**Visual Surveys Ponds and Impoundments:**

**Percent Cover of Floating, Non-Rooted Vegetation**

**SOP CN. 151.5**

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**Background:**

The addition of nutrients to aquatic systems through cultural enrichment can lead to biological responses that cause impairment of water uses from algal blooms, choking weeds, lack of oxygen, taste and odor problems, turbidity, sedimentation, decreases in biodiversity and elimination of important species. These conditions impair Massachusetts water use goals for public water supply, recreation and protection of aquatic life. Massachusetts is developing a framework and policy for nutrient management in freshwater systems that will quantitatively translate the narrative criterion. Massachusetts Department of Environmental Protection (MassDEP) established numeric response indicators guidance thresholds (Secchi disc, planktonic chlorophyll, and non-rooted macrophytes/algal scum) that will be used in a weight-of-evidence to judge the support of designated uses within lakes and impoundments. The guidance criteria specify that whole-area, floating, non-rooted vegetation on or near the water surface including duckweed and/or algae and/or cyanobacteria shall not exceed 25% coverage in more than one site visit during the summer index period for impoundments (April to October) and Lakes (June 15 to September 15) (Mattson 2013).

Standard Operating Procedures for providing general estimates of percent cover of floating, non-rooted vegetation across the whole lake, pond or impoundment have been developed by the Department. This ensures that standardized and approved methods are used consistently. In the event that more rigorous plant survey measures are needed for non-rooted floating plants, refer to the Long-term Duckweed Monitoring on the Assabet River Impoundments (SOP CN 239.0).

**NOTE: This SOP covers floating, non-rooted cover estimation ONLY. A separate SOP (CN 67.2) provides procedures for more intensive macrophyte surveys for all plant types.**

**Equipment:**

* Boat with all associated lake survey equipment (see CN 151.0 for equipment checklist)
* a digital camera with a minimum 1 Gb free memory\*,
* spare camera battery;
* binoculars (optional when using boat; required when estimating from the shoreline);
* Pond and Lake Fieldsheet Form
* Plan View Outline Maps of Pond or Lake (to scale) clipboard;
* pens

*\*The photos are not used in the analysis per se but serve to document what observers are seeing relative to what coverage percentages they record on the forms. They can, thus, serve as a QC check over time and between observers, if necessary. Selected photos will also be useful in reports and public displays.*

**Procedures:**

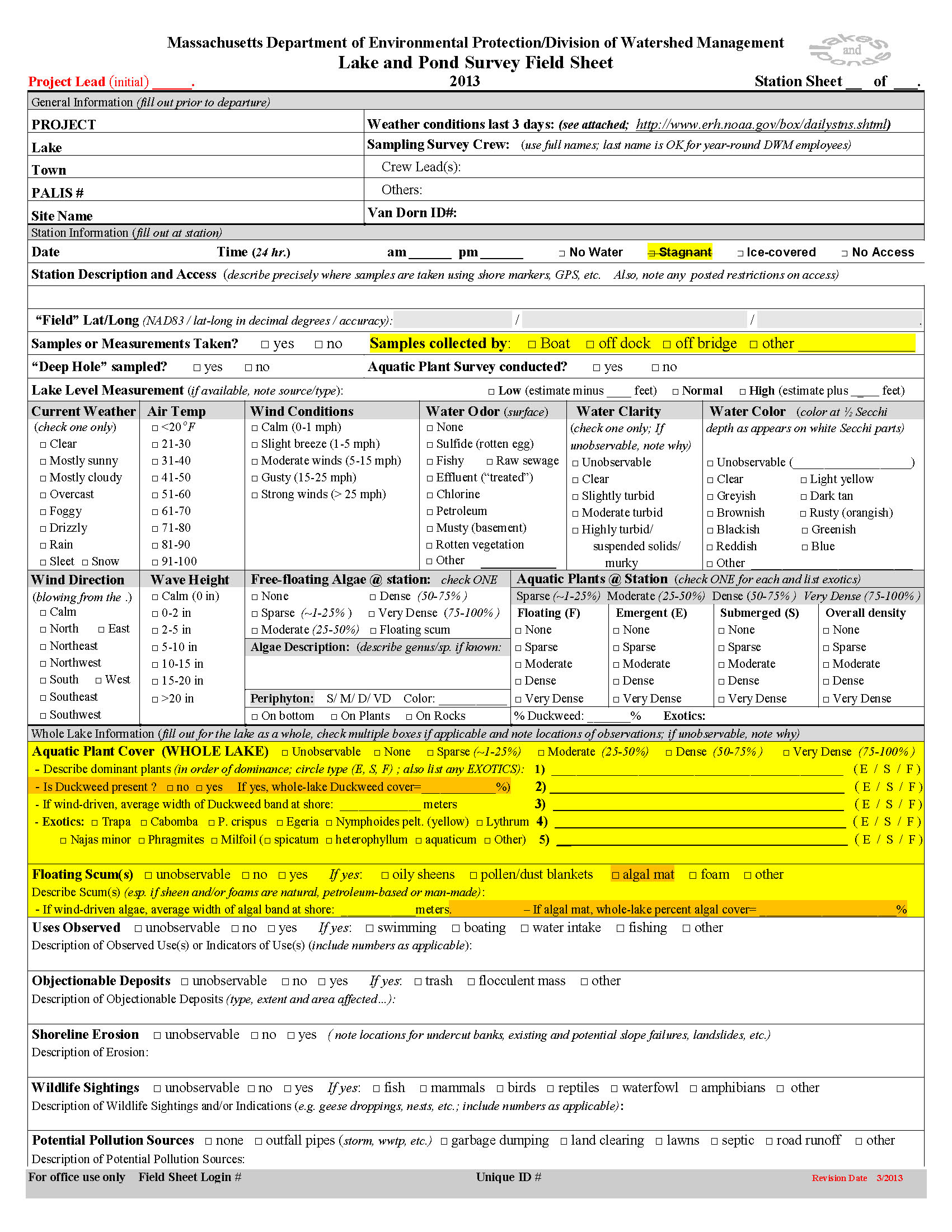
**By Boat:** DWM field surveys for lakes and ponds are carried out monthly during the summer index period for impoundments (April to October) and Lakes (June 15 to September 15). The “whole-lake” portion of the lakes & Ponds Fieldsheet (page1, bottom half; yellow highlighted) is used to record Aquatic Plant Cover and Floating Scums.Dependent on lake size, sufficient time is taken to traverse the waterbody by boat and visually assess whole-lake areal coverage by non-rooted plants (macrophytes and/or algal films/clumps). Because rooted plants can often reach the surface in shallow lakes, use of the boat allows closer inspection to differentiate between rooted and non-rooted plant coverage and also to discern between duckweed/wolfia and surface clumps of cyanobacteria. As a result, the visual assessment from the boat allows the relevant fieldsheet sections noted above to be filled out with greater accuracy and confidence. Visual observations are made of both the open water areas and the bank/littoral areas. For very minimal coverages, try to estimate fractional percentages (e.g., 0.5% vs. 0.01%) rather than simply “<1%”. Similarly, try to record thin shoreline bands to sub-meter accuracy (e.g., 0.1 meter rather than “<1meter”). Record fieldsheet density categories for “whole-lake” duckweed and algae (orange highlighting). A floating-plant-coverage sketch is made using a lake-specific outline (to scale), using separate codes for each plant type. Photos are taken throughout the traverse to photo-document the coverage survey. Voucher specimens collected as needed for later identification.

**From Shore**: The surveyorshould determine the appropriate vantage point during the initial visit and this vantage point should be maintained in subsequent site visits. Some impoundments may have observation areas for dams and for causeways. Visual observations are made of both the open water areas and the bank/littoral areas. Photos are taken at the same time from each of the observation points. Photo-observation points and non-rooted coverage are marked by sketching on the lake outline map, using binoculars as needed to get “closer” to the rest of the lake area. If different types of coverage (e.g., duckweed vs. algae) are possible from distance, sketch plant-type-specific areas. Populate fieldsheet density categories for “whole-lake” duckweed and algae (orange highlighting).

**Fieldsheet categories**: Estimate and record the percent coverage of duckweed and algae onto the whole-lake portion of the field sheet (orange highlighted) to the nearest whole number %. As noted above, try to estimate fractional percentages and band widths for very minimal coverages (e.g., 0.5% and 0.01% rather than simply “<1%”; 0.1 meter rather than “<1meter”). These percentages and related information will be entered as defined fields or as “comments” during fieldsheet entry. To the extent possible, identify the type(s) of non-rooted plants (e.g., Lemna, Wolfia, etc.) and algal types, in order to discriminate against rooted, floating leaf plant cover. Weather conditions and wind patterns should also be noted, especially if they are creating high density duckweed bands at the shore.

**Data Reduction**: DWM fieldsheet data are entered into a database using defined fields or as comments where needed (e.g., exotic plant types, whole-lake algal scum %). Following entry, data are proofed and QC’d per standard data management protocols. The data fields containing floating plant and algae information are available for export and data analysis. These data can be exported to Excel spreadsheets for each lake/impoundment along other relevant information collected during the survey. Completed lake outline sketches containing floating plant densities are scanned and placed in folders on the W: drive for each impoundment. The completed field forms (paper) are retained in the project file folder drawers.

**Photo-Documentation:** Digital photos are downloaded and placed into project-specific folders on the WPP network per standard WPP protocols.

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### Floating, Non-Rooted Macrophyte Codes \*

*\* excerpted from CN 67.2; new codes*

##### Plant species (common name) Code

Macroscopic algae (mats, clumps, etc.) and misc. Δ

Moss □

Riccia fluitans “Slender Riccia” □ 

Ricciocarpus natans “Purple-fringed Riccia” □ 

|  |
| --- |
|  |
| Ceratophyllum sp. “Coontail” K  Ceratophyllum demersum “Coontail” K1  C. echinatum K2 |

Azolla caroliniana “Water-velvet” ■3

Salvinia rotundifolia “Floating Moss” ■4

[*Azolla mexicana*](http://www.ecy.wa.gov/programs/wq/plants/plantid2/descriptions/azomex.html) - Mexican Water-fern ■5

[Water fern - *Salvinia minima*](http://plants.ifas.ufl.edu/node/395) ■6

[*Eichhornia crassipes*](http://www.ecy.wa.gov/programs/wq/plants/plantid2/descriptions/eiccra.html) - Water Hyacinth $

Spirodela polyrhiza “Big Duckweed” L1

Wolffia sp. “Watermeal” L2

Wolffiella floridana “Florida Wolffiella” L3

Lemna sp. “Duckweed” L4

L. minor “Common Duckweed” L5

L. trisulca “Star Duckweed” L6

[*Wolffiella gladiata*](http://www.ecy.wa.gov/programs/wq/plants/plantid2/descriptions/wol.html) - Mud Midget L7

Utricularia sp. “Bladderwort” U

U. vulgaris “Common Bladderwort” U1

U. purpurea “Purple Bladderwort” U2

U. radiata “Floating Bladderwort” U3

U. intermedia “Flat-leaved Bladderwort” U4

U. gibba “Creeping Bladderwort” U5

[***Pistia stratiotes***](http://plants.ifas.ufl.edu/node/328) [Water lettuce - *Pistia stratiotes*](http://plants.ifas.ufl.edu/node/328) #1

[Frog's-bit - *Limnobium spongia*](http://plants.ifas.ufl.edu/node/233) #2

### Floating-Leaf, Rooted Macrophyte Codes \*\*

*\*\* Common rooted plants with floating leaves can also be accounted for during the survey, as they may interfere with cover estimates for non-rooted plants.* ***They should not, however, be included in cover estimates for non-rooted cover.***

*excerpted from CN 67.2;*

##### Plant species (common name) Code

Chara sp. “Muskgrass” C1

Nitella sp. “Stonewort” C2

Najas sp. “Bushy Pondweed” or Naiad” J

Ruppia maritima “Widgeon Grass” J1

Najas flexilis “Slender Naiad” J2

Najas minor “European Naiad” J3

Najas guadalupensis “Naiad” J4

Najas gracillima J5

Elodea sp. “Waterweed” H2

E. nattallii “Waterweed” H3

E. canadensis “Canadian Waterweed” H4

Egeria densa “Brazilian elodea” H5

Polygonum sp. “Smartweed” Q2

Nymphaea sp. “Water Lily” N1

N. odorata “Fragrant Water Lily” N2

N. tuberosa “White Water Lily” N3

Nuphar sp. “Yellow Water Lily”, “Cow Lily”, or “Spatterdock” N5

N. variegatum “Painted Cow Lily” N6

Brasenia schreberi “Water Shield” n1

Nelumbo lutea “American Lotus” n2

Cabomba caroliniana “Fanwort” n3

Trapa natans “Water Chestnut” V2

Nymphoides cordatum “Floating Heart” g1

**APPENDIX**

1. Field Forms

All blank field forms for Lake and Pond surveys can be found internally by DWM-WPP staff on the W: network drive at: [W:\DWM\SOP\FORMS & RECORDS\FORMS\Fieldsheets (DWM)](file:///\\dep.govt.state.ma.us\enterprise\Worcester-Workgroup\DWM\SOP\FORMS%20&%20RECORDS\FORMS\Fieldsheets%20(DWM)).

B. Sample Photos

Open water sections

Margin and littoral areas

