Technical Appendix D

Vegetation Monitoring

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The following two documents describe, in detail how wetlands in Island County will be monitored. The first document, called Wetland Vegetation Monitoring describes the purpose of the monitoring and the process for choosing which wetlands are scheduled to be monitored. The second document, called Wetland Water Quality and Vegetation Monitoring Procedure describes in detail, the procedures that will be utilized to monitor each wetland. This document incorporates the wetland monitoring effort, including vegetation monitoring, into the existing Water Quality Monitoring Program.

Currently, the wetland monitoring is scheduled to begin in the summer of 2007. As described in the documents below, there are limitations to the scheduling. The sampling must occur during a brief window in the summer. It is the overall goal to begin this monitoring, but time is very rapidly becoming an issue.

Further, it is assumed that as the monitoring work is conducted there will be a need to refine the Standard Operating Procedures. The Procedures that are described are based on projections. Again, as the work begins the Standard Operating Procedure will likely require alterations and modifications.

Document 1

Wetland Vegetation Monitoring

Sampling wetland vegetation is a critical element for determining the effectiveness of Island County's Critical Areas Ordinance. Island County's Water Quality Monitoring Program also benefits from wetland vegetation information. Vegetation composition may affect water quality conditions either positively or negatively. Without vegetation information, establishing a water quality baseline in a wetland may be difficult or impossible.

Both vegetation and water quality monitoring are the minimum required to determine the overall health of a wetland. Wetland vegetation composition is a biological indicator of overall wetland health, while water quality is a chemical indicator of wetland health. Obviously, both are mutually dependent and affect each other. Although additional information and techniques would be needed to assess habitat function and aquatic species composition, both vegetation and water quality are the minimum required to answer the question of overall wetland health.

Vegetation, together with water quality monitoring will be used to evaluate the effectiveness of various buffer sizes and the buffers ability to protect the wetland. The monitoring will evaluate the overall risks or effects of various buffer intrusions from activities such as exemptions, exceptions and conditional use decisions.

An adaptive management approach to wetland monitoring will drive the program and its future efforts. Where the monitoring frequency is providing little or no information due to lack of changes in species composition, water quality changes or buffer alterations the wetland monitoring frequency may be altered. Where more intensive wetland monitoring is required due to changes in conditions, the monitoring frequency may be increased. Reporting of results and staff recommendations will be provided to the Planning Commission on an annual basis. Again, the wetland monitoring is intended to measure the overall effectiveness of various buffers and for this reason an adaptive approach must be considered.

All vegetation monitoring should be conducted within a window around or near the first two weeks in July. The vegetation monitoring should occur when conditions allow for accurate plant species identification and accurate cover percentages to be determined.

Water-quality monitoring should take place four (4) times per year, once during each season. Collection of water quality information along with water-level fluctuation is fairly inexpensive. This effort will allow determination of seasonal affects on water quality to be determined.

Monitoring of wetlands and assessment of various man-induced stressors is a difficult and time dependent undertaking. The effects of stressors to both a wetland and the many species that depend on the wetland may take years to assess. For this reason the following schedule is proposed for long-term monitoring of the overall effectiveness of the CAO requirements: 15 wetlands from the 2005 wetland inventory will be monitored during the first year. Five of the wetlands will have little or no signs of buffer disturbance (>100' buffers) and will be comprised predominately of native vegetation. These wetlands will act as a baseline for both water quality and vegetation composition. Five other wetlands will be chosen based on a slightly diminished buffer size (100-50 feet). The final five wetlands will have increasingly compromised buffers along a broad range (50-20 feet). In the following four years, five new "baseline" wetlands will be monitored for both vegetation and water quality. Five new "slightly diminished" wetlands and five "compromised" wetlands will be monitored. In year five, wetlands monitored in year one will be monitored again. In year six, all wetlands monitored in year two will be monitored again and so on.

This method will result in the monitoring of 60 different wetlands every five years. It is understood that this methodology may change if conditions dictate or opportunities to measure specific decisions or buffer intrusions are identified. Obviously, any future disturbance or decision in a previously monitored wetland may allow special opportunities to evaluate the affects of the disturbance/decision.

In every instance, as much as is feasible, the contributing characteristics (slopes, soils, vegetation composition, wetland size, hydrology, etc.) influencing each wetland will be matched as much as possible between each wetland.

In every case, prior to any field work, a full land-use evaluation within the contributing area of each wetland will be assessed. The assessment will evaluate the distances from the wetland to structures, landscaping, roads, utilities, etc. The results of this assessment will be mapped using GIS. The assessment and report will act as a bank to assess decisions that are made over time in and around a wetland.

Document 2

Wetland Water Quality and Vegetation Monitoring Procedure
SOP # 2008

Scope

This standard operating procedure (SOP) is applicable to the collection of water quality data and vegetation data from wetlands in Island County. Standard operating procedures ensure that methodology is consistent and repeatable. The SOP for water quality and wetland vegetation monitoring will be followed at all times. Proper methodology supports the Water Quality Monitoring Programs Quality Assurance Plan.

Water quality monitoring in wetlands may indicate the chemical condition of waters but it will not, by itself, directly indicate if natural biological communities are being adequately protected. Therefore, it is important that biological communities be sampled in addition to water quality monitoring. Although the monitoring of wetland vegetation and water quality will not allow for definitive conclusions about trends in a wetland's health, they are being monitored because they are the most practical and widely-accepted indicators of wetland health. Unlike herbaceous vegetation, woody vegetation will not be quantified by the Water Quality Monitoring Program because it is unlikely to change measurably between years, and thus is a relatively insensitive indicator of wetland health.

Standard operating procedure for wetland monitoring will require collection of water quality information, the wetland vegetation to be identified, and total vegetative cover to be estimated. Vegetation monitoring will occur at both the "plot" scale and the whole-wetland ("site") scale. The following variables will be used to interpret possible declines in wetland health:

A decline in the number and proportion of herbaceous species per sample plot and per site.

Declines in percent cover of native (vs. non-native) herbaceous species per sample plot.

Declines in overall aerial cover of native (vs. non-native) herbaceous species per site.

Before concluding that the above changes are due to the effects of land-use activities, inadequate implementation of best management practices or flaws in the critical area ordinance, the natural factors that may cause such changes must be evaluated. For example, an unusually dry growing season can temporarily decrease the number and percent cover of a wetland species. These natural influences will be assessed using precipitation records, wetland water level information, and water quality data. The sampling protocol itself will be examined to ensure that methodology is not introducing bias or error.

Sampling Methodology

Water Quality Monitoring

Water quality information will be collected quarterly from every wetland where vegetation monitoring is scheduled to occur. All analytes currently being collected by the Water Quality Monitoring Program will be collected. Water quality sampling will be conducted as described in SOP #2003. Water depth in the wetland will be collected during all water quality monitoring events.

Vegetation Monitoring

During year one (1), vegetation monitoring will occur in fifteen (15) wetlands in Island County. Five (5) of the wetlands will have buffers that are largely in tact with little or no disturbance within 100 feet of the wetland edge. These wetlands and their associated buffers will act as a baseline for both water quality and vegetative conditions. The next 5 wetlands will be monitored because they show signs of slight buffer intrusions (75-100 feet). The final 5 wetlands to be monitored will have buffers that show signs of moderate to intense buffer intrusions or disturbances (<75 foot).

In each of the following two years (years 2 & 3) 15 new wetlands will be monitored based on the same conditions described above. The program acknowledges the need to evaluate exceptions and reasonable use decisions as they relate to protection of wetlands. For this reason, the program will monitor wetlands where development opportunities and decisions allow this data to be collected. Opportunities to evaluate these decisions may require alteration to this schedule.

In general, the wetland visits will be made between July 5 and July 15. This is a time when some the most difficult-to-identify species (e.g., grasses and sedges) are most identifiable. Where the proceeding months have been unusually cold and wet, or warm and dry, the timing of the monitoring may be altered to obtain reliable and standardized information. Alteration of monitoring frequencies will be limited where possible, to minimize inter-annual variation due to day-length and weather factors, which can affect species presence thus estimates of species richness and cover.

Within each wetland, three different methods – each with its own distinctive and complementary advantage -- will be used to assess vegetation.

In each wetland, a voucher specimen of each different species encountered will be collected (unless already collected during a prior monitoring event), pressed, labeled, and maintained in a herbarium. To avoid disturbing the plant community, all specimens will be collected from outside of the sample units. Where that is not possible, specimens will be photographed. The voucher specimens will be invaluable both for documenting the identifications and as a reference for future plant identifications.

1. <u>Permanent Perimeter Quadrats</u>

Prior to the first visit, a series of permanent quadrats, each 1 x. 1 m, will be staked and GPS'd in each wetland. These quadrats will be located at approximately equal spacing along the estimated wetland edge (perimeter), no closer than 2m apart. The total number of quadrats will be determined by the length of the wetland perimeter. In every case, no more than 30 quadrats will be used in any single wetland. The spacing may deviate somewhat where it is obvious that doing so would allow the inclusion of different plant communities or species. Perimeter monitoring will evaluate the area and species which are most sensitive to the potential impacts of adjoining land use activities. The perimeter length (and thus the number of quadrats) can be estimated from an aerial image before laying out the quadrats. During each event, the absolute percent cover of each herbaceous species in each quadrat will be recorded. Care will be taken to not step into the quadrat at any time.

2. Point Line Method

This method is described by Bergholt & Thomas (2001). This method will provide estimates of a wetland's overall aerial cover.

To implement this strategy, transects that span the wetland will begin at randomly-located starting points along the wetland edge. Transects will be oriented to span the primary environmental gradient in the wetland (e.g., elevation). Alternatively, if cursory observation indicates that the wetland's plant communities exist in distinct zones transects will be stratified by zone.

The number of random points that will be assessed along these transects is equivalent to the number needed to achieve:

$$n = (z^2 * s^2) / B^2$$

Where n = unadjusted sample size
z = standard normal deviate
s = sample standard deviation
B = precision level, which shall be half the maximum acceptable confidence interval width multiplied by the sample mean.

At each random point, a vertical rod tipped with a pin is lowered from above, and the vegetation directly intercepted by the rod is recorded. A plant that is "hit" by the pin is recorded, if none are hit, the trial is recorded as "bare." Intercepts of downed wood, water, and artificial debris will also be recorded. The overall frequency with which a species is "hit" in the wetland can be translated into statistically-valid estimates of overall aerial cover. Sample size estimates will be used to adjust the number of points and transects used in the same wetland during the sampling event as well as the monitoring in subsequent years. The beginning and ending points of each transect will be GPS'd and a map will be sketched of their location.

3. Plant Identification Walk-through

After the data has been collected using the above methods, the person doing the assessment will walk portions of the wetland not covered by the quadrats or transects, and will record any species not encountered and recorded. The time spent searching, as well as parts of the wetland that

were inaccessible, will be recorded. This effort is not intended to comprise a comprehensive botanical inventory of each sampled wetland but to capture species that may be present but not captured in the monitoring. Voucher specimens of any species encountered in any sampled wetlands will be collected.

Quality Assurance

Quality of the identifications will be verified through review of the voucher specimens by an independent expert botanist. The objective is to ensure that 90% of the species identified in a wetland are identified accurately.

To examine the thoroughness of the survey, a second person will visit one wetland per year and independently assess 30 percent of the permanent quadrats. Data will be compared. The data quality objectives are:
a) Among the permanent quadrats, no more than 10% of the documented species will have been missed by the primary observer;
b) For the two most-common species in the permanent quadrats, estimates of percent cover will average no more than 20% difference between the two observers;
c) 90% of the species contained in the wetland will be identified in the first evaluation. The quadrat evaluation and the walk-around will be used to assess the representativeness of the first evaluation.

References

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