Natural Resource Damage Assessment and Restoration Considerations: Ephemeral Data Collection Plan for a Spill to a Dry Wash/Ephemeral Stream Habitat

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List of Abbreviations and Acronyms

AWB	Auto White Balance
BMI	benthic macroinvertebrates
BTEX	benzene, toluene, ethylbenzene, and xylene
CDFW-OSPR	California Department of Fish and Wildlife, Office of Spill Prevention and Response
COC	Chain of Custody
DOI	Department of the Interior
EDCC	Ephemeral Data Collection Coordinator
EPA	U.S. Environmental Protection Agency
GNOME	General NOAA Oil Modeling Environment
GPS	global positioning system
HAZWOPER	Hazardous Waste Operations & Emergency Response
L	liter
mL	milliliter
MU	mussel
NOAA	National Oceanic and Atmospheric Administration
NPFC	National Pollution Fund Center
NPFC	National Pollution Fund Center
NPS	National Park Service
NRDAR	Natural Resource Damage Assessment and Restoration
PAH	polycyclic aromatic hydrocarbons
PFD	personal floatation device
PIANO	paraffins, iso-paraffins, aromatics, naphthenes, and olefins
PPE	personal protective equipment
RI	Rocky Intertidal
RP	Responsible Party
SCAT	Shoreline Cleanup Assessment Technique
SLR	single lens reflex
SOP	Standard Operating Procedure
SWAMP	Surface Water Ambient Monitoring Program
the Plan	Ephemeral Data Collection Plan
TPH	total petroleum hydrocarbons
“Trustees”	Natural Resource Trustees

UAS	using uncrewed aerial systems
USDA	U.S. Department of Agriculture
USFWS	United States Fish and Wildlife Service
WCJAT	West Coast Joint Assessment Team
WSR	Wild and Scenic Rivers

Executive Summary

This Ephemeral Data Collection Plan (the Plan) was developed in collaboration between Natural Resource Damage Assessment Trustees with funding from the Department of the Interior's (DOI) Inland Oil Spill Preparedness Project. The Plan describes and prioritizes ephemeral data collection in the event of an accidental release of oil that affects a dry wash/ephemeral stream habitat. Ephemeral data are information that can only be collected within a narrow timeframe after a spill occurs–before that information is lost. This effort is intended to be a "general template" applicable to a broader habitat setting. The Natural Resources Damage Assessment and Restoration (NRDAR) team will collect this information and may consist of representatives of the responsible party (RP) and the natural resource trustees (hereafter referred to as the 'Trustees'), including but not limited to the California Department of Fish and Wildlife, Office of Spill Prevention and Response (CDFW-OSPR), Department of the Interior (the U.S. Fish and Wildlife Service [USFWS] or the National Park Service [NPS], the Bureau of Land Management and/or other DOI Bureaus), National Oceanic and Atmospheric Administration (NOAA), and U.S. Department of Agriculture (U.S. Forest Service). State Trustee representatives from the California Department of Parks and Recreation and the California State Lands Commission may also contribute to the implementation of the Plan.

The purpose of the Plan is to enhance and increase preparedness for effective implementation of ephemeral data collection for NRDAR of a spill that affects dry wash/ephemeral stream habitat. NRDAR is dependent on successful collection of ephemeral data during an accidental release. Thus, a well-designed ephemeral data collection plan that can be implemented in a timely way is key. Ephemeral data consist of many types of information needed to determine immediate effects of a release on the surrounding environment and resources, including petroleum hydrocarbon concentrations in environmental media, impacts to biota from released oil, or changes in recreational use. To this end, the Plan describes a conceptual model of the behavior, fate, impacts, and resources at risk from spills of a medium crude oil or a diesel fuel. The Plan also includes detailed procedures for collection of ephemeral data for different media (source oil, soil, sediment) and resources (human/ recreational use, bryophytes, and arthropods) in the event of an accidental release of petroleum into a dry wash/ephemeral stream habitat. Several components important to NRDAR, such as procedures for fish collections and bird necropsies, are not included because they are not relevant to the resources at risk or because they require specialized equipment and training. Therefore, the Plan has representative NRDAR ephemeral data considerations but may not be comprehensive for all NRDAR needs. Finally, the Plan provides guidance on working with the response organizations and co-trustees during a spill. Proper coordination with the multiple parties involved in a spill response and NRDAR will be critical for safe and effective collection of ephemeral data, without negatively affecting the incident response. Having this Plan in place prior to a release will facilitate the collection of critical environmental information during the early stages of a response effort.

The goals of the Plan are to collect ephemeral data that will (1) assist in documenting the source of oil(s); (2) document petroleum hydrocarbon concentrations in soil and sediment; and (3) document impacts to human/recreational users, bryophytes, and arthropods prior to and following an accidental release of oil in a dry wash/ephemeral stream habitat.

Before implementing this Plan, representatives of the NRDAR team should determine whether incident circumstances warrant implementation of the Plan, and, if so, any modifications to the Plan that may be required. Also, during an incident, the ephemeral data collection procedures and locations detailed in this Plan may be modified following lessons learned from future oil spill response drills or real-time responses to accidental releases within a dry wash/ephemeral stream habitat.

Finally, the Trustees recognize that other (non-petroleum) spills may occur in a dry wash/ephemeral stream habitat and may benefit from the sampling design and procedures described in this Plan. In the event of a release, the Trustees may choose to implement this Plan to assist them during NRDAR pre-assessment and assessment activities.

1.0 Introduction

1.1 Purpose, Goals, and Objectives of this Plan

Purpose: Enhance and increase preparedness for effective implementation of ephemeral data collection for natural resource damage assessment (NRDAR) of a spill that affects a dry wash/ephemeral stream habitat. The Plan includes: (1) A conceptual model of the behavior, fate, impacts, and resources at risk from spills of a medium crude oil and a diesel oil that is used to guide the ephemeral data collection plan; (2) Detailed procedures for collection of ephemeral data for media (source oil, soil, sediment) and resources (human/recreational use, bryophytes, and arthropods) in the event of an accidental release of petroleum into a dry wash/ephemeral stream habitat; and (3) Guidance on working with the response organizations and co-trustees during a spill.

Goals: To obtain data that will assist in determining the source of oil(s); document petroleum hydrocarbon concentrations in soil, sediment, and select biological organisms; and document impacts to human/recreational users prior to and following an accidental release of oil in a dry wash/ephemeral stream habitat.

Objectives: (1) To collect source oil, sediment, and soil samples within the first hours, days, and weeks after an accidental release of oil for petroleum hydrocarbon analysis; (2) Collect data on human/recreational use and bryophytes/arthropod abundances and species composition. During an incident, there is a narrow window of opportunity for collection of these data, and accordingly, they are referred to as “ephemeral” data (i.e., if the samples are not collected, the opportunity to collect them will be lost permanently). Ephemeral and baseline data can be critical in identifying the need for, and scope of, subsequent environmental sampling and injury assessment.

1.2 Safety

Safety is the most important consideration in plan implementation. Field teams may encounter oil during collection of water, sediment, soil or tissue samples. Personnel collecting data in the field should be at least 24-hour Hazardous Waste Operations & Emergency Response (HAZWOPER) certified if oil is present and have received permission from the Unified Command Incident Site Safety Officer to enter impacted areas.

Before sampling in impacted areas, all field team members must read and be familiar with and follow the procedures specified in the site safety plan prepared by the Unified Command. Before going into the field, all field team members will receive a daily safety briefing from the Ephemeral Data Collection Coordinator (EDCC; discussed in detail in Section 1.4). Good judgment must be used at all times, particularly when considering fieldwork during inclement weather and collecting samples near cliffs. No sampling will be conducted in the dark. While working near the dry wash, stream or river, field team members should be aware of the potential for flash flooding and extreme heat. Weather forecasts should be checked each day before conducting field work. Field team members should wear sunglasses, sunscreen, appropriate footwear, and other personal protective equipment (PPE) as might be required by the safety officer.

PPE will depend on the specific hazardous petroleum materials and their concentrations. Under no circumstances should the field team enter uncharacterized, freshly impacted zones without proper training (i.e., 40-hour HAZWOPER certification and current 8-hour refresher) and combustible gas/hydrogen sulfide meters. Likewise, sampling in the impacted area will not be conducted if respirators are required or the safety officer deems the area unsafe. When collecting samples in the impacted area, field sampling team members will wear appropriate PPE (e.g., gloves, Tyvek, booties).

Nitrile gloves and/or cut-resistant gloves will be worn when sampling any medium of interest and will be changed between each sampling site.

1.3 Communication Among Agency Representatives

After receiving notification of a release of greater than *de minimis* quantities, CDFW-OSPR will notify, to the extent feasible, the key RP and Natural Resource Trustee Agency Lead(s) or their alternates (Section 4). RP and Trustee Agency representatives may coordinate to assess the circumstances and determine sampling priorities including what, if any, elements of the plan should be implemented, modified, or if additional monitoring elements should be considered. Key contacts for mobilizing field teams are identified in Section 4. If the RP and Trustee Agency Lead(s) are unreachable in the early hours/days of the spill, CDFW-OSPR Agency Lead(s) will begin coordinating initial sampling priorities and efforts, including implementation of this plan.

The RP, Trustee Agency Lead(s), or their alternates (Section 4), may participate in an initial conference call to determine the specific plan elements to be implemented, to share needed contact and location information, and then to assign their respective staffs to participate in sample collection activities as appropriate. A Trustee EDCC, appointed by the NRDAR Agency Lead(s), will be assigned to provide project oversight and management. The EDCC will manage implementation of this Plan and coordinate with the Unified Command for the response (see Section 1.4), via the NRDAR Representative, for increased efficiencies in all aspects of data collection for the response and the damage assessment.

1.4 Relationship and Communication with the Unified Command

The NRDAR for an incident is done in parallel with the incident response but is separate from it. The goals of response and NRDAR are different. The goals of spill response are to stop and stabilize the source of the spill, remove oil from the environment, protect the safety and health of the responders and the public, and avoid or minimize harm to the environment. The goal of NRDAR is to identify the type and amount of restoration needed to restore injured natural resources.

Figure 1 details the response Incident Command Structure organization for a spill and the coordination points with NRDAR. Since NRDAR field assessment activities may overlap those of the response, close coordination and cooperation between the two efforts is necessary. The NRDAR Agency Lead(s) are responsible for establishing the communication link with the Incident Command (Unified Command if the incident is federalized) via the NRDAR Representative or Liaison as described in the West Coast Joint Assessment Team (WCJAT) guidance document (WCJAT, 2017) and the CDFW-OSPR Policy 603-1, Communication and Coordination between Natural Resource Damage Assessment and Restoration (NRDAR) and Incident Command Structure During Spill Response (2009). All communications with the Unified Command will be coordinated through the NRDAR Representative.

The EDCC will prepare a General Message (ICS 213) to establish and document communications and resource requests between NRDAR and the Planning Section (Environmental Unit) and the Operations Section (Wildlife Branch) of the Unified Command. This will allow for the coordination of environmental sampling and field data collection activities between NRDAR and the response. For example, when NRDAR ephemeral data collection field teams are directed to sample in impacted areas, health and safety must be addressed and permission to enter impacted areas must be coordinated through the NRDAR Representative and the EDCC. A General Message (ICS 213) will be provided to the Unified Command daily throughout the duration of the field activities or as appropriate based on the incident.

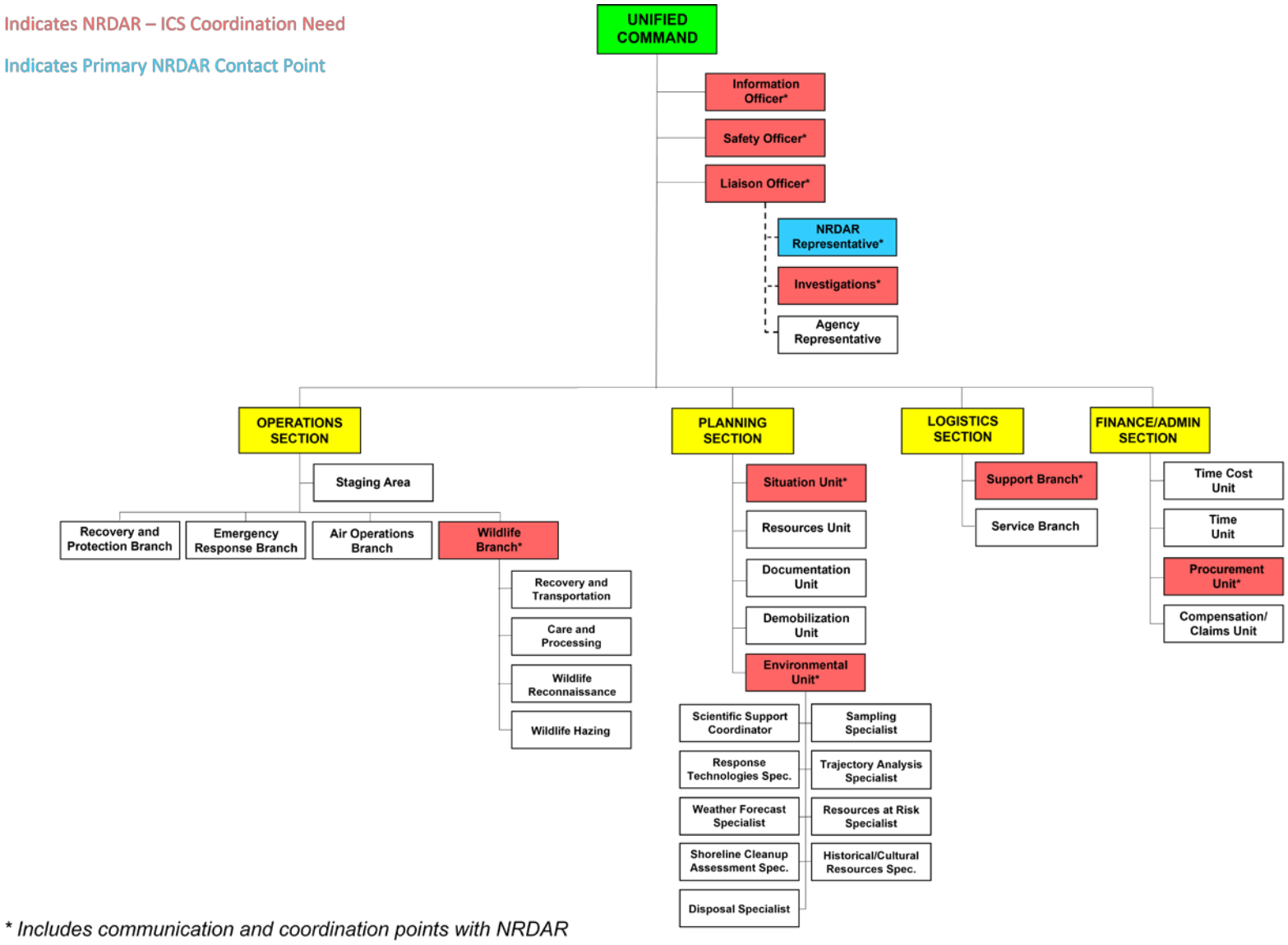


Figure 1. Spill response Unified Command Structure, including communication and coordination points with NRDAR.

1.5 Field Teams

The EDCC makes field assignments, reviews and disseminates health and safety procedures, monitors all field activities, and provides the field team leaders with information containing specific guidelines (e.g., health and safety, sampling locations and sites, sample collection procedures, etc.) for implementing the Plan. All personnel involved in implementation of the ephemeral data collection plan are responsible for reporting progress and results to the EDCC. The EDCC also will verify that all field sampling team members have read and signed a copy of the incident health and safety plan. NRDAR field teams, including representatives of the RP and/or the Trustees, may collect samples from dry wash/ephemeral stream habitat. This will most likely consist of sampling primarily on land and in dry stream beds. In the event that water sampling is required (e.g., during a wet period), other EDCPs may be consulted (i.e., "Ephemeral Data Collection Plan for Central Valley River and Freshwater Wetlands" and "Ephemeral Data Collection Plan for a Northern California River Spill That Also Impacts Coastal Resources"). Source oil sample collection will usually be undertaken by a person designated by the Unified Command or Investigations. All communications with the Unified Command will be coordinated through the NRDAR Representative (Section 1.4). Key contacts for mobilizing field teams are identified in Section 4.

1.6 Special Requirements for Response in Wild and Scenic Rivers and Federally Designated Wilderness Areas

Wild and Scenic Rivers (WSR) are those designated as part of the National Wild and Scenic Rivers System, created by Congress in 1968 (PL 90-542;16 U.S.C. 1271 et seq.) to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Wild and Scenic Rivers Act charges administration of rivers in the National Wild and Scenic Rivers System to four federal land management agencies (Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, and U.S. Forest Service). The Act allows for designation of segments of rivers, including tributaries. Boundaries of a WSR are typically one-quarter mile on either bank (lower 48) or one-half mile (Alaska) on either bank of the river.

The National Wilderness Preservation System is a network of more than 800 designated wilderness areas co-managed by the National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, and U.S. Forest Service. The primary mandate of the Wilderness Act (16 U.S.C. 1131-1136) is to preserve wilderness character–the natural, untamed, undeveloped, and primitive aspects that make wilderness worthy of its name. The Act states that:

> "...within any wilderness area designated by this Act and, except as necessary to meet *minimum requirements* for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area."

If a spill affects a WSR or federal wilderness area and its boundaries, the administrating agency must be contacted immediately**.** Special use permits may be required for emergency access to the WSR and its boundaries, including for Shoreline Cleanup Assessment Technique (SCAT)-type surveys, wildlife rescue, ephemeral data collection, and other response-related activities. Routine response and damage assessment activities may need to be adjusted for consistency with protections afforded WSRs or wilderness areas. The agency Point of Contact can assist with identifying the permitting entity and facilitate the process. Furthermore, response actions will need to have close monitoring and adherence to best management practices so that the character of the WSR or wilderness area is not degraded.

2.0 Oil Spill Conceptual Models

2.1 Oil Fate and Behavior

Oil may be commonly released by one of three ways in the dry wash environment: 1) well-head failure (i.e., high-pressure blowout); 2) pipeline leak; or 3) train derailment/truck crash. Depending on the release type, the extent and potential amount of dispersion of oil into dry wash/ephemeral stream habitats will vary. For example, a well-head failure may result in a more dispersed release over a larger area compared to a pipeline leak. Depending on time of discovery and repairs, both a well-head failure and pipeline leak may result in a larger amount of oil released than a truck- or train-related incident. The type of release and resulting dispersion of oil should be considered when planning the spatial distribution and scale of initial data collection efforts.

The type of oil released will also impact the injury. The comparative fate, behaviors, and effects for two oil types are summarized below.

Medium crude oil:

- Is a mixture of a wide range of compounds, from light to heavy and tends to increase in viscosity as it weathers;
- Has of loss by evaporation usually up to 30% in the first day after the release;
- Tends to spread into thick slicks that can coat surfaces and foul animals and vegetation; and
- Fresher oil can penetrate porous sediments and soils.

Diesel fuel

- Is a refined product with a narrow range of lighter compounds and very low viscosity;
- Can have high rates of loss by evaporation (up to 80%) in the first day after a release;
- Has high rates of natural dispersion because of its low viscosity;
- Coating of surfaces and vegetation tends to be thin and decreases over time; and
- Only thicker accumulations will penetrate into and persist in porous sediments and soils.

These two oils are used in the conceptual model discussed in the following section.

Unlike perennial streams, an oil release into a dry wash habitat is not expected to have high downstream transport due to the lack of water in the stream bed. If an oil release does occur during a rare wet period, other EDCPs (i.e., “Ephemeral Data Collection Plan for Central Valley River and Freshwater Wetlands” and “Ephemeral Data Collection Plan for a Northern California River Spill That Also Impacts Coastal Resources”) may be referenced for standard operating procedures (SOPs) regarding appropriate sampling techniques (e.g., water and sheen sampling).

2.2 Conceptual Model: Oil Spill That Impacts a Dry Wash/Ephemeral Stream Habitat

The conceptual model in Table 1 is based on a release of a medium crude oil or a diesel fuel into a dry wash/ephemeral stream habitat. The first column is the habitat that could be affected. The second column are the potential resources at risk from a spill in that habitat. The third column describes the expected behavior of a diesel fuel or crude oil in that habitat. The fourth column describes the media samples to be collected, and the fifth column describes the impact assessment methods.

Table 1. Conceptual model for the dry wash/ephemeral stream scenario.

HABITAT	RESOURCES AT RISK	OIL BEHAVIOR	EXPOSURE ASSESSMENT	IMPACT ASSESSMENT
Streambed (dry)	• Vegetation (esp. bryophytes) • Arthropods • Birds • Mammals • Herpetofauna • Soil • Biocrust • Fossils • Cultural resources • Recreational use - Hiking - Prospecting - Off-highway vehicles (e.g., ATV)	• Low risk of natural dispersion during dry periods • Oil coating of vegetation and soil including biological crusts • Oil penetration into soil, sediments, and groundwater, particularly for diesel fuels due to their lower viscosity	• Source oil sample • Tissue samples for bioavailability (e.g., arthropods), inside and outside release area • Oiled soil and sediments, inside and outside release area	• Oil and response impact documentation with photography and field notes, including area and degree of vegetation oiling (esp. bryophytes) • Documentation of presence (counts by species) and oiling/mortality of birds, mammals, herpetofauna, arthropods, cultural resources, and fossils during spill site visits • Comparison of tissue and sediment or soil chemistry to relevant toxicological benchmarks • Bryophyte and arthropod bioassessment • Bioassays with spilled oil
Riparian and Upland	• Vegetation (esp. bryophytes) • Arthropods • Birds • Mammals • Herpetofauna • Soil • Biocrust • Fossils • Cultural resources • Recreational use - Camping - Hiking	• Oil coating of woody vegetation, debris, and riparian vegetation, including biological crusts • Oil penetration into soil, sediments, and groundwater, particularly for diesel fuels due to their lower viscosity	• Source oil sample • Tissue samples for bioavailability (e.g., arthropods), inside and outside release area • Oiled soil, inside and outside release area	• Oil and response impact documentation with photography and field notes, including area and degree of vegetation oiling (esp. bryophytes) • Documentation of presence (counts by species) and oiling/mortality of birds, mammals, herpetofauna, arthropods, cultural resources, and fossils during spill site visits • Comparison of tissue and soil chemistry to relevant toxicological benchmarks • Bioassays with spilled oil

The timeline for ephemeral data collection is shown in Table 2. In the first 1-3 days of a spill, the first agency responders are likely local resource managers who are tasked with reconnaissance and documentation of the extent of oiling and immediate impacts to animals in oiled areas.

Table 2. Timeline for ephemeral data collection for dry wash/ephemeral stream scenario.

VERY EARLY (DAYS 1-3)	EARLY (DAYS 3-6)	NEXT (DAYS 7-14)
• Source oil (best available) • Sediment and soil samples inside and outside release area • Slicks/sheens from the water surface (wet period) • Reconnaissance ▪ Documentation of oiled sediment, soils, and vegetation, especially biological crusts and bryophytes. ▪ Documentation of presence and oiling/mortality of biota (e.g., birds, mammals, bryophytes) during spill site visits ▪ Documentation of site location (e.g., oiled vegetation, biological crusts, etc.). Map surficial spill extent. ▪ Identify property boundaries, designated wilderness boundaries, and right-of-ways	• Tissue samples from inside and outside release area • Sediment or soil samples as the oil spreads • Reconnaissance ▪ Documentation of oiled sediment, soils, and vegetation, especially biological crusts and bryophytes ▪ Documentation of presence and oiling/mortality of biota (e.g., birds, mammals, herpetofauna) during spill site visits ▪ Documentation of site location (e.g., oiled vegetation, biological crusts, etc.). Remap surficial spill extent in case of migration	• Continued documentation of site location (e.g., oiled vegetation, biological crusts) • Continued documentation of oiled soil and sediment, especially biological crusts • Continued documentation of presence and oiling/mortality of biota (e.g., birds, mammals, herpetofauna) during spill site visits • Sampling of oiled sediments and soils • Quantitative surveys (species richness and tissue samples) of arthropod and bryophyte/biological crusts at spill and downstream locations • Monitor any excavation for paleontological and cultural resources

3.0 Ephemeral Data Collection Plan

3.1 Overview

This section describes procedures for collecting ephemeral data on source oil, weathered oil (i.e., tarballs), sediment, and soil, as well as methods for assessing impacts to human/recreational use. The protocols described below are to be followed unless the NRDAR Agency Lead(s) decide otherwise and provide an alternative. This section provides a general overview of sample collection procedures. Appendices 1 to 6 provide more detailed standard operating procedures and guidelines for the different types of samples and data. **Appendix 7** includes example Coordination Agreements (e.g., for cooperative assessments with Responsible Party) and Initiate Funding Requests to the National Pollution Fund Center (NPFC). **Appendix 8** provides links to examples of resource-specific injury assessment work plans. **Appendix 9** provides links to job aids and data sets on baseline resource condition. The protocols contained in this EDCP assume that there is no surface flow during sampling. If surface flow does occur, EDCPs for other regions (i.e., "Ephemeral Data Collection Plan for Central Valley River and Freshwater

Wetlands" and "Ephemeral Data Collection Plan for a Northern California River Spill That Also Impacts Coastal Resources") may be referenced for protocols pertaining to water sampling.

Habitats in and near dry washes and ephemeral streams are readily subject to injury from cleanup and assessment efforts. In particular, biological crusts are easily injured by compression (e.g., walking and motorized vehicles) and may take decades to recover (Weber et al. 2016). Care should be taken to minimize damage to sensitive resources when planning data collection and response activities.

Any spill is likely to occur during a dry period. However, cleanup and assessment activities can occur over a relatively long period. The likelihood of surface flow (e.g., due to rain) within the cleanup period 10 days, 2 months, and 6 months from the spill can be initially assessed and then periodically reassessed throughout the response.

3.2 Source Oil/Oil

It is critical that all sources of released oil be identified and sampled at the point of release. This is typically, and most appropriately, done as part of the response activities directed by the Unified Command or by state and federal incident investigators, not NRDAR personnel. The NRDAR Representative will coordinate with the Unified Command and incident investigators to confirm that sampling of the released material (e.g., oil) from its source will be conducted and can be split with or made available for the NRDAR efforts. The NRDAR Representative also will brief the incident investigators and Unified Command regarding sampling activities and any special NRDAR concerns. Source sample collection at the point of release is overseen by the State incident investigator (i.e., warden) and collections are normally done by CDFW-OSPR Oil Spill Prevention Specialists. Source sampling by NRDAR personnel is usually not recommended because of the hazards and expertise needed to sample fuel tanks, pipelines, or vessels following a release.

Sampling of released oil in the environment is recommended for documenting the spatial extent of impacts and confirming the source of the oil. Provided safety considerations are met (Section 1.2), NRDAR field teams may collect these types of samples, such as tarballs or residual evaporated oil. A detailed standard operating procedure for source oil sampling is included in **Appendix 1**.

3.3 Sediment/Soil

Samples of oiled sediment or soil are collected for chemical analysis for fingerprinting to the source oil, to document exposure of sediment- or soil-dwelling organisms to the oil, and to track oil weathering over time. There are sediment/soil quality criteria that can be compared with the concentrations of PAHs to determine initial toxicity and changes over time. Sampling locations for oiled substrate should be representative of potential exposure, such as from within the wash or adjacent alluvial deposits where the oil has stranded or accumulated. Samples are collected at accessible locations from unoiled sites and from oiled sites various distances from the release site.

Composite samples (of at least three subsamples) are preferred for characterization of a sampling site. Sub-samples of wash substrate should be collected using a pre-cleaned stainless-steel scoop or wooden spoon at random locations within a 5-meter radius and within the same oiling level. The subsamples are homogenized in a clean aluminum tray before placement in a pre-cleaned 250 mL glass jar.

When the dry wash is water free, sediment samples should be taken from stream channels and alluvial deposits, working out from the edge of visible oil. Being careful not to disturb the sampling area, use a pre-cleaned, hand-held stainless-steel scoop or wooden spoon, to scoop the sediment from the stream bed. Collect sediment from 5 to 10 zones that represent the left bank, right bank, and center channel. Each sample should be described (grain size, visual oiling conditions) and photographed. See **Appendix 2** for a detailed standard operating procedure for collecting sediment and soil samples, as well as sampling procedures for collecting sediment in wet conditions.

3.4 Response/Impact Injury

Habitats in and near dry washes and ephemeral streams are subject to injury from cleanup and assessment efforts. In particular, biological crusts (made up of cyanobacteria, lichens, and bryophytes) are easily injured by compression (e.g., walking and motorized vehicles) and may take decades to recover (Weber et al. 2016). Care should be taken to minimize damage to sensitive resources when planning data collection and response activities. Any visible injury caused by response activities should be documented according to the Field Documentation and Photography standard operating procedures (**Appendix 5**).

The biological assessments for response injury will focus on bryophytes and arthropods. Arthropod assessment consists of sampling both the terrestrial and riparian vegetation arthropod assemblage. Terrestrial arthropods are sampled using a modified pitfall trap placed in the dry channel over a 24-hour period. The riparian vegetation arthropod assemblage is sampled by placing a cloth bag over the nearest plant to the channel and beating 30 times to dislodge arthropods. Bryophytes should be collected from the channel, and both the left and right riparian zones. All microhabitats within each zone should be sampled. A spray bottle of water can be used to identify bryophytes, which are then collected using a spoon and collection envelopes. See Pena et al. 2019 and **Appendix 3** (excerpt of section 2.2 from Pena et al. 2019) for detailed procedures for collecting bryophyte and arthropod samples.

3.5 Human Use/Recreational Use

Human and recreational uses of natural resources may be impacted as a result of an oil spill and the ensuing incident response (e.g., closure of recreational areas). Many of these impacts may be relatively short-term and difficult or impossible to document later. The primary purpose of this initial data collection is to determine the type of uses and injuries that should be investigated in longer-term studies. Data that local land managers should consider collecting to assess potential human use impacts in the immediate aftermath of a spill include:

- Photo documentation of impacted uses (e.g., closures, advisory signs, etc.);
- Curation of relevant media such as news articles and social media posts;
- Identification of areas of heavy recreational use for further study; and
- As appropriate based on available time and staff experience, interviews with recreational users in the impacted area or with site managers familiar with the normal regional recreational activities.

Early data collection, even if qualitative, is important and can guide the development of more quantitative studies if necessary. More detailed guidelines on the collection of ephemeral human use data can be found in **Appendix 4**.

3.6 Field Documentation and Photography

Systematic field observations by the first responders in the days after a spill are key to documentation of potential injuries that may be lost before scientific surveys can be conducted. A dedicated field notebook should be used to record all observations, noting date and time, location, observations, and photographs. Do not erase or black out erroneous entries in the field notebook. Errors should be corrected by crossing out the entry with a single line and initialing and dating the strike-through.

The following is a partial list of items to always document:

- The general site conditions and location;
- How the oil spill happened – including oil source;
- Oil stranded in the stream channel, and in direct contact with or over sensitive areas such as dry stream beds, in-stream debris, and adjacent alluvial deposits;

- Oiled vegetation or wildlife;
- Oil recovery and cleanup operations (response);
- NRDAR staff working and sampling activities;
- Presence of cultural resources;
- Species presence and habitat use; and
- Site use by humans (camping, hiking, off-road vehicles).

Field sketches showing the locations of these types of items are good to make, in addition to photographs. The field sketch is an important part of documentation because: 1) it provides a focused picture of the site conditions and affected resources and 2) it adds discipline to the field observation process because it forces the person doing the sketch to make detailed mental notes of all the relevant features at a site. Sketches, in combination with photographs, provide a powerful way to capture information.

Photographs and video are taken in the field to document the pre-oiling and oiling conditions and are key pieces of information that can be introduced as evidence. All the SOPs for ephemeral data collection include taking photographs. Each photograph should tell a specific part of the story. Before taking a photograph, you should consider what critical information you are trying to convey. Did the photograph capture the details you need? Are there key images (data) that you have missed? In the first case, you should take a better photograph (but without deleting any photographs). In the second case, you should look for photographs that will fill in gaps. Time series of photographs are helpful to document exposure or changes in oil degree and distribution over time. Time series should be taken by standing in the same spot and facing the same direction each time; it helps to have notes or prior photographs to be able to occupy the same location and perspective. See **Appendix 5** for a detailed standard operating procedure for field documentation using photography.

Imagery collected using uncrewed aerial systems (UAS) or drones can also be used to document extent of oiling, response activities, and user activities, among others. Any deployment of UAS must comply with requirements from the Federal Aviation Authority as well as airspace restrictions and other restrictions from organizations managing restricted areas. Examples include critical infrastructure; designated wilderness areas; wildlife sanctuaries; national parks; and areas where wildlife disturbance may be a concern, such as nesting bird colonies. The NOAA (2021) guide provides specific guidance for use of small UAS to collect data in support of an oil spill response.

3.7 Chain of Custody

For the purposes of litigation, agencies must be able to prove the legal integrity of all samples and data introduced as evidence. This means that it is necessary to have an accurate written record to track possession, handling, and location of samples and data from collection through reporting. Chain of custody (CoC) procedures are followed to authenticate a sample from the time it is taken until the results are introduced as evidence and facilitate the verification process. Failure to follow chain of custody procedures does not necessarily render data unusable; however, any deviations from the chain of custody guidelines should be noted. Assuring that proper chain of custody guidelines are followed is vital to assuring the integrity of the samples, and the data generated by the analysis of those samples.

All samplers handling samples collected for NRDAR MUST follow CoC procedures when collecting, handling, and securing samples. All team leads and supervisors are responsible for ensuring that the designated custodian(s) understand this procedure and strictly adhere to it for all sampling events. The sample collector is responsible for care and custody of the samples until they are turned over to an assigned custodian or properly dispatched to the receiving laboratory. All custodians must ensure that each sample remains in their custody (as defined below) so that no one can tamper with it during the entire duration of their responsibility.

The Chain of Custody Form is a document detailing who is legally responsible for samples at any point in time from collection until the sample is received by the laboratory. A sample is in your custody when:

- It is in your actual physical control and presence;
- It is in your view after being in your possession;
- It is not in your physical presence, but is secure in a place of storage to which only you have access; or
- It is not in your view or physical presence, but is secured in a place of storage or secure area to which only you and identified others have access.

Before shipping samples, make sure that each chain-of-custody form is filled out completely and properly. Check that the sample identifications on sample bottles match the sample identifications on the chain-of-custody. Verify that the date, time, type, matrix and container types, and analyses requested are clearly indicated. Not all locations will ship samples with wet ice; however, when shipping with wet ice be sure that the cooler is properly sealed, contained from leaking, and that bottles are protected from breakage. Hazardous material shipping regulations must be followed if samples contain large volumes of oil. Consult with the laboratory about the volume of oil that will trigger these regulations. The CDFW-OSPR chain of custody form and procedures are provided in **Appendix 6**.

3.8 Chemical Analysis Guidelines

Samples collected with the SOPs in Appendices 1 and 2 will be sent to analytical laboratories under chain of custody. This section outlines the types of analysis generally requested following oil spills.

The NRDAR Agency Lead(s) and the EDCC shall coordinate which chemical analyses are suitable for the collected samples. Table 3 presents the anticipated container and storage types by sample matrix. Table 4 presents the standard analyses and methods by sample matrix. Samples will be sent to a laboratory based on the decision of the NRDAR Agency Lead(s). The address and shipping instructions will be on the COC form.

Table 3. Key sampling requirements for each sample type.

SAMPLE TYPE	COLLECTION CONTAINER(S)	STORAGE
Source Oil/Oil	• 1 L wide mouth glass jars, amber glass preferred • 250 mL wide mouth glass jars, amber glass for weathered oil such as tarballs	Keep at 4°C. Do not freeze.
Sediment/Soil	• 250 mL (8 oz) certified organic-clean jars with Teflon-lined lids – for TPH/PAH/biomarkers; can use 1 L bottles if smaller-sized jars are available • Zipper-top or Whirl-Pak bags – for grain size and TOC samples	Chemical Analysis, TOC - Keep at 4°C. Do not freeze. Grain Size – No refrigeration required.
Tissue	• 250 mL wide mouth glass jars, amber glass preferred. (Note, if samples are collected for taxonomy as per suggested protocols in **Appendix 3**, they may be preserved in ethanol. Samples for chemistry should not have an external preservative.)	Keep at 4°C. Do not freeze.

Table 4. Analytes and analysis methods by matrix.

ANALYTES (SUGGESTED ANALYSIS METHOD)	SOURCE OIL/ SHEEN/TARBALL	SEDIMENT/SOIL	TISSUE
PAHs and alkylated PAHs (EPA Method 8270-modified-GC/MS/SIM)	X	X	X
Total Petroleum or Extractable Hydrocarbons (TPH/TEH) (EPA Method 8015, GC/FID, extended range)	X	X	n/a
BTEX (EPA Method 8260 modified GC/MS/SIM)	TBD	TBD	n/a
% Moisture	n/a	X	X
% Lipids	n/a	n/a	X
Grain Size, Total Organic Carbon	n/a	X	n/a

The request for BTEX (benzene, toluene, ethylbenzene and xylene) analysis will depend upon the volatility of the source oil; BTEX is more prevalent in lighter weight fuels such as gasoline than in crude oils. Additional methods that may be requested for oil samples include SARA (saturates, aromatics, resins and asphaltenes), PIANO (paraffins, iso-paraffins, aromatics, naphthenes and olefins; may include BTEX), density, boiling curve (simulated distillation), metals, and sulfur content. Fingerprinting analyses vary between laboratories and may include standard terpane and sterane biomarkers as well as mono- and tri-aromatic steroids. Contact the EDCC or the laboratory that will be analyzing these samples to determine which analyses to request.

4.0 Natural Resource Trustee Representatives Contact Information

4.1 CA Department of Fish and Wildlife, Office of Spill Prevention and Response

4.2 U.S. Fish and Wildlife Service

4.3 U.S. Department of the Interior

Office of Environmental Policy & Compliance

Bureau of Land Management, California Desert District Office

4.4 National Oceanic and Atmospheric Administration, Office of Response and Restoration

4.5 U.S. Department of Agriculture

National Response Team / Regional Spill Coordinator - Pacific Southwest Region

5.0 Technical Support and Chemical Analysis Contact Information

5.1 U.S. Environmental Protection Agency

Pacific Southwest (Region 9) Duty Officer for oil or chemical spills

5.2 CA Department of Fish and Wildlife – Office of Spill Prevention and Response Bioassessment Team

5.3 Chemical Analysis/Technical Support

California Department of Fish and Wildlife Petroleum Chemistry Laboratory

6.0 Other State and Local Agency Contacts

6.1 CA Department of Fish and Wildlife – Regional Office

Consult the CDFW Region list to get in contact with correct office representing the area the spill occurred.
https://wildlife.ca.gov/Regions

6.2 CA Department of Parks and Recreation

Consult the CA Department of Parks and Recreation District Office list to get in contact with correct office representing the area the spill occurred.
https://www.parks.ca.gov/?page_id=24248

Office of Historic Preservation

6.3 CA Regional Water Quality Control Board

Consult the CA Regional Water Quality Control Board Directory to get in contact with correct office representing the area the spill occurred.

https://www.waterboards.ca.gov/about_us/contact_us/rwqcbs_directory.html

6.4 Office of Environmental Health Hazard Assessment

Pesticide and Environmental Toxicology Branch

6.5 California Coastal Commission

6.6 California State Lands Commission

6.7 Public Utilities

Pacific Gas & Electric

California Geologic Energy Management Division (CalGEM) - Northern District

6.8 Railroads

Union Pacific Railroad (UPRR)

Burlington Northern Santa Fe (BNSF)

6.9 Tribal Contacts

California Native American Heritage Commission

7.0 References Cited

National Oceanic and Atmospheric Administration (NOAA). 2021. Uncrewed Aircraft Systems Oil Spill Response Job Aid. https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/uncrewed-aircraft-systems-oil-spill-response-job-aid.

Weber, B., M. Bowker, Y. Zhang, and J. Belnap. 2016. Biological Soil Crusts: An Organizing Principle in Drylands 226:479–498.

West Coast Joint Assessment Team (WCJAT). 2017. Recommendations for Conducting Cooperative Natural Resource Damage Assessment. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=200743&inline

APPENDIX 1: Detailed Standard Operating Procedures for: Source Oil and Oil

Standard Operating Procedure for Collecting Ephemeral Data: SOURCE OIL and OIL

June 2023

Sampling Objectives

Characterize Oil

- Obtain sample(s) of the original oil source(s) involved in the incident for characterization, fingerprinting, and predicting/quantifying oil fate and effects.
- Obtain samples of oil released to the environment for fingerprinting to the source oil.

Quality Assurance/Quality Control

- Ensure the integrity of the oil sample(s) throughout sampling, transport, and storage.
- Ensure the reliability of chemical characterizations.

Before Field Sampling

- Ensure that all personnel have required safety training and protective equipment for field work.
- Source sample collection at the point of release is overseen by the State incident investigator (i.e., warden) and collections are normally done by CDFW-OSPR Oil Spill Prevention Specialists. Source sampling by NRDAR personnel is usually not recommended because of the hazards and expertise needed to sample fuel tanks, pipelines, or vessels following a release. Coordinate with the emergency response before carrying out source oil sampling.
- Sampling of released oil in the environment **is recommended for documenting the spatial extent of impacts and confirming the source of the oil in the environment**. Provided safety considerations are met, NRDAR field teams may collect these types of oil samples.

Sampling Areas and Timing

- Follow a sampling plan/work plan if one is available.
- The source oil sample should be collected from the freshest source possible (i.e., directly from the tank truck, wellhead, or pipeline); secondary options are from the water or ground as close as practical to the spill release site.

Field Sampling Methods

Sampling Equipment/Containers

Note: Analytical laboratories may provide required sampling and sample storage and transport materials.

- Coolers – for sample storage and transport
- Blue ice packs or wet ice − for storage temperature regulation
- Thermometer or temperature logger (1 per cooler)
- Disposable nitrile gloves
- Sampling jars – certified organic-clean glass jars (solvent rinsed) with Teflon-lined lids and labels:
  - 1 L wide mouth glass jars, amber glass preferred
  - 250 mL wide-mouth glass jars, with Teflon-lined lid, amber glass for weathered oil such as tarballs
  - If BTEX (volatile) samples are to be collected, 40 mL septum-capped vials, HCl-preserved preferred, amber glass preferred

- Samplers – Wheaton grab sampler, Volskom sampler (if available)
- Stainless steel spatulas or spoons for collection of viscous oil samples
- Sampler material – Teflon (preferred), glass, or PVC (less ideal)
- Funnels (for transferring; solvent rinsed) – metal/stainless steel (preferred), glass or plastic (less ideal)
- Field sample forms (template in Appendix 10) and field notebook
- Chain of Custody forms
- GPS, camera (with spare batteries), photo scales, evidence tape
- Packaging materials (bubble wrap, sorbent pads, and tape) for glass jars − may be provided by the analytic laboratory
- Suitable disposal bags for oiled PPE and disposable sampling materials

Sample Collection Methods

- Use field data forms included in the work plan if one is available. Otherwise, use form in Appendix 10. Coordinate data form development/modification with the NRDAR data management group.
- Make sure that all GPS units are using the same coordinate system, datum, reporting units, and correct time. Follow the recommended GPS datum of the study plan if one is available. Alternatively, set the default to WGS84.
- Record GPS coordinates for each sample site.
- Photograph the sampling site prior to sample collection to document the site conditions, as well as the sample collected. Make sure each photograph or series can be later associated with the corresponding sampling locations (e.g., through use of GPS Photo link software or by keeping a detailed photo log with waypoints and/or lat/long). Do not delete or alter any photographs. The numbering sequence of photographs uploaded from your camera must not have any gaps (see Field Photography guidelines).
- Safety is the highest priority. Be aware of physical and chemical hazards at the site. Get a safety briefing from the Safety Officer before entering any restricted area. Use recommended safety equipment and procedures.
- There may be different products loaded in different compartments or tanks. Get as much data as practical on the products from the RP. Slight differences in product properties, such as specific gravity, may indicate different products. Each unique product should be sampled.
- Collect a minimum of 1 L per source.
- Collect sample with gloved hands.
- When collecting source oil:
  - Source samples can be collected directly into the sample container, minimizing risks of contamination. Use a device that holds the container, such as a Wheaton grab sampler (holds a 1 L bottle strapped to a metal rod with the ability to unscrew the cap remotely) or a Volskom sampler (frame which holds a container lowered on a rope). For black oils, these methods are less ideal because of heavy oil coating of the device and container.
  - Sampler material, in order of preference, include Teflon (there are inexpensive, disposable models), glass, and PVC.
  - Leave 1 cm headspace in the neck of each jar. A larger headspace (e.g., 2.5 cm) is recommended to allow for sample expansion if water is present in the sample and freezing may occur.
  - Care should be taken not to contaminate the outsides of the lid or the sample jars. If contamination does occur, the containers should be cleaned with soap and water, or less preferably with sorbent material. Do not store containers that have external oil contamination with other samples until they have been cleaned.

- If the collection of samples directly from the source is not possible, 1 L samples of oil should be from the water or ground as close to the source as practical.
  - When collecting source oil from water surface, concentrate the source oil in the sample container by skimming the oil from the water, sampling from the thickest part of the freshest oil slick.
  - When collecting source oil from the ground, carefully scrape the thickest part of the stranded source oil from the surface into the sample container minimizing the transfer of sediment/soil or other foreign material.
- Be aware of sources of contamination or mixing of products on-scene, such as transferring of product between tanks, dilution with fire-fighting water, or application of a foam blanket. If contamination is suspected, it may be appropriate to take samples of the potential source of contaminant.

Sample Labeling and Record Keeping

- Verify that all oil samples are properly labeled and that field sample forms are properly filled out.
- Follow chain of custody procedures for securing samples and complete chain of custody forms (See Chain of Custody guidelines in Appendix 10).
- Make notation on the Chain of Custody form about any problems or observations during sampling, such as presence of water or sediment in the sample.
- Maintain strict chain of custody during sample storage and transportation.
- Record the sample number on both the sample jar label and lid. Fill out the data sheet.
- Keep a detailed photo log so that each photograph can be labeled. All sample numbers must be unique. The sample number should consist of a 2-letter Field Team name (e.g., ED for ephemeral data), 1-number field team number, 6-number date (MMDDYY), 2-letter sample type, and a 2-number sequential sample number. See the Sample Collection Summary Form for codes in Appendix 10. All sample numbers must be unique. Note any deviations from the SOPs in the field notebook.

Sample Preservation, Holding Times, and Shipping

- Tape lids on sample bottles so that they do not accidentally come off.
- Protect the samples from direct sun exposure (e.g., UV radiation).
- Immediately place all source oil samples in a refrigerator or cooler and keep at 4°C. DO NOT FREEZE. Use frozen gel packs or wet ice to maintain the temperature. A programmable temperature logger or thermometer should be placed in each cooler to maintain a record of storage temperatures.
- Keep source oil samples separate from environmental samples to reduce risk of cross contamination.
- Keep the samples under chain of custody until they are handed off for transport to the laboratory.
- Do not discard ANY oil samples.

APPENDIX 2: Detailed Standard Operating Procedures for: Sediment/Soils

Standard Operating Procedure for Collecting Ephemeral Data: SEDIMENT/SOILS

June 2023

Note: These protocols are applicable to a variety of sediment and soil types, dry or otherwise. References to aquatic sampling requirements or processes can be ignored for the dry wash environment.

Sampling Objectives

Characterize Oil in Sediment or Soils

- Determine the concentration and composition of oil compounds in sediments or soils compared to background concentrations
- Determine the source of contamination via chemical fingerprinting analysis and characterize oil weathering and fate
- Estimate the areal extent and degree of oiling along the affected area, including the shoreline and on the bottom of waterbodies

Describe Habitat

- Measure sediment or soil characteristics for interpreting chemical and biological results

Study Exposure

- Document exposure of sediment- or soil-dwelling organisms to oil compounds
- Support exposure modeling

Quality Assurance/Quality Control

- Ensure the integrity of the sample(s) throughout sampling, transport, and storage
- Ensure the reliability of chemical characterizations

Before Field Sampling

- Assure that all personnel have required safety training and protective equipment for field work.

Study Design

- It is important to have a defined sampling strategy prior to conducting fieldwork. Representative sediments or soils are difficult to sample for oil contamination because of the inherent heterogeneity of oil distribution over space, depth, and time.
- The following terminology is used to define general to specific sampling geographies:
  - Area = general area of uniform characteristics, such as degree of oil exposure, physical setting, habitat types present, etc.
  - Location = a specific location that is representative of the area and contains the type of habitat to be sampled, such as a stream pool or shoreline of uniform oiling
  - Site = a specific point at which samples are collected or observations are made
- Plan the number of locations and number of sites per location, taking into account level of effort, potential logistical limitations, weather conditions, and other issues that may compromise sample integrity.

Equipment

- Review the list of sampling equipment/containers, make adjustments as needed, and ensure that all essential field materials are ready to be taken to the field.

- It may be necessary to coordinate with the laboratory that will receive the samples to ensure that acceptable materials and conditions are used for sampling and sample storage and shipping.
- Make sure that all essential equipment is in working order and operational and that spare equipment and materials are available.

Sampling Areas and Timing

- Follow a sampling plan/work plan if one is available.
- If a sampling plan is not available for ephemeral data collection immediately after a spill, data collection should focus on collecting samples from a range of unoiled, likely to be oiled, and already oiled areas.
- The number of locations and number of sites per location need to be considered, making sure that there is enough space in the coolers to accommodate all samples without sacrificing their integrity.
- If water is present, sediment samples can be collected from boats, the shoreline/stream bank, or wading in shallow water.

Area Selection

- Sampling locations should be representative of areas that have been or may be oiled by the spill and unoiled reference locations.
- Use trajectory models, overflight information, SCAT data, field observations, or other information to determine what areas have been oiled and which ones are likely to be oiled.
- Samples should also be collected from locations known or suspected to be impacted by other natural or anthropogenic sources of contamination (e.g., oil seeps, coal, peat, mining, combustion engines), as these will be important to differentiate background sources and levels of contamination.
- It may be necessary to prioritize sampling locations. In this case, highest priority samples are to be collected from oiled locations that are sensitive habitats, biologically productive, or highly relevant for human use. Collecting pre-oiling sediment or soils from sensitive/productive locations that are likely to be oiled by the spill in the near future is also a priority. Sampling at unoiled "control" locations and sampling other sources of contamination should be prioritized based on the ephemerality of the data and relative importance to developing a NRDAR case.
- The number of locations and number of sites per location should be defined in the study design. A minimum guideline for collecting sediment or soil samples is at least three sites per location of relatively uniform oiling exposure.
- Sample along exposure gradients, starting in the cleanest zone and then at regular intervals proportional to the exposure area.

Field Sampling Methods

Sampling Equipment/Containers

Note: The amount of equipment required depends on the sampling plan, desired sample volumes, and logistics. Analytical laboratories may provide required sampling and sample storage and transport materials – contact the receiving lab before preparing to collect samples in the field.

- Coolers – for sample storage and transport
- Blue ice packs/wet ice – for storage temperature regulation
- Thermometer or temperature logger (1 per cooler)
- Disposable nitrile gloves
- Sampling jars – 8 oz certified organic-clean jars with Teflon-lined lids and labels – for TPH/PAH/biomarkers

- Zipper-top (up to 1 gallon) or Whirl-Pak bags – for grain size and TOC samples
- Underwater sediment sampling devices. E.g., modified van Veen grab, Ekman grab, or ox dredge
- Coring tubes – single-use, disposable preferred
- Flat scoops (stainless steel or plastic) for shallow water, banks, and shorelines
- Stainless steel spatulas and spoons – cleaned, wrapped in foil, and sealed for transport
- Disposable aluminum pans – for composite samples
- Aluminum foil
- Sorbent pads
- Field Sample Forms (template in Appendix 10) and field notebook
- Chain of Custody forms (Appendix 10)
- Evidence tape (see Chain of Custody guidelines)
- GPS, camera (with spare batteries), and photo scales
- Packaging materials for glass jars (e.g., bubble wrap, sorbent pads, tape) – may be provided by the analytic laboratory
- Suitable disposal bags for oiled PPE and disposable sampling materials

Sample Collection Methods

- Use field data forms included in the work plan if one is available. Otherwise, use forms in Appendix 10. Coordinate data form development/modification with the data management group.
- Because GPS units will be used to record locations and times, make sure that all units are using the same coordinate system, datum, reporting units, and correct time. Follow the recommended GPS datum of the study plan. Alternatively, set the default to WGS84.
- Record the sampling site location using a GPS.
- Photograph the sampling site prior to sample collection to document the site conditions, as well as the sample collected. Make sure each photograph or series can be later associated with the corresponding sampling locations (e.g., through use of GPS Photo link software or by keeping a detailed photo log with waypoints and/or lat/long). Do not delete or alter any photographs. The numbering sequence of photographs uploaded from your camera must not have any gaps (see Field Photography guidelines, Appendix 5). If taking photographs of the sampling site is impractical, only take photographs of the sample collected.
- Surface sediment or soil samples can be collected by using a pre-cleaned stainless steel scoop or disposable wooden spoon. Collect the sample at a selected interval (e.g., 0-5 cm deep) from 3 locations and composite them using the aluminum tray before placing in a pre-cleaned 8-oz glass jar.
- Any sediment sampling device for collecting samples under water which meets the following requirements can be used:
  - Creates a minimum bow wake when descending
  - Penetrates the sediments to below the desired sampling depth
  - Closes to form a leak-proof seal after the device is triggered to close
  - Prevents sediment washout and disturbance when ascending
- Clear surface slicks prior to deploying the device by sweeping the area with a sorbent pad or placing a barrier up-current to divert surface oil around the sampler deployment area.
- Collect sample with gloved hands.
- When deploying and retrieving the sampling device under water:
  - Lower and retrieve the sampling device at a controlled speed of ~30 cm per second to minimize potential bow wake activity and bottom disturbance as the sampler contacts the bottom, and loss and disturbance of the subtidal sediment sample during retrieval

- The device should contact the bottom gently, making sure it settles flat; only its weight or piston mechanism should be used to penetrate the sediment. It is important to minimize disturbance to the surface floc, which is likely to contain oil contaminants if they are present
- Secure the sampler on board and examine the sample for acceptability as follows:
  - The sampler is not overfilled; the sediment surface is not pressed against the sampler top
  - Overlying water is present, indicating minimal leakage
  - Sediment surface is undisturbed, indicating lack of channeling or sample washout
  - The desired penetration depth is achieved (e.g., 4-5 cm for a 2 cm sample)
- Siphon off the overlying water near one side of the sampler
- Using a flat scoop, accurately collect the top 2 cm from the center of each grab, avoiding sediments in contact with the sides of the sampler. Collect other intervals, as needed, using a new scoop for each sampling interval
- Make a composite sample of at least three subsamples within the same site and sampling interval, using a disposable aluminum pan or aluminum foil-lined container to homogenize the samples
- If time, equipment, or logistics do not allow collection of composite samples, collect grab sediment by following steps above, omitting the collection and mixing of subsamples. Place grab samples directly into jars for mixing, homogenizing and splitting in the laboratory
- In addition to collecting samples for chemical analysis, take samples for TOC and grain size (placed in Ziploc or Whirl-Pak bags)

Quality Assurance/Control

- Obtaining an adequate number of quality control samples is essential. At a minimum, a trip blank (accounts for contamination introduced during shipping and handling) and field blank (accounts for contamination introduced during sampling) should be maintained for each sampling effort and generally be collected at a rate of 5% and 10%, respectively, of all samples.
- A trip blank is an unopened sampling jar and should be transported with the samples and remain sealed in the cooler during sampling activities.
- A field blank should be collected at approximately every third sampling site, or at least at an "unoiled" and "oiled" site, by leaving the field blank sample jar open for the duration of the sampling period at that site. Record the site where field blanks were taken on the field sample form.
- Ideally, kiln-fired sand supplied by the laboratory can be transferred (poured or scooped) from one jar to another and returned to the lab as a field blank, but if this is not possible, use the open-jar technique (empty jar).
- Duplicate samples should be collected at every third sampling site or following the specifications of the work plan. A duplicate sample is collected from the same location and following the same steps as the preceding sample. This is not the same as collecting replicates from each site/depth. Duplicates should account for 10% of all samples, but consideration should be given to sample storage capacity. Do not split samples unless specified in the work plan.

Good Sampling Practices and Decontamination

- Good field practices and the development of a consistent sampling routine will ensure the integrity of the samples and their validity in damage assessments.
- Disposable nitrile gloves should be worn when sampling and changed between each sample collected or as necessary to prevent cross contamination.
- To reduce the need for field decontamination, use pre-cleaned and/or disposable equipment and tools.

- Sediment or soil samples for THC and PAH analysis should be placed in certified organic-clean (solvent rinsed) glass containers with Teflon- or aluminum foil-lined lids. Samples for grain size and TOC can be placed in Ziploc or Whirl-Pak bags.
- Sampling devices (e.g., dredges, coring tubes) must be decontaminated between samples:
  - Wipe off as much bulk oil as possible using sorbent pads
  - Wash device with laboratory-grade detergent and clean with a triple clean-water rinse. Cleaning with laboratory-grade water is preferred, though store-bought distilled water is a less ideal alternative and, as a last resort, "background" water from an up-current clean area can be used
  - Rinse with methanol or acetone, followed by hexane (Capillary GC Pesticide Residue Grade or equivalent). Collect solvent rinsate for proper disposal. Allow solvents to evaporate from equipment before use. If solvents are not available, use a diluted detergent solution and fresh water, followed by a distilled water rinse
- Take precautions to avoid cross-contamination of the site from oil on personal equipment (e.g., boots, shovels, etc.). Sampling unoiled areas first, then lightly oiled areas and finally heavily oiled areas can minimize cross-contamination. Personal equipment should be exchanged or cleaned between sites if it becomes contaminated.
- Potential sources of contamination while sampling from vessels (exhaust fumes, oily surfaces) are a concern. Work up-wind of any exhausts and designate clean areas for handling samples. Segregate dirty/clean areas. Layout clean surfaces to work on and replace frequently.

Sample Labeling and Record Keeping

- Verify that all samples are properly labeled and that field sample forms are properly filled out.
- Follow chain of custody procedures for securing samples and complete chain of custody forms (See Chain of Custody guidelines, Appendix 10), noting where each subtidal sample was collected, sampling equipment used, time/date of collection, size and container type, and sampler name.
- Make notation on the Chain of Custody form about any problems or observations during sampling.
- Maintain strict chain of custody during sample storage and transportation.
- Record the sample number on both the sample jar label and lid. All sample numbers must be unique. The sample number should consist of a 2-letter Field Team name (e.g., ED for ephemeral data), 1-number field team number, 6-number date (MMDDYY), 2-letter sample type, and a 2-number sequential sample number. See the Sample Collection Summary Form for codes in Appendix 10.
- If sample volume is split between two jars, both jars should receive the same sample ID and be recorded on a single line of the Chain of Custody form.
- Keep a detailed photo log so that each photograph can be labeled.
- Note any deviations from the recommended guidelines in the field notebook.

Sample Preservation, Recommended Holding Times and Shipping

- Follow chain of custody procedures for sample storage and shipping.
- Immediately place all sediment or soil samples for chemical analysis in a cooler and keep at approximately 4°C. Use frozen gel packs or wet ice to maintain the temperature if ambient temperatures are above freezing. A programmable temperature logger or thermometer should be placed in each cooler to maintain a record of storage temperatures.
- Refrigerate (do not freeze) samples for TOC. Samples for grain size do not require refrigeration.
- Protect samples for chemical analysis from direct sun exposure (e.g., UV radiation).
- Samples for TOC and grain size can be stored separately from samples for chemical analysis.

- Tape lids on sample bottles in accordance with chain of custody guidelines so they do not accidentally come off.
- Store samples for chemical analysis from unoiled areas in one set of coolers, with oiled samples in a separate set of coolers.
- Use packing material, such as bubble wrap or sorbent pads, around glass jars to prevent breakage during transport and shipping. Take special care with gravel sediments because individual pieces can rattle around during shipping and break the glass jars.
- Freeze samples for chemical analysis as soon as practical or by the end of each day if samples are not going to be analyzed within 7 days of collection.
- Ship samples directly to the laboratory as soon as practical with complete Chain of Custody forms. If necessary, samples can be stored under specified conditions and with complete chain of custody until they can be shipped. Ensure that samples are packaged to protect them from breakage, shipping containers are sealed, and use ice packs to maintain storage temperatures during shipment to the lab.
- Ship highly oil-contaminated samples separate from non-contaminated or low-contaminated samples to reduce risk of cross contamination.
- NEVER discard any samples even if these have exceeded their recommended holding times or storage temperatures.

APPENDIX 3: Sampling Protocols for Bryophytes and Arthropod Sampling

Bioassessment of Non-Perennial Streams affected by Oil and Gas Extraction

This study examined how stresses related to oil production affect a dry stream ecosystem near Bakersfield, California, by characterizing arthropod (beetles) and bryophyte (mosses) assemblages along a gradient of increasing disturbance (e.g., oil-field cover area, well counts) from upstream oil and gas extraction. The abundance of mosses increased with stress, while richness of some arthropod species (especially beetles) decreased at stressed sites. These changes may be related to increased fine sediments and nutrients from wastewater discharges. Protocols for characterizing arthropods and bryophyte assemblages are included. This work was funded by the California Oil Spill Study and Evaluation Program of the California Department of Fish and Wildlife via the Southern California Coastal Water Research Project Authority. We include an excerpt from section 2.2 that provides the detailed operating procedures for collecting bryophyte and arthropod samples.

Pena, S.J., Mazor, R., and Olson, J.R. 2019. Bioassessment of Non-perennial Streams affected by oil and gas extraction (PDF). Report No. WI-2019-XX. 18 August 2019.
https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=201969

Sampling Protocol excerpted from above document:

Sampling Biological Indicators

We evaluated three potential biological indicators at each site: terrestrial arthropods in the dry stream-bed, arthropods on riparian vegetation, and bryophytes (i.e., mosses) growing in the channel or on the banks. Typically, all three indicators are sampled over the course of a 2-day sampling event.

We sampled terrestrial arthropods in dry channels using ramp traps, a type of modified pitfall trap that is more efficient and has less bycatch than traditional pitfall traps (Patrick and Hansen 2013). A trap was set-up at eight random locations between each transect. Traps were filled with approximately 250 mL of propylene glycol (which acts as both a kill agent and preservative) for approximately a 24-hour period, and then contents were gathered into a sample jar, labeled, and sealed for transport.

We sampled the riparian vegetation arthropod assemblage at the beginning of the second day of sampling, before other activities in and along the sampling reach. Between each transect we identified the most robust plant closest to the channel that provided good habitat for arthropods to sample. An approximately 1-m2 cloth bag was placed over the plant (or a portion of the plant), closed and beat 30 times to dislodge arthropods. Then, all the contents of the bag except for large debris were collected in a jar, labeled, preserved with ethanol, and sealed for transport.

Bryophytes were collected in three mesohabitats of a reach: channel, left and right riparian zones. We surveyed each mesohabitat for 20 minutes in order to identify and flag all microhabitats that contained bryophytes; microhabitats include boulders, soil, tree roots, and other stable substrate where bryophytes typically grow). We then collected bryophytes for 12 minutes across a representative sample of the identified microhabitats using spray bottle (to help identify bryophytes which re-green upon wetting), spoon, and collection envelopes. Samples were then labeled and allowed to dry.

APPENDIX 4: Detailed Standard Operating Procedures for: Human/Recreational Use

Standard Operating Procedure for Collecting Ephemeral Data: HUMAN AND RECREATIONAL USE

June 2023

Guideline Objectives

The primary objective of this document is to provide guidelines for collecting ephemeral data relating to human and recreational use of natural resources during the early stages of an oil spill to support NRDAR.

Background

Human and recreational uses of natural resources may be impacted as a result of an oil spill and the ensuing incident response (e.g., closure of recreational areas). Many of these impacts may be relatively short-term and difficult or impossible to document later. The following sections outline ephemeral data that local land managers can consider collecting to assess potential human use impacts in the immediate aftermath of a spill. What types of data can be collected will depend on the available time and experience of land managers or other local staff. Early data collection, even if qualitative, is important and can guide the development of more quantitative studies if appropriate.

Document Pathways

Documentation is the primary focus of early ephemeral data collection.

- Photo documentation:
  - Take pictures of oiled beaches/sites, advisory signs ("Warning: Do not contact water or eat fish"), closure signs/cordoned off areas, presence of response workers, and similar factors that may limit use of the area.
  - Follow the "Field Documentation Using Photography" guidelines found in Appendix 5 where possible.
  - At a minimum, include landmarks in pictures to assist with geolocation and with time-series images.
- Media documentation:
  - Save news articles and social media posts about the event made by health officials, towns, recreational users themselves, etc.
  - These may not stay online forever, so save all media on an electronic resource that is regularly backed up.
  - Online sources can be saved as screenshots (social media posts), saved locally as a static webpage (online news articles and the like), printed to PDF, or otherwise electronically archived.
  - Physical new articles or other documentation (e.g., informational flyers, community meeting posters) should be scanned or photographed and saved electronically with other media documentation.
  - Collect Basic Information about Recreational Use:

These observation and interview activities are intended to provide information to guide development of comprehensive surveys of recreational and other use at affected sites. These activities are optional and are applicable depending on the available time and experience or background of staff.

- Observations of recreational users:

  - Count recreational users present at sites and define the boundaries of the count using permanent landmarks (e.g., between two jetties).
  - Observe and record what recreational users are doing and not doing, as applicable (e.g., playing volleyball, birdwatching, and sunbathing; nobody fishing or wading/swimming).
  - Conduct counts and record observations once or twice a day after the incident, targeting different times of day.
  - If feasible, implement data collection that can easily be repeated on the anniversary of the spill and document the process in a protocol document.

- Informational/qualitative interviews with recreational users
  - Talk to recreational users at sites about what they usually do at the site and how the spill may be affecting them.
    - Are they doing something else than they had planned?
    - Are they enjoying their experience less than usual?
    - Do they know of people who are avoiding the site?

- Information gathering from site managers (beach lifeguards, parks staff, etc.)
  - Ask for their impressions about how recreation use levels and activities are being affected, if at all, by the spill.
  - Ask them to compare that to the days leading up to the spill or during the same time of year without the spill.
  - If they have data on recreation use levels leading up to the spill, make sure they keep those data and continue collecting the data using the same methods in the days following the spill.
  - Note: resource managers themselves such as parks staff may be the ones documenting this information. It's important to still document the information and store with other electronic records, even if it is a "self" interview.

APPENDIX 5: Detailed Standard Operating Procedures for: Field Documentation Using Photography

Standard Operating Procedure for Collecting Ephemeral Data: FIELD DOCUMENTATION USING PHOTOGRAPHY

June 2023

Guideline Objectives

The primary objective of this document is to provide guidelines on procedures for taking photographs and recording videos for ephemeral data and samples collected in the field during the early stages of an oil spill to support NRDAR exposure and injury evaluations.

Background

Photographs and video are taken in the field to document the pre-oiling and oiling conditions and are key pieces of information that can be introduced as evidence. Each photograph should tell a specific part of the story. Before taking a photograph, you should consider what critical information you are trying to convey. Did the photograph capture the details you need? Are there key images (data) that you have missed? In the first case, you should take a better photograph. In the second case, you should look for photographs that will fill in gaps.

Document the Incident, the Location, and Use

- Photographs are taken to visually communicate what happened at a specific location or sampling site.
- Because photographs can be later viewed by various audiences (e.g., upper-level management, Congressional hearings, courts, the USCG National Pollution Fund Center, public hearings, training talks, outreach events, etc.) try to capture photographs for all types of audiences.
- Take as many photographs as needed. You may not get a second chance.
- The following is a partial list of subjects to always document:
  - The general site conditions and location
  - How the oil spill happened – including oil source
  - Oil on the water surface, stranded on the shoreline, and in direct contact with or over sensitive areas such as shallow pools, in-stream debris, and dry stream beds
  - Oiled wildlife
  - Oil recovery and cleanup operations (Response)
  - NRDAR staff working/sampling
  - Species presence and habitat use
  - Site use by humans (kayaking, canoeing, fishing)
- Time series of photographs are helpful to document exposure or changes in oiling over time. Repeat photographs for a time series by standing in the same spot and direction.

Document the Injury and Cause of the Injury

Directly Observable Injury

- Photographing and video recording direct injury can be very effective. Take photographs and make videos that clearly show conditions that are or may be caused by oil exposure and response actions, including but not limited to:
  - Oil on biota

- Dead or injured animals and plants
- Aberrant animal behavior (best capture with a video recording)
- Impacts of cleanup operations

Cause of Injury

- Photographs and video are good for documenting visible oil exposure and impacts to recreation and human use:
  - When taking photographs of oiled areas, include perspective shots that show the degree of oiling as oiling occurs. Repeat day-to-day, if possible. Do not rely solely on SCAT to record the presence of oil.
  - It is important to document response actions that impact biota (e.g., removing, crushing, re-oiling, hazing) and other resources (e.g., sediment disturbances, etc.).
  - Also document closures of beaches, waterways, access points for fishing or recreation, including but not limited to photographs of official closures (e.g., posted closure signs), congestion effects (e.g., response taking over boat ramps), and popular use areas showing little or no recreational use.

Qualitative and Quantitative Approach

- Using a systematic photographic process to document oiled areas, reference areas, and the transitions between them can be an effective approach for documenting direct exposure.
- Rigorous photo transect and photo quadrat techniques may be appropriate depending on the assessment.
  - Use the sampling designs used for manual transect and quadrat surveys
  - Include oiled and non-oiled sites, or gradients in a continuum from most heavily oiled to non-oiled

Before Going to the Field

- Use field data forms included in the work plan if one is available. Otherwise, use forms in Appendix 5, Attachment A. Coordinate data form development/modification with the data management group.
- Make sure you have assembled a full photography kit appropriate for NRDAR field work (See Appendix 5, Attachment A: Full Gear and Field Gear checklists).
- Make sure all photographic gear is ready and complete before going to the field, including:
  - Fully charged batteries
  - Memory cards (SD cards) (see below)
  - Clean lenses
- It is extremely important than the designated photographer and all personnel taking a camera into the field are knowledgeable of key camera settings. The recommended camera settings are as follows:
  - Resolution – MAX
  - ISO – Auto (avoid higher than 400 unless you are an experienced photographer)

  - Mode – Program (P)
  - Time stamp – off, especially if you are using GPS-Photo Link. Unlike film, there is no need to clutter photographs and use up pixel space with a time stamp. That information is automatically recorded in "EXIF" data—which is part of the image file
  - Time – local time
  - Continuous picture numbering – Set to use a running count for file names even after changing or formatting memory cards
  - Daily folders – Set camera to create a new folder each day
  - Advanced settings (e.g., spot metering, custom white balance, etc.) – reset. It is a good idea to return these advance settings to auto or a general setting before you go into the field
  - Camera reset – Most cameras have a way to return all settings to the factory default values. This is useful if images are poor or you have been experimenting with different camera settings and you cannot determine what setting may be causing the problem

- Make sure there are sufficient memory cards. Prior to going into the field, keep in mind the following recommendations:

  - Use high-quality memory cards with large storage capacity. Get enough capacity for a whole day's photography.
  - Be sure all memory cards are working properly and are compatible with the camera being used.
  - Changing cards in the field risks getting moisture, salt, and dirt on the memory card contacts and inside the camera.
  - Format memory card after downloading photographs, at the end of day. It's better to format than to delete all photographs.
  - At all times protect the electric contacts of memory cards from dirt and mechanical deformation.
  - NEVER take out a memory card when the camera is still writing to it. Turn off the camera before changing memory cards.
  - Use a quality memory card reader.

Learn Basic Camera Functions

- Remember that each digital camera is different. It is critical that all camera users know how to use their assigned camera before going into the field.
- For most field purposes and weather conditions, compact (aka "point-and-shoot") cameras are cheaper, easier to use, more portable, and more resistant to salt, moisture, sand, and other factors. If you are an experienced photographer, can wait for favorable weather conditions, or require photographs for quantitative analyses, single lens reflex (SLR) cameras can provide higher resolution. and better quality photographs. SLR cameras generally perform well under freezing temperatures.
- Under some circumstances, and when taking photographs or video of underwater habitats and resources, small drop cameras (e.g., GoPro) or other underwater cameras may be necessary to document these areas.
- Cameras with 7-10 megapixels are recommended.
- The following are some basic functions that everyone should know. Many cameras require you to be in "P" (program) mode (not "A" [auto]) to use these:

  - **Light metering**: Spot. At this setting the camera meters the exposure at a designated spot in the photo frame. Most cameras show the "spot" as a box or circle in the center of the

viewfinder. Spot metering is helpful when photographing a subject is much darker or lighter than the rest of the frame.
  - **Light metering**: Exposure compensation (+/-) adjustment. This feature tells the camera to make the photograph lighter or darker. It works like the lighter-darker adjustment on most copy machines.
  - **White balance adjustments**: White balance settings help the camera adjust the colors in the photographs based on the type of light (fluorescent, incandescent, sunny, cloudy, etc.). Most of the time Auto White Balance (AWB) works fine, but sometimes the camera does not adjust correctly. Manually choosing the type of light can fix the problem.
  - **Review photographs**: Know how to use the camera display to review a photograph. Know how to zoom in on the photograph in the display screen to check focus, exposure, and other key details.
  - **Forced flash**: In dim light or harsh shadows you may need to force the camera to use the flash to avoid losing details.
  - **Continuous shooting**: Most cameras will shoot consecutive photographs while you hold down the shutter. This is sometimes helpful when trying to capture moving wildlife.

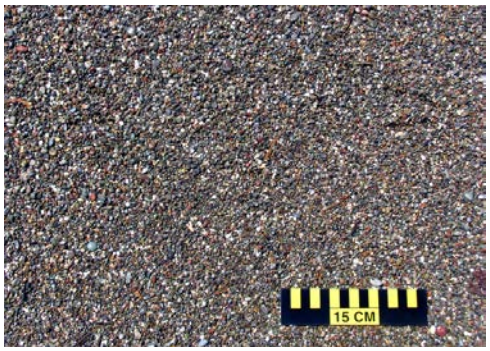
- Some cameras may have GPS capabilities. The use of these cameras reduce location errors when labeling photographs as the location information is attached to the photo data. Basic GPS capability is essential for all field work, including photography. There are several key functions you need to set including (see Appendix 5, Attachment A for detail):
  - Local time zone
  - Datum
  - Track (wrap, interval)
  - WAAS (on), etc.

Note: When the GPS recording is enabled, the camera battery life is shortened considerably.

While in the Field

- At each sampling location or site where photographs are taken, use the GPS to record waypoints. This will help with GPS-photo synchronization and processing.
- It is important to take photographs of a sampling site using labeled photo scales (e.g., 15 cm, 6 inches). The photo scale should be in one of the corners, preferably the lower right (see photograph).
- Scales should have intermediate reflectance, not bright white. A bright scale object can cause the camera to underexpose the rest of the photograph.
- Use spot metering or camera flash to eliminate harsh shadows that can obscure details. Use one of each if you're not sure which is better. Remember that setting the exposure for shadows may wash out and lose detail in bright areas of the photograph.
- Every close-up should be followed by one or more wider-angle shots that will show the close up in the context of the rest of the area. The closer the initial shot the more perspective shots are needed.

- Use the following distances as a guideline:
  - Macro (field of view ≤12”), useful for species identification, fine detail, or injury documentation
  - Close-Up (<1 m), useful for general documentation of oiled biota and resources
  - Mid-Level (1-2 m – at an angle), useful when documenting groups of biota and oiling
  - Distant/landscape (>10 m), useful when documenting habitats and spatial patterns of oiling; it is best to have a person in the photograph for scale (at least two photographs, facing forward and to the side of the observed area)



- Change batteries as soon as they are low so the camera does not lose power just as you are taking a critical photograph.
- Use the review feature to ensure that photographs show what you need.
- Use the zoom in function to see if you captured necessary details.
- Note key photographs and important details in the field notebook.
- Record basic information - locations, times, photographer, team members, including descriptions of GPS locations or waypoints.

Taking Photographs of Quadrats

- You may take high-resolution photographs of sampling quadrats for quantitative analysis.
- Quadrats should not be bright white. Make quadrats out of grey PVC (see photograph) or wrap white quadrats in grey colored duct tape.
- All photographs of quadrats must include a label containing the location name, transect, quadrat number.
- Take high-resolution, directly overhead photographs of each quadrat and record GPS coordinates. When taking photographs:
  - High-resolution photographs must include all four sides of the quadrat as these will be used to digitally count individuals and measure their coverage on a computer screen
  - Photographs need to be relatively flat so that the entire quadrat falls within a similar focal plane, with minimal shadowing from crevices or projections.

Taking Panoramic Photographs

- Panoramas are often unnecessary but if you need a wide, detailed photograph do the following:
  - Keep photo edges parallel
  - Do not change “zoom” factor
  - Overlap photographs by about 30%
  - Place a scale or natural distinctive feature in each overlap area for accurate alignment
  - Lock your elbows against your sides for stability and pan as close to horizontally as you can. Use a tripod or monopod if you have one

Taking Video

- A short video synopsis of a location can be very helpful later for relaying or reviewing the general layout of a location.
- It is important to take video recordings documenting oil mixing into the water column over rapids as these can have impacts on oil fate.
- Take 30-45 seconds to slowly pan through a site while narrating key features.

Taking Photographs While Flying

- Taking photographs from a plane or helicopter can be difficult and requires additional skills. Point and shoot cameras and phones can take good photographs from the air but SLRs typically perform better.
- When taking photographs from a plane or helicopter:
  - Do not wear bright clothing as these may reflect in the windows of the aircraft
  - Use manual focus to set cameras to infinity (∞). This avoids accidentally focusing on the window
  - Using image-stabilized cameras or lenses will help take good quality photographs
  - To prevent transmitting aircraft vibration to the camera, do not rest the camera on an aircraft window frame or other part of the aircraft. Instead, hold the camera with your arms braced against your legs or torso, or the camera held against your face
  - Avoid shooting through a bubble window
  - Smaller aircraft often have sliding windows, or easily removable windows or doors; Make arrangements with your pilot before take-off
  - Avoid taking photographs towards the sun
  - Record on the field notebook the basic flight plan including altitude and track line, aircraft type, pilot and passenger names, port or starboard

Taking Underwater Photographs

- When taking underwater photographs:
  - Ensure that the camera is set on the underwater mode, which is designed to filter some wavelengths
  - If possible, include a scale with each photograph
- Underwater cameras may be the only way to document the extent and degree of oiling (sunken oil mats) and impacts (dead fish that sank to the bottom) below the surface. A GoPro camera with waterproof housing can be deployed by wading in shallow, quiet water.

Upon Returning from the Field

Legally Defensible Photographs

- Creating a legally defensible photograph record requires:

- Maintaining a complete photograph record. DO NOT delete photographs from the camera or from your computer before the official archive is created
- Keep one set of photographs that are never opened. In practice this means transferring one copy of the photographs from the camera memory card to a computer and then to a DVD-R or CD-R (non-editable) without ever opening them. The resulting continuous set of photograph files that have not been opened will demonstrate that that you have a full, un-edited, photograph record for the court

- When you return from the field, download all photographs to a computer. Before reviewing photographs on the computer (review = open):
  - Create a copy in the "*Working*" directory and one copy in the "*Archive*" directory
  - The "*Working*" directory is used to process photographs through GPS-linking software and to log all photographs. DO NOT rename files in the "*Working*" directory
  - The *"Archive*" directory MUST include unopened, un-editable copy of all photographs. Burn the "*Archive*" directory to DVD-R. Do this when you have enough to fill a CD/DVD or at some set interval (every 2-3 days), and make a copy of the CD/DVD
  - NEVER open the files stored in the "*Archive*" directory
  - Additional backup copies can be made to portable hard drives

Locate Photographs – GPS Linking

- Field photographers should always collect a GPS track while in the field.
- Be sure to take a clear photograph of the operating GPS screen showing the date and time to synchronize the photographs with the GPS track (see photograph). The ideal GPS photograph should clearly show the GPS clock in Hours, Minutes, and Seconds.
- With the synch photo and a track file, all photographs can be linked to a specific Lat/Long/Time using special software. However, a different team would likely be responsible for processing GPS-camera information. They will the synch photo and downloaded track file (using the software that came with the GPS) to GPS-link these photographs.

Appendix 5 Attachment A

1. Supporting Documentation – Photography Checklist and Forms

Photography forms may be provided by the NRDAR lead; otherwise, use the attached form.

- Print the form on weather-resistant paper (if available). Make more than enough copies of the form before going into the field.
- Fill out forms with waterproof pen or permanent marker. Do not use pencil or biro (erasable) ink.
- Fill in blanks with "N/A" if data are not applicable or not available. Avoid leaving blank values on data forms.
- Do not erase or black out erroneous entries on the field data forms. Errors should be corrected by crossing out the entry with a single line and signing and dating the strike-through.

2. Photography Gear Checklist

Photography - Complete Gear List; *F* Indicates Field Gear

☐	Camera ***F***	With neck strap
☐	Camera case ***F***	Sized to hold all camera gear; plus polypropylene freezer bag, if appropriate
☐	Memory cards ***F***	1-2 extra depending on size – (e.g., 200-300 high resolution photographs, each)
☐	Rechargeable batteries ***F***	Camera batteries: 2 is OK, 3 is better. AA's two sets of rechargeable are OK – extra alkaline or lithium for GPS etc.
☐	Battery charger	Appropriate for each type of rechargeable batteries
☐	Lens cleaning kit ***F***	(e.g., soft cloth)
☐	Card reader	One that accepts many types of cards is preferred
☐	Cable – Camera to PC	
☐	Camera manual	Paper and pdf
☐	Underwater housing/kit ***F***	Optional - useful in rough weather and small boat ops.
☐	Photo scale ***F***	15 cm waterproof, 15 cm disposable. Avoid white or light colors.
☐	Image viewing software	All PC's and many cameras have software for reviewing photographs
☐	Image editing software	Optional. Good for processing photographs for presentations etc.
☐	External hard drives	
☐	PhotoLogger database	
☐	GPS-Photo Link software	
☐	DVD-Rs – NOT RWs	
☐	Waterproof bag ***F***	Dry sack or heavy duty zip-lock bags
☐	Polarizing lens ***F***	Optional – reduces glare and reflections
☐	GPS ***F***	
☐	Field notebook ***F***	

3. Photo Log

PHOTO LOG Page ___A of ___

Incident/Case:_____ Field Team Name and #:_____

Date (MMDDYY):_____

This form must be filled out for photos taken in the field.

Field Team Lead/ Photographer Name: Phone # *(Indicate if a personal number)*:	Camera Make/Model/ID: Time zone:
Agency/Affiliation:	GPS Make/Model/ID: Time zone:

Photos must include: GPS unit (displaying time and date), up coast, down coast, landward, seaward, tissue sample (with photo scale ruler), sample label(s) and misc. sampling photos

WP # [1]	Photo # *from camera*	Description/Notes/Comments *Include Location/Site name and Keywords*	*Sample ID [2] (if collected)*

[1] *GPS Waypoint;* [2] *Sample ID: Field Team Name (2 letters); Field Team # (1 number); Date (MMDDYY); Sample Type (2 letters); Sample # (sequential numbering begin with 01)*

Team Member Initials:_____ Date:_____

PHOTO LOG

Page ___B of ___

Incident/Case:_____ Field Team Name and #:_____

Date (MMDDYY):_____

Suggested Keywords – These are suggested keywords to describe your photos. Keywords are used when importing the photos, where they will be queried by field staff, management, or outreach staff. Please select keywords that are general enough to represent the photos. Specific details should be entered into the Description/Notes/Comments section above.

Response/NRDA Related	Response/NRDA Related	Habitats	Habitats	Organisms	Conditions
Barge	Oil-Stain/Coat	Agricultural land	Marine Water	Amphibian	Cold/ Cool
Barrel	Outreach	Barren land	Marine Protected Area	Birds	Drought
Boat	Overflight	Beach-Sandy	Marsh	Coral	Dry
Boom	Pipeline	Beach-Gravel	Riverine	Crab	Fire
Cleanup Operations	Pits/Trenches	Cave	Riparian	Dead Wildlife	Flood
Dispersant	Produced water	Chaparral	Rip-Rap	Fish	High elevation
Dredging	Railroad	Desert land	Rocky Shoreline	Insect	High tide
Drilling Platforms	Quadrat	Desert shrub	Sediment/Soil	Invertebrate -Aquatic	Hot
Ephemeral data	Response Vessel	Dry creek	Stream	Invertebrate -Terrestrial	Ice
GPS Unit	Sample Container	Dune	Streambed	Mammal-Marine	Leak
Grounding	Sampling	Ephemeral Wetland	Subtidal	Mammal-Terrestrial	Low tide
Human Uses	SCAT	Estuary	Tree dominated	Native/ Non-native	Rain/wet
In-Situ Burn	Skimmer	Forest	Vernal pool	Reptile	Snow
Marine Debris	Source Oil	Grassland	Wetland	Shellfish	Storm
NRDA	Sunken Vessel	Herbaceous		Threatened/ Endangered	Wind
Oil	Tank	High Sierra		Tree	
Oil-Emulsified	Tanker Ship	Intertidal		Vegetation-Aquatic	
Oil-Sheen	Transect	Kelp Bed		Vegetation-Riparian	
Oil-Surface Residue	Waste Site	Lake			

Photos & GPS Data Relinquished By	Photos & GPS Data Received By
Name Signature:	Name Signature:
Name Printed:	Name Printed:
Agency/Affiliation Name Printed:	Agency/Affiliation Name Printed:
Date/Time:	Date/Time:

I, _____ ***[Data Intake Manager print name]***, without modification, downloaded the photographs referenced on this form in accordance with the NOAA OR&R Data Intake Protocols and uploaded without modification to DIVER in the File Collection ID number _____ with the following Photo Zip file named _____ and GPS File named _____.

_____ _____

Signature *Date/Time*

Team Member Initials:_____ Date:_____

APPENDIX 6: Detailed Standard Operating Procedures for: Chain of Custody and Sample Collection Summary Form

Standard Operating Procedure for Collecting Ephemeral Data: CHAIN OF CUSTODY

June 2023

Guideline Objectives

The primary objective of this document is to provide guidelines on chain of custody procedures for ephemeral data and samples collected in the field during the early stages of an oil spill to support NRDAR exposure and injury evaluations.

Background

Chain of custody procedures are followed to authenticate a sample from the time it is taken until the results are introduced as evidence. For the purposes of litigation, agencies must be able to prove the legal integrity of all samples and data introduced as evidence. This means that it is necessary to have an accurate written record to track possession, handling, and location of samples and data from collection through reporting. Chain of custody facilitates this verification process. Failure to follow chain of custody procedures in this guideline does not necessarily render data unusable; however, any deviations from the chain of custody guidelines should be noted. Assuring that proper chain of custody guidelines is followed is vital to assuring the integrity of the samples, and the data generated by the analysis of those samples.

Responsibilities

All samplers handling samples collected for NRDAR MUST follow this procedure when collecting, handling, and securing samples. All team leads and supervisors are responsible for ensuring that the designated custodian(s) understand this procedure and strictly adhere to it for all sampling events.

Important Definition

- **Chain of Custody Form**: A document detailing who is legally responsible for samples at any point in time from collection until the sample is received by the laboratory.
- **Custody**: A sample is in your custody when
  - It is in your actual physical control and presence
  - It is in your view after being in your possession
  - It is not in your physical presence, but is in secure a place of storage to which only you have access
  - It is not in your view or physical presence, but is secured in a place of storage or secure area to which only you and identified others have access
- **Secure Area**: An area in which entry is restricted by keyed lock or similar to a designated custodian

Equipment for Chain of Custody

- Sample labels
- Tamper resistant evidence tape (for small sample jars and large shipping containers)
- Permanent markers
- Chain of custody and field data forms
- Secure storage area

Sample Collection – Chain of Custody

Note: As few people as practical should handle the sample from when it is collected through laboratory analysis.

- Sample custody begins immediately after a sample is collected. The sampler who collected the sample is responsible for the preservation and integrity of the sample(s) until that responsibility is transferred to someone else and documented with the chain of custody form. This chain of custody form then travels with the sample(s) and is used to document any other transfers of custody.
- When a sample is taken, the sampler must:
  - Complete a sample tag or label that identifies each sample. Use waterproof ink and attach the label to the sample jar or container at the time the sample is collected. Labels should contain that following legible information:
    - Sample number
    - Sample type (e.g., sediment, soil, water)
    - Sample containing hazardous goods (such as formalin used as a preservative) (if applicable)
    - Time/date of collection
    - Location
    - Sampler name(s)
  - Seal each sample jar or container with tamper resistant evidence tape. When sealing jars, the tape should connect the jar to the lid. The sample collector should sign and date evidence tape so that the signature is partially on the tape of both the lid and the jar
  - If the sample is collected in a container that is not tamper proof (such as a plastic bag) then the container should be sealed with tamper resistant tape, a serial numbered zip-tie, or other means of verifying that the container has not been opened. The sample should also be stored in a container that is appropriate for chain of custody, such as a box or cooler that can be sealed with tamper resistant tape and signed by the collector
  - If tamper resistant evidence tape is not available, use masking or duct tape and sign across the end of the tape
  - Enter each sample on the chain of custody form
  - Document the sample in the field data sheet, noting details about the sample that may be pertinent later during sample analysis and injury determination
- The sample collector is responsible for care and custody of the samples until they are turned over to an assigned custodian or properly dispatched to the receiving laboratory. All custodians must assure that each sample remains in his/her custody (as defined above) so that no one can tamper with it during the entire duration of their responsibility.
- When samples are turned over to a new custodian:
  - The current custodian must officially relinquish the samples by signing the chain of custody form
  - The new custodian must review the samples, ensuring that they are in good condition and that the sample IDs matches the chain of custody form. Any damage or deviation must be noted on the chain of custody form before the new custodian accepts the samples by signing the form
  - The former custodian must retain a copy of the full set of forms. The original chain of custody forms always stay with the samples

- Pack and seal samples in suitable containers to avoid damage. A sample seal should be attached across the lid of each shipping container in such a manner that the container cannot be opened without breaking the seal. This lock and/or seal are not to be removed until the shipping container is opened by the laboratory custodian or designee.
- Ship samples by registered courier. Other certified shipping services may also be used. Keep all shipping receipts as part of the permanent chain of custody documentation regardless of how samples are shipped. The shipper does not need to sign the chain of custody form.
- Couriers picking up samples at the airport, post office etc. should sign the shipping documents to acknowledge receipt of the samples.

Photographs

- Digital photographs can be used as evidence. Like with physical samples, the objective is to be able to ensure that the photographs are an accurate representation of what was seen in the field (see Field Photography guideline).
- It is important to protect the legal integrity of digital photographs stored on digital memory cards (SD cards), as well as the legal integrity of the SD card itself.
- Digital photographs taken in the field and information stored on a digital memory card or camera internal memory MUST NOT be deleted, no matter the quality or other issues that may arise.
- All digital photographs files MUST be stored sequentially on the SD card and not renamed.
- Photographs should be downloaded to a secured PC and copied to an un-editable format (e.g., CD/DVD).
- Always keep a back-up copy of all photographs.
- See the Field Photography guideline for more details.

Other Important Considerations

- **Custodian list**: Maintain a list of people who are custodians on samples that includes how each person is related to the assessment.
- **Multiple custodians**: If multiple qualified custodians have access to a secure sample storage area then it is not necessary to document change of custody between custodians. All custodians should be identified on the custodian list.
- **Chain on multiple sheets**: Starting chain of custody documentation on one form and continuing it on a second form for the same samples is not a break in the chain. Care must be taken to keep the forms together.
- **Broken chain**: If the chain is broken for any reason or if you foresee deviations from the procedures in this guideline, contact the legal team for guidance. Changes to the procedures can be made but should be informed by a lawyer. Do not discard ANY samples even if the chain of custody has been broken.
- **Samples on the same sheet are split**: If samples that were recorded on a single chain of custody form are split for shipping, clearly mark the original chain of custody form to show which samples were removed, and when and where they are going. Create a new chain of custody form for the samples that are shipped and include a copy of the original chain of custody form. Keep the original form and a copy of the new form with the samples that are not shipped.

CA OSPR CoC Form

The information below describes how to fill out a Chain of Custody (COC) form with specific information applicable to NRDAR sampling during marine oil spills using the standard FG 1000 (Rev. 9/01) COC form.

The boxes across the top of the form are needed to identify the sampler, how the samples are being transported, the person who should receive the results, and the general information about the spill.

- Sampler and Ph #, address, city, zip: Print the name, affiliation, and contact information (phone and address) of the sampler.
- Date Required/Reason: Need not be completed unless desired by a specific date. ASAP indicates to the lab that the case is to be analyzed, but not rushed or held.
- Shipped Via: Usually completed by stating “Delivered in person” or “Hand carried”. However, if transported by a third party carrier (e.g., UPS), indicate the name of the transporter in that space.
- Send Results to, Address, City, Zip: The name and contact information of the person to be sent the lab results, often the NRDAR case lead (e.g., Michael Anderson, Resource Restoration Program Manager).
- Copies to, Address, City, Zip: The name and contact information of additional people, if any, to receive
- copies of the lab results, such as sampler.
- Lab Number: Leave blank. This is for lab use only.
- Field Number: Leave blank. This is for lab use only.
- Lab Storage: Leave blank. This is for lab use only.
- Spill Title: Name of Spill (e.g., Alameda drill).
- Suspect: Suspect source (e.g., T/V Moon).
- Index-PCA: Spill-specific billing code for use by OSPR and/or CDFW laboratories.

The next level of boxes is more applicable to sampling done by CDFW during enforcement actions - Fish & Wildlife (date and region); Fish & Game Code Violation; Suspected or Potential Problem; and Routine Analysis. None of these fields must be completed during NRDAR field sampling. In addition, the boxes for water quality measurements (temperature, pH, and conductivity), would be left blank unless measured.

The main portion of the COC in the middle is needed to identify the sample information and the specific analyses that should be run by the laboratory.

- Sample Identification: The general sample labeling scheme is: [FieldTeamName # Date SampleType Sample#]. For example, the sample collected by the Rocky Intertidal (RI) team 1 (1) on February 26, 2011 (022611) that was the second (02) mussel (MU) sample taken that day would be RI1022611MU02.
- Collection: Date and Time: Record the date and time (military) when the sample was collected (e.g., 2/26/11, 1310).
- Analysis Requested: Put an “X” in the box for the appropriate analysis. Write in analysis if not already included on the COC (e.g., PAH, BTEX, TPH, TOC, grain size, % lipid, % moisture).
- Sample Type: Place an “X” in the box under the sample type (e.g., water, filtered water, soil (or sediment), or tissue. If the sample type is not listed, cross through one option and write in the appropriate type.
- Number of Containers: write in the number of containers (e.g., 1), below the type of container used for a given sample (e.g., Plastic, Glass, VOA Vial, Foil, other). If more than one, describe in the Sample Identification and/or Comment/Special Instruction boxes how the lab should handle these samples.

- Preservation: In the blank column, identify the type of preservation used. Typically, this would be a cooler with cube ice; if so, write in “Wet Ice,” and place an “X” in the box below.

Note: See the attached three examples of completed COCs for details on appropriate labeling for sediment, water, sheen, tarball, and tissue.

See below for recommendations on how to distinguish the following situations:

- Field Duplicates - use a different sample ID, but same location and analysis
- Multiple chemical analyses of a sample stored in one container - use the same sample ID (e.g., WC3041411TB01) and put an “X” for each analysis needed
- Multiple chemical analyses of a sample stored in multiple containers (same location/same time) - use the same sample ID for each, specify the number of containers on the label (e.g., 1 of 4). Put an X for each analysis needed and write in the number of containers below the type of container used for a given sample
- Backup samples - use different sample ID and note “hold unless needed” in the comments/special instructions (e.g., WC3041411WT04).

Next, in the bottom right, leave blank the boxes for Pollution Action Kit, Glove Size, and Hazmat Shipper Requested.

In the bottom right, include:

- Problem Description: write in the type of incident, such as “Oil Spill.”
- Suspect/Incident Location: write in the appropriate suspect source and incident location (e.g., T/V Moon/Anchorage 9).
- Comments/Special Instructions: Examples might include: “Mussel Samples – Hold Until Further Notice; or “Homogenize sediment samples in the laboratory prior to analysis”.

The bottom of the COC is completed by both parties when the samples are transferred, the person relinquishing and the person receiving the samples. The original COC stays with the samples and the person relinquishing the samples keeps a copy.

- Samples Relinquished By (Signature): Signature of sampler releasing the sample.
- Print Name: Sampler to print name.
- Date: Date relinquished.
- Samples Received By (Signature): Signature of person receiving the sample.
- Print Name: Printed name of person receiving the sample.

Date: Date relinquished

DFG REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY RECORD

Page____ of _____

Sampler	Ph #	Send Results To	Lab Number
Dennis Ryan, CDFW-OSPR	*(916) 323-6288*	*Michael Anderson, CDFW-OSPR*	
Address		**Address**	**Field Number**
1700 K Street		*1700 K Street, Suite 250*	
City	**Zip**	**City** / **Zip**	**Lab Storage**
Sacramento	*CA 95811*	*Sacramento* *CA* *95811*	
		Copies To *N/A*	**Spill Title** *T/V Moon*
Date Required/Reason		**Address** *N/A*	**Suspect** *T/V Moon*
Shipped Via *Hand Delivered*		**City** *N/A* / **Zip**	**Index-PCA** *e.g., 6121-54303*

o Fish & Wildlife Loss Date:_____ Region:_____

o DFG Code Violation:_____

o Suspected or Potential Problem

o Routine Analysis

Water Temp: F or C pH: DO: mg/L Conductivity: *u* mhos/cm

Sample Identification/Location (Draw map on separate sheet if necessary)	Collection Date	Collection Time	Analysis Requested >>> Petroleum Fingerprint	Trace Elements (Specify Below)	Pesticides (Specify Below)	PAH (include alkylated PAHs)	BTEX					Sample Type: Water	Filtered Water Sheen	Soil Tarball	Tissue	Number of Containers: Plastic	Glass	VOA Vial		Preservation: Temp	Acid	Wet Ice
WC3041411TB01 [tarball]	*4/14/11*	*1130*	*X*			*X*								*X*			*1*					*X*
WC3041411SH01 [sheen]	*4/14/11*	*1321*	*X*										*X*				*1*					*X*
WC3041411WT01 [water]	*4/14/11*	*1340*				*X*						*X*					*1*					*X*
WC3041411SH02 [sheen]	*4/14/11*	*1510*	*X*										*X*				*1*					*X*
WC3041411WT02 [VOA]	*4/14/11*	*1523*					*X*					*X*						*2*				*X*
WC3041411WT03 [trip/field blank]	*4/14/11*	*1534*				*X*						*X*					*1*					*X*

Problem Description *T/V Moon Oil Spill NRDA*

Suspect/Incident Location *T/V Moon at Anchorage 9, San Francisco Bay*

Comments/Special Instructions *Water Samples - Extract: Hold Extracts Until Further Notice*

Hold WC3041411WT02 unless needed as backup

Pollution Action Kit: Yeso Noo

Glove Size: Large o Medium o

Hazmat Shipper Requested: Yeso Noo

Samples Relinquished By (Signature)	Print Name	Date	Received By (Signature)	Print Name	Date
Dennis Ryan	Dennis Ryan	*4/14/2011*	[person receiving samples]	[person receiving samples]	*4/14/2011*

LAB COPIES: WHITE, CANARY, PINK SUBMITTER: GOLDENROD FG 1000 (Rev. 9/01)

Pesticide Investigations Lab
1701 Nimbus Road
Rancho Cordova, CA 95670

Petroleum Chemistry Lab
1995 Nimbus Road
Rancho Cordova, CA 95670

Water Pollution Control Lab
2005 Nimbus Road
Rancho Cordova, CA 95670

DFG REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY RECORD

Page_____ of _____

Sampler	Ph #	Send Results To	Lab Number
Dennis Ryan, CDFW-OSPR	*(916) 323-6288*	*Michael Anderson, CDFW-OSPR*	[leave blank]
Address		**Address**	Field Number
1700 K Street, Suite 250		*1700 K Street, Suite 250*	[leave blank]
		City *Sacramento* **CA** **Zip** *95811*	Lab Storage [leave blank]
City *Sacramento*	**Zip** CA *95811*	**Copies To** *N/A*	**Spill Title** *T/V Moon*
Date Required/Reason *[Not required unless needed by certain date]*		**Address** *N/A*	**Suspect** *T/V Moon*
Shipped Via *Hand Delivered*		**City** *N/A* **Zip**	**Index-PCA** *e.g., 6121-54303*

o Fish & Wildlife Loss Date:_____ Region:_____

o DFG Code Violation:_____

o Suspected or Potential Problem

o Routine Analysis [leave whole box blank]

Water Temp: F or C pH: DO: mg/L Conductivity: u mhos/cm

Sample Identification/Location (Draw map on separate sheet if necessary)	Collection Date	Collection Time	Petroleum Fingerprint	Trace Elements (Specify Below)	Pesticides (Specify Below)	PAH (include alkylated PAHs)	Grain Size (hydrometer with sieve method)	TOC	Sample Type: Water	Sample Type: Filtered Water	Sample Type: Soil-sediment	Sample Type: Tissue	Number of Containers: Plastic	Number of Containers: Glass	Number of Containers: VOA Vial	Preservation: Temp	Preservation: Acid	Preservation: Wet Ice
SB041411SD01 [sediment composite, 250 mL, field homogenized]	*4/14/11*	*1305*				*X*					*X*			*1*				*X*
SB041411SD02 [sediment composite, 1 L, lab homogenized]	*4/14/11*	*1430*				*X*	*X*	*X*			*X*			*1*				*X*
SB041411SD03 [sediment composite, quart-sized bag, field homogenized]	*4/14/11*	*1305*					*X*	*X*			*1*		*1*					*X*
SB041411SD04 [sediment, 250 mL]	*4/14/11*	*1500*				*X*					*X*			*1*				*X*

Problem Description T/V Moon Oil Spill NRDA

Suspect/Incident Location T/V Moon at Anchorage 9, San Francisco Bay

Comments/Special Instructions *Sediment Samples - Hold Until Further Notice*

SB041411SD02: Homogenize sample in jar before analysis

Pollution Action Kit: Yes o No o

Glove Size: Large o Medium o

Hazmat Shipper Requested: Yes o No o

[leave whole box blank]

Samples Relinquished By (Signature)	Print Name	Date	Received By (Signature)	Print Name	Date
Dennis Ryan	Dennis Ryan	*4/14/2011*	[person receiving samples]	[person receiving samples]	*4/14/2011*

LAB COPIES: WHITE, CANARY, PINK SUBMITTER: GOLDENROD FG 1000 (Rev. 9/01)

Pesticide Investigations Lab
1701 Nimbus Road
Rancho Cordova, CA 95670

Petroleum Chemistry Lab
1955 Nimbus Road
Rancho Cordova, CA 95670

Water Pollution Control Lab
2005 Nimbus Road
Rancho Cordova, CA 95670

DFG REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY RECORD

Page_____ of _____

Sampler	Ph #	Send Results To		Lab Number *Lab use only*
Dennis Ryan, CDFW-OSPR	*(916) 323-6288*	*Michael Anderson, CDFW-OSPR*		
Address		**Address**		Field Number *Lab use only*
1700 K Street		*1700 K Street*		
		City	**Zip**	Lab Storage *Lab use only*
City	**Zip**	*Sacramento*	*CA* *95811*	
Sacramento	*95811*	**Copies To** *Not Required, but allowed if requested.*		**Spill Title**
	CA			*T/V Moon*
Date Required/Reason		**Address** *See above*		**Suspect**
Not required unless needed by certain date				*T/V Moon*
Shipped Via		**City** *See above*	**Zip** *See above*	**Index-PCA**
Hand Delivered				*e.g., 6121-54303*

o Fish & Wildlife Loss Date:_____ Region:_ _____

o DFG Code Violation:_____

o Suspected or Potential Problem

o Routine Analysis

Water Temp: F or C pH: DO: mg/L Conductivity: u mhos/cm

Sample Identification/Location (Draw map on separate sheet if necessary)	Collection Date	Collection Time	Petroleum Fingerprint	Trace Elements (Specify Below)	Pesticides (Specify Below)	PAH [include alkylated PAHs]	% Lipid					Sample Type: Water	Sample Type: Filtered Water	Sample Type: Soil	Sample Type: Tissue	Number of Containers: Plastic	Number of Containers: Glass	Number of Containers: VOA Vial	Number of Containers: Foil	Preservation: Temp	Preservation: Acid	Preservation: Wet Ice
RI1041411MU01 [mussel, laboratory composite]	*4/14/11*	*1310*				*X*	*X*								*X*				*1*			*X*
RI1041411MU02 [mussel, laboratory composite]	*4/14/11*	*1430*				*X*	*X*								*X*				*1*			*X*
RI1041411MU03 [mussel, laboratory composite]	*4/14/11*	*1505*				*X*	*X*								*X*				*1*			*X*

Problem Description *T/V Moon Oil Spill NRDA*

Suspect/Incident Location *T/V Moon at Anchorage 9, San Francisco Bay*

Comments/Special Instructions *M ussel Samples - Hold Until Further Notice; homogenize prior to analysis*

Pollution Action Kit: Yeso Noo

Glove Size: Large o Medium o

Hazmat Shipper Requested: Yeso Noo

Samples Relinquished By (Signature)	Print Name	Date	Received By (Signature)	Print Name	Date
Dennis Ryan	Dennis Ryan	*4/14/2011*	[person receiving samples]	[person receiving samples]	

LAB COPIES: WHITE, CANARY, PINK SUBMITTER: GOLDENROD FG 1000 (Rev. 9/01)

Pesticide Investigations Lab
1701 Nimbus Road
Rancho Cordova, CA 95670

Petroleum Chemistry Lab
1995 Nimbus Road
Rancho Cordova, CA 95670

Water Pollution Control Lab
2005 Nimbus Road
Rancho Cordova, CA 95670

CDFW REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY RECORD

Page_____ of _____

Sampler Ph #	Send Results To	Lab Number
Address	Address	Field Number
City Zip CA	City Zip CA	Lab Storage
	Copies To	Spill Title
Date Required/Reason	Address	Suspect
Shipped Via	City Zip	Index-PCA

☐ Fish & Wildlife Loss Date:_____ Region:_____

☐ DFG Code Violation _____

☐ Suspected or Potential Problem

☐ Routine Analysis

Analysis Requested >>>

Water Temp: F or C pH: DO: mg/L Conductivity: u mhos/cm

Sample Identification/Location (Draw map on separate sheet if necessary)	Collection Date	Collection Time	Petroleum Fingerprint	Trace Elements (Specify Below)	Pesticides (Specify Below)	PAH (include alkylated PAHs)	Grain Size (hydrometer with sieve method)	TOC	% Lipid			Sample Type: Water	Sample Type: Filtered Water	Sample Type: Soil / Sediment	Sample Type: Tissue	Number of Containers: Plastic	Number of Containers: Glass	Number of Containers: VOA Vial	Number of Containers: Alum. Foil	Preservation: Temp	Preservation: Acid	Preservation: Wet Ice

Problem Description

Suspect/Incident Location

Comments/Special Instructions

Pollution Action Kit: Yes☐ No☐

Glove Size: Large ☐ Medium ☐

Hazmat Shipper Requested: Yes☐ No☐

Samples Relinquished By (Signature)	Print Name	Date	Received By (Signature)	Print Name	Date

LAB COPIES: WHITE, CANARY, PINK **SUBMITTER: GOLDENROD** FG 1000 (Rev. 9/01)

Pesticide Investigations Lab
1701 Nimbus Road
Rancho Cordova, CA 95670

Petroleum Chemistry Lab
1995 Nimbus Road
Rancho Cordova, CA 95670

Water Pollution Control Lab
2005 Nimbus Road
Rancho Cordova, CA 95670

APPENDIX 7: Example Coordination Agreements

KEYDET ENERGY CORPORATION
123 Petroleum Road
Los Angeles, CA

April 22, 2004

Charles McKinley
Field Solicitor
Office of the Solicitor
U.S. Dept. of Interior
1111 Jackson St., Ste. 735
Oakland, CA 94607

LCDR Reismer, JACG, USN Assistant
Office of the Staff of Judge Advocate
Commander Navy Region Southwest
937 North Harbor Drive
San Diego, CA 92131-0058

Wendy Johnson
Office of Spill Prevention and Response
California Dept. of Fish and Game
1700 K St., Ste 250
Sacramento, CA 95814

Katherine Pease
Office of General Counsel
NOAA
501 W. Ocean Blvd., Ste. 4470
Long Beach, CA 90802

Re: Funding Commitment for Joint Pre-assessment/Assessment Activities

This is to confirm that Keydet Energy Corporation (Keydet) wishes to participate with the Natural Resource trustees (trustees) who are in receipt of this letter in their pre-assessment and assessment of injuries to natural resources related to the oil spill which occurred on or about April 20, 2004 in the waters approximately 10 miles northwest of San Diego, California. In consideration of the trustees' agreement to allow Keydet to participate cooperatively in these activities, Keydet hereby agrees to pay the reasonable costs previously incurred or to be incurred by the Department of the Interior (including the U.S. Fish and Wildlife Service, Bureau of Land Management, National Park Service, Office of Environmental Policy and Compliance, and Office of the Solicitor), the State of California (including the Department of Fish and Wildlife and Office of Oil Spill Prevention and Response), the Department of Commerce (including the National Oceanic and Atmospheric Administration), and the Department of Defense (including the U.S. Navy), or their designees, (collectively known as the "agencies"), for such activities.

So as to avoid any potential for violation of the Anti-Deficiency Act, Keydet agrees to provide within fifteen (15) days an initial payment of $100,000 to the Department of the Interior for its costs, via electronic funds transfer, pursuant to instructions to be provided by the Department of the Interior. Additionally, Keydet agrees to provide within fifteen (15) days an initial payment of $400,000 to the Department of Defense for its costs via electronic funds transfer, pursuant to instructions to be provided by the Department of Defense. Expenses incurred by the Department of Commerce will be reimbursed within 15 days of receipt of invoices. All requests for reimbursement for these activities should

be provided, along with supporting documentation, to Jay Jones, Keydet Energy, at the above address.

The trustees and Keydet expect to negotiate and enter into a Cooperative Agreement for further specific cooperative assessment activities.

The costs of the cooperative assessment covered under this Agreement will be limited to the reasonable costs to implement the activities outlined in the attached "Exhibit A". The commitment contained in this letter will also cover all other costs incurred by the Agencies until five (5) days after Keydet provides the Agencies with written notice terminating the Funding Commitment, provided that Keydet's liability for such costs under this commitment shall not exceed $1,000,000 without prior written agreement between Keydet and the Agencies.

Jay Jones
Incident Commander
Keydet Energy
Corporation

West Coast Joint Assessment Team (WCJAT). 2017. Recommendations for Conducting Cooperative Natural Resource Damage Assessment. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=200743&inline

APPENDIX 8: Resource-Specific Work Plan Examples

CDFW-OSPR Ephemeral Data Collection Plans

Marine – https://wildlife.ca.gov/OSPR/NRDA/Marine-EDCPs

Inland – https://wildlife.ca.gov/OSPR/NRDA/Inland-EDCPs

Conceptual Model

- Ricker, R. 2014. Guidance for Developing Conceptual Models for Oil Spills. (PDF)

Amphibians

Arroyo Toad

- Survey Protocol for The Arroyo Toad. https://rctlma.org/Portals/3/EPD/consultant/arroyo_toad_survey_protocol.pdf

California Red-legged Frog

- USFWS. 2005. Revised Guidance on Site Assessment and Field Surveys for the California Red-legged Frog. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83914&inline

California Tiger Salamander

- USFWS. 2003. Interim Guidance on Site Assessment and field surveys for determining presence or a negative finding of the CA tiger Salamander. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83915&inline

Foothill Yellow-legged Frog

- PGE. 2002. Standardized approach for habitat assessment and visual encounter surveys for the foothill yellow legged frog. https://relicensing.pcwa.net/documents/Library/PCWA-L-270.pdf

Aquatic Bioassessment

- California Rapid Assessment Method (CRAM) Resource and Document Website https://www.cramwetlands.org/documents#field+books+and+sops
- California Water Quality Monitoring Council. 2013. California Rapid Assessment Method for Wetlands. **Bar-Built Estuarine Wetlands** Field Book ver. 6.1. https://www.cramwetlands.org/sites/default/files/May2013_CRAM%20Field%20Book%20BBE_v61.pdf
- California Water Quality Monitoring Council. 2013. California Rapid Assessment Method for Wetlands. **Depressional Wetlands** Field Book ver. 6.1. https://www.cramwetlands.org/sites/default/files/2013.03.19_CRAM_Fieldbook_Depressional_final_0.pdf
- California Water Quality Monitoring Council. 2020. California Rapid Assessment Method. **Episodic Riverine** Field Book ver. 6.2. https://www.cramwetlands.org/sites/default/files/Episodic%20Riverine%20CRAM%20Field%20Book_v6.2.pdf
- California Water Quality Monitoring Council. 2013. California Rapid Assessment Method for Wetlands. **Perennial Estuarine Wetlands** Field Book ver. 6.1. https://www.cramwetlands.org/sites/default/files/2013.03.19_CRAM%20Field%20Book%20Estuarine%206.1_0.pdf
- California Water Quality Monitoring Council. 2013. California Rapid Assessment Method for Wetlands. **Riverine Wetlands** Field Book ver. 6.1.

https://www.cramwetlands.org/sites/default/files/2013.03.19_CRAM%20Field%20Book%20Riverine%206.1_0.pdf

- California Water Quality Monitoring Council. 2017. California Rapid Assessment Method for Wetlands. **Slope Wetlands** Field Book ver. 6.2. https://www.cramwetlands.org/sites/default/files/CRAM%20Slope%20Wetland%20Field%20Book%20v6.2_2018-09-05.pdf
- California Water Quality Monitoring Council. 2020. California Rapid Assessment Method. **Individual Vernal Pools** Field Book ver. 6.2. https://www.cramwetlands.org/sites/default/files/Individual%20Vernal%20Pools%20CRAM%206.2%20Field%20Book%202020.3.31.pdf
- California Water Boards. 2016. Standard Operating Procedures (SOP) for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, algae, and physical habitat. https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/docs/01-combined-sop-final-v4-11mar2016.pdf
- California Water Boards. 2016. Supplemental Guidance for the SWAMP Bioassessment Field Protocol. https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/docs/02-guidance-document-v311mar2016-update.pdf

Birds

Document links below are from - CDFW Resource and Document Website: https://wildlife.ca.gov/Conservation/Survey-Protocols

Bald Eagle

- USFWS. 2004. Protocol for Evaluating Bald Eagle Habitat And Populations In California. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83707&inline
- CDFW. 2017. Bald Eagle Breeding Survey Instructions. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83706&inline

Burrowing Owl

- Burrowing Owl Survey Protocol and Mitigation Guidelines. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83842&inline

Coastal CA Gnatcatcher

- Coastal California Gnatcatcher (Polioptila californica californica) Presence/Absence Survey Protocol. https://www.fws.gov/sites/default/files/documents/survey-protocol-for-coastal-california-gnatcatcher.pdf

Golden Eagle

- Driscoll, D.E. 2010. Protocol for golden eagle occupancy, reproduction, and prey population assessment. American Eagle Research Institute. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83955&inline
- USFWS. 2010. Interim Golden Eagle Inventory and Monitoring Protocols (PDF).

Great Grey Owl

- USDA. 2000. Survey Protocol for The Great Gray Owl In The Sierra Nevada Of California. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83965&inline

Land Birds

- USDA - Handbook of Field Methods for Monitoring Landbirds https://www.fs.usda.gov/psw/publications/documents/psw_gtr144/psw_gtr144.pdf

Least Bell's Vireo

- DOI. 2001. Least Bells Vireo Survey Guidelines/. https://www.fws.gov/sites/default/files/documents/survey-protocol-for-least-bells-vireo.pdf

Marbled Murrelets

- Pacific Seabird Group. 2003. Methods for Surveying Marbled Murrelets In Forests:
- A Revised Protocol For Land Management And Research http://www.pacificseabirdgroup.org/publications/PSG_TechPub2_MAMU_ISP.pdf

Northern Goshawk

- USDA. 2006. Northern goshawk inventory and monitoring technical guide. https://www.fs.usda.gov/rm/pubs_series/wo/wo_gtr071.pdf

Northern Spotted Owl

- USFWS. 2012. Protocol for Surveying Proposed Management Activities that may impact Northern Spotted Owls, https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83977&inline

Swainson's Hawk

- CA Energy Commission. 2010. Swainson's Hawk Survey Protocols, Impact Avoidance, and Minimization Measures for Renewable Energy Projects in the Antelope Valley of Los Angeles and Kern Counties, California https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83990&inline
- Swainson's Hawk Technical Advisory Committee. 2000. Recommended Timing and Methodology for Sainsons Hawk Nesting Surveys in California's Central Valley https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83991&inline

Tricolored Blackbird

- CDFW. 2015. Guidance for avoidance of impacts to Tricolored blackbird breeding colonies on Agricultural fields in 2015. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=99310&inline

Willow Flycatcher

- Bombay, H.L., Benson, T.M., Valentine, B.E., Stefani, R.A. 2003. Willow flycatcher survey protocol for CA. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=84019&inline

Dry Washes

- Pena, S.J., Mazor, R., and Olson, J.R. 2019. Bioassessment of Non-perennial Streams affected by oil and gas extraction (PDF).
- VIDEO: Bioassessment of Non-perennial Streams affected by oil and gas extraction. https://www.youtube.com/watch?v=6uB4s-H8OXc
- Mazor, R.D., Olson, J., Robison, M., Caudillo, A., and Brown, J. 2019. Assessing the biological condition of dry ephemeral and intermittent streams. http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/1089_EphemeralStreams.pdf

Electrofishing

- Reynolds, J.B., and Holliman, F.M. Guidelines for Assessment and Reduction of Electrofishing-Induced Injuries in Trout and Salmon. https://trainingcenter.fws.gov/courses/CSP/CSP2C01/resources/8-Electrofishing-Effects/2_Guidelines%20for%20Assessment%20and%20Reduction%20of%20EF%20Injury.pdf
- Temple, A.J., and Dean, J. Electrofishing Standardization Protocol. https://trainingcenter.fws.gov/courses/CSP/CSP2C01/resources/1-Introduction/6_Electrofishing%20Standardization%20Protocol.pdf
- USEPA. 2019. National Rivers and Streams Assessment 2018/19. Field Operations Manual Non-wadeable ver 1.2. https://www.epa.gov/sites/default/files/2019-05/documents/nrsa_1819_fom_nonwadeable_version_1.2.pdf

Invertebrates

Document links below are from - CDFW Resource and Document Website: https://wildlife.ca.gov/Conservation/Survey-Protocols

Branchiopods

- DOI. 2017. Survey Guidelines for Listed Large Branchiopods. https://www.fws.gov/sites/default/files/documents/survey-guidelines-for-large-branchiopods.pdf

Mollusks

- USDA. 2008. Survey Protocol for Aquatic Mollusk Species: Preliminary Inventory & Presence/Absence Sampling. https://www.blm.gov/or/plans/surveyandmanage/files/10-mollusks_v3-1.pdf

Valley Elderberry Longhorn Beetle

- USFWS. 2017. Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle. https://www.fws.gov/sites/default/files/documents/survey-guidelines-for-valley-elderberry-longhorn-beetle.pdf

Mammals

Document links below are from - CDFW Resource and Document Website: https://wildlife.ca.gov/Conservation/Survey-Protocols

San Joaquin Kit Fox

- USFWS. 2011. Standardized Recommendations for Protection of The Endangered San Joaquin Kit Fox Prior To Or During Ground Disturbance. https://www.fws.gov/sites/default/files/documents/survey-protocols-for-the-san-joaquin-kit-fox.pdf

Morro Bay Kangaroo Rat

- DOI. 1996. Survey Protocol for the Morro Bay Kangaroo Rat. https://www.fws.gov/sites/default/files/documents/survey-protocols-for-the-morro-bay-kangaroo-rat.pdf

Reptiles

Document links below are from - CDFW Resource and Document Website: https://wildlife.ca.gov/Conservation/Survey-Protocols

Barefoot banded gecko

- CDFW. 2011. Survey protocol for presence of or negative finding for the barefoot banded gecko (Coleonyx switaki). https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=39305&inline

Blunt-nosed leopard lizard

- CDFW. 2019. Approved Survey Methodology for the Blunt-nosed leopard lizard. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=174900&inline

Desert Tortoise

- Preparing for any Action that may occur within the range of the Mojave Desert Tortoise. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=174633&inline

Western Pond Turtle

- USGS. 2006. USGS Western Pond Turtle trapping survey protocol for the Southcoast Ecoregion. https://sdmmp.com/upload/SDMMP_Repository/0/q4x2pztbkns61wv9hy30rjc78fg5dm.pdf
- USGS. 2006. USGS Western Pond Turtle Visual Survey Protocol for the Southcoast Ecoregion. https://sdmmp.com/upload/SDMMP_Repository/0/4fnpv18xm0sqtw29j7d3rz56bkychg.pdf

Vegetation

Document links below are from - CDFW Resource and Document Website: https://wildlife.ca.gov/Conservation/Survey-Protocols

- CDFW. 2018. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18959&inline
- USFWS. 2000. Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants. https://cnps.org/wp-content/uploads/2019/10/Bot-Cert_US-Fish-and-Wildlife-Service-guidelines-botanical-inventories-LR.pdf

West Coast Joint Assessment Team (WCJAT)

This document contains information about the cooperative damage assessment process conducted by Trustees. It also includes sampling methods.

WCJAT. 2017. Recommendations for Conducting Cooperative Natural Resource Damage Assessment. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=200743&inline

APPENDIX 9: Links to Oil Spill Job Aids and Data Sets on Baseline Resource Condition

Job Aids

- Oil Fact Sheets for Spill Responders – https://response.restoration.noaa.gov/resources/oil-fact-sheets-spill-responders
- California Department of Fish and Wildlife, Office of Spill Prevention and Response Natural Resource Damage Assessment. – https://wildlife.ca.gov/OSPR/NRDA
- Uncrewed Aircraft Systems Oil Spill Response Job Aid – https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/uncrewed-aircraft-systems-oil-spill-response-job-aid
- Soucek, D.J., A.M. Farag, J.M. Besser, and J.A. Steevens. 2023. Guide for benthic invertebrate studies in support of Natural Resource Damage Assessment and Restoration: U.S. Geological Survey Open-File Report 2022–1110, 11 p. https://doi.org/10.3133/ofr20221110.
- Oil Spills in Marshes: Planning and Response Considerations: https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/oil-spills-marshes.html
- Shoreline Assessment Job Aid: https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/shoreline-assessment-job-aid.html
- Oil Spill Response and Assessment Guidelines for Sea Turtles: https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/oil-spill-response-and-assessment-guidelines-sea-turtles
- Guidelines for Oil Spill Response and Natural Resource Damage Assessment: Sea Turtles: https://www.fisheries.noaa.gov/resource/document/guidelines-oil-spill-response-and-natural-resource-damage-assessment-sea-turtles
- Guidelines for Assessing Exposure and Impacts of Oil Spills on Marine Mammals: https://response.restoration.noaa.gov/guidelines-assessing-exposure-and-impacts-oil-spills-marine-mammals
- Oil Spill Response and Killer Whales: https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/oil-spill-response-and-killer-whales.html

Monitoring and Historical Data Sources

- CAEPA Central Coast Ambient Monitoring Program – http://rdc-omega.mlml.calstate.edu/ca/view_data.php?org_id=rb3&org_id=rb3
- CA State Water Resources Control Board – SWAMP (Surface Water Ambient Monitoring Program) State Mussel Watch Program – https://www.waterboards.ca.gov/water_issues/programs/swamp/mussel_watch.html#hd
- CalCOFI (CA Cooperative Oceanic Fisheries Investigations) – Oceanographic and Marine based datasets. https://calcofi.org/data/
- CDFW's BIOS (Biogeographic Information and Observation System) – Data collected by CDFW and partner agencies. https://wildlife.ca.gov/Data/BIOS
- CEDEN (California Environmental Data Exchange Network) – Data collected from various CA state agencies. Data categories include water quality, toxicity, tissue, benthic and habitat. – http://www.ceden.org/find_data_page.shtml
- MARINe (Multi-Agency Rocky Intertidal Network) - Data on more than 200 rocky intertidal monitoring sites in CA. – https://marine.ucsc.edu/index.html
- NOAA's ERMA (Environmental Response Management Application – Southwest) – used to support NRDA process. – https://erma.noaa.gov/southwest

- SCCWRP – Southern California Coastal Water Research Project
  - Bight Program (Marine monitoring) – Includes sediment toxicity, sediment chemistry, benthic infauna, and megabenthic invertebrate and demersal fish – https://www.sccwrp.org/about/research-areas/regional-monitoring/southern-california-bight-regional-monitoring-program/bight-program-data-portal/
- SFEI (San Francisco Estuary Institute) – Regional data center for SF Bay-Delta. Manages water quality, tissue, wetlands, historical and spatial data. Various data tools available. – https://www.sfei.org/sfeidata.htm
- SFEI (San Francisco Estuary Institute) – Contaminant Data Display & Download (CD3) – https://cd3.sfei.org/

Other Useful Resources

- CDFW's California Natural Diversity Database (CNDDB) - Inventory of status and locations of rare plants and animals. Public access – https://wildlife.ca.gov/Data/CNDDB/Maps-and-Data
- CDFW Marine Species Portal – Basic species information. – https://marinespecies.wildlife.ca.gov/
- CA Department of Water Resources – CA Data Exchange Center – Hydrologic and climate information – https://cdec.water.ca.gov/
- CA Department of Water Resources – Water Data Library Station Map – water quality data – https://wdl.water.ca.gov/waterdatalibrary/Map.aspx
- CA State Water Resources Control Board - water quality control plans and state policies for water quality. Will contain acceptable water quality levels for known contaminants and dischargers. May also specify total maximum daily loads (TMDLs).
- EcoAtlas – Aggregates data from various sources (https://www.ecoatlas.org/data/). Mapping tool found here: https://www.ecoatlas.org/regions/ecoregion/statewide
- NOAA Tide Predictions - https://tidesandcurrents.noaa.gov/tide_predictions.html
- USGS Current Water Data for California – daily streamflow conditions for monitored waterbodies. – https://waterdata.usgs.gov/ca/nwis/rt

Regional Board Water Quality Control Plans (Basin Plans)

- Region 1 - North Coast Region – https://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/
- Region 2 - San Francisco Bay Region – https://www.waterboards.ca.gov/sanfranciscobay/basin_planning.html
- Region 3 - Central Coast Region – https://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/
- Region 4 - Los Angeles Region – https://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/basin_plan_documentation.html
- Region 5 - Central Valley Region – https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/
- Region 6 - Lahontan Region – https://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/index.html
- Region 7 - Colorado River Basin Region – https://www.waterboards.ca.gov/coloradoriver/water_issues/programs/basin_planning/
- Region 8 - Santa Ana Region – https://www.waterboards.ca.gov/santaana/water_issues/programs/basin_plan/index.html

- Region 9 - San Diego Region – https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/index.html