MassDEP Guidance for Disposal Site Risk Characterization

Chapter 17

Environmental Risk Characterization:

Wetland Habitats

17.0 WETLAND HABITATS

Wetlands provide numerous environmental functions, including flood control, groundwater protection and re-charge, removal and cycling of sediments, organic material and nutrients from surface water, protection of water supply, storm damage prevention, and bank/shoreline stabilization as well as critical habitat for a variety of wildlife. This guidance focuses on the effects of site contaminants on a wetland's function as a wildlife habitat and on the organisms that depend on it. Nutrient cycling is another wetland function that could also be adversely affected by contamination. Although some wetland functions may not be affected directly by contamination, they can be seriously impaired or damaged by site investigation or cleanup activities if appropriate precautions are not taken. Therefore, the risk of physical damage to wetland habitats must be considered when planning site investigation and cleanup activities. Risks directly associated with remediation activities are addressed during Phase III (310 CMR 40.0858(4)b).

Wetlands subject to protection under the wetland Wetlands Protection Act (M.G.L. c. 131, § 40) include, but are not limited to:

(1) All permanent surface water and the land underneath;
(2) all areas subject to flooding during a hypothetical 100-year storm event;
(3) all "vegetated wetlands" bordering on a surface water, such as bogs and swamps, including wooded swamps, marshes and wet meadows; and
(4) all seasonal (intermittent) streams draining from a wetland.

These four wetland classes are broad; they could be further categorized by applying other classification systems, such as that developed by the U.S. Fish and Wildlife Service (Cowardin et al., 1979).

17.1 Wetland Classification and Delineation

Classification and delineation both apply to:

- Environmental risk characterization, in which the nature of the wetland determines the potential receptors; and
- Phase III feasibility studies, in which the habitat value of a wetland as well as the potential to replicate it may have to be considered in choosing remediation techniques.

Delineation may be considered at several points in the MCP process, including:

- Tier classification, which determines the priority of the site and allocation of DEP staff for oversight,
- Selection of the appropriate assessment method, in which the presence of contamination within the boundary of a wetland precludes the use of Method 1 alone, and
- Stage I Screening, because the recommended Stage I Screening procedures for wetlands differs from other habitats a delineation may be necessary to distinguish between terrestrial and wetland areas that may be impacted by a site or release of Oil or Hazardous Material (OHM).

Note that any work in wetlands or the 100-foot buffer zone may require permitting and additional requirements under 310 CMR 10.00.

The term "wetlands" is a very broad one, encompassing lands that are components of a wide variety of habitats. The definition of wetlands in the MCP includes:
"…any area subject to protection under the Wetlands Protection Act, M.G.L. c. 131, § 40, 314 CMR 9.00: *401 Water Quality Certification for Discharge of Dredged or Fill Material, Dredging, and Dredged Material Disposal in Waters of the United States Within the Commonwealth* or Section 401 of the federal Water Pollution Control Act, 33 U.S.C. 1341". Wetlands can also be described as areas that are inundated or saturated with water at a frequency or duration sufficient to support a prevalence of vegetation adapted for life in saturated soil conditions.

Areas subject to the Wetlands Protection Act (M.G.L. 131, Section 40) and associated regulations (310 CMR 10.00) include, but are not limited to any bank, freshwater wetland, coastal wetland, beach, dune, flat, marsh, wet meadow or swamp bordering on the ocean or on any estuary, creek, river, stream, pond, or lake, or any land under said waters or any land subject to tidal action, coastal storm flowage, or flooding and Riverfront Area, which extends 200' horizontally from a river's mean annual high water line. The U.S. Fisheries and Wildlife service has defined wetlands somewhat more narrowly, as lands transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface or the land is covered by shallow water. (Cowardin et al., 1979).

Given the transitional nature of wetlands between terrestrial and aquatic systems, wetlands often consist of unique aquatic and terrestrial habitats and wetland soils and/or sediment may be present in any given wetland. The MCP (310 CMR 40.0006) gives the following definition for sediment:

Sediment means all detrital and inorganic or organic matter situated on the bottom of lakes, ponds, streams, rivers, the ocean, or other surface water bodies. Sediments are found:

> (a) in tidal waters below the mean high-water line as defined in 310 CMR 10.23: Additional *Definitions for 310 CMR 10.21 through 10.37*; and
>
> (b) below the upper boundary of a bank, as defined in 310 CMR 10.54(2), which abuts and confines a water body.

All other unconsolidated earth in wetlands, including the 10-year floodplain, is considered soil. In general, exposure to contaminated sediment should be evaluated with reference to Chapter 15 (Aquatic habitats), and exposures to contaminated soil should be evaluated with reference to Chapter 16 (Terrestrial habitats). The risk characterization must also address exposures of terrestrial birds and mammals which may eat, drink or nest in wetlands and associated surface waters, as well as the habitat of protected flora.

17.1.2 Distinguishing wetland soils from sediments

Wetland hydrologic conditions are a critical factor in determining the health and type of wetland present. For the purposes of conducting an environmental risk assessment in wet areas it can be difficult to distinguish between areas that are consistently and/or perennially wet with consistent standing water from areas that are wet for long periods of the year but may not have consistent surface waters. This is important in developing assessment endpoints because persistently aquatic habitats will require assessment of the sediment and the associated aquatic habitat whereas habitat that is less frequently saturated with water may be assessed as wetland soil.

For purposes of conducting ecological risk characterizations under the MCP, practitioners should err on the side of caution when delineating between wetland soils and sediments such that if it is not clear, practitioners should assume the habitat to be aquatic/sedimentary in nature and should be appraised using the approaches put forth in Chapter 15 (Aquatic Ecological Risk). Areas that are drier, that do not have persistent surface waters and that are consistent with soil habitat should be appraised as wetland soils. This distinction has ecological, regulatory and resource significance and should be clearly determined and expressed and supported in the risk assessment.

MassDEP has used the term "bank" to describe the transition from wetland soil areas or habitat to wet or aquatic habitat. For the purposes of MCP environmental risk assessments, the "bank" means a habitat that is below a certain elevation and is different from areas that are above the "bank". Determining the bank location can be difficult in wetland habitats due to the subtle elevation and hydrologic changes between wetland soils and sediments. In most instances, areas above the bank are considered wetland soil and areas below (at a lower elevation) the bank are considered aquatic/sediment habitats.

The Wetlands Protection Act (310 CMR 10.54(1 & 2)) indicates banks "act to confine floodwaters during the most frequent storms" and defines the critical characteristics of a bank to be "…a portion of the land surface which normally abuts and confines a water body. It occurs between a water body and a vegetated bordering wetland and adjacent flood plain, or in the absence of these, it occurs between a water body and an upland".

The delineation between aquatic and wetland habitats may require a trained biologist, ecologist or risk assessor to make a professional judgment at the site to discern where the habitat transitions from wetland soil habitat to sediment/aquatic habitat. Ideally, this decision is made after several visits to the area across more than one season to understand the hydrologic variability of the area.

This distinction is important as the risk assessment process for assessing exposures and risks in soil are different than the methods used for assessing exposures and risks in sediment habitats.

17.2 Wetlands Protection Considerations

The scope and rigor of the Wetlands Protection Act and corresponding Regulations provide an indication of the biological and societal value placed on wetlands, open water, vernal pools and rare species wildlife habitats. The Regulations prohibit the alteration of the habitat of all wildlife within bordering vegetated wetland and new development in Riverfront Area, and within certain thresholds of bank, land under water, land subject to flooding and redevelopment of Riverfront Area. The Regulations also forbid any adverse effects on any amount of vernal pool habitat or any short- or long-term effect on the local population of a rare species as determined by the Natural Heritage and Endangered Species Program, a division of the MassWildlife (e.g., 310 CMR 10.59, etc.). Adverse effects on wildlife habitat may include direct and indirect effects on food and shelter as well as on breeding, migratory and overwintering areas. Potential causes of adverse effects include alteration in water quality or in plant community structure. Additional guidance on habitat impacts can be found in the **Massachusetts Wildlife Habitat Protection Guidance for Inland Wetlands**.

The habitats and ranges of exposed organisms may not coincide with legally defined wetland delineations. When evaluating exposures of biota and habitats, the focus should be on the distribution of contamination and the habitats of the exposed organisms, so that all locations where organisms are exposed are considered.

17.2.1 Assessment Endpoints: indicators of environmental harm

At sites where habitat degradation is visible or easily measured, and other endpoints are difficult or impractical to measure, habitat degradation by itself can be an appropriate endpoint, and would provide support for a decision that remediation is necessary. For example, the "Visible presence of oil, tar, or other non-aqueous phase hazardous material in soil within three feet of the ground surface over an area equal to or greater than two acres, or over an area equal to or greater

than 1,000 square feet in sediment within one foot of the sediment surface" would be considered Readily Apparent Harm (310 CMR 40.0955(3)(b)).

The use of habitat degradation as an assessment endpoint may eliminate the need for more resource-intensive quantitative evaluation. However, the absence of visible habitat degradation by itself does not demonstrate a condition of "no significant risk of harm", and, therefore, may not be a useful and appropriate assessment endpoint for sites where degradation is not readily apparent.

17.2.2 Threatened and Endangered Species

Some wetlands provide habitat for organisms that are considered threatened or endangered species under the Massachusetts Endangered Species Act (MESA) (321 CMR 10.00). All habitats containing threatened or endangered species require special attention and must comply with the MESA. Details relating to the handling of threatened and endangered species at MCP sites can be found in Appendix 14A. While the MESA can impose some restrictions on what type of work or impacts may occur in protected areas, there are exemptions to allow for basic information gathering detailed in 321 CMR 10.14.

17.2.3 Vernal Pools

Vernal pools are a unique type of wetland habitat that requires special considerations. These habitats are unique due to their ephemeral nature and because they present desirable breeding habitat for a variety of species, including amphibians, reptiles and a variety of threatened or endangered species.

Vernal pools often occur over either bedrock or a hard clay layer in the soil that helps keep water in the pool. The pools are typically filled with water during winter and spring rains, varying in water depth in response to weather patterns. In years of drought, some pools may not fill at all. In the spring, wildflowers often bloom in circles around the shoreline of the pools. Water in vernal pools will typically evaporate by early summer, and the clay pools may appear brown and cracked. Because they are ephemeral, vernal pools can be difficult to identify. Vernal pools should be identified and evaluated during spring unless conditions are exceptionally dry.

Vernal pools provide habitat for rare plants and animals that require unique conditions. Many of these plants and animals spend the dry season as seeds, eggs, or cysts, and then grow and reproduce when the ponds fill with water. In addition, birds such as egrets, ducks, and hawks use vernal pools as a seasonal source of food and water. Vernal pools are a valuable and increasingly threatened ecosystem, as development often results in their destruction, resulting in the loss of important habitat and associated plant and animal species (USEPA, 2024).

Certifying vernal pools can be difficult because "the biological evidence required to certify a vernal pool can only be observed and documented in the spring and summer when amphibian breeding evidence is present (with the exception of the Marbled Salamander)" (MFW, n.d.).

Features associated with vernal pools may include, but are not limited to, depressions in the landscape, stained leaves in depressions, water staining marks and buttressed tree trunks.

17.2.4 Potentially altered wetland habitat

In areas adjacent to wetlands or in areas that appear to have been altered, additional investigation of site conditions may be warranted to determine if the area represents altered wetland habitat. Historical records, such as National Wetland Inventory (NWI) maps, aerial photographs, MassGIS wetlands data layers, and visual assessments of adjacent areas may be helpful in identifying a potential historical wetland. In addition, local topography and hydrology and nearby plant species can help determine if the area may have been a wetland.

Wetlands where vegetation has been altered or removed or where fill has been placed may be difficult to assess. A soil assessment may provide useful information about the historical hydrological conditions at the wetland. The presence of hydric soils is often the best indicator for identifying recently drained wetlands. A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper soil horizon (U.S. Soil Conservation Service, 1987). The presence of hydric soils beneath fill material would suggest the area was previously wetland habitat. Additional guidance is provided in the 2022 Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands by MassDEP.

17.2.5 Precipitants/Flocculants

The Surface Water Quality Standards at 314 CMR 4.05 include Additional Minimum Criteria Applicable to All Surface Waters which includes aesthetics. Specifically, 314 CMR 4.05(5)(a) asserts: "All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life."

When fine particulate matter and/or precipitants settle on top of aquatic or semi-aquatic bottom habitats they can create a physical layer on the habitat that can cause adverse effects on organisms through their physical, chemical and/or biological activity. For some sites, the impacts from precipitants or flocculants on aquatic benthic organisms are related to impacts on dissolved oxygen (D.O.) concentrations such as hypoxia, anoxia or suffocation which can stress and potentially kill any sessile benthic organisms that cannot move away from impacted areas. The Massachusetts Surface Water Quality Standards have requirements for maintaining dissolved oxygen concentrations in surface water that must be considered when appraising impacts to surface waters in the Commonwealth.

In some instances, flocculants or precipitants that are the result of the release of OHM or wastes from a site may be considered readily apparent harm during the Stage I screening step. If the

visible presence of oil, tar or other non-aqueous phase hazardous material is deposited or precipitates over an area of sediment equal to or greater than 1,000 square feet of sediment, a condition of readily apparent harm exists (310 CMR 40.0995(2)(b)).

Flocculant may be caused by reducing conditions created by the anaerobic degradation of hydrocarbons in groundwater. The most common example of precipitant flocculent issues occurs in aquatic habitats downgradient of landfills. When the organic contaminants in landfill leachate are metabolized by aerobic microbes the dissolved oxygen concentration decreases and this can result in some metals becoming more mobile, increasing the concentration of metals in the leachate. When this leachate surfaces downgradient in well oxygenated areas, the metals and other contaminants can precipitate out of solution forming a distinct film or flocculant layer on the bottom of the water body. In some instances, the impact of flocculant formation can be measured by collecting D.O. concentrations in surface water beneath the flocculant and comparing those concentrations to D.O. in nearby areas where flocculant is not present.

The Wetlands Protection Act does not specifically discuss floc but does address the need to minimize the potential for smothering the aquatic and semi-aquatic benthic habitats at 310 CMR 10.56(4)(b).

17.3 Stage I Environmental Screening

As is the case for aquatic and terrestrial habitats, Stage I Screenings in wetland areas identifies all potential receptor groups and exposure pathways and evaluates the likelihood of each potential exposure pathway. A further, effects-based screening step should be performed to identify any of the complete exposure pathways that are clearly unlikely to result in significant risk of harm to the environment. The Stage I screening steps are described in 17.3.1 and 17.3.2.

17.3.1 Wetland Background Determination

In risk characterizations conducted to meet the requirements of the MCP, the concentrations of OHM should be evaluated to determine whether concentrations are consistent with background conditions. Background evaluations may be conducted at any point in the site assessment and cleanup process, including prior to Stage I screening. In contrast to screening benchmark comparisons, background evaluations may be used to eliminate individual chemicals from further consideration in the risk characterization. Chapter 6 of this Guidance Document discusses background issues in detail.

Background conditions should be evaluated separately for sediment, surface water and soils, where appropriate. Habitat above the bank, or those areas characterized as soil, may be compared to background levels of PAHs and metals in soil (Appendix 6A).

The MCP (310 CMR 40.0006) defines background as those levels of OHM that would exist in the absence of the disposal site of concern including both Natural Background and Anthropogenic Background. Background wetland samples should be collected from an appropriate reference wetland where practical. Ideally, a wetland background location would be a

wetland of similar type and quality to the site wetland that has not been impacted by site contaminants or other known releases or contaminants. See Chapter 4 (Sampling for Risk Assessment) for additional information.

To evaluate whether a potential reference wetland is suitable, the investigator should consider several historical, chemical and physical factors, including but not limited to whether the proposed reference wetland is:

- susceptible to non-point source runoff that differs significantly from runoff affecting the wetland at the site,
- impacted by any other source of contamination that does not impact the site wetland,
- a wetland where significant alteration or amendment has occurred,
- a wetland with similar morphology and hydrology as the site wetland, and
- a wetland of similar in size, depth, trophic status and geochemical conditions.

Comparisons of site wetland soil and/or sediment concentrations to background wetland soil/sediment concentrations should be made on a chemical-specific basis. A chemical may be considered attributable to background conditions and may be eliminated from the quantitative risk assessment if:

(1) the detected concentrations are consistent with background concentrations determined specifically for the site in question, and

(2) the spatial distribution of concentrations at the site does not indicate that the chemical was "released" at the site.

The risk assessment should provide detailed justification of the selected location as an appropriate reference area. The reference area should be as similar as possible to the site in terms of habitat, physical characteristics, and concentrations of non-site-related chemicals. MassDEP recommends obtaining chemistry data for the reference area to compare to the site data prior to conducting any toxicity tests or benthic community surveys. The purpose of this sampling would be to ensure that the use of the reference area would not introduce other chemicals as confounding factors when site toxicity test results or benthic community survey results are compared to the reference area. In addition to analyses for site COCs, ORS recommends conducting analyses for metals, EPH/VPH and PAHs as well as pesticides to ensure that levels of these chemicals are similar (except for site-related contamination) in the site and reference areas.

Evaluation of the reference area is particularly important if the reference area is from a different stream, rather than a location on the same stream but upstream of the site. It is not appropriate to choose a reference location that is downstream of the site. Using a reference area from a different waterbody will likely introduce more uncertainty into the comparison making it more difficult to discern if the site differs from the reference location. Identifying an appropriate reference wetland is particularly difficult in tidally influenced areas because site-related contamination may be located both upstream and downstream of the site. See Chapter 6 (Background) for more details about background selection.

17.3.2 Using Ecological Soils Screening Levels (EcoSSLs) for Wetland Soils

For wetland habitat that has been impacted by site contaminants but that does not have persistent aquatic habitat the Department considers ecological soil screening levels (EcoSSLs) from EPA as an appropriate Stage I screening measure for contaminants in wetland soils. See chapter 16 (Terrestrial Habitats) for more details.

Comparison of wetland soils to sediment screening values is also permissible in MCP environmental risk assessments because the approach is thought to be a conservative comparison.

17.3.3 Identification of Complete Exposure Pathways

The risk assessor should consider all the habitat types and receptors present in the affected area in order to identify exposure pathways of concern when a wetland has been affected by contamination. Exposure of aquatic organisms should be considered in submerged or regularly wet areas. Exposure of animals that periodically visit borders or banks of surface water bodies should also be considered. For upland areas in or adjacent to wetlands, the exposure pathways discussed in the Terrestrial Habitat section should be considered.

17.3.4 Effects-based Screening for Sediment

Effects-based screening of contaminated sediments may be done by comparing detected concentrations with sediment screening values. See Chapter 14 (Aquatic habitats) and Appendix 15A (Revised Sediment Screening Values). Probable Effect Concentrations are recommended for metals and Threshold Effect Concentrations are recommended for all other contaminants in freshwater sediment. Effects Range-Low (ER-L) values are recommended for sediment in marine and brackish water. The values on which the ER-Ls are based were derived from studies of both marine and freshwater sediments. Effects-based screening of standing water in wetlands may be conducted in the same way as described for surface water in general (i.e., comparing detected concentrations with the National Recommended Water Quality Criteria values for the COC. Aquatic life criteria table (https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table)).

Many of these values are based on toxicity to a species that do not inhabit wetland areas, and they may not be appropriate as benchmarks in quantitative wetland assessments. However, the values are considered sufficiently protective for use as wetland screening criteria in a Stage I risk assessment.

If the risk of harm cannot be ruled out for any exposure pathway, an evaluation of that pathway by a Stage II Risk Characterization is necessary.

17.3.5 Assessing risks to amphibians and reptiles

Amphibians and/or reptiles may be present in wetlands in the Commonwealth. However, assessing the potential adverse effects of exposure of amphibians and reptiles to chemicals from a site can be very difficult. For sites where amphibians and/or reptiles are observed to be present the environmental risk assessment must, at a minimum, discuss the species present, conduct a literature review of the potential adverse effects of exposure to COCs to determine if there is any information relevant to site COCs for the amphibians/reptiles present. The literature review should be summarized in a narrative and documented in the risk characterization and the potential uncertainty around the exposure and potential risks to amphibians and reptiles from site contaminants must be addressed in the uncertainty section. EPA's ECOTOX database contains many amphibian toxicity studies. In cases where amphibian data are unavailable, data on other aquatic species can be used as a surrogate. Reptile toxicity data is typically extremely limited.

17.4 Stage II Environmental Risk Characterization

Potential assessment endpoints for wetlands include all the conditions that have been discussed for both terrestrial and aquatic habitats. The sampling and analysis considerations and measurement methods discussed for other habitats are also applicable in wetland areas. Consequently, this section is limited to a very brief discussion of considerations specific to wetland habitats.

The relative significance of various exposure pathways and the most sensitive species may differ from other habitats because of the unique structural and functional characteristics of wetlands. Wetlands provide extraordinarily productive and biologically diverse habitats. They provide important nursery areas and primary habitats for many species. These functions are primary considerations in identifying receptors of concern and selecting assessment endpoints. For example, given that wetlands function as nurseries for a wide array of species, assessments should consider potential effects on early life stages, which may be more sensitive to toxins than later life stages.

Risk assessors should consider separately the risks to state-listed (rare) species that spend a significant portion of their life cycle in or along water bodies, within the hundred-year floodplain, or within any jurisdictional wetland area.

The Wetlands Protection Act includes requirements to avoid impacting areas adjacent to jurisdictional wetland habitat. This area, called the buffer zone, is a 100-foot area around wetlands that serve to reduce or eliminate impacts to the jurisdictional wetland. Any work within the buffer zone may require review under the Wetlands Protection Act.

Contaminant impacts to soils in the buffer zone would normally be addressed in the terrestrial habitat chapter (Ch.16). However, in cases where there is no terrestrial environmental risk characterization yet there are impacts to the buffer zone, the risk assessor should incorporate the impacted buffer zone soils and habitat with the wetland soils in the jurisdictional wetland, so the buffer zone is assessed even if the terrestrial areas do not require characterization (e.g., less than 2 acres).

Although many animal species of concern in wetland habitats are also likely to be exposed in terrestrial or aquatic habitats, the exposure conditions are likely to be very different, and the relative impacts of the contaminants on various species may differ. For example, some amphibians are likely to receive higher exposures in wetlands than in other habitats because they spend most of their time in wetland areas. Endangered species are also of particular concern, because wetlands are primary habitat area for a large proportion of endangered species.

Damage to ecological function is an impact which may have more serious implications for wetlands than for other habitats. Because high productivity and chemical and mineral recycling processes normally occur in wetlands, impairment or loss of these functions over a substantial wetland area would represent a significant risk of harm to the environment in the vicinity of the site.

17.4.1 Wetland Assessment Endpoints

For wetland soil, aquatic and/or terrestrial receptor species may be appropriate. For sediments, aquatic receptors should be used. Ideally, assessment endpoints should be relatively sensitive to the COCs at the site. Adverse effects on survival, growth & reproduction are considered biologically significant adverse effects. The assessment endpoint species selected should be representative of the more sensitive or susceptible guilds and the assessment endpoints should provide key ecological functions or represent a group that does. Ideally, the assessment endpoints will have some societal value.

References:

Cowardin, L.M. et al. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish & Wildlife Service. FWS/OBS-79/31.

MassDEP. 2014. Wetlands Protection Act. 310 Code of Massachusetts Register (CMR) 310 10.00.

Massachusetts Endangered Species Act (MESA) 321 Code of Massachusetts Register (CMR) 10.00.

Massachusetts Fish and Wildlife (MFW). No date. Guidance on the Field Identification of Vernal Pools When Dry. https://www.mass.gov/doc/identification-of-vernal-pools-when-dry/download

Massachusetts Surface Water Quality Standards (314 CMR 4.00).

U.S. Soil Conservation Service (USSCS). 1987. Hydric soils of the United States.

U.S. EPA. May 15, 2024. Wetlands: Vernal Pools. https://www.epa.gov/wetlands/vernal-pools.