

1.0 Performance Measure Title

Total Nitrogen Loads/Flow-Weighted Mean Concentration in Inflows to the Greater Everglades Wetlands

Last Date Revised: March 2, 2007

2.0 Justification

Nutrient loading is widely used to estimate the nutrient enrichment impact of discharges on water bodies. Nitrogen (N) and phosphorus (P) loading are two of the most fundamental metrics needed to assess ecosystem dynamics. As P loads to the Greater Everglades and hydro patterns are altered by CERP and non-CERP projects, it is unclear how N loading patterns, removal efficiency, availability, and transport may be affected. Because P is typically the limiting nutrient in most of the Greater Everglades wetlands, a large uncertainty exists as to the cycling and impact of N on the system. Current research suggests a possible consequence of effective P removal may be that N reaching the Everglades Protection Area may be more likely to be transported to the coast, i.e., the hypothesis that increased P limitation yields more conservative behavior for N. Estuaries are typically N limited, so N loading to the coastal zones can impact CERP's plans for ecologic restoration. Consequently, total nitrogen (TN) should be monitored in the Greater Everglades wetlands region along with total phosphorus (TP). The 2002 CROGEE report emphasizes the need for additional nitrogen monitoring.

The Everglades Construction Project and future water management practices will affect the nutrient loads and concentrations in the Greater Everglades wetlands. CERP projects that change flows or water quality will also change nutrient loads. All of these programs and projects need to be integrated to optimize stormwater treatment area performance and achieve overall objectives, especially regarding plant community and food web structure. To understand and wisely manage large-scale dynamics of interacting watersheds and estuaries, a nutrient budget as complete as possible for the system as a whole must be developed. By quantifying nutrient sources, flows, and transformations through monitoring and assessment of freshwater marshes in the Greater Everglades, data will be available to develop evaluation tools and to better understand downstream effects of nitrogen export on estuaries. Therefore, if adaptive management of the system is to be successful, tools must be in place to identify and quantify nutrient sources and their links to CERP activities. We must be able to distinguish anthropogenic from natural influences, and understand how CERP actions impact both.

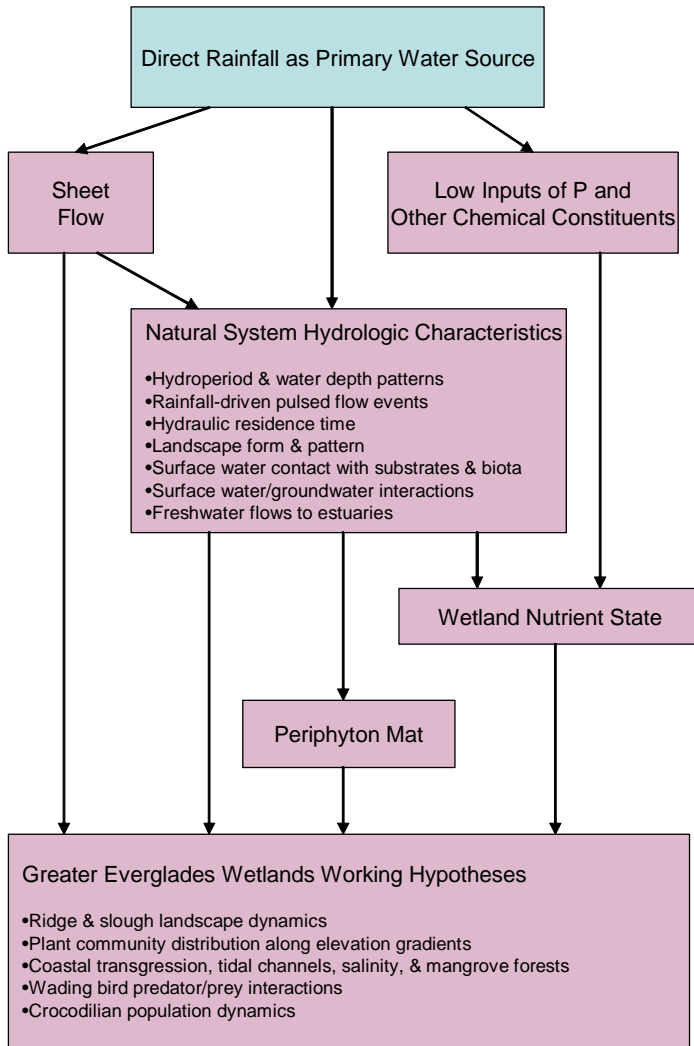
Current conditions of N loading to the Greater Everglades wetlands were reported annually in the Everglades Interim Report (McCormick 1999), Everglades Consolidated Reports (McCormick 2000, Payne et al. 2001, 2002, 2003, Payne and Weaver 2004), and the South Florida Environmental Report (Payne et al. 2005, 2006, 2007).

3.0 Relationship to CEMs and Adaptive Assessment Hypotheses

Everglades Ridge and Slough Conceptual Ecological Model (Ogden 2005) and Everglades Mangrove Estuaries Conceptual Ecological Model (Davis et al. 2005) stressor

9.2.3 Integrated Hydrology and Water Quality (RECOVER 2006) Hypothesis Cluster

Integrated Hydrology and Water Quality Conceptual Ecological Model



Hypothesis 3: Nitrogen Dynamics in the Everglades

N dynamics, such as rates of nitrification, denitrification, uptake of inorganic N species, and production of organic N, are dominated by local cycling and processing under natural conditions in the Everglades.

Rationale. The importance of local N cycling and processing presently increases with distance from surface water inflow locations, while the importance of surface water N loading concurrently decreases. This trend is expected to continue under restored water inflows and associated N loadings.

4.0 Restoration Expectation

4.1 Predictive Metric and Target

This performance measure does not have an evaluation metric and should not be used when evaluating alternative plans. Tools are currently under development to create a predictive aspect of this measure.

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| <p>4.2 Assessment Parameter and Target</p> |
| <p>Two targets are relevant for TN loads in inflows to Greater Everglades wetlands:</p> <p>The flow-weighted mean concentration target at all inflow structures for TN should be less than or equal to baseline flow-weighted mean N concentrations determined by a 10-year period of record from 1994-2004.</p> <p>Maximum basin-wide loading targets will be determined at inflow structures based on the flow-weighted mean concentration previously stated and basin flows estimated from the most current update of the CERP. The target should not be greater than average baseline annual loads determined by a 10-year period of record from 1994-2004.</p> <p>Where determined by RECOVER’s Assessment Team to be appropriate, the targets will be adjusted to account for annual rainfall or discharge in a manner similar to that used in the South Florida Water Management District’s Best Management Plan Rule. Targets will be evaluated on a subregional basis consistent with the Everglades Protection Area Tributary Basins Long-Term Plan for Achieving Water Quality Goals (Burns & McDonnell 2003), but including other Everglades basins such as the Rotenberger and Holey Land Wildlife Management Areas and the Lake Belt.</p> |
| <p>5.0 Evaluation Application</p> |
| <p>5.1 Evaluation Protocol</p> |
| <p>This performance measure does not have an evaluation metric and should not to be used for evaluation of alternative plans. Tools are currently under development to create a predictive aspect of this measure.</p> |
| <p>5.2 Normalized Performance Output</p> |
| <p>An established normalization protocol does not exist for this measure.</p> |
| <p>5.3 Model Output</p> |
| <p></p> |
| <p>5.4 Uncertainty</p> |
| <p>Recognition of model uncertainty is needed when interpreting the ecological significance of model output. The Model Uncertainty Workshop Report provides guidance on the potential implications of uncertainty on model output interpretation (RECOVER 2002).</p> |
| <p>6.0 Monitoring and Assessment Approach</p> |
| <p>See CERP Monitoring and Assessment Plan: Part 1 Monitoring and Supporting Research - Greater Everglades Wetlands Module section 3.1.3.1 (RECOVER 2004)</p> |
| <p>7.0 Future Tool Development to Support Performance Measure</p> |
| <p>7.1 Evaluation Tools Needed</p> |
| <p>Water quality and ecological models capable of predicting N loading, cycling, resultant concentrations, and transport still need to be developed. Such models need to account for major N sources (from surface water, groundwater, atmospheric deposition, N fixation) and sinks (denitrification, burial). An important goal of these models is to estimate N export to the coastal boundary as a function of changing freshwater flow and P and N loads into the Greater Everglades wetlands.</p> |

7.2 Assessment Tools Needed

Linking fate and transport from Greater Everglades to the Southern estuaries is needed for a more complete understanding of TN loading.

8.0 Notes

Please note this performance measure is also related to Hypotheses 1-3 in the Wetland Landscape and Plant Community Dynamics hypothesis cluster of the Assessment Strategy (RECOVER 2006).

Without a water quality model, caution must be used in interpreting hydrologic performance. It is not only necessary to attain the correct timing and distribution of water, but it is also necessary to attain appropriate water quality.

This performance measure supersedes and addresses GE-7 Total Nitrogen Loads/Flow-Weighted Mean Concentration in Inflows to the Greater Everglades wetlands (Last Date Revised: July 7, 2005).

9.0 Working Group Members

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10.0 Acceptance Status

GE Working Group July 7, 2005

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Public Review

Final Acceptance Date

11.0 References

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