

**Modification 3: Addendum 3 to the Scope of Work for the  
Water Quality Target Refinement Project**

**To Incorporate Development of Numeric Nutrient Criteria Expressed as Concentrations,  
Downstream Protective Values, Relationships to Dissolved Oxygen Standards, and an  
Implementation Plan.**

**DRAFT 2 – 2010 07 13**

The initial Water Quality Refinement Project was modified to incorporate development of numeric nutrient criteria for CHNEP estuaries, in response to the U.S. Environmental Protection Agency's (USEPA) pending federal numeric nutrient criteria. The four purposes of this project addendum are to expand the project further to provide the following:

- Express the CHNEP numeric nutrient criteria as concentrations (in addition to loads) as required by USEPA;
- Develop Downstream Protective Values (DPVs) for CHNEP waters for Total Nitrogen (TN) and Total Phosphorus (TP);
- Demonstrate that the proposed CHNEP numeric nutrient criteria protect Dissolved Oxygen (DO) standards; and
- Develop a numeric nutrient criteria implementation plan for CHNEP.

**Task 8: Express Numeric Nutrient criteria as Concentrations.**

USEPA informed CHNEP that it intends to express the numeric nutrient criteria as concentrations for both TN and TP. The relationships between chlorophyll *a*, TN and TP concentrations for each harbor segment will be examined to determine the most likely limiting nutrient. Based on the result of the analyses, potential numeric criteria for both TN and TP concentrations will be recommended for each harbor segment. If a defensible quantitative relationship between TN and TP concentration is found, it will be used. If no quantitative relationship is found, a method for expressing the current recommended criteria (ie. as loads) will be developed. Potential effects of confounding factors, such as residence time, will be considered.

**Task 8 Deliverables:**

A letter memo including:

- Examination of relationships between chlorophyll *a*, TN and TP concentrations and identification of limiting nutrient for each harbor segment.
- Proposed numeric criteria for TN and TP expressed as both loads and concentrations for each bay segment.
- Brief documentation of models and analyses, including databases developed and used for this task, as an attachment.

**Task 8 Estimated Time Period:** October 2010

**Task 8 Estimated Budget:** \$10,800

**Task 9: Develop Downstream Protective Values (DPVs).**

Downstream Protective Values (DPVs) for TN and TP are being developed as part of the numeric nutrient criteria effort by USEPA. USEPA defines DPVs as those water quality criteria in flowing waters that ensure protection of designated uses in downstream estuarine waters as required by the Clean Water Act (CWA) under 40 CFR 131.10 (b). USEPA previously proposed TN DPVs based on proposed protective estuarine TN loads, with the DPVs being expressed as TN concentrations in upstream reaches (USEPA, 2010). DPVs will be developed for both the

terminal and upstream segments within the CHNEP watershed, including the following considerations: temporal scales, spatial scales, metrics and units of measure for the DPV.

A clear definition of DPVs will be recommended, including definitions of the boundaries between the estuaries, terminal segments and upstream segments, **as well as their relationship to state waterbody identification segments (WIBDs)**. The estuarine, terminal and upstream segments, along with the appropriate spatial bounds (i.e. how far upstream), will be identified before developing the DPVs. A map depicting the segments and spatial bounds used in developing the DPVs will be provided.

The following methods for developing DPVs for CHNEP will be investigated:

- If the numeric criterion for the receiving estuary is expressed as a concentration, then the DPVs for the terminal segments will be set to the numeric nutrient criteria for the estuary.
- If the criterion is expressed as a load, then the terminal segment DPV could be estimated by taking into account the relative hydrologic contribution from the terminal segment to the overall hydrologic load to the estuary.
- If the criterion is expressed as a concentration, the DPV could also be derived from the relationship between the nutrient concentrations in the terminal segments and those in the receiving estuary; but this method requires adequate water quality data in both the estuarine and terminal segments.

After the upstream segments have been defined, an approach will be developed to translate the terminal segment DPVs into upstream segment DPVs. It is likely that the approach will utilize logic similar to that used by USPEA in the proposed DPVs (USEPA, 2010), which assumed that given an estuarine load limit, the watershed load limit can be assigned to contributing areas through a mechanism that considers nutrient inputs from the stream network. The total CHNEP watershed load will be partitioned into the loadings that reach the estuary from each subbasin. The need to quantify in-stream load attenuation will be assessed and quantified as appropriate. If the attenuation needs to be quantified, consideration will be given to utilizing first-order decay or mechanistic modeling, whichever is most appropriate, to derive factors for load attenuation from upstream segments to the estuary.

Relationships between ambient concentrations from upstream and terminal segments will be evaluated. If significant relationships are found between the concentrations, the DPV of the downstream terminal segment can be used to derive the upstream segment DPVs. However, this method depends on having adequate water quality data available in both segments.

***Task 9 Deliverables:***

A letter memo including:

- Definition of a DPV.
- Definition of a terminal segment.
- Proposed terminal segment DPVs.
- Proposed DPVs for upstream segments.
- Brief documentation of models and analyses, including databases developed and used for this task, as an attachment.

***Estimated Time Period for Task 9:*** October-November 2010

***Estimated Budget for Task 9:*** \$27,200

**Task 10: Demonstrate that proposed CHNEP numeric nutrient criteria protect Dissolved Oxygen (DO) standards.**

The relationship between existing nutrient loadings and chlorophyll *a* targets in CHNEP and the frequency of DO values less than the state standard of 4 mg/l will be investigated and quantified. The spatial and temporal variability of DO concentrations will be examined within each harbor segment. Maps, graphics and tables will be provided that show annual and seasonal frequencies of deviations from the state DO standards. The maps will show inter- and intra-annual variability of DO conditions. Spatial heterogeneity will be examined using the probabilistic data set and bathymetry contours to allow evaluation of relationship between DO levels and water depth.

The relationship between hydrologic and nutrient loads, and chlorophyll *a* and DO responses in each harbor segment will be investigated. Rainfall and water temperatures vary seasonally and both natural and anthropogenic stressors influence DO concentrations. The variability in DO concentrations will be partitioned between these drivers. The relationships between nutrient loads and/or concentrations, chlorophyll *a* concentrations and DO will be assessed to see if they are quantifiable, with consideration given to natural drivers, using several analytical methods. Simple and multiple regressions, logistic regression models, changepoint methods and "bootstrapping" will be utilized to quantify the relationships and predict the expected DO level from any given nutrient load and/or concentration and chlorophyll *a* concentration.

**Task 10 Deliverables:**

A letter memo including:

- Summary of spatial and temporal distributions of DO within CHNEP harbor segments.
- Quantitative relationships between nutrient loads and/or concentrations, chlorophyll *a* concentrations, and DO.
- Examination of the expected DO given the proposed numeric nutrient criteria for each bay segment.
- Brief documentation of models and analyses, including databases developed and used for this task, as an attachment.

**Estimated Time Period for Task 10:** October-November 2010

**Estimated Budget for Task 10:** \$25,100

**Task 11: Develop a Numeric Nutrient Criteria Implementation Plan for CHNEP.**

Key issues identified by USEPA which must be addressed to successfully implement numeric nutrient criteria for the CHNEP will be examined and appropriate implementation methods will be recommended.

Key issues include:

- Currently, USEPA is proposing allowable exceedances of criteria no more than once in three years. However, many important water quality assessments (i.e. domestic wastewater and stormwater NPDES permits) use 5 year assessment periods. The ramifications of both 3 and 5 year assessment periods to the probability of producing Type I and Type II errors in achieving the criteria will be examined. An appropriate nutrient assessment period will be recommended for CHNEP.
- The effects of non-anthropogenic and significant anthropogenic events (ie. spills or accidental releases) on the harbor's response to nutrient inputs will be examined. Potential methods will be proposed to account for these events and harbor responses in implementing the nutrient criteria.
- The appropriateness of applying the estuarine criteria upstream to tidal creeks and bayous will be examined using existing data for these habitats. The appropriateness of the existing chlorophyll *a* targets and DO standards will also be examined.

**Task 11 Deliverables:**

A numeric nutrient criteria implementation plan that takes into account:

- the temporal frequency of assessment and exceedances,
- the appropriate spatial scale of assessment and exceedances, including tidal creeks and bayous,
- the appropriate data sources that should be used in assessing future compliance according to the spatial and temporal scales defined above, and
- the effect of catastrophic events.
- Presentations of project deliverables to CHNEP Management Conference.

*Estimated Time Period for Task 11:* October-November 2010

*Estimated Budget for Task 11:* \$12,000

<b>Task</b>	<b>Deliverables</b>	<b>Month</b>	<b>SWFWMD Area of CHNEP</b>	<b>SFWMD Area of CHNEP</b>	<b>Project Total</b>
1-4	Water Quality Targets by Estuary Segment.	1-10			\$105,000
5-7	Numeric Nutrient Criteria Expressed as Loading.	June-Aug., 2010	\$59,700	\$28,000	\$87,700
8	Numeric Nutrient Criteria Expressed as Concentrations.	October 2010	\$7,236	\$3,564	\$10,800
9	Downstream Protective Values	Oct.-Nov., 2010	\$18,224	\$8,976	\$27,200
10	Demonstration that Numeric Nutrient Criteria Protect DO Standards.	Oct.-Nov., 2010	\$16,817	\$8,283	\$25,100
11	Numeric Nutrient Implementation Plan. Presentations to CHNEP Management Conference.	Oct.-Nov., 2010	\$8,040	\$3,960	\$12,000
<b>Addendum Subtotals:</b>			<b>\$50,317</b>	<b>\$24,783</b>	<b>\$75,100</b>
<b>AMENDED CONTRACT TOTAL (including Addendums 1, 2 &amp; 3):</b>					<b>\$267,800</b>