# STANDARD OPERATING PROCEDURE FOR DETERMINING PERCENT COVER OF AQUATIC VEGETATION IN WETLANDS

# GSL IMPOUNDED WETLAND 2012 MONITORING ACTIVITIES

State of Utah
Department of Environmental Quality
Division of Water Quality

Revision 1
Effective 09/09/2011

*Utah Division of Water Quality (DWQ) Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical experts. The primary purpose of this document is for internal DWQ use. This SOP should not replace any official published methods.*

*Any references within this document to specific equipment, manufacturers, or supplies is only for descriptive purposes and does not constitute an endorsement of a particular product or service by the author or by DWQ. Additionally, any distribution of this SOP does not constitute an endorsement of a particular procedure or method.*

*Although DWQ will follow this SOP in most instances, there may be instances in which DWQ will use an alternative methodology, procedure, or process.*

## REVISION PAGE

| Date | Revision # | Summary of Changes | Sections | Other Comments |
|---|---|---|---|---|
| 09/09/2011 | 1 | not applicable | not applicable | Creation of document, began document control/revision tracking |
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## 1.0 SCOPE AND APPLICABILITY

This document presents the standard operating procedure (SOP) for measuring percent areal cover of submerged aquatic vegetation (SAV), filamentous algae, and floating aquatic vegetation in wetlands, and applies to any Utah Division of Water Quality (UDWQ) monitor or non-UDWQ cooperator performing wetlands monitoring.

Percent cover of SAV (and percent change in SAV cover) is an important indicator of the overall ecological health of a wetland, and is used by the UDWQ as a key component in a multi-metric index (MMI) tool used to assess wetland condition. SAV provides protective habitat for macroinvertebrates and other organisms, stabilization of sediments, nutrient cycling and attenuation, and attenuation of other pollutants. SAV, primarily sago pondweed (*Stuckenia pectinata*) and western fineleaf pondweed (*Stuckenia filiformis* ssp. *occidentalis*) also plays a critical role in wetland food webs, in particular, providing forage for migrating waterfowl (Miller and Hoven, 2007 and Hoven and Miller, 2009).

Observations and visual estimations of the percent cover of algae, particularly algal mats, and floating vegetation, primarily duckweed, are performed concurrently with the SAV measurement.

This SOP has been created for UDWQ monitoring and is based on a modification of procedures described in the following documents: Miller and Hoven (2007), Hoven and Miller (2009), EPA's Methods for Evaluating Wetland Condition Module #10 – Using Vegetation to Assess Environmental Conditions in Wetlands (2002), EPA's National Wetlands Condition Assessment (NWCA) Field Operations Manual (2010), and Daubenmire (1959).

## 2.0 SUMMARY OF METHOD

The procedure involves making visual estimations of percent cover of SAV (and algae and duckweed) within 5 randomly selected quadrants placed along a 100-m transect.

## 3.0 DEFINITIONS

IW: impounded wetland(s)

PVC: polyvinyl chloride

SAV: submerged aquatic vegetation; for the purpose of this SOP, SAV includes vascular vegetation rooted in sediment for which most of the plant is submerged or floating on water

m: meters

## 4.0 HEALTH AND SAFETY WARNINGS

Field personnel should take appropriate precautions when operating watercraft and working on, in, or around water. All boats should be equipped with safety equipment such as personal flotation devices (PFD's), oars, air horn, etc. Utah's Boating Laws and Rules shall be followed by all field personnel.

Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, the sample visit is recommended to be rescheduled. If hazardous weather conditions arise during sampling, such as lightning or high winds, personnel should cease sampling and move to a safe location.

## 5.0 CAUTIONS

Field personnel should attempt to minimize disturbance of sediments and should wait for any kicked-up sediment to settle or otherwise dissipate before making the percent cover estimation at each sampling point along the transect.

## 6.0 INTERFERENCES

Wave action, turbidity, and sediment plumes can interfere with observation of SAV. Additionally, algal mats can become "stacked up" or pushed to pond edges due to wind. Field conditions potentially affecting the measurement should be noted on the field sheet/notebook. If conditions inhibit the ability to make the SAV measurement, this should be noted in the field notebook and the site should be revisited.

## 7.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

Monitors performing SAV measurements must read this SOP annually and acknowledge they have done so via a signature page (see **Appendix 1**). New field personnel must also demonstrate successful performance of the method. The signature page will be signed by both trainee and trainer to confirm that training was successfully completed and that the new monitor is competent in carrying out this SOP. The signature page will be kept on-file at UDWQ along with the official hard copy of this SOP.

## 8.0 EQUIPMENT AND SUPPLIES

_____ Copy of this SOP

_____ PVC frame ($1m^2$, dimensions 2 m by 0.5 m) with foam for flotation and markings to aid in % cover estimate (**Figure 1)**

_____ Laser range finder or reel tape and PVC posts to mark ends of transect

_____ GPS (and batteries) to determine sampling locations if monitors are sampling from a boat due to high water levels

_____ Field sheet (**Appendix 2** is an example of a project-specific field sheet), field notebook, pens and pencils

_____ Printed list of sets of random numbers (from 0 to 100)

_____ Camera

_____ Plastic, high-sided utility sled or float tube (fishing type) for toting equipment

_____ Meter stick made of PVC and marked in centimeters for measuring water depth and SAV height

_____ Viewing bucket, ~2 gallon plastic bucket with bottom cut out

## 9.0 PROCEDURES

### 9.1 Setting up the Transect

#### 9.1.1 Impound Wetlands

1) Locate the pond outlet.
2) Gather the equipment in the sled or float tube and walk approximately 100 m into the IW and away from the outlet.
3) Set up the 100 m transect perpendicular to the outflow, using laser range finder or reel tape. Using this technique, the transect will run East-West for a majority of GSL IW.
4) Make sure each end of the transect is at least 50 m from any impoundment.
5) Mark each end of the transect with a PVC post. To minimize disturbance of sediments avoid moving within the two posts within the pond when setting up the transect. Individuals on each end of the transect should start > 100 m apart and then move toward each other to set the posts.

#### 9.1.2 Fringe Wetlands

Transect location and orientation to be determined on a project/site specific basis.

### 9.2 Performing the SAV Measurement and Associated Observations

1) Use the list of randomly generated numbers to look up a set of 5 random sampling points, which correlate to the number of paces (meters) from the transect start.

2) Starting at the western or northernmost end of the transect, pace off steps to the lowest randomly determined sample location.

3) Floating the PVC frame on the water surface, lay the long side of the frame perpendicular to the transect at the established distance (m) along the transect,

centered on the transect line. Look through the frame and estimate percent cover, starting at the water surface, and then moving down through the water column. If necessary, vegetation for which cover has been estimated and recorded can then be moved out of the way to visualize submerged vegetation.

4) Cover is estimated directly as the percentage (0 to100%) of the plot area covered by the vegetation group under consideration. Use the continuous range of values from 0 to 100% when estimating cover for an entity within the PVC frame. For values < 1%, record <1%. **Figure 2** is an excerpt from EPA's NWCA Field Operations Manual and may aid in estimating percent cover.

5) Record the estimated percent cover of SAV, floating vegetation, algal mats, SAV height, and water depth as indicated on the field sheet (**Appendix 2**). Also make note of potentially interfering conditions such as turbidity or wind.

6) Repeat Steps 3-5 for the 4 remaining random sampling points.

### 9.3 Supplemental Method to Perform SAV Measurement

Some field situations, primarily water levels too deep to safely allow wading, will necessitate floating in a boat or on a float tube to conduct the visual estimations of vegetation cover. This method will be performed in the same way as the previous method, with the following exceptions.

1) Using a GPS unit, either mark the current point or use the stored point as the starting point of the transect.

2) Sight the transect direction along which the measurements will be performed.

3) Using the 5 random numbers corresponding to meters travelled along the transect, row or pole the boat/tube along the determined transect (a motor will cause too much disturbance to the substrate and vegetation).

4) When the lowest randomly determined sampling location is reached, according to the distance function (set to meters) on the GPS, hold the boat/tube in place with an anchor or pole placed gently to prevent disturbance.

5) Follow the above method (**Section 9.2**), holding the quadrant frame over the side of the boat/tube to conduct vegetation cover estimates.

### 9.4 Site Photos

Photos should be taken during each site visit to qualitatively capture SAV, duckweed, and algae cover at the site.

1) Take a photo of the field station ID on the field sheet before taking any site photos (in lieu of a photo logbook).

2) If a vantage point for the sampling site is available, take one or several photos of the overall study area, documenting general vegetation conditions. Also, note the observed general conditions on the field sheet.

3) Take one or several photos looking down over the PVC frame at the sampling points along the transect (greater heterogeneity of vegetation = more photos).

4) Standing at one end of the transect (chose the end that produces less glare on the photo, depending on the time of day), take a photo looking down to the other end of the transect.

5) Using best judgment, take any other photos that may aid in capturing conditions at the site.

## 10.0 DATA AND RECORDS MANAGEMENT

All measurements of % cover vegetation, descriptions of the transect and random sampling points, and other field observations should be recorded on the field sheet.

Monitors must review the field sheet for completeness and accuracy in the field before leaving the site.

Upon returning to the office, both the monitor performing the measurement and the field team leader (or another reviewer if the field team leader performed the measurement) sign/initial that they have reviewed the field sheet. The field sheet is then scanned and the PDF file saved into the shared “Willard Spur” folder. The original form is placed in the project file.

The data from the field sheet is uploaded into the water quality database staging area at the same time as the other field data collected for that day (ideally with 2 weeks from the date of the site visit).

## 11.0 QUALITY ASSURANCE AND QUALITY CONTROL

Replicate measurements will be performed at a minimum rate of 10% (1 replicate for every 10 regular measurements), or at a frequency required in a program/project specific quality assurance plan or sampling and analysis plan. To perform the replicate measurement, choose 10 random numbers instead of 5 for the transect. Every other station along the transect (stations 2, 4, 6, 8, and 10) will be the replicate measurement while transect stations 1, 3, 5, 7, and 9 will constitute the regular measurement. Precision of these replicates (calculated as relative percent difference) will be evaluated and may be used to refine sampling procedures in the future.

## 12.0 REFERENCES

Daubenmire, R.F. 1959. Canopy coverage method of vegetation analysis. Northwest Science 33: 43-64.

Hoven, H.M. and T.G. Miller. 2009. Developing vegetation metrics for the assessment of beneficial uses of impounded wetlands surround Great Salt Lake, Utah, USA. Natural Resources and Environmental Issues. 15(1): 62-72.

Miller, T.G. and H.M. Hoven. 2007. Ecological and beneficial use assessment of Farmington Bay Wetlands: Assessment and site-specific nutrient criteria methods development Phase I. Progress Report to EPA, Region VIII and Final Report for Grant: CD988706-03, 760 pp.

U.S. EPA. 2002. Methods for evaluating wetland condition: #10 Using vegetation to assess environmental conditions in wetlands. Office of Water, U.S. Environmental Protection Agency, Washington, D.C. EPA-822-R-02-020.

U.S. Environmental Protection Agency. 2011. National Wetland Condition Assessment: Field Operations Manual. U.S. Environmental Protection Agency, Washington, D.C. EPA-843-R-10-001.

## 13.0 FIGURES

**Figure 1 – Diagram of PVC quadrant frame**

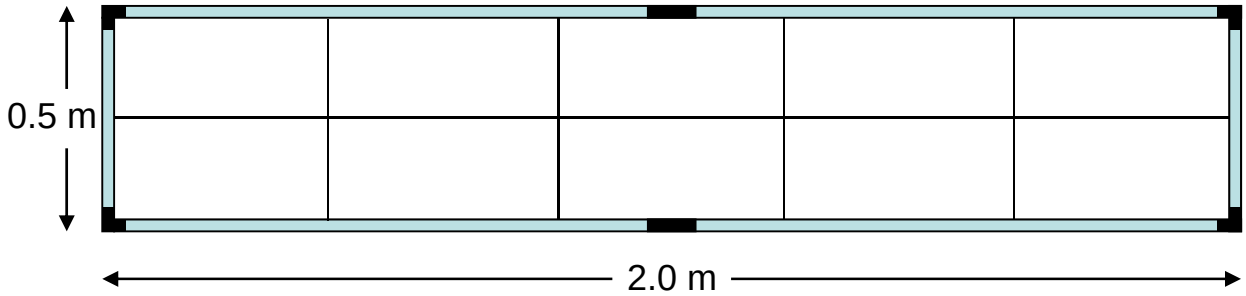
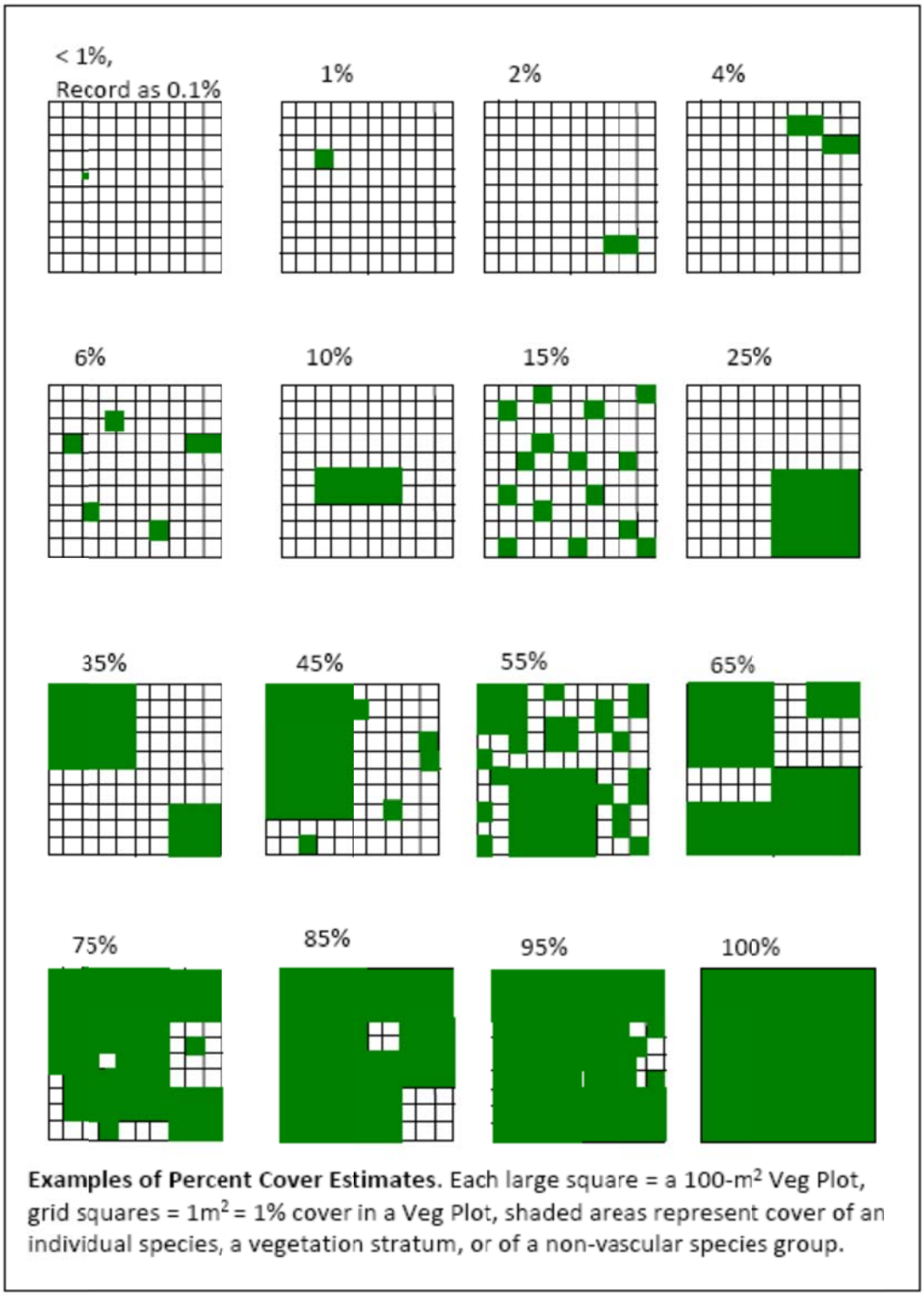


**Figure 2 – Percent cover estimation guidance (from EPA's NWCA Field Operations Manual, 2011)**




**Examples of Percent Cover Estimates.** Each large square = a 100-$m^2$ Veg Plot, grid squares = 1$m^2$ = 1% cover in a Veg Plot, shaded areas represent cover of an individual species, a vegetation stratum, or of a non-vascular species group.

# 14.0 APPENDICES

## Appendix 1 - SOP Acknowledgment and Training Form (front and back)



### SOP Acknowledgement and Training Form

This SOP must be read and this form signed annually. This form must be kept with the current version of the SOP.

| | |
|---|---|
| Document Title: | |
| Document Revision Number: | |
| Document Revision Date: | |

Please sign below in accordance with the following statement: "I have read and understood the above referenced document. I agree to perform the procedures described in this SOP in accordance with the document until such time that it is superseded by a more recent approved revision."

| Printed Name | Signature | Date |
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## SOP Acknowledgement and Training Form (continued)

Trainee: Sign below to acknowledge that training on this SOP was received, understood, and all questions/concerns were addressed by the trainer.

Trainer: Sign below to acknowledge that training on this SOP was completed for the individual listed and that trainee is competent to perform the procedures described within.

| Date of Training | Trainee Printed Name | Trainee Signature | Trainer Printed Name | Trainer Signature |
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## Appendix 2 – Field sheet example

**2011 GSL Wetlands SAV Condition Sheet**

Site Description_____
Trip ID_____ STORET_____
Date & Time _____ Sampler(s)_____

**Algal Mat Cover ≤50 m of sampling location (%):**_____

**Regular Measurement:**

| Quadrant number | 1 | 2 | 3 | 4 | 5 | Average |
|---|---|---|---|---|---|---|
| Quadrant location along transect (m) | | | | | | |
| Water depth (cm) | | | | | | |
| Height of SAV (cm) | | | | | | |
| SAV cover (%) | | | | | | |
| [1]SAV condition | | | | | | |
| [2]Filamentous algae cover (%) | | | | | | |
| Duckweed cover (%) | | | | | | |

[1]SAV condition: 1 = Decomposing/senescing, 2 = Intact, but stressed, 3 = Healthy
[2]Filamentous algae: Extent of algae on SAV and/or surface of pond (%)

**Algal Mat Cover ≤50 m of sampling location (%):**_____

**Replicate Measurement:**

| Quadrant number | 1 | 2 | 3 | 4 | 5 | Average |
|---|---|---|---|---|---|---|
| Quadrant location along transect (m) | | | | | | |
| Water depth (cm) | | | | | | |
| Height of SAV (cm) | | | | | | |
| SAV cover (%) | | | | | | |
| [1]SAV condition | | | | | | |
| [2]Filamentous algae cover (%) | | | | | | |
| Duckweed cover (%) | | | | | | |

Other Observations or Comments: