Wetland Hydrology Monitoring Guidance for Water Withdrawal Permit Compliance

Massachusetts Department of Environmental Protection
Bureau of Resource Protection, Wetlands and Waterways Program

Note: (see Glossary for **bolded** words/phrases)

Preamble

Wetland plant community structure and composition and the formation of hydric soils are driven by the presence and characteristics of wetland hydrology [per *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (FICWD 1989) Part II, Section 2.0].

Monitoring of resource areas under the jurisdiction of the Massachusetts Department of Environmental Protection (the Department) for compliance with Water Management Act (as implemented at 310 CMR 36.00) Water Withdrawal Permits shall be conducted at the discretion of the Department whenever it is determined that the operation of a proposed public water supply well may have an adverse impact on **wetland hydrology**. Monitoring shall focus on investigating the potential for a drop in the **apparent water table** within the substrate of vegetated wetlands due to the affects of a public water supply well on groundwater elevation. The Department will review the results of the monitoring and at the conclusion of the five (5)-year compliance review determine if the wetland hydrology monitoring plan should be continued, revised, or discontinued.

The following standards and basic techniques shall be employed in the design and implementation of a document to be referred to as a "Wetland Hydrology Monitoring Plan". A draft "Wetland Hydrology Monitoring Plan" shall be submitted to the Department prior to implementation. The Department reserves the right to modify the plan in order to assure compliance with a Water Withdrawal Permit. A "Wetland Hydrology Monitoring Report" detailing the findings of the preceding calendar year must be submitted to the Department annually.

Standards and Basic Techniques

Define the Study Area

1. With the input of the Department, define the geographic extent of the study area. Unless otherwise instructed, the study area shall consist of all jurisdictional vegetated wetlands [see 310 CMR 10.00] within the **zone of influence** of the proposed wellhead.

2. Describe each distinct wetland plant community within the study area relative to its US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) classification and Dominance Type [see *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin, et al 1979)]. Most critical in this inventory is a description of the water regime modifier. The water regime modifier is to be initially determined from an analysis of evidence found on-site and collateral data (see below), and is a long-term descriptor of wetland hydrology within the plant community. Additional to the water regime modifiers listed in Cowardin, there is one (1) specifically adopted for the northeastern United States by the USFWS' NWI Regional Wetland Coordinator. This is the "seasonally flooded/saturated" water regime modifier ("**E**" on NWI maps). It is defined as follows:

- "Floods (sic: technically **inundated**) most years for two weeks or more during growing season and remains saturated near the surface for most of the growing season" ["NWI Maps Made Easy: A User's Guide to National Wetlands Inventory Maps of the Northeast Region" (Smith 1991)].

3. Delineate wetland plant community boundaries on a **site plan**. The resultant **map units** (polygons) shall be labeled with the appropriate NWI **alphanumeric classification** and Dominance Type.

Collection of Wetland Hydrology Data

4. Establish at least one (1) "**observation plot**" within each distinct map unit (polygon). Base the plot position and dimensions on criteria in *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* [MADEP 1995] (see Chapter 2, page 11 and elsewhere). At a minimum, there shall be four (4) observation plots for a given study area.

5. Color photographs captured from a fixed location and angle shall be taken as a visual record of each observation plot.

6. Photointerpret high-resolution aerial photography in order to refine the water regime modifier assigned to each map unit. Aerial photography from a number of different years should be interpreted. Reliable wetland photointerpretation can only be achieved using leaf-off photography, preferably color-infrared. The applicant is advised to consult **"Methods to Determine the Hydrology of Potential Wetland Sites" [US Army Corps of Engineers WRP Technical Note HY-DE-4.1, January 1998]** for *general* guidelines. For additional information on wetland aerial photointerpretation techniques and standards contact the Department's Massachusetts Wetlands Inventory or visit the NWI's homepage [http://www.nwi.fws.gov/].

7. Analyze other collateral data sources to further refine the assignment of water regime modifiers. Tabulate data on mapped soil series [US Department of Agriculture, Natural Resources Conservation Service county soil surveys], Massachusetts Wetlands Inventory Program mapping classifications, NWI map alphanumeric codes, Federal Emergency Management Agency Flood Insurance Rate Maps, hydrogeomorphic classification, etc.

8. Establish a shallow monitoring well adjacent to a representative portion of each observation plot. The shallow monitoring wells shall be constructed, installed, and operated in accordance with **"Installing Monitoring Wells/Piezometers in Wetlands" [US Army Corps of Engineers WRP Technical Note HY-IA-3.1, August 1993]**. Record water table levels on a monthly basis during the growing season of each sampling year. Record evidence of capillary fringe saturation, or at least describe its influence on the root zone. Establish a staff gauge at the well location in order to record surface inundation in terms of depth *and* duration. Estimate the areal extent of surface inundation for areas of mound-and-pool microtopography within each observation plot. Also record source(s) of wetland hydrology on site (ponding, overbank flooding, interception of groundwater table, sheet flow from surrounding upland, seep, etc.).

9. Provide a description of standard indicators of wetland hydrology within each observation plot using approved US Army Corps of Engineers indicators. These include: visual observation of inundation; visual observation of soil saturation; watermarks; drift lines;

sediment deposits; drainage patterns within wetlands; oxidized channels (rhizospheres) associated with living roots and rhizomes; water-stained leaves; surface scoured areas; and morphological plant adaptations. [see *Corps of Engineers Wetlands Delineation Manual* (Department of the Army, Waterways Experiment Station, Environmental Laboratory, Technical Report Y-87-1, 1987); and *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetland Delineation 1989)].

Collection of Supportive Collateral Data

10. Identify soils within each observation plot using *Field Indicators for Identifying Hydric Soils in New England* [NEIWPCC (Version 2, 1998) or later version]. Analysis of soil profiles should specifically reference hydrologic characteristics included within the technical definition of hydric soils, natural soil drainage classes, and high water table/flooding data specific to the soil series encountered [see *Hydric Soils of New England* (Tiner and Veneman 1987)].

11. Prepare a description of the plant community within each observation plot using Section I of the "DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form" (Appendix G). Determine through scientific literature search and/or professional experience the water regime affinity(ies) of the particular wetland plant communities found within the observation plots. Compare or contrast these affinities with the water regime modifier initially assigned to each observation plot, and offer an explanation of any discrepancies observed. Identify vascular plants to the species level. Scientific nomenclature should follow the most recent classification found within *The Vascular Plants of Massachusetts: A County Checklist* (Sorrie & Somers 1999). Wetland Indicator Categories should follow the *1995 Supplement to the List of Plant Species that Occur in Wetlands: Northeast (Region 1)* (Tiner, et al. 1995). Identify bryophytes to the appropriate genus. The plant community data collected on Appendix G's shall be solely used to characterize the general ecology and hydrology of each observation plot. Said data is not intended for use in statistical change analysis of the plant community.

12. The applicant shall determine the acidity (pH) of free water within at least one (1) of the established observation plots during the initial baseline data collection. This measurement shall be used to confirm the NWI water chemistry modifier assigned to each plot.

13. Compare data collected to climatological data from a station as close as possible to the observation plot. Climatological anomalies should be accounted for within the data analysis. The applicant is advised to consult the US Department of Agriculture, Natural Resources Conservation Service, National Water and Climate Center, WETS Tables for additional climatological data.
    See (http://www.nrcs.usda.gov/water/w_clim.html)

Data Analysis

15. The applicant will provide a complete and thorough description of wetland hydrology at each observation plot. The synthesis of this data will lead to a long-term "model" of the wetland hydrology at the observation plot. Once established, detected changes within the observation

plot may be measured against the model, and significant changes illuminated for further analysis.

16. Potential sources of bias should be identified. Is there a potential for a significant change in the rate of evapotranspiration within the observation plot over time? (e.g., is the observation plot subject to disturbance; increasing levels of canopy shading over time; are there components of the plot's plant community that are recognized early and mid-successional species?) Does the observation plot exhibit evidence of past land use practices (plow layer, foundation species such as *Vinca minor*, tree stumps, etc.)? Is there any evidence of plant pathology or extensive herbivory that could lead to a shift in plant community (eastern tent caterpillars, fungal diseases, gypsy moth infestation, etc.)?

17. A control observation plot is not recommended unless stringent and defensible means of eliminating and/or accounting for bias are undertaken. As a result, analysis of generated data will need to be strongly tied to the model established for wetland hydrology, and observed sources of bias should still be fully explored.

18. Analysis of hydrologic shift based upon correlations between wetland indicator status and water regime affinity is discouraged, unless supportive scientific literature indicates *species-specific* correlations [see *National List of Plant Species that Occur in Wetlands* (Reed 1988)].

19. ***The Department will rely heavily upon data generated from #8 in order to assess and respond to any detrimental impact to the study area. Scientifically relevant observances of wetland hydrology generated from the analysis at #8 that are not related to climatological or other natural phenomena shall be considered linked to the operation of the public water supply well, and will be just cause for Departmental review and/or manipulation of data collection protocol and/or well operation until such time as wetland hydrology has been returned to normal parameters. If, in the opinion of the Department, the sampling procedure detailed at #8 is deemed to be insufficient to elucidate such change, the Department reserves the right to modify #8 accordingly.***

20. The applicant shall include a thorough analysis of the data within the annual draft and final "Wetland Hydrology Monitoring Reports" and any plans, summaries, etc. submitted to the Department. This shall be accomplished using standard and defensible scientific principles, and shall consider the sum total of collected data being submitted, the model for wetland hydrology developed by the applicant for the study area, and an analysis of observed or expected sources of bias which may compromise the data set. Submittals to the Department of raw or summarized data without principled analysis shall be considered insufficient.

Mitigation

21. Once per growing season the study area shall be inspected for the presence/absence of non-native and/or **noxious** invasive plant species, including but not restricted to glossy buckthorn (*Rhamnus frangula*), purple loosestrife (*Lythrum salicaria*), Asiatic bittersweet (*Celastrus orbiculata*), and the native common reed (*Phragmites australis*). If any activity [as defined at 310 CMR 10.04 (Activity)] performed by the applicant, whether permitted or otherwise, is demonstrated or may be directly linked to the establishment and/or population increase of non-native and/or noxious invasive plant species within the study area, the applicant shall be responsible for the elimination of that species. The applicant shall alert the Department in a timely manner when non-native and/or noxious species are first documented within the study area, and upon such notice will consult with the Department's Wetlands and Waterways

Program to develop an eradication/control plan. Said plan shall be submitted to the Department for review and acceptance. The applicant shall be responsible for identifying and obtaining any required permits that may be necessary in order to implement said plan.

Glossary

Alphanumeric Classification A letter-numeral code which is used to abbreviate NWI classifications. Refer to the collar of NWI maps or to the NWI homepage [http://www.nwi.fws.gov/] for details.

(Apparent) Water Table "The upper surface of ground water *or* that level below which the soil is saturated with water. It is at least 6 inches thick and persists in the soil for more than a few weeks" (emphasis added) [***Corps of Engineers Wetlands Delineation Manual*** (Department of the Army, Waterways Experiment Station, Environmental Laboratory, Technical Report Y-87-1, 1987)]

Map Unit A single polygon (or symbol, linear feature, etc.) on a map whose boundary encloses a homogenous cover type or other thematic category.

Noxious Plant Species Typically, an indigenous species of plant that, due to human-induced causes, out-competes other native species within a given habitat; and thus reduces the biodiversity and other functions provided by that habitat. Common reed (*Phragmites australis*) in disturbed salt marsh habitat is an example.

Observation Plot A circular boundary placed horizontally on the substrate of a wetland within a relatively homogenous plant community, and used to collect various ecological data. An imaginary cylinder projects vertically both in the upward and downward directions. Ecological parameters (typically plant community composition/structure; soil characteristics; and evidence of surficial and sub-surface hydrology) are sampled within the confines of this cylinder.

Pit-and-Mound Microtopography A wetland substrate composed of elevated mounds of unconsolidated material and/or rock fragments interspersed with deeper pools. The pools are typically much wetter on average than the mounds. The mounds often support the majority of woody plant species within pit-and-mound wetlands.

Site Plan A large-scale map of a small area. For the purpose of the "Wetland Hydrology Monitoring Plan", a site plan shall include: a scale bar, a compass rose, the zone of influence or other demarcation of the study area, location of <u>all</u> wells (both public water supply and research, existing and proposed) within the study area, resource area map units, location and identifying code of each observation plot, topographic contours, man-made surfaces.

Wetland hydrology "…all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season. Areas with evident characteristics of wetland hydrology are those where the presence of water has an over-riding influence on characteristics of *vegetation* and *soils* due to anaerobic and reducing conditions, respectively" (emphasis added) [*Corps of Engineers Wetlands Delineation Manual* (Department of the Army, Waterways Experiment Station, Environmental Laboratory, Technical Report Y-87-1, 1987)]. Included within this concept are the following categories:

Flooded "A condition in which the soil surface is temporarily covered with water from any source, such as streams overflowing their banks, runoff from

adjacent or surrounding slopes, inflow from high tides, or any combination of sources."

Inundation "A condition in which water from any source temporarily or permanently covers a land surface." (flooding + ponding)

Ponded "A condition in which water stands in a closed depression. Water may be removed only by percolation, evaporation, and/or transpiration."

Saturated "A condition in which all easily drained voids (pores) between soil particles in the root zone are temporarily or permanently filled with water to the soil surface at pressures greater than atmospheric."

Zone of Influence "…a lowering (drawdown) of water levels in an area around the well" …caused by… "(t)he withdrawal of water by a well" ["Guidelines for Delineation of Wellhead Protection Areas" EPA 440/6-87-010]

END