Signature: _____ Date: 6/2004

Approval: Michael Wignot
Title: Principal/Senior Engineer

Signature: _____ Date: 6/2004

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1.0 SCOPE AND APPLICATION

HSOP-4 presents procedures to be followed when shipping samples of environmental media (e.g., air, water, soil, waste material) to a laboratory for analysis. All samples submitted should be accompanied by chain-of-custody documentation.

2.0 SUMMARY OF METHOD

Samples of environmental media submitted to laboratories for analysis are often shipped via commercial carrier. Samples are packed in shipping containers to minimize the potential for container breakage or leaking. Each shipment will be accompanied by sample documentation, including chain-of-custody forms and a list of required analytical parameters, methods, and detection limits. Samples are cooled with ice during transport, to maintain temperature at approximately 4°C (±2°C). Shipments of hazardous materials must conform to International Air Transport Association (IATA) Dangerous Goods regulations and/or Department of Transportation (DOT) regulations, as well as any carrier-specific requirements.

3.0 HEALTH AND SAFETY WARNINGS

Field personnel should be aware of the health and safety precautions to be followed during any field event, and should be familiar with any project-specific hazards. This may include review of project-specific health and safety plans, site-specific and/or organization-specific safety requirements and training.

- Care should be exercised when handling samples of hazardous or potentially hazardous waste. Personal protective equipment (PPE) should be utilized (gloves, safety glasses, coveralls) as appropriate.
- Glass sample containers should be handled with extreme care to avoid breakage, loss of sample, and possible injury.

4.0 INTERFERENCES

Not Applicable

5.0 PERSONNEL QUALIFICATIONS

Personnel should be familiar with the project work plan and objectives, and with the operation of equipment listed in Section 6.0 below. Personnel should also familiarize themselves with the schedule of the shipping location to be used for shipping samples. For projects involving hazardous materials, consult the project work plan, courier regulations, and any state and federal air or ground shipping regulations for details on shipping hazardous material.

6.0 EQUIPMENT AND SUPPLIES

- Shipping container (metal or plastic cooler);
- Packing material (bubble wrap, Styrofoam peanuts);
- Absorbent material (clay absorbents, rock wool);
- Shipping tape;

- Shipping strap;
- Custody seals;
- Chain-of-custody (COC) forms;
- Heavy-duty or contractor grade garbage bags or similar plastic bags;
- Ziploc bags; and
- Ice.

7.0 CHAIN-OF-CUSTODY PROCEDURE

1. Chain-of-custody involves ensuring that samples are traceable from the time of collection until received by the analytical laboratory. The laboratory is responsible for custody during processing and analysis. A sample is under custody if:
    - It is in your possession;
    - It is in your view, after being in your possession; or
    - It was in your possession and you then placed it in a designated secure or locked area to prevent tampering.
2. When ready to ship samples, set out samples in a clean, secure area to complete chain-of-custody forms. Chain-of-custody forms may be obtained from the project laboratory, or from Hydrometrics' Data Quality Department. An example COC form is shown in Attachment 1. Each sample should be identified on the form by its sample number, date and time of collection, and analysis requested. Check sample labels against information recorded in field notebook and on chain-of-custody to ensure consistency and guard against transcription errors (HSOP-29). It is usually best to use one chain-of-custody form per shipping container, covering the samples included in the container. When shipping multiple coolers to the laboratory, label chain-of-custody forms as "Cooler 1 of 3," "Cooler 2 of 3," etc. While chain-of-custody forms obtained from various sources may differ, certain information regarding sampling dates and times, sample identification, contact information, and requested parameters for analysis should be included on all acceptable forms. Complete all fields on the chain-of-custody form, as applicable to the particular sampling event. Examples of typical COC information to be completed are as follows:
    a) **Company Name:** Enter "Hydrometrics, Inc."
    b) **Project Name:** Enter the project name and Hydrometrics' project number
    c) **Report Mail Address:** Enter the name, address, and e-mail address of the person who should receive the laboratory report.
    d) **Contact Name:** Enter the name of the project manager, sampling personnel, or other responsible contact.
    e) **Phone/Fax:** Enter the phone and fax number of the contact person for the project.
    f) **E-mail:** Enter the e-mail address for the contact person.
    g) **Sampler:** Print the name of the person who collected the samples.
    h) **Invoice Address:** Enter the address where the invoice should be sent.
    i) **Invoice Contact and Phone:** Enter the name and phone number of the person responsible for approving the invoice.
    j) **Purchase Order:** Enter the Hydrometrics' Purchase Order number for the sample order.

k) **Quote/Bottle Order:** Enter the laboratory quote number for the project or bottle order number provided with the sample bottle order.

l) Note any special reporting requirements or formats.

m) **Sample Identification:** Enter the unique sample number assigned to the sample.

n) **Collection Date:** Enter the date each sample was collected. Do not use ditto (") marks, arrows or lines to represent the same date.

o) **Collection Time:** Enter the time each sample was collected. Do not use ditto (") marks, arrows or lines to represent the same time.

p) **Number of Containers and Matrix:** Enter the number of bottles the sample is contained in followed by a dash and then a letter representing the type of sample matrix (i.e., A=Air, W=Water, S=Soil/Solid, V=Vegetation, B=Bioassay, O=Other).

q) **Analysis Requested:** Write the analysis to be performed on each sample and check the box for each sample you want to receive this analysis. Also include an analytical parameter list.

r) **Remarks:** Use this field to make notes or comments to the laboratory.

(Note: If a laboratory-provided COC form is used, be sure to follow any additional instructions included from the laboratory.)

3. Record shipping information (tracking numbers, name of courier, other pertinent information) on chain-of-custody form. Sign and date chain-of-custody form, and retain one copy of form for project file.

8.0 PACKING AND SHIPPING PROCEDURE

1. Seal drain holes in bottom of shipping cooler (inside and out) to prevent leakage. Check sample container lids to ensure they are tightly sealed.
2. Line bottom of cooler with packing material (bubble wrap). Open and place two heavy-duty plastic bags in cooler (one inside the other).
3. Seal samples within individual plastic or bubble wrap bags, as necessary. All glass containers (VOAs, amber glass bottles, glass soil jars) should be placed in individual bubble wrap bags. Place sealed sample containers in shipping cooler, inside double plastic bags. In most instances, a labeled temperature blank should be included with the samples to allow the laboratory to check the sample temperature upon arrival. The temperature blank is generally a small vial or bottle filled with tap water and labeled "Temperature Blank." Ensure that temperature blank meets temperature requirements upon receipt by laboratory.
4. Cover samples with ice, inside double plastic bags.
5. Close and seal double plastic bags, by knotting or with shipping tape. Fill any empty space in cooler with additional packing material or absorbent material.
6. Record shipping information (tracking numbers, name of courier, other pertinent information) on chain-of-custody form. Sign and date chain-of-custody form, and retain one copy of form for project file.
7. Place original chain-of-custody, sample parameter list, cover letter, and any other documentation needed by the laboratory into a plastic Ziploc bag. Seal Ziploc bag and tape to the inside of the shipping container lid.

8. Label outside of shipping container with sampling organization name, address, and phone number, laboratory destination name, address, and phone number, and any required DOT shipping labels.
9. Place custody seals on front and back of cooler (see Attachment 2) and tape in place with shipping tape to avoid accidental breakage. Wrap cooler securely in at least two places with a minimum of three wraps of shipping tape. Shipping strap may also be used to provide additional insurance against the cooler opening during shipment.
10. Deliver sample containers to the shipping location. Since samples should reach the laboratory as soon as possible to protect sample integrity, **overnight shipping is required,** unless unavailable at the shipping location. Retain copies of shipping receipts for the project file. Shipping receipts and tracking numbers serve as chain-of-custody documentation during sample transport from the sampler to the laboratory.
11. Additional guidance may be found in the EPA's *Contract Laboratory Program Guidance for Field Samplers* (EPA, 2004). More stringent shipping requirements may apply to samples collected under CLP protocols. The project work plan should be consulted to determine any special requirements.

9.0 DATA AND RECORDS MANAGEMENT

The following documents generated during sample packing and shipping will be retained in the project file:

- Chain-of-custody form;
- Analytical parameter list;
- Cover letter; and
- Shipping receipts.

10.0 QUALITY CONTROL/QUALITY ASSURANCE

- Field personnel should cross-reference information on sample labels, in the field notebook, and on sample chain-of custody forms during the sample packing and shipping process.
- Data quality review will include checking of sample documentation to ensure consistency.
- Temperature blank measurements by the laboratory upon arrival of samples will document that samples were maintained at the appropriate temperature during shipping.

11.0 REFERENCES

EPA, 2004. Contract Laboratory Program Guidance for Field Samplers (Draft Final). EPA 540-R-00-003. January 2004.

Hydrometrics' HSOP-29: Labeling and Documentation of Samples

Attachment 1
Example Chain-of-Custody Form

CHAIN OF CUSTODY RECORD

Hydrometrics, Inc.

3020 Bozeman Ave. • Helena, MT 59601 • (406) 443-4150

PROJ. NO.	PROJECT NAME
SAMPLERS: *(Signature)*	

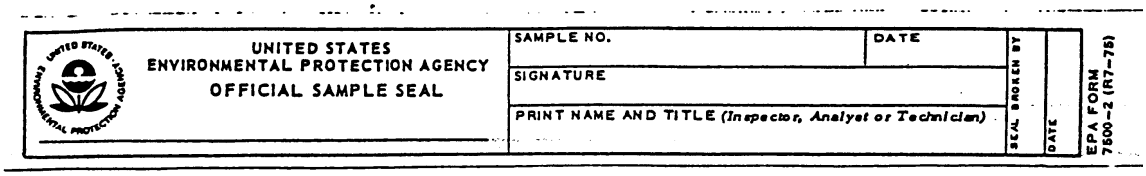
DATE	TIME	COMP	GRAB	SAMPLE NUMBER	NO. OF CON-TAINERS	Commons UF / RAW	Nutrients UF / H_2SO_4	Diss. Metal F / HNO_3	CN UF / NaOH	Total Metals UF / HNO_3	Total Recoverable Metals UF / HNO_3	BTEX	TPH								REMARKS

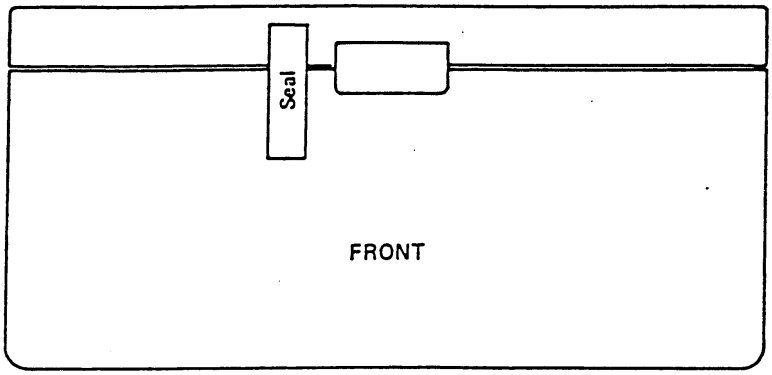
Relinquished *(Signature)*	Date / Time	Received by *(Signature)*	Lab	P.O. #	Shipped via: Bus FedEx UPS Other _____ Air Bill # _____
Relinquished *(Signature)*	Date / Time	Received by *(Signature)*	Remarks		
Relinquished *(Signature)*	Date / Time	Received for Laboratory by *(Signature)*	Date / Time	Enclosed: ❑ Parameter sheet w/detection limits ❑ QA / AC standard mixing instructions ❑ Cover letter ❑ Other _____	
				Split Samples: ❑ Accepted ❑ Declined _____ Signature	

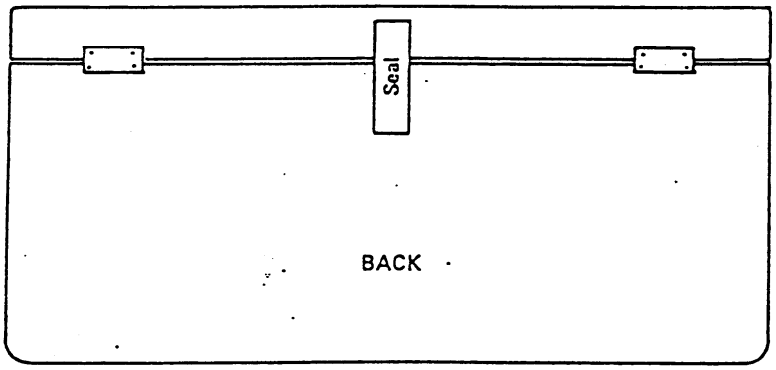
HFORM-1 07/11
TNO 406-443-8550

Return results & electronic copy to:
QA / QC Dept. at address at top of page

Attachment 2: Example of Custody Seals and Placement







STANDARD OPERATING PROCEDURE

HSOP-5

GLOBAL POSITIONING SYSTEM (GPS) EQUIPMENT OPERATION

Hydrometrics, Inc.
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Signature: _____ Date: 6/2004

Reviewer: Michael Wignot
Title: Principal/Senior Engineer

Signature: _____ Date: 6/2004

Approval: Michael Wignot
Title: Principal/Senior Engineer

Signature: _____ Date: 6/2004

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1.0 SCOPE AND APPLICATION

HSOP-5 presents general procedures for operation of global positioning system (GPS) equipment to map points, lines, or areas while working in the field. GPS is typically used to determine the coordinates of a specified point, to navigate to a previously determined point, or to map landmarks, natural, or man-made features. Collection of data with a GPS allows information to be transferred to mapping or CAD software, to facilitate the development of accurate site maps and drawings. The accuracy of a GPS varies with the type of equipment and the available satellite coverage. Hydrometrics uses three major types of GPS units with applications based on the required level of accuracy for the spatial data to be collected. The survey-grade GPS unit (Topcon Hiper+/Legacy E) is used for surveying tasks that require very high accuracy (1 cm or less). The mapping-grade unit (Trimble GeoXH 2005) can map features from sub-meter to sub-foot (30 cm) accuracy, employing either real-time or post-processing differential correction. The recreational-grade GPS unit (Garmin Oregon 450) can map features from 5 – 30 meters.

Although elevations are also determined with all of the GPS units, elevation data is typically only accurate using the survey-grade GPS unit. Use of the mapping grade GPS or recreational grade GPS data to determine elevations where high accuracy is required (e.g., monitoring well measuring point elevations measured to $\pm$0.01 feet) is not appropriate. Deciding which type of unit to use is an essential part of project planning, and depends on the end product needed. In addition, note that the Trimble GeoXH 2005 unit records elevations relative to height above ellipsoid (HAE) rather than above mean sea level (AMSL). Local geoid corrections (available from the National Geodetic Survey) are required to convert HAE elevations obtained with the Trimble GeoXH 2005 into AMSL elevations.

2.0 SUMMARY OF METHOD

GPS equipment is used in the field to record positions in a data file. The GPS uses a network of satellites to collect positional information in virtually any location with a relatively clear view of the sky. The data file is subsequently downloaded for use in various mapping applications. In some cases, data post-processing may be conducted to increase the accuracy of recorded positions.

3.0 HEALTH AND SAFETY WARNINGS

Field personnel should be aware of the health and safety precautions to be followed during any field event, and should be familiar with any project-specific hazards.

4.0 INTERFERENCES

The most common problem with GPS operation is difficulty collecting data due to obstructions (i.e., buildings, trees) or inherently weak satellite signals. These problems may usually be minimized as follows:

- Use of project planning software prior to fieldwork, to determine when satellite signals will be greatest in the area where mapping is to be conducted.
- Use of offsets (capturing positions lateral to the actual position desired) to avoid obstructions.

In many cases, GPS equipment will need several minutes to lock in satellite signals. If a certain location presents difficulty, waiting a few minutes, or returning to the location at a later time may alleviate the problem.

5.0 PERSONNEL QUALIFICATIONS

Personnel should be familiar with the operation of the selected GPS equipment. It is strongly recommended that the equipment be tested and operated prior to conducting field work, including both capturing data and downloading data in the desired format. In addition, the manufacturer's manuals should be reviewed prior to operation.

6.0 EQUIPMENT AND SUPPLIES

- Global Positioning System (GPS) instrument

Hydrometrics currently utilizes three GPS instruments for most projects:

- A Topcon Hiper+/Legacy E system, a survey grade GPS with RTK (real-time kinematic) capability, logging of points, lines, and areas with centimeter-level horizontal and vertical accuracy. This unit is typically used for topographic surveys, construction staking, or when vertical accuracy is essential.
- A Trimble GeoXH 2005 system, a mapping grade GPS with real-time differential correction capability, logging of points, lines, and areas, and sub-meter to sub-foot horizontal accuracy. This unit is typically used for logging general locations of features when vertical accuracy is not essential.
- A Garmin Oregon 450 differential-ready handheld GPS unit with topographic map storage, an automatic track log, and <15 meter accuracy in non-differential mode (actual field accuracy has been observed to be better in many instances). This unit is typically used for logging general locations of features when vertical accuracy is not essential.

Selection of GPS equipment will depend on the project objectives and the required positional accuracy. Advantages of the Garmin unit include portability and ease of use; advantages of the Topcon or Trimble unit include superior accuracy and the ability to easily capture point, line, or area features.

7.0 PROCEDURE

An exhaustive description of GPS operation is beyond the scope of this SOP, and the equipment manuals should be consulted for additional details, such as setting up the desired units and coordinate system, position logging intervals, differential correction, and other configuration options. The following procedures cover simple point data capture with the Topcon, Trimble and Garmin GPS units.

One point of GPS use should be emphasized: in order to be useful, the coordinate system and datum of positional data captured with the GPS must be known. This will allow spatial data to be overlaid with other datasets to create project maps. Most GPS data is referenced to the World Geodetic System of 1984 (abbreviated WGS84).

Garmin Oregon 450 Procedure

1. Power unit on and navigate to "Satellite" screen. The display will show the number of satellites, an estimated accuracy, and the latitude and longitude coordinates.
2. Make sure the GPS coordinate system is set to WGS84.
3. When ready to capture a location, navigate to the Main Menu and select "Mark Waypoint" to enter the Mark Waypoint screen.
4. Select "Save and Edit" and name the position with the site name or other designation using the alphanumeric character selection matrix. Click "OK," and the waypoint is saved with the given designation.
5. Record pertinent information (date, time, surveyor, etc.) in field notebook.
6. Download waypoints to a text file in accordance with manufacturer instructions; text files will usually include the waypoint name, latitude and longitude, and altitude.

Trimble GeoXH 2005 Procedure

1. Power unit on; tap Start/ArcPad 7.0.1 (upper left of screen).
2. Open existing map or create new map and associated shapefiles to log points, lines, and/or areas as needed.
3. Activate GPS; tap dropdown arrow next to satellite icon on top row, tap "GPS Active". When sufficient satellites are locked in, location icon should show a red circle with a crosshair in the middle and a pointer on the side. A red circle with slash through it indicates additional time to lock on to satellite signals is needed.
4. Zoom in to a reasonable scale; tap zoom icon on left of second row, drag a rectangle around current position until scale in lower right of display is appropriate for planned data collection.
5. Set up on the feature (point, line, area) to log. Tap appropriate satellite icon (point/line/area) on bottom row to begin logging.
6. Tap keyboard icon on bottom of screen and a keyboard will pop up. Enter text in the comment field (i.e., location ID, feature type, etc.). Tap keyboard icon again to hide keyboard.
7. To finish logging point features, tap OK (green button) in lower left of screen after point averaging is finished. For lines and areas, tap "continue" arrows (arrow pointing right) to proceed to comment screen.
8. Move to next feature and repeat logging procedure. Save map occasionally by tapping typical save (disk) icon on top row.
9. When finished, tap dropdown arrow by File icon (upper left), then tap "Exit" to exit ArcPad. Turn off instrument with green button on lower right.
10. Download file and associated GPSCorrect file via USB connection. Post-process data as desired using ArcMap and GPSAnalyst extension.

Topcon Hiper+/Legacy E Procedure

1. Set up Legacy E Base Station unit over a known control point. Connect all Base Station GPS, antenna, radio, and power cables. Power Base Station unit and radio on and wait for solid green light. Make sure radio channel is set to Channel 1.
2. Connect data logger to Base Station unit via cable and power on data logger. Select "Open Job," pick correct job file and select "Open."
3. Select "Connections" and set GPS device to "BaseStatic." Make sure Bluetooth check box is unselected and press "Connect."

4. Select "Setup" and press "Start Base." When "Base Started Successfully" is displayed, disconnect data logger from Base Station cable.
5. Connect rover to rover rod and power up Hiper+ rover. Select "Connections" and set GPS device type to "Rover." Make sure Bluetooth check box is selected and press "Connect." The Bluetooth device address will be displayed. Select the address and press "Select."
6. Press "Survey" and then "Topo." Wait until the unit displays "fixed" and begin recording points.
7. Record pertinent information (date, time, surveyor, etc.) in field notebook.
8. Download job using Topcon software *Topcon Link*, Version 8.0 or higher.

8.0 DATA AND RECORDS MANAGEMENT

Data files downloaded from the GPS should be stored in the appropriate project directory on the network. Personnel should ensure that the downloaded files are complete and correct prior to deleting the original data from the GPS unit. Either GPS has sufficient memory to obtain data for multiple sampling events. Once the data has been verified as complete and correct, report all coordinate data in the State Plane NAD83 HARN (feet) Coordinate system, and/or in a coordinate system consistent with other project data.

9.0 QUALITY CONTROL/QUALITY ASSURANCE

Accuracy of GPS equipment should be periodically checked using local survey control points (USGS Benchmark, Section Corner, etc.), by comparing coordinates and elevations obtained with the GPS with the established coordinates of the control point. Local survey control point information is available at the following internet address:

https://geodesy.noaa.gov/datasheets/

10.0 REFERENCES

Hydrometrics' HSOP-2: Determination, Identification, and Description of Field Sampling Sites

STANDARD OPERATING PROCEDURE

HSOP-7

DECONTAMINATION OF SAMPLING EQUIPMENT

Hydrometrics, Inc.
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Reviewer: Greg Bryce
Title: Senior Hydrogeologist

Signature: _____ Date: 6/2004

Approval: Michael Wignot
Title: Principal/Senior Engineer

Signature: _____ Date: 6/2004

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1.0 SCOPE AND APPLICATION

HSOP-7 presents general procedures to be followed to decontaminate reused sampling equipment between sampling locations. Examples of equipment that may require decontamination are:

- Non-disposable air sampling equipment;
- Water level probes;
- Reusable bailers;
- Containers used to obtain composite samples;
- Water filtration apparatus;
- Concrete or soil coring devices; and
- Drill rig or other heavy equipment.

2.0 SUMMARY OF METHOD

Sampling equipment is cleaned between sampling locations to minimize the potential for cross-contamination. Basic decontamination procedures consist of soap and water, tap water, and/or deionized water rinses. More involved decontamination procedures may be specified and described in the project work plan or Quality Assurance Project Plan (QAPP).

3.0 HEALTH AND SAFETY WARNINGS

Minimum personal protective equipment (PPE) to be worn during decontamination procedures consists of safety glasses or goggles, latex or nitrile gloves, and steel-toed safety boots. Additional PPE may be required by the work plan or project Health and Safety plan. Use caution when handling organic solvents and non-phosphate detergents to prevent spills, leaks, or contact with incompatible materials. Also, ensure that ventilation is adequate when using volatile solvents for decontamination. Safety data sheets (SDS) for all chemical substances used during decontamination should be available at the site where decontamination activities are performed.

4.0 INTERFERENCES

Not Applicable

5.0 PERSONNEL QUALIFICATIONS

Personnel conducting decontamination activities should be familiar with the usage of the equipment being cleaned, and with the intended suite of analytes for samples collected with the equipment, if any. Additional training such as 40-hour HAZWOPER certification may be required for decontamination of equipment that has contacted hazardous material.

6.0 EQUIPMENT AND SUPPLIES

- Tap water;
- Deionized water;
- Organic solvent (acetone, hexane, methanol);
- Non-phosphate detergent;
- Plastic sheeting;

- Pressure washer;
- Latex or nitrile gloves;
- Buckets; and
- Brushes.

7.0 PROCEDURE

1. Select an appropriate area for cleaning and drying equipment to be decontaminated. The area should be free of potential contaminants and sheltered from inclement weather (if possible). Cover decontamination area with plastic sheeting if necessary.
2. Disassemble any equipment that may have trapped material within components.
3. For equipment used to sample for inorganic constituents, the following three-step process is usually sufficient for decontamination:

   - Wash equipment in warm water and non-phosphate detergent, scrubbing with brushes as necessary to remove visible contaminants;
   - Rinse equipment with clean tap water; and
   - Rinse equipment with deionized (DI) water and air dry.

   For organic parameters, decontamination of water or soil sampling equipment may require additional steps:

   - Rinse equipment with solvent (hexane, acetone); and
   - Rinse equipment with DI water and air dry.

   Note that organic solvents will not be used for decontamination when cleaning equipment for use in collecting volatile constituents in air samples.
4. Rinse water from decontamination should be disposed of according to work plan requirements. Moderate quantities of non-hazardous rinse water can typically be disposed of on the ground. Organic solvents should be containerized and disposed of in accordance with local environmental regulations.
5. Heavy equipment used for sampling purposes (including drill rig auger flights and tools) should be cleaned as necessary between sampling locations with a hot- or cold-water pressure washer. If practical, soap and water may be used to scrub equipment as well.
6. DI water should be obtained from a source with documented capability to produce contaminant-free water. The source of DI water used and other specifics of decontamination procedures should be recorded in the field notebook.
7. Drying and storage of decontaminated equipment should be in a contaminated-free, protected area if possible. Equipment that will not be used again immediately may be storage in plastic bags or other clean containers for additional protection.

8.0 DATA AND RECORDS MANAGEMENT

Decontamination procedures will be documented in the field notebook, which is maintained in accordance with HSOP-31.

9.0 QUALITY CONTROL/QUALITY ASSURANCE

The effectiveness of decontamination procedures and the potential for cross-contamination of samples may be assessed through the collection and analysis of equipment rinsate blank samples, as described in HSOP-13. In general, equipment rinsate blank collection involves thoroughly decontaminating sampling equipment, then rinsing the clean equipment with deionized water, and capturing the rinse water in containers to be submitted to the laboratory for the parameters of interest. The project work plan and QAPP should be reviewed for project-specific directions regarding collection and analysis of equipment rinsate blanks.

10.0 REFERENCES

Hydrometrics' HSOP-13: Equipment Rinsate Blank Collection

Hydrometrics' HSOP-31: Field Notebooks

STANDARD OPERATING PROCEDURE

HSOP-29

LABELING AND DOCUMENTATION OF SAMPLES

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Signature: _____ Date: 6/2004

Reviewer: Bob Anderson
Title: Principal/Senior Hydrogeologist

Signature: _____ Date: 6/2004

Approval: Michael Wignot
Title: Principal/Senior Engineer

Signature: _____ Date: 6/2004

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1.0 SCOPE AND APPLICATION

HSOP-29 describes typical procedures used to label sample containers, to ensure that information on the label is complete and correct, and to document the number and type of samples collected at a particular site. Samples must be thoroughly documented so that analytical data received from the laboratory can be correlated to the correct sampling site.

2.0 SUMMARY OF METHOD

Hydrometrics uses unique sample codes to identify individual samples. Sample codes are distinct from site identification codes, to ensure that the laboratory is unaware of the sample source, and whether the sample is a quality control (QC) or routine sample. Sample codes and other pertinent information are written on adhesive labels affixed to the sample container, or directly on the sample container in some cases. Sample documentation includes recording information in the field notebook (and on sampling forms if required), and completing chain-of-custody documentation for sample storage and shipping.

3.0 HEALTH AND SAFETY WARNINGS

Field personnel should be aware of the health and safety precautions to be followed during any field event, and should be familiar with any project-specific hazards. This may include review of project-specific health and safety plans, site-specific and/or organization-specific safety requirements and training.

4.0 INTERFERENCES

Some common problems with sample labeling and documentation might include the following:

- Use of incorrect sample numbers;
- Transcription errors during sample labeling or recording information in the field notebook; and
- Duplication of sample numbers.

These errors may be avoided by having an additional member of the sampling team check the labeling and documentation during the field event. If one person is conducting the sampling event, information entered on the sample label and in the field notebook should be double-checked for accuracy.

5.0 PERSONNEL QUALIFICATIONS

Labeling and documentation of samples should be conducted by personnel familiar with the project work plan and the proposed sample numbering scheme.

6.0 EQUIPMENT AND SUPPLIES

- Sample ID tag or label;
- Permanent marker;
- Container seals;
- Chain-of-custody form;
- Sampling forms; and
- Field notebook.

7.0 PROCEDURE

1. Determine appropriate sample number to be assigned to the sample. Hydrometrics' numbering convention is as follows:

   XXXX-YYMM-ZZZ

   where: XXXX=three- or four-letter project prefix;
   YYMM=last two digits of year followed by month (e.g., 0407 for July 2004);
   ZZZ=sequential numbers, starting with 100.

   This convention may be modified as necessary; most Quality Assurance Project Plans (QAPPs) contain information on sample numbering to be used for a particular project. For some projects, sample numbers for each site to be sampled may be pre-assigned by Hydrometrics' Data Quality Department, to facilitate sample entry into the project database.
2. Fill out information on sample ID tag or label. ID tags are typically serially numbered, and may be used for samples that are likely to be the subject of litigation, or as mandated by EPA, other agency, or work plan requirements. Sample labels are similar to ID tags, but are not numbered.
3. Waterproof permanent markers (such as Sharpie pens) should be used to complete sample ID tag or label information. Information to be included on the sample ID tag or label **must** include:

   - Date and time (24-hour style, e.g. 1400 for 2:00 p.m.);
   - Unique sample number;
   - Sample processing and preservative (whether the sample has been field-filtered, whether a preservative has been used, and the type of preservative); and
   - Sampling personnel names or initials.

   Optional information that may also be included on the sample label or tag as warranted could include the type of analysis requested, or whether the sample is a grab or composite. In no case should a QC sample (blank, duplicate, or blind performance evaluation sample, used to evaluate lab performance with a standard of known concentration) be identified as such on the sample label. QC samples are assigned sample numbers in the same manner as other samples.
4. When multiple sample containers are used at the same site due to differing preservation requirements or additional volume requirements, the same sample numbers should be used on each container.

5. Due to requirements for cooling samples and field conditions, sample containers often become wet. If possible, it is advisable to place clear shipping tape over the label to ensure that it stays on the container. In addition, some sample information may be written on the sample lid, to aid in sample identification should the label become separated from the container.
6. If required by the project, signed and dated seals may be placed over the container lid to prevent opening without breaking the seal.
7. Sample information is recorded in the field notebook, including the same information recorded on the sample label (date and time, sample number, etc.), as well as identifying information for the sampling site, and QC sample information (see HSOP-31). If desired, sampling forms may also be used to record sampling information.
8. On large projects, with multiple field sampling activities occurring at the same time, multiple field notebooks may be used to document sampling activities. Each notebook should clearly state in the initial entry what tasks will be recorded in the particular book.
9. After collection and documentation, samples should be handled in accordance with standard chain-of-custody procedures (see HSOP-4).
10. Any corrections made to sample labels, field notebooks, or chain-of-custody documentation should be made by crossing out the incorrect information with a single line, entering the correct information, and signing and dating the correction.

8.0 DATA AND RECORDS MANAGEMENT

Copies of all sample documentation, including field notebooks, sampling forms, and chain-of-custody forms will be maintained in the project file. Sampling crews are responsible for submitting this information to the Data Quality Department for filing at the completion of each sampling event.

9.0 QUALITY CONTROL/QUALITY ASSURANCE

- At the conclusion of the sampling event, field personnel should collate and review all sampling documentation materials for accuracy, prior to submitting the information to the Data Quality Department.
- Sample codes and associated sampling sites will be cross-referenced during data review and validation procedures stipulated by the project work plan and QAPP.
- Field samplers should ensure that complete documentation of samples has occurred prior to the close of sampling activities each day, by counting the number of samples collected and checking the field notebook for entries related to each sample.

10.0 REFERENCES

Hydrometrics' HSOP-4: Chain-of-Custody Procedures, Packing, and Shipping Samples

Hydrometrics' HSOP-31: Field Notebooks

STANDARD OPERATING PROCEDURE

HSOP-31

FIELD NOTEBOOKS

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1.0 SCOPE AND APPLICATION

HSOP-31 presents general guidance on recording field activities in a dedicated project notebook. Field books are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the implementation of the project. In legal proceedings, field notes are typically admissible as evidence and subject to cross-examination.

2.0 SUMMARY OF METHOD

Bound notebooks with sequentially numbered pages are used to record observations, sampling information, weather conditions, and other pertinent information during field activities. Entries are made in permanent ink, and signed and dated at the bottom of each page. Both original notebooks and copies of field notes are retained as part of the project file.

3.0 HEALTH AND SAFETY WARNINGS

Field personnel should be aware of the health and safety precautions to be followed during any field event, and should be familiar with any project-specific hazards. This may include review of project-specific health and safety plans, site-specific and/or organization-specific safety requirements and training.

4.0 INTERFERENCES

The primary potential problem with recording information in field notebooks is dealing with incorrect entries. In no case should erasures be made or information be obliterated or made illegible. Errors should simply be crossed out with a single line, dated, and initialed by the person making the original entry.

5.0 PERSONNEL QUALIFICATIONS

No specific qualifications are necessary for recording information in field notebooks. Personnel should be familiar with the scope and objectives of the project in order to record more meaningful field observations.

6.0 EQUIPMENT AND SUPPLIES

- Bound notebook with water resistant, sequentially numbered pages; and
- Pen (indelible ink).

7.0 PROCEDURE

1. New field notebooks should be labeled with the project title and number on the cover. Inside the front cover, write Hydrometrics' address and phone number as contact information, in case the notebook is lost. Multiple field notebooks may be required for large or ongoing projects; these should be assigned sequential numbers or labeled on the cover with the inclusive dates of observations recorded in the notebook (e.g., Project X, May 2002 through May 2004).

2. Notebook entries should begin on a fresh page for each day during a field event. While specific entry formats may vary with personal preference, the intent of the field notebook is to provide a daily record of significant events, observations, and measurements, as well as sampling information. All entries should be accompanied by date and time. Examples of information to be recorded in the field notebook includes:

    - Weather conditions;
    - Personnel on-site, including arrival and departure times and identities of visitors and observers;
    - Purpose of daily activities;
    - Site sketch maps;
    - Health and safety briefing information;
    - Field meter calibration information;
    - Identification and description of sampling sites (see HSOP-2);
    - Descriptions of photos taken;
    - Communication logs;
    - Documentation of deviation from methods; and
    - Sampling instrument decontamination records.

    Sampling-specific information should include (see also HSOP-29):

    - Sample number, date, and time;
    - Site identifier;
    - Description of sample containers, preservation, and sample collection method;
    - Sample tag number (if applicable);
    - Field parameter measurements and water calibration (static water level, total well depth, pH, specific conductance, water temperature, turbidity, color, odor, etc.); and
    - Soil depth intervals and descriptions.

    This list is not meant to be exhaustive, and other pertinent information should also be recorded in the field notebook as determined by field personnel.

3. The field notebook will be used to record communication with individuals on-site and on the phone that could result in a deviation from the SAP or that could impact the quality of the data being collected as part of the investigations.
4. Observations and measurements should be recorded in indelible ink, at the time they are made.
5. If erroneous entries are recorded, corrections should be made by deleting incorrect information with a single line, and dating and initialing the deletion in the notebook. Do not erase or obliterate incorrect entries, or remove pages from the notebook.
6. Blank and unused portions of notebook pages should be crossed out with a single line.
7. At the conclusion of the field event, review notebook entries, sign and date each page (if not already done), and photocopy notebook pages for inclusion in the project file. Original notebooks may be maintained in the project file, or in the files of individual field personnel at the discretion of the project manager.

8.0 DATA AND RECORDS MANAGEMENT

Copies of field notes are retained in the project file. Original field notebooks are maintained in the project file, or in the files of individual field personnel at the discretion of the project manager. Completed (filled) notebooks should be placed in the project files or the Data Quality Department notebook library, at the discretion of the project manager. Copies of field notebooks should be updated in project files at the end of each field event.

9.0 QUALITY CONTROL/QUALITY ASSURANCE

Standard procedure requires review of field notes by a person other than the person who recorded the field notes, prior to entering the information into the project files, to check for inaccurate, incomplete, or unclear entries, blank pages, or other problems with documentation. Peer review of notebook entries should also be conducted at least once per day during field activities.

10.0 REFERENCES

Hydrometrics' HSOP-2: Determination, Identification, and Description of Field Sampling Sites

Hydrometrics' HSOP-29: Labeling and Documentation of Samples

STANDARD OPERATING PROCEDURE

PROCEDURE FOR COLLECTING DIRECT-PUSH SOIL SAMPLES©

HS-SOP-34

1.0 PURPOSE

This SOP describes the procedure for collecting a soil sample from a direct-push drill rig for subsequent laboratory analysis.

Soil types and soil characteristics can vary considerably within and between sampling sites. It is important, therefore, that detailed records be taken; particularly of the sampling location, depth, and soil characteristics such as grain size, moisture and color. While this SOP describes a general procedure for collection of soil samples, because of soil heterogeneity issues, modifications to this procedure may be appropriate depending on site-specific conditions and data reporting objectives. Therefore, the project specific sampling and analysis plan should take precedent for any deviations to the procedure described below.

2.0 EQUIPMENT

- Stainless steel spoon or plastic spoon;
- Wide mouth 125ml glass jar (organics);
- 1-gallon size Zip-lock plastic bags (metals);
- Latex or nitrile gloves;
- Utility knife;
- Measuring tape; and
- Field notebook.

When sampling for metals, a stainless steel or plastic spoon should be used for collecting the sample. Sampling tools which are plated with chrome or other materials are to be avoided.

3.0 PROCEDURE

1. Locate the site to be sampled and record the site name and location on form **HF-407** and/or in the field notebook (**HSOP-31**). The notes and drawings should outline the property boundary, location of sample units and sample sites, sample site names, sample depths and sample numbers, as appropriate.

2. After the approximate drilling area has been physically and legally cleared for buried utilities, the direct-push drill rig can be allowed to collect soil samples. Soil sampling occurs using a double-walled drive tube in which the inside wall

consists of a clear acrylic liner that can be removed while leaving the outer wall in place. Typical liner lengths are 4 feet and have 1 1/8 inch diameters. After the drill rig operator extracts the clear liner, the liner can be cut in half with a utility knife exposing the soil sample. If headspace analysis is required by the project work plan, composite samples should be immediately collected before logging the lithology following the steps outlined below and **HS-SOP-45**. Some soil compaction may occur during collection using the direct push method, especially in clay-rich substrate. Soil loss may also occur through the open end of the liner during liner extraction. In the event either soil compaction or soil loss occurs documentation should occur in the field notes and on Form **HF-701**. After documentation, the resultant sample should be split into equal depth intervals in the event of soil compaction or the appropriate interval should be recorded as missing in the event of soil loss (in the event that can be determined). After visual inspection of the sample and recording the lithology (if required by the project work plan), a soil sample can be collected for laboratory analysis. Generally, between 100 and 500 grams of soil are required. If more sample is required a larger diameter liner can be used or an auger type drill rig can be employed.

3. For composite samples, soil collected in the liner should be extracted with a stainless steel or plastic spoon from depth interval to be composited and should be placed directly into the sample container. Representative samples from the entire composite depth interval should be collected with care being taken not to bias or exclude any particular depth interval. Since the laboratory may only use a small portion of the total sample, it is important that the sample be thoroughly mixed in the sample container so that the analysis is representative of the composite depth interval. For metals samples a plastic zip-lock bag is an appropriate container. For organic samples, a 125 ml glass container is required unless otherwise specified. Generally, coarse material should be excluded from the sample (greater than approximately 1/4 inch if feasible).

4. For field split samples, the soil grab sample should be transferred from the liner with a stainless steel or plastic spoon to a stainless steel mixing bowl, Teflon tray, or similar utensil free of potential sample contaminants (refer to **HSOP-7**). Once enough sample is collected to create an original and a duplicate sample, the soil should be thoroughly mixed prior to transferring the soil to the sample containers.

5. Sample containers should be labeled, at a minimum, with sample date and sample number to permit cross referencing with the field notebook. If the sample is not to be submitted as a completely blind sample, other information may also be appropriate including sample depth, station identification, soil type. Refer to **HSOP-29**, Labeling and Documentation of Samples.

6. Refer to **HSOP-4**, Chain-of-Custody Procedures, Packing and Shipping Samples for sample handling procedures.

7. All equipment which contact the soil should be decontaminated after collecting the sample. Refer to **HSOP-7**, Decontamination of Sampling Equipment.

4.0 ASSOCIATED REFERENCES

HF-407	**IDENTIFICATION AND DESCRIPTION OF FIELD SAMPLING SITES**
HF-701	**GEOTECH FIELD FORM**
HSOP-31	**FIELD NOTEBOOKS**
HSOP-29	**LABELING AND DOCUMENTATION OF SAMPLES**
HSOP-4	**CHAIN-OF-CUSTODY PROCEDURES, PACKING AND SHIPPING SAMPLES**
HSOP-7	**DECONTAMINATION OF SAMPLING EQUIPMENT**
HS-SOP-45	**ORGANIC VAPOR ANALYZER HEADSPACE ANALYTICAL SCREENING PROCEDURE**
FORM DP-1	**DIRECT-PUSH SOIL BORING LOG**

STANDARD OPERATING PROCEDURE

HEADSPACE GAS
ANALYTICAL SCREENING PROCEDURE FOR SOILS
HS-SOP-45

1.0 PURPOSE

This operating procedure is to be used to conduct field screening of hydrocarbon contaminated soil using a photoionization detector (PID), flame ionization detector (FID), organic vapor analyzer (OVA), or other appropriate equipment. The specific instrument should be selected based on anticipated levels and types of contaminants in soils.

2.0 EQUIPMENT

- Headspace analyzer (PID, FID, OVA, or other);
- Acetone;
- 16 oz. “mason” or soil jars and/or Ziploc bags;
- Industrial grade soap;
- Aluminum foil;
- Tap water;
- Stainless steel hand shovel;
- Paper towels;
- Distilled water; and
- Field Notebook.

3.0 PROCEDURE

1. Thoroughly clean stainless steel sample shovel with industrial grade soap mixed with tap water, rinse with straight tap water.

2. Carefully rinse shovel with acetone and wipe off with a clean paper towel.

3. Thoroughly rinse shovel twice with distilled or deionized water.

4. Start and calibrate headspace screening instrument using procedures outlined by manufacturer in the manual.

5. Obtain and record a background organic vapor content in the ambient air (be sure to obtain background content away from contaminated soil). This may be repeated periodically during field work to assess changing background conditions or instrument drift.

6. Half fill two clean glass jars (16 oz. mason or soil type) with soil using the stainless steel shovel. Be careful that the soil has not been directly exposed to the atmosphere for very long before sampling, and quickly cover the jars with two sheets of aluminum foil and affix lids to jars. Alternatively, place soil in a Ziploc bag and seal, allowing air to be trapped in bag. If plastic bags are to be used for headspace development, background readings should be collected from within bags that have been allowed to warm up.

7. Allow headspace development for at least ten minutes, vigorously shaking jars or bags for 15 seconds before and after headspace development. Headspace development is temperature dependent. If ambient air temperature is below 32°F, development should be done within a heated vehicle or building. Note that if readings are taken in a separate location, background organic vapors should be rechecked before taking a reading. Time and temperature should be standardized (same from site to site) and is recorded in the field notebook.

8. Remove screw lids and expose foil seal on jars. Puncture foil seal on Ziploc bag carefully and insert probe halfway into air space. Exercise care to avoid uptake of moisture and/or soil particles. Keep in mind that excess soil moisture can affect readings and therefore should be noted in the field book. Some instruments include intake filters to help minimize the effects of soil moisture on instrument readings.

9. Measure and record highest value of meter response as headspace concentration. Erratic meter response should be noted; however, analysis should be repeated with another fresh sample (start at Step 6). Maximum response should occur between two and five seconds.

10. Calculate the difference between ambient conditions and headspace values obtained in Steps 5 and 9 above.

11. Instrument must be checked and calibrated as stated by the manufacturer.

12. All records will be properly logged in an engineering field notebook and maintained in the project data file.

STANDARD OPERATING PROCEDURE

HSOP-58

GUIDELINES FOR QUALITY ASSURANCE OF ENVIRONMENTAL DATA COLLECTION ACTIVITIES, DATA QUALITY PLANNING, REVIEW, AND MANAGEMENT

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1.0 PURPOSE AND APPLICABILITY

This Standard Operating Procedure (SOP) outlines Hydrometrics' standard data review and data management policies and procedures. These policies and procedures provide a general framework to guide the collection, analysis, technical review, and management of data obtained during an environmental investigation. Although the required level of rigor will vary based on individual project goals and objectives, some provisions for assessment of data quality and data usability should be incorporated into all projects involving collection and analysis of environmental samples. This SOP describes aspects of data review, validation, and management that are applicable throughout the full duration of a typical environmental investigation, from initial project planning through preparation and submittal of any final reports. Note that project-specific requirements for data review, data validation, and data management are frequently detailed in project planning documents such as Work Plans, Sampling and Analysis Plans (SAPs), and/or Quality Assurance Project Plans (QAPPs). The procedures outlined in this SOP are intended to function as a basis for development of project-specific requirements, and also to provide a fundamental set of review, validation, and management practices applicable to all environmental investigations.

2.0 ORGANIZATION AND RESPONSIBILITY

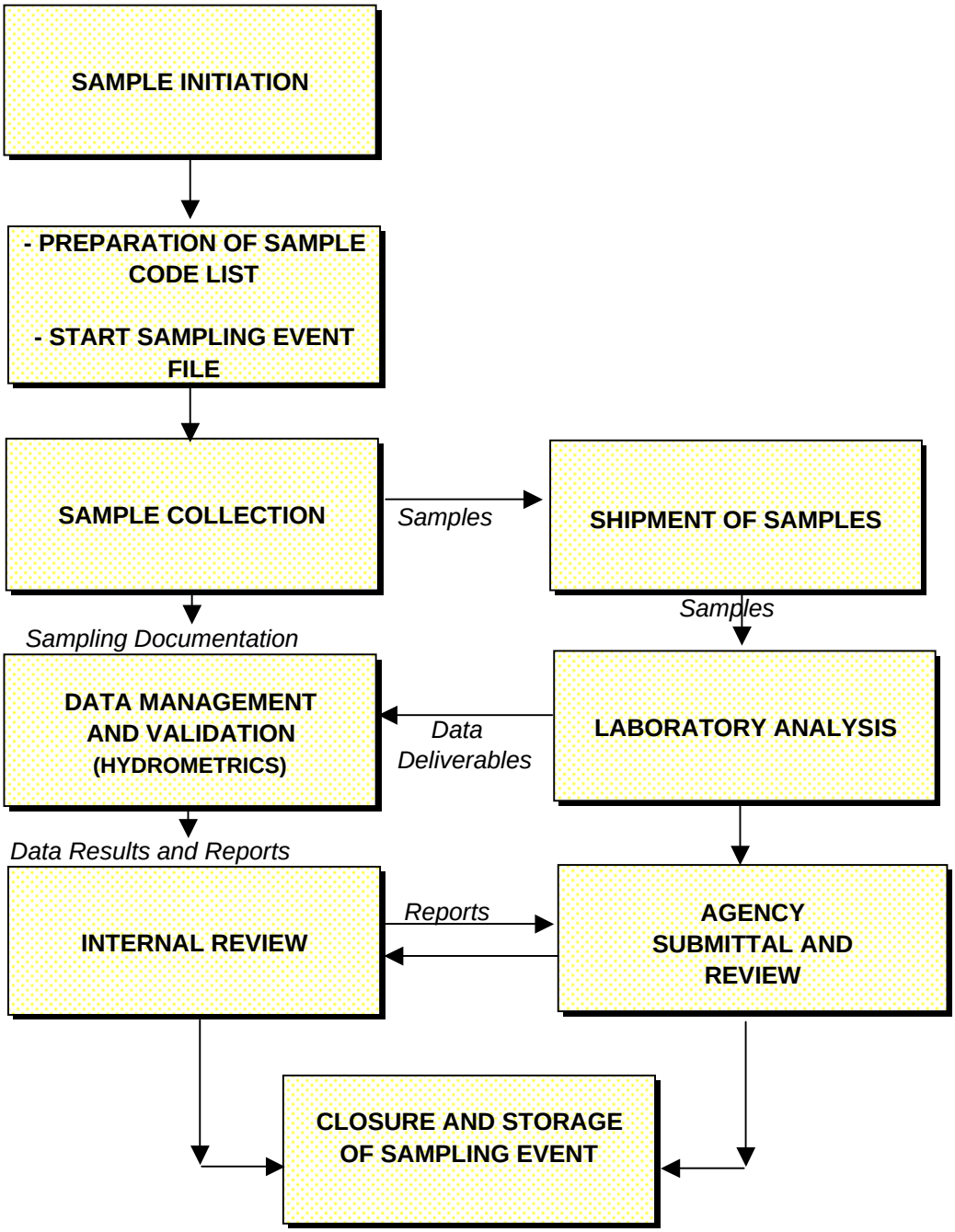
A QA manager is assigned to each individual project. The QA manager has the primary responsibility of overseeing implementation of field activities and laboratory analysis, to ensure that requirements in the project planning documents (Work Plan, SAP, QAPP) are met. These requirements may include specified field and laboratory methodologies, sample types and locations, data quality objectives, quality control sample types and frequencies, and data review, validation, and management procedures. At the direction of the client or QA manager, periodic audits may be performed to evaluate project-specific QA/QC and data management procedures and to provide an avenue for corrective actions.

The QA manager and project manager are responsible for assigning personnel to additional roles, including field team leaders and data quality review and management coordinators. Maintenance of complete and accurate field and laboratory documentation should be a focus of the QA team throughout the life of the project. The integrity of the data is maintained throughout all transfers and manipulations between principal data handlers/users. The flow of information is shown in Figure 1.

3.0 DATA QUALITY OBJECTIVES

Project-specific Data Quality Objectives (DQOs) should be developed during the project planning phase. The DQO process is designed to ensure that the type, quantity and quality of data collected during the investigation are appropriate for the intended application (EPA, 2006). The DQO process sets the stage for development and implementation of the project work plan.

FIGURE 1. SAMPLE INFORMATION AND DOCUMENTATION FLOW CHART



4.0 DATA REVIEW AND VALIDATION

Data review and validation involve the evaluation of the completeness, correctness and conformance of a specific data set against requirements set forth in the project planning documents (EPA, 2002). The level of review used for a particular data set will therefore depend on a comprehensive consideration of not only the intended end use and project objectives but also of project documentation requirements, QA/QC procedures, and inherent limitations in various sampling techniques and analytical methods. These levels are fairly fluid and can be customized to meet project requests/requirements. Table 1 lists Hydrometrics' established validation levels and their applications. Additionally, for any Montana Department of Environmental Quality CECRA site, the MDEQ's Data Validation Guidelines will be performed and will take precedence over any inconsistencies with this SOP. The MDEQ guidance document is located at http://deq.mt.gov/ StateSuperfund/PDFs/DataValidationReport.pdf.

- **Level I - Visual Validation -** At this level the verification of completeness and accuracy of all sampling information takes place. This includes the following: confirming all results (both field and lab); all parameters, units and measurement basis, as being correct; cross checking of field notes and forms; and the verification of flow calculations. The results of this validation, at this level, are documented in a data review report memo. This level of validation generally corresponds to "data verification" as discussed in EPA (2002).
- **Level II - Standard Validation -** This level of validation encompasses the visual validation plus a more comprehensive review of all of the sampling information. The additional review includes the following: an examination of both field and laboratory QC (any laboratory QC that is included within the analytical package) using validation criteria limits as specified in the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic/Organic Data Review (EPA, 2010; 2008); a survey of the achievement of the project data quality objectives; qualification of the data per project requirements; data evaluation; historic trend comparison and/or graphs; ion balance; and statistical comparisons. The results of this validation, at this level, are documented in a comprehensive data review report.
- **Level III - (Contract Laboratory Program) CLP Validation -** At this level of review, both the visual and standard validation tasks are performed. Analytical data is characterized by rigorous QA/QC protocols and documentation. Validation procedures utilize such documentation as necessary to support project needs. Additional review requirements are: verification of the laboratory's raw data and quality control for frequency; accuracy; completeness; and procedures as required by the criteria limits specified in the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic/Organic Data Review.

Performance criteria for the following sampling and analytical specific data quality indicators (DQIs) for the precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters are typically specified in the project SAP or QAPP. Assessment of these non-direct measurements provides the basis for the evaluation of overall data quality.

TABLE 1. VALIDATION LEVELS AND APPLICATIONS

VALIDATION LEVELS	APPLICATION
Level I - Visual Validation	• Verify Completeness and Accuracy of Input Data: - Results - Sampling Information - Parameters - Units - Measurement Basis • Cross Check Field Notes and Forms • Verify Flow Calculations • Report via Validation Memo
Level II - Standard Validation	• Visual Validation • Quality Control Review - Field Quality Control - Laboratory Batch Quality Control • Data Quality Objectives(DQO) Summary for Precision, Accuracy, Representativeness Comparability, Completeness (PARCC) • Qualify Data as per Project Requirements • Data Evaluation - Statistical Comparison - Ion Balance - Trend Comparison and Graphs • Report via Standard Comprehensive Data Review Report
Level III - CLP Validation (EPA, 2010; 2008)	• Visual • Standard • Quality Control Validation - Laboratory Quality Control - Field Quality Control • Verification with Raw Data - Frequency - Accuracy - Completeness - Procedure • Quality Data as per Project Requirements • Report via Standard Comprehensive Data Review Report

Precision Objective

Precision is defined as a measure of reproducibility of replicate measurements, and is inversely related to the variability among the results obtained (e.g., highly variable results have low precision). Precision of field duplicates is a measure of both field sampling variability and the laboratory analytical variability. Precision will be assessed using field and laboratory duplicates, and laboratory matrix spike duplicates.

Accuracy Objective

Accuracy is the agreement between a measured value and a 'true' value. Accuracy will be assessed using field trip blanks, field equipment/rinsate blanks, laboratory matrix spikes, laboratory control standards (LCS), laboratory method blanks, laboratory fortified blanks, and laboratory surrogate standard checks.

Representativeness Objective

Representativeness is the extent to which discrete measurements and testing accurately describe the environmental system. Representative data are achieved through careful selection of sampling sites, and proper sampling and analytical procedures.

Completeness Objective

Completeness is achieved when the number of valid measurements is sufficient to satisfactorily address all-important issues about the site. Completeness is assessed as the number of "valid" measurements. A "valid" measurement is one in which the sample was properly collected and considered representative of the material sampled, and which was not rejected during the data quality review process. Results qualified during the data quality review process as estimated will be considered valid measurements, unless extenuating circumstances or professional judgment indicate otherwise.

Comparability Objective

Comparability is the degree to which two or more data sets from the same site are generated using consistent procedures. Inherent compositional differences aside, discrete data sets may differ as a result of non-random (biased) sampling, variability in sampling technique, and variations in methods of analysis. To ensure comparability of data collected under the plan, the following actions will be implemented:

1. Standard Operating Procedures (SOPs) will be employed for sampling and analytical activities, as appropriate;
2. Field personnel will be thoroughly trained in sampling techniques;
3. Data results will be reported in standard units;
4. Data qualifiers will be consistent for all project data;
5. All sampling sites will be accurately delineated and recorded (HSOP-2); and
6. Analyses will be performed using EPA-accepted methods, as available and appropriate.

5.0 DATA MANAGEMENT ACTIVITIES

The process of collecting, analyzing, managing, tracking, evaluating, and reporting data involves many steps. The data management system for a project should address documentation requirements, document control and storage, and reporting formats. Figure 2 gives an overview of typical data management activities.

5.1 DOCUMENTATION

All sampling and analytical related project documents, field notes, laboratory analyses and/or testing results, as well as supporting documentation, should be maintained as part of the data management records organized by sampling events in the project file. Figure 3 outlines the flow of data documentation. The types of documentation that may be part of the data management records are as follows.

5.1.1 Field Sampling Documents

Field sampling documents contain all pertinent information recorded in the field and/or associated with samples collected in the field they include:

Calculated Flow Sheets	Field Sampling Forms	Transmittal Letter(s)
Calibration Logs	Shipping Records	Pump Tests
Parameter Lists	Well Logs	Sample Code List
Site Maps	Field Notebooks	

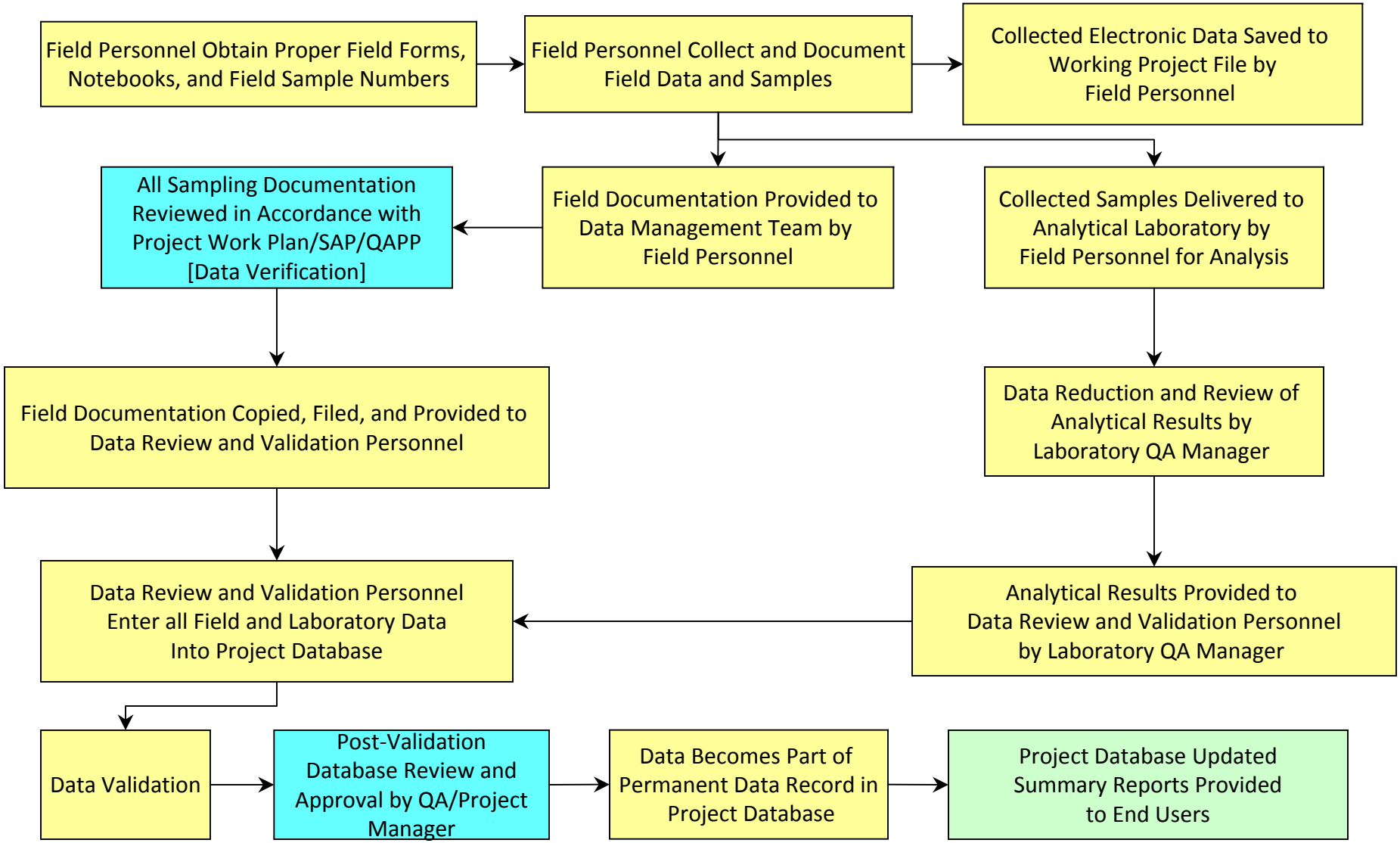
5.1.2 Laboratory Documents

Laboratory documents contain all pertinent information relating to the handling, processing, and subsequent analysis of the samples. Laboratory documents fall within the following categories:

- **Transmittal Records -** allow for tracking of the samples, and aid in communication between the laboratory and the Hydrometrics QA/QC personnel.

Cover Letter	Parameter List
Case Narrative	Sample Login Records
Chain of Custody Documents	Sample Preservation Check

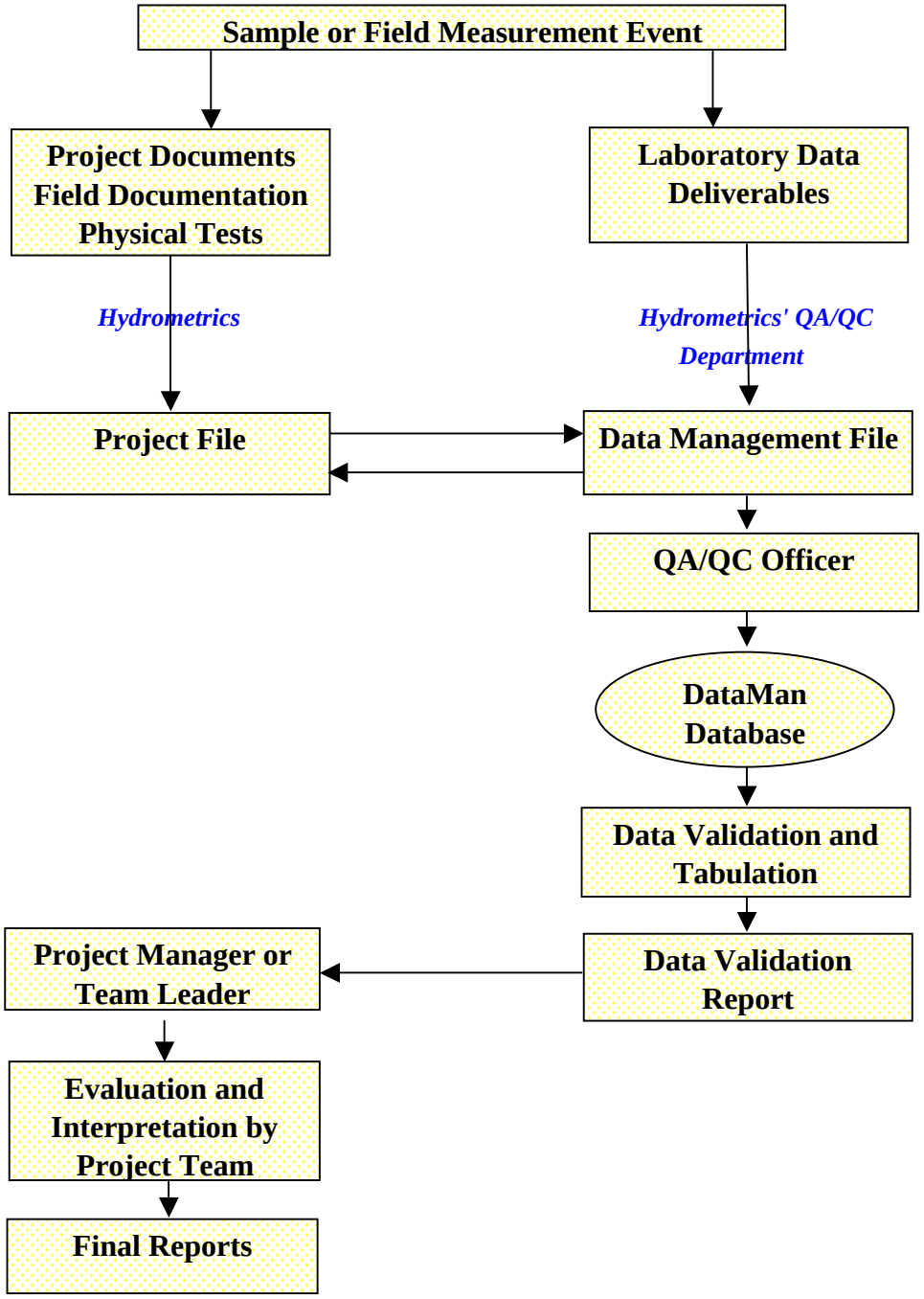
- **Hard Copy Data Deliverables -** all deliverables received as part of the analytical package. The amount and type are dependent on the level of analysis and may range from a summarization of results to complete CLP deliverables (e.g., raw instrument output, lab bench logs, etc.).



GUIDELINES FOR QUALITY ASSURANCE OF ENVIRONMENTAL DATA COLLECTION ACTIVITIES DATA QUALITY PLANNING, REVIEW, AND MANAGEMENT	TYPICAL DATA MANAGEMENT ACTIVITIES	FIGURE 2

H:\admin\HSOP\2005 New HSOPs\HSOP-58 Figure 2.ppt\HLN\01/05/2012

FIGURE 3. DATA DOCUMENTATION FLOW



- **Electronic Data Deliverables** - allows for rapid transfer of laboratory data results into the specific client project database. Electronic deliverables contain analytical results and associated quality control data. Analytical results can be converted either into the Microsoft® FoxPro database program DataMan, developed by Hydrometrics, or data can be converted to other spreadsheet or database software.

5.1.3 Data Management Records

Data management records integrate client and project information with the field and laboratory data documentation for specific sampling events. The data management files may contain the following information.

A. **Project specific client project information**

- Work Plan
- Sampling and Analysis Plan (SAP)
- Quality Assurance Project Plan (QAPP)
- Site List
- Map
- Well Inventory
- Project Detection Limits
- Communications
- Any Other Relevant Project Information

B. **Event specific files**

- Field Documentation
- Laboratory Hard Copy Deliverables
- Electronic Deliverables
- Supporting Documentation
- Retest Requests
- Validation Reports
- Correspondence
- Communications

5.2 DATA STORAGE

Formats for handling data storage involve both electronic formats via the database system or spreadsheets, and physical hard copy files. The finalized data records and documents are always unique. A complete set of all project documents and data analyses will be stored in accordance with Hydrometrics' records management procedures, and/or as stipulated in the project QAPP or Data Management Plan. A set of project documents related to data or data analyses will also be stored at the originating Hydrometrics' office along with associated electronic files. All data documentation will be received by the Hydrometrics QA/QC data management department to be entered into the data management files as appropriate, to allow efficient retrieval of information.

5.3 DATA/DOCUMENT RETRIEVAL

Retrieval of documents will be accomplished through the use of the data management filing system. Project data are maintained in project information files, and sampling event files, as well as the client database. Retrieval is quick and efficient with the use of these tools and can readily be provided in hard copy format and/or electronic format depending on client needs.

5.4 EXTERNAL DOCUMENT SOURCES

In order to maintain project information flow, it will be necessary to include any relevant project analytical/physical testing information generated by contractors or subcontractors. Analyses and documentation generated by external sources can be maintained in the data management system.

5.5 REPORTING

A schedule for reports will be established by the client and the project manager. The reporting schedule and specific report formats and content are normally outlined in the project work plan or contract.

Reports may include any of the following formats:

- General Information Summary - summarizes overall activity of the project.
- Status Report - updates the recipient as to the progress of specific activities.
- Data Evaluation/Interpretive Reports - includes and elaborates on topics covered in the General Information Summary; additionally, these reports highlight and may attempt to explain any data anomalies or trends that have been noted.
- Data Validation Reports - summarizes data quality in a formal report that is distributed both in-house and to external agencies.

5.6 SYSTEMS AUDIT/CONTROL

Database and electronic file security is controlled via network access limitations. Only authorized personnel have access to create or revise data files based on assigned user rights. A change log form documents all changes to the DataMan database files. Electronic data and document files are backed up daily.

Periodic system audits, if required by the client or oversight agencies, may be performed on field collection activities, laboratories and the data management activities. System audits are qualitative evaluations conducted for the purpose of determining compliance with the organizational and work element requirements for the specific client project activities. Performance will be assessed and non-compliance will be addressed and/or corrected. The schedule and content of the audits will be dictated by the client and QA or project manager.

6.0 REFERENCES

EPA, 2002. Guidance on Environmental Data Verification and Data Validation (EPA QA/G-8). EPA/240/R-02/004. Office of Environmental Information. November 2002.

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APPENDIX B

FIELD LOG SHEET

Former Husky Service Station Valier, MT

HYDROMETRICS, INC. **Boring Name:**[2] **SB -**

Geotech Log Field Form: Graphical Logs **Personnel:** **Date:** Page ___ of ___

Sample Collection Log							**Geological Log**			
Time	Depth Interval (ft)	Recovery (in feet)	PID Reading (ppm)	Lab Sample ID [1]	Photo # / Direction	Notes	Top Depth	Bot. Depth	Material Name	Unit Name
							Description			
							Description			
							Description			
							Description			
							Description			
							Description			

1 Lab Sample ID, if applicable (YYMM-HVAL-100, etc. i.e., 2103-HVAL-100)

2 2021 Soil Borings will start at SB-15

APPENDIX C

QA/QC PLAN

FORMER HUSKY SERVICE STATION
CORNER OF HIGHWAY 44 AND MONTANA STREET
VALIER, MONTANA
QUALITY ASSURANCE / QUALITY CONTROL PLAN

Facility:
Former Husky Service Station
Corner of Highway 44 and Montana Street
Valier, MT
DEQ Facility ID #56-13802, Release #3197, Work Plan #34092

Prepared by:

Hydrometrics, Inc.
3020 Bozeman Avenue
Helena, MT 59601

September 2020

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FORMER HUSKY SERVICE STATION
CORNER OF HIGHWAY 44 AND MONTANA STREET
VALIER, MONTANA
QUALITY ASSURANCE / QUALITY CONTROL PLAN

1.0 PROBLEM DEFINITION AND BACKGROUND

The former Husky Service Station site is located on the southeast corner of the Montana Street and Highway 44 (Teton Avenue) intersection in Valier, Montana. Two underground storage tanks (USTs), which had contained gasoline, were removed from the site in 1997. During removal of the USTs contamination was discovered in adjacent soils, reported to the Montana Department of Environmental Quality (MDEQ), and subsequently removed under the direction of MDEQ in 1998. From 2006 through 2019, a series of remedial investigations, including soil borings, groundwater monitoring, and receptor surveys have indicated that petroleum impacts at this site are limited to the vicinity immediately surrounding MW-1 and MW-4. Clayey native soils surrounding the source area restrict the movement of petroleum hydrocarbon constituents away from this area. However, groundwater fluctuations have in the past and may continue to reintroduce residual petroleum contamination into the aquifer nearby monitoring wells MW-1 and MW-4.

The objective of the 2020/2021 remedial investigation is to determine the current extent and magnitude of petroleum contamination of soil remaining in the vicinity (west, east, and south) of monitoring wells MW-1 and MW-4. This data will be used to determine the next steps toward closure of this Site.

1.1 CONSTITUENTS OF INTEREST

The constituents of interest for this investigation are petroleum hydrocarbons in soils, including gasoline. Soil samples will be submitted for laboratory analyses by Volatile Petroleum Hydrocarbons (VPH) by the Massachusetts Method.

2.0 PROJECT DATA QUALITY OBJECTIVES

This QA/QC for the collection, analysis, and interpretation of data as part of the Former Husky Service Station, Valier, Montana has been developed to ensure data is collected, analyzed, stored, managed and reported in a manner of high enough quality to meet Data Quality Objectives (DQOs) for a specific project. The results of the DQO process for this investigation, consisting of brief descriptions of the outcomes for each phase in the planning process are presented in Appendix A.

2.1 DATA USES

Data collected during this Remedial Investigation will be used to meet the primary objectives of this investigation (identified in Section 1.0) including identifying current extent and magnitude of soil contamination to the west, south and east of monitoring wells MW-1 and MW-4. Section 3.6 of this document describes the data evaluation process.

2.2 EXPECTED DATA QUALITY

Quality Assurance/Quality Control (QA/QC) practices and analytical methods for this project have been designed to produce data of sufficient quality to support the intended data uses (Section 2.1). Quality of data will be assured by adherence to the methods and procedures outlined in the Work Plan and this QA/QC Plan, including full documentation of all field activities; specification and use of appropriate analytical methods; reviewing laboratory reports; verification and validation of analytical data; and adequately designing the sampling plan. Each of these data quality elements is discussed in subsequent sections of this document.

2.3 DATA QUALITY INDICATORS

Data assessment criteria will be used to aid in the evaluation of overall data quality for data generated during the Husky Valier remedial investigation. These data quality indicators (DQIs) are expressed in terms of precision, accuracy, representativeness, completeness, and comparability, which are described in detail below.

2.3.1 Precision

Precision is defined as a measure of variability or reproducibility of replicate measurements, and is inversely related to the variability among the results obtained (e.g., highly variable results have low precision). Precision is assessed by field and laboratory duplicate result comparisons (including matrix spike and laboratory control sample or LCS duplicates). Field duplicates measure combined field and laboratory precision, whereas laboratory duplicates measure only laboratory precision.

Field and laboratory precision will be expressed in terms of RPD between the values resulting from duplicate analysis. RPD is calculated as follows:

$$RPD = [(x1 - x2)/X][100]$$

where: x1 = analyte concentration in the primary sample;
x2 = analyte concentration in the duplicate sample;
X = average analyte concentration in the primary; and duplicate sample.

The precision objective for soil sample duplicates will be agreement of duplicate sample results to within an RPD of plus or minus 35% when both sample concentrations (original and duplicate) are greater than ten times the reporting limit, and plus or minus the reporting limit when either of the sample concentrations is less than ten times the reporting limit.

2.3.2 Accuracy

Accuracy is a measure of the closeness of a reported concentration to a true (i.e., known to a certain degree of confidence) value. For this project, accuracy will be assessed by calculating percent recovery (%R) for LCSs, matrix spikes, and matrix spike duplicates. Matrix spike %Rs indicate accuracy relevant to a unique sample matrix, while LCS %Rs indicate accuracy relevant to an analytical batch lot, and are strictly a measure of analytical accuracy conditions independent of samples and matrices. The %R of an analyte, and the resulting degree of accuracy expected for the analysis of QC spiked samples, are dependent upon the sample matrix, method of analysis, and the compound or element being measured.

The concentration of the analyte relative to the detection limit of the method also is a major factor affecting the accuracy of the measurement.

Accuracy is expressed as %R, calculated as follows for matrix spike (and matrix spike duplicate) samples:

$$\%R \text{ for matrix spike samples} = [(A-B)/C] \times 100$$

where:	A	=	spiked sample concentration.
	B	=	measured sample concentration (without spike).
	C	=	concentration of spike added.

The accuracy objective for matrix spike samples is recovery within the range established by the laboratory for each analysis. Method-specific control limits for matrix spike (and matrix spike duplicate) samples are shown in Table 2-1.

For LCSs, %R is calculated as follows:

$$\%R \text{ for LCSs} = [(SR/KV)] \times 100$$

where:	SR	=	reported sample result for LCS.
	KV	=	known value of LCS.

The accuracy objective for LCSs is recovery within the range within the range established by the laboratory for each analysis. Method-specific control limits for matrix spike (and matrix spike duplicate) samples are shown in Table 2-1.

TABLE 2-1. ACCURACY OBJECTIVES

Method	LCS	MS/MSD	RPD
VPH	70-130 %	70-130 %	20%

2.3.3 Completeness

Completeness is defined as the number of samples or valid measurements obtained, compared with the total number planned, expressed as a percentage ("percent complete" or PC). PC is calculated as follows:

$$PC = NA/NI \times 100$$

where: NA = actual number of samples/valid measurements obtained.
NI = intended or planned number of samples/valid measurements.

For this project, two separate measures of completeness will be calculated, as follows:

1. Sampling Completeness – A minimum of six soil borings are planned under this Work Plan. The number of samples collected from the soil boring is expected to be three, however, may be one or more than three based on field PID screening results. Additional borings may be required based on site conditions and will results in additional samples, as required. Sampling completeness will therefore be calculated as the actual number of samples collected (including routine, and IDW characterization sampling, if any) as a percentage of the planned number of samples included in this Work Plan, which will vary depending on site conditions.
2. Data Completeness – Each sample will be analyzed for VPH, by Method MA-VPH. Data completeness will be calculated as the actual number of valid (not rejected) individual measurements (parameter concentration values) obtained as a percentage of the planned number of total measurements. Results qualified during the data validation process (see Section 3.6) are counted as valid measurements, unless the value is qualified with an "R" as rejected.

The completeness goal for this project is 100 percent for sampling completeness, and 95 percent for data completeness. Sampling completeness will be assessed following field sampling activities, and data completeness will be assessed following data validation.

2.3.4 Comparability

Comparability expresses the confidence with which data from one sample, sampling round, site, laboratory, or project can be compared to those from another. Comparability during sampling is dependent upon sampling program design and time periods. Comparability during analysis is dependent upon analytical methods, detection limits, laboratories, units of measure, and sample preparation procedures.

Comparability is determined on a qualitative rather than quantitative basis. For this project, comparability of all data collected will be ensured by adherence to standard sample collection procedures, standard field measurement procedures, standard reporting methods, including consistent units, and the use of the same analytical laboratory. In addition, to support the comparability of the dataset with those obtained in future testing, all samples will be analyzed using EPA-approved methods. All analytical standards will be traceable to standard reference materials. Instrument calibrations will be performed in accordance with EPA method specifications, and will be checked at the frequency specified for the methods. The results of these analyses can then be compared with analyses by other laboratories and/or with analyses for other sites.

2.3.5 Representativeness

Representativeness expresses the extent to which collected data define actual environmental conditions (the true "state of nature"). Similar to comparability, representativeness is determined on a qualitative rather than a quantitative basis.

Sample collection, handling, and analytical procedures for the Former Husky Service Station (Valier) have been designed to maximize the representativeness of both sample collection and analytical results. Collection of representative samples of soils within borings will be achieved by:

- Establishment of appropriate general sampling locations; and
- Adherence to Standard Operating Procedures.

Generation of representative analytical data will be achieved by:

- Use of consistent sample preparation (i.e., homogenization and digestion), analytical, and reporting procedures by the selected analytical laboratory; and
- Analysis of specified laboratory QC samples to ensure analytical processes are in control.

2.4 DATA MANAGEMENT

In order to provide complete documentation of the Former Husky Service Station (Valier) Remedial Investigation, detailed field records will be collected by field personnel, as described in Section 3.0 and the Work Plan. All field notes, sample logs, and site photographs will become part of the permanent data record, and will be included with the final investigation report. All hard copy original field documents will be scanned to Adobe Portable Document Format (.pdf) to facilitate electronic storage and transfer. Documentation of sample custody (completed chain-of-custody forms) and sample transfer from sampling personnel to the laboratory, including cover letters and parameter lists with project-required analytical methods and reporting limits, will also be included as part of the field records package for this project. Details regarding field sample documentation and handling, including sample identification and labeling, field forms, logs, and notebooks, and sample custody and shipment are in Section 3.0.

Laboratory analytical reports and electronic data deliverables (EDDs) will be archived by the project contractor (Hydrometrics) and transmitted to DEQ in electronic and/or hard copy formats. Summary data tables, data validation results and reports, draft and final project reports, and other files generated as part of the data analysis will also be archived by the project contractor and transmitted to DEQ.

2.5 ASSESSMENT OVERSIGHT

Field QA/QC procedures will include use of analyte-appropriate sample collection equipment and sample containers, chain-of-custody procedures for sample handling and tracking, and

daily review of field documentation to ensure complete and accurate field records are collected.

Laboratory QC sample types and frequencies will be consistent with standard operating procedures of the selected analytical laboratory (Energy Laboratories in Helena, Montana). The results of laboratory QC sample analysis will be reviewed during the data validation process.

2.5.1 Field Quality Control Samples

Field QC samples will not be collected during the Former Husky Service Station (Valier) soil boring activities including duplicate soil samples.

3.0 METHODS AND PROCEDURES

3.1 EQUIPMENT CALIBRATION AND MAINTENANCE

A hand-held PID will be used to identify potential petroleum hydrocarbon contamination in soils. This instrument will be calibrated according to the manufacturer instructions. A calibration check will be conducted before use. Normal maintenance for hand tools, cameras, will be performed as necessary by the field team.

3.2 FIELD DATA MANAGEMENT

All data generated from field activities such as field notebooks and sampling forms, and digital photographs will remain in the possession of field sampling crews during the field sampling event. Upon return from the field, field sampling crews will duplicate and scan all hard copies of their records as soon as possible, to prevent the possibility of lost or misplaced information. Laboratory transmittal documents (chains-of-custody, cover letters, and analytical parameter lists) will also be duplicated and scanned after samples are delivered to the laboratory. Electronic and hard copies of these records will be stored in the project contractor's files and network system, and provided to DEQ as part of the final project report.

3.3 SAMPLE DOCUMENTATION AND SHIPMENT

All samples collected and delivered to the laboratory for analysis will follow standard documentation, packing, and chain-of-custody procedures, as described in Standard Operating Procedure HSOP-4 and in the following sections.

3.4 SAMPLE HANDLING, DELIVERY, AND CUSTODY

Soil samples will be delivered from the field to the laboratory as soon as practical following sample collection to ensure that holding times are not exceeded. Prior to delivery to the laboratory, samples will be maintained on ice or will be refrigerated to about 4°C. Samples will be hand-delivered to the analytical laboratory under standard chain-of-custody procedures (see HSOP-4). Each set of samples delivered will be accompanied by a cover

letter, analytical parameter list, and chain-of-custody documentation for recording the transfer of samples from the possession of field personnel to the possession of the laboratory.

3.4.1 Chain-of-Custody

During and after sampling until the time of sample shipment or delivery, samples will be in the custody of sampling personnel. Sample custody (responsibility for the integrity of samples and prevention of tampering) will be the responsibility of the field crews until samples are delivered to the laboratory. "Custody" refers to the samples being in the immediate care of the field personnel, either in physical possession, immediate view, locked up, or held in a secure area restricted to authorized personnel.

Chain-of-custody procedures will be followed to establish a written record of sample handling and movement between the sampling site and the laboratory. All sample deliveries will be accompanied by a chain-of-custody record, to be signed by both the person delivering the samples and the receiving laboratory. Sampling personnel will retain one copy of the chain-of-custody after signing samples over to the laboratory, and the remaining copies will be transferred to the laboratory.

Upon arrival at the laboratory, sample custody shifts to laboratory personnel, who are responsible for tracking individual samples through login, analysis, and reporting. At the time of sample login, the laboratory will assign a unique laboratory sample number, which can be cross-referenced to the field sample number and used to track analytical results.

3.5 LABORATORY ANALYSIS

Samples will be submitted to an EPA approved Laboratory for analysis of VPH by the Massachusetts Department of Environmental Protection (MADEP) methodology. Table 3-1 provides analytical methods. Reporting limits are shown in Appendix B.

All samples will be submitted to Energy Laboratories in Helena, Montana for analysis. The laboratory will analyze and provide results for standard laboratory QC samples as part of the analytical results package, to ensure that the data obtained are of sufficient quality to support the site investigation and any subsequent remedial activities.

TABLE 3-1. ANALYTICAL METHODS FOR SOIL SAMPLES

Parameter	Analytical Method	Maximum Holding Time (days)	Preservation
VPH	MA-VPH	7 days	Cool to 4°C

3.6 DATA EVALUATION

Data evaluation for the Husky Valier remedial investigation will be conducted using the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases (DEQ, 2018a) by comparing the analytical soil results for petroleum hydrocarbons to DEQ's Tier 1 Risk-based Screening Levels (RBSLs; May 2018). Although groundwater is unlikely to be encountered during drilling activities to a depth of twenty-four feet, groundwater levels in Site monitoring wells are generally less than ten feet below ground surface once equilibration is obtained. Therefore, screening levels selected from Tier 1 RBSLs on Table 1 (Surface Soil 0-2 feet) or Table 2 (Subsurface Soil >2 feet) will be Commercial RBSLs from less than ten feet to groundwater. Applicable screening levels for soil analytical results are contained within Appendix B.

Following the completion of activities described in the September 2020 Work Plan, Hydrometrics will discuss ongoing Work Plan tasks and results with DEQ's project manager.

3.6.1 Data Verification and Validation

Overall completeness and adherence to project procedures will be assessed through validation and verification (HSOP-58, Appendix B). Verification includes confirmation of adherence to sample design, collection, handling, custody, shipping, transmittal, and documentation procedures. Validation includes the confirmation of adherence to specific analytical procedure criteria and protocols, and the assessment of data quality in terms of usability. Data will be assessed and summarized on the DEQ Data Validation Summary Form and included as an appendix to the final project report. The DEQ Data Validation Form is included as Appendix C.

4.0 CORRECTIVE ACTION

Corrective action is the process of acting on non-conforming procedures that are unacceptable based on the procedures set forth in the Work Plan. Corrective actions can be implemented for field activities, laboratory analyses, data validation and data assessment. The data validation report (an attachment to the final project report) will document non-conforming conditions identified (e.g., when overall objectives for precision, accuracy, completeness, representativeness, or comparability are not satisfied), or when procedural practices or conditions differ from those described in the Work Plan. All corrective actions proposed and implemented will also be documented and will include measures to preclude a repetition of the original deficiency.

4.1 FIELD CORRECTIVE ACTION

Field conditions may vary from those anticipated in project planning documents; therefore, it may become necessary to implement minor modification to sampling procedures presented in the Work Plan (see HF-SOP-30 in Appendix B). If such modifications are deemed necessary, the Hydrometrics Project Manager will be notified and verbal approval obtained prior to implementing the changes (if feasible), or as soon as possible thereafter. Any field modifications or corrective actions will be documented in the field logbook, and in the data validation and final project reports.

4.2 LABORATORY CORRECTIVE ACTION

The laboratory is required to comply with the most recent version of their Quality Assurance Manual (January 2019), including all applicable Standard Operating Procedures (SOPs). The Laboratory Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with Work Plan. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data. The Laboratory Project Manager or QA/QC Manager will be notified if any QC sample exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. A narrative describing the anomaly, the steps taken to

identify and correct the anomaly and the treatment of the relevant sample batch (i.e., recalculation, reanalysis) will be submitted with the data package.

4.3 DATA VALIDATION / VERIFICATION CORRECTIVE ACTION

Corrective action may be needed based on either the data validation or data assessment. Potential types of corrective action may include re-sampling or re-analysis of samples by the laboratory. DEQ will be responsible for approving any corrective action, including re-sampling or re-analysis. All corrective actions of this type will be documented.

5.0 REFERENCES

DEQ, 2018a. Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases. May 2018.

DEQ, 2018b. Tier 1 RBSLs Tables. http://deq.mt.gov/Land/statesuperfund/rbca_guide. May 2018.

APPENDIX A

SITE SPECIFIC
QUALITY DATA OBJECTIVES

Site-Specific Data Quality Objectives
Former Husky Service Station, Valier, Montana
DEQ Facility ID #56-13802, Release #3197, Work Plan #10882

1. State the Problem	2. Identify the Goal of the Study	3. Identify Information Inputs	4. Define the Boundaries of the Investigation	5. Develop the Analytic Approach	6. Specify Performance of Acceptance Criteria	7. Develop the Plan for Obtaining Data
The Facility operated as a former Husky Service Station. Two underground gasoline storage tanks (USTs) on site, one approximately 1,000 gallon and one approximately 500 gallon were removed in 1997. During removal of the USTs contamination was discovered in adjacent soils, reported to the Montana Department of Environmental Quality (MDEQ), and subsequently removed under the direction of MDEQ in 1998.	The objectives of the 2020/2021 Remedial Investigation are to: • Determine the current extent and magnitude of petroleum contamination of soil remaining in the vicinity (west, east, and south) of monitoring wells MW-1 and MW-4 • Use the soil data to determine the next steps toward closure of this Site.	Soil samples will be collected from borings at locations with highest potential for contamination to the west, south, and east of monitoring wells MW-1 and MW-4.	The Assessment is to be located on the property formerly operated as a Husky Service Station (Site). The Site is located on the southeast corner of the Montana Street and Highway 44 (Teton Avenue) intersection in Valier, Montana.	Soil samples will be submitted to Energy Laboratories for analysis by Volatile Petroleum Hydrocarbons (VPH) by Method MA-VPH.	Quality assurance procedures, quality control procedures, and data validation will be completed in accordance with the Site Work Plan.	Six proposed soil borings will be drilled to a depth of 24 feet below ground surface (bgs). Borings will be located in areas of highest potential for petroleum contamination to the west, south, and east of monitoring wells MW-1 and MW-4. See Figure 3-1 within the Work Plan for proposed soil boring locations.
From 2006 through 2019, a series of remedial investigations, including soil borings, groundwater monitoring, and receptor surveys have indicated that petroleum impacts at this site are limited to the vicinity immediately surrounding MW-1 and MW-4.						Soil will be collected using a Power Probe direct push sampler. Continuous soil samples will be collected from each boring and screened for heated headspace using a Photoionization Detector (PID).
Clayey native soils surrounding the source area restrict the movement of petroleum hydrocarbon constituents away from this area. However, groundwater fluctuations have in the past and may continue to reintroduce residual petroleum contamination into the aquifer nearby monitoring wells MW-1 and MW-4.						Up to two soil samples will be collected from each boring for laboratory analysis including: 1) a sample from the bottom of the boring, or a sample from above the soil/groundwater interface, if any, and 2) a sample exhibiting the highest PID headspace readings (if readings are above 100 parts per million (ppm).

APPENDIX B

APPLICABLE SCREENING LEVELS FOR SOIL ANALYTICAL RESULTS

APPLICABLE SCREENING LEVELS FOR SOIL ANALYTICAL RESULTS

Parameter	Analytical Method	Analytical Reporting Limit (mg/kg)	DEQ Montana Risk Based Screening Levels (RBSL)[1]	
			Surface Soil Commercial <10' to GW (mg/kg)	Subsurface Soil Construction <10' to GW (mg/kg)
VPH				
Methyl tert-butyl ether (MTBE)	MA-VPH	0.11	0.078	0.078
Benzene	MA-VPH	0.056	0.07	0.07
Toluene	MA-VPH	0.056	21	21
Ethylbenzene	MA-VPH	0.056	26	26
m+p-Xylenes (meta+para)	MA-VPH	0.056	310	320
o-Xylene (ortho)	MA-VPH	0.056	310	320
Xylenes, Total	MA-VPH	0.056	310	320
Naphthalene	MA-VPH	0.11	12	12
C9 to C10 Aromatics	MA-VPH	2.2	130	130
C5 to C8 Aliphatics	MA-VPH	2.2	220	220
C9 to C12 Aliphatics	MA-VPH	2.2	360	640
Total Purgeable Hydrocarbons	MA-VPH	2.2	--	--

VPH = Volatile Petroleum Hydrocarbons

NOTES:

1. DEQ Tier 1 Risk-Based Screening Levels (RBSLs), May 2018.

APPENDIX C

DEQ DATA VALIDATION SUMMARY FORM

Montana DEQ - Waste Management and Remediation Division

Data Validation Summary Form (Version 1.3.0, Revised 1/26/18)

Please fill out the information below, using one form for each lab batch (one form can be used for multiple analytical methods). The form will grow and adjust, based on your responses. Please include a discussion regarding the sampling event in the report that is sent to DEQ with this form. For additional instructions, please click the Open Complete Instructions button.

Open Complete Instructions

Basic Questions View example (Note: example optimized for viewing in Chrome browser)

1. Site/Facility name	
2. Site code or facility ID (if applicable)	
3. Release ID (if applicable)	
4. Sample delivery group	
5. Name of DEQ-approved sampling plan	
6. Date DEQ approved the sampling plan	M/D/YY
7. Name of data validator	
8. Phone	
9. Date validated	M/D/YY

Field Collection Questions View example (Note: example optimized for viewing in Chrome browser)

10. Sample matrix	☐ Soil ☐ Sediment ☐ Surface water ☐ Groundwater ☐ Tap water ☐ Air (including soil gas) ☐ Other
11. Sample collection start date	M/D/YY
12. Sample collection end date	M/D/YY
13. Analytical methods used *Use Add Method button to list multiple methods. Enter any other methods in the field manually.*	Add Method / Delete Method — Analytical Method(s)

Laboratory-related Questions View example (Note: example optimized for viewing in Chrome browser)

14. Laboratory name and location	
15. Laboratory project ID	
16. Were samples received in good condition and at appropriate temperature, chain-of-custody forms complete, and all samples analyzed within holding times?	Yes ○ No ○ See Below ○ Comments
16a. Were chain-of-custody forms complete?	Yes ○ No ○ Comments

16b. Were samples received in good condition, preserved, and at appropriate temperature (VOA no headspace, appropriate pH, temperature 4° C +/- 2° for most samples)?	Yes	No		Comments
16c. Were the samples analyzed within method-specified or technical holding times?	Yes	No		Comments
17. Were all laboratory quality control procedures complied with and is data validated without qualifiers?	Yes	No	See Below	Comments
17a. Were all calibration verification results within acceptable limits?	Yes	No		Comments
17b. Were laboratory (method) blank samples free of contamination?	Yes	No		Comments
17c. Are the percent recoveries and relative percent differences of matrix spike and matrix spike duplicates within quality control limits?	Yes	No		Comments
17d. Are the laboratory control samples the same matrix as the samples and prepared the same as associated samples?	Yes	No		Comments
17e. Were laboratory control samples and laboratory control sample duplicate percent recoveries and relative percent differences within laboratory control limits?	Yes	No		Comments
17f. Were surrogate recoveries within laboratory quality control limits?	Yes	No		Comments
17g. Were the laboratory duplicate relative percent differences within data validation quality control limits?	Yes	No		Comments
18. Were the total number of lab method blanks at least 5% of the total number of samples, or as required by the method?	Yes	No		Comments
19. Were the total number of lab matrix spike samples prepared at least 5% of the total number of samples, or as required by the method?	Yes	No		Comments

20. Please list any project samples used for matrix spike/matrix spike duplicates.

Add Sample	Lab ID	Field Sample ID	Comments
Delete Sample			

21. Is the total number of laboratory control samples at least 5% of the total number of samples?	Yes	No	Comments

Consultant/Validator Questions View example (Note: example optimized for viewing in Chrome browser)

22. Are the detection limits appropriate for the project (i.e. at or below screening levels)?	Yes	No	Comments
23. Are the reported units appropriate for the sample matrix (i.e. water results in ug/L, not mg/kg)?	Yes	No	Comments
24. Do the analytical methods comply with project requirements (e.g. in the SAP, work plan, or QAPP)?	Yes	No	Comments
25. Do the laboratory reports include all constituents requested to be analyzed on the chain-of-custody or under the sampling plan or other applicable document?	Yes	No	Comments
26. Is the number of sample blanks (e.g. equipment, trip, or field blanks) equal to at least 10% of the total number of samples, or as otherwise required?	Yes	No	Comments
27. Are field blanks free from contamination, duplicates collected as required, and field duplicate percent differences within data validation quality control limits?	Yes	No	See Below Comments
27a. Were all blank samples free of analyte contamination?	Yes	No	Comments
27b. Were field duplicates collected as required?	Yes	No	Comments
27c. Are field duplicate relative percent differences within data validation quality control limits?	Yes	No	Comments

28. Please provide an Excel or CSV file to the DEQ project manager (via e-mail or CD) that lists all samples evaluated in this summary and lists any qualified data.
Please use the following format:

Lab ID	Field Sample ID	Qualifiers	Comments (indicate whether the issue biases the results high or low)
Example 48310-2.31E	Example GW-1	R	Sample dropped in lab and unrecoverable
Example 48310-2.32D	Example GW-2		

Please use the following format for qualifiers. See EPA's National Functional Guidelines for more information on qualifiers for unique samples such as dioxins.

Qualifier	Explanation
C	Pesticide and Arochlor results confirmed with GC/MS
J-	Estimated value, may be biased low
J	Analyte identified, but concentration is estimated
J+	Estimated value, may be biased high

NJ	Tentatively identified compound
R	Sample result rejected
U	Analyte analyzed for, but not detected above quantitation limit
UJ	Analyte not detected above CRQL, but CRQL may be inaccurate
X	Pesticide and Arochlor results attempted using GC/MS, but unsuccessful

If you wish to manually enter qualified sample results, please use the table below.

Add Sample	Lab ID	Field Sample ID	Qualifiers	Comments (indicate whether the issue biases the results high or low)
Delete Sample				

29. What is the percent completeness (samples planned versus valid samples collected)? Comments

30. Was the completeness goal met? Yes No Comments

31. Does all data conform to analytical methods and data quality objectives specified for this project? Yes No Comments

32. Other general comments or observations?

Split Samples

33. Did DEQ collect split samples? Yes No Comments

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