Lake Okeechobee Emergent Aquatic Vegetation Performance Measure Comment Response Matrix for the public review period from October 27 – November 10, 2016.

Public Review Comments	**Lake Okeechobee Emergent Aquatic Vegetation Performance Measure Comments From The Public Review Period**	**Lake Okeechobee Regional Coordinator Responses**
Paul Gray, Audubon Florida Comment 1	Basing the LOEV PM on Pesnell and Brown's (1977) mapping makes sense. Overall I think the recommended PMs are good and offer additional considerations.	Thank you for the positive feedback and for your support of using the Pesnell and Brown map to help establish the performance measure (PM) targets.
Paul Gray, Audubon Florida Comment 2	The proposed goal for floating leaved plants is less than 2500 ha. This natural plant community is highly valued by migratory and resident waterfowl, the gallinule group and many animals. It can occur along the outer edges of the littoral zone for a linear distance of perhaps 100 km around the Lake (guestimated with the Google Earth path measurer tool). Pesnell and Brown sampled the Indian Prairie transect in July and August 1972, and the Moore Haven transect between December 1972- April 1973. The period before the sampling was marked by the 1971 drought when the Lake dropped to about 10.29 feet (likely drying many floating leaf beds), and the year 1972 when the maximum level only reached 14.07 feet (see table below). These low levels do not allow the long hydroperiods needed by the floating leaved communities and my guess is they probably were at below-average levels for that time period. Considering the value of this community, the large area that it can cover in the Lake, and the potential that it was at low levels when sampled, I would change the floating leaved community goal to "more than 2500 ha," without a maximum value. A larger threshold might be warranted. (?)	While Pesnell and Brown 1973 mapping numbers were used as the base to develop these EAV targets, in some cases, the targets were adjusted based on recent conditions. Using 2500 ha, as Dr. Gray suggests, would more than double the maximum coverage identified during the UF study from 1973 – 1992; where the maximum coverage was 1242 ha during a wet year (1992). While floating leaved vegetation is good habitat for waterfowl, it is poor habitat for wading birds, fish and snail kites and tends to degrade underlying sediments. Floating leaved plant coverage during mapping years since the UF study has consistently been greater than the proposed not to exceed 2500 ha target except during the drought of 2007. When Moonshine Bay was covered by 80% Nymphaea, it was not good habitat in general and when floating leaved plants spread along

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<tr><td></td><td></td><td>the outer edges of the littoral region, they cause a reduction in SAV coverage, which can negatively impact fish and macroinvertebrate habitat and densities. Therefore in the authors' opinion, a larger threshold for floating leaved vegetation is not warranted.</td></tr>
<tr><td>Paul Gray, Audubon Florida Comment 3</td><td>The proposed goal for cattails is 4000-8000 ha. Cattail tends to be poor habitat and considered an invasive native whose spread is aided by nutrients and disturbance. In my experience in Kissimmee Prairie wetlands in the Lake Okeechobee watershed, cattail almost never forms monocultures in unimpacted/natural wetlands. Figure 11 of Pesnell and Brown notes cattail expansion between the years of 1960 to 1968, indicating that levels measured by them were greater than what would be natural.
Considering the undesirable nature of cattail monocultures and the possibility they already had expanded by the time Pesnell and Brown sampled them, I recommend lowering the PM goal to less than 2000 ha.</td><td>While we agree that cattail is a native invasive, it is used by secretive marsh birds for nesting habitat in areas that are near open water.

In some places near the outside edge of the littoral region thick walls of cattail serve as a physical wave barrier and nutrient filter for portions of the littoral region.

Although the proposed target range may sound high, it is only 10% to 20% of the available littoral region habitat.</td></tr>
<tr><td>Paul Gray, Audubon Florida Comment 4</td><td>The proposed target for non-willow woody vegetation is 500-1500 ha. This number probably is a good recommendation for the most of the marshes, but seems to omit historical observations, cited by Pesnell and Brown (and others), of the southern organic islands being covered with forests of pond apple, rubber (Ficus), pop ash and other trees. Similarly, Observation Island was sandy and dominated by cypress, ash, willow, and custard apple.
I recommend establishing Island-based goals (as depicted in Figure 1) of re-establishing the Pond Apple forest totaling about 6 square kilometers on Torry, Kraemer and Ritta Islands, and maintaining the existing forested nature of Observation Island.

<table><tr><td>YEAR</td><td>MONTH</td><td>MONTH</td><td>MAX</td><td>MEAN</td><td>MIN</td></tr><tr><td>1971</td><td>J</td><td>JAN</td><td>12.99</td><td>12.80</td><td>12.60</td></tr></table></td><td>Since the dike was constructed, the areas on the islands where pond apple forests existed during the historical observation period have been mostly too dry to support them. They now exist mostly around the edge of the southern islands, and it is doubtful that they would ever appear as dominants in our current grid cell approach to classifying vegetation. Currently, except for Observation</td></tr>
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	1971	F	FEB	12.61	12.56	12.49
	1971	M	MAR	12.60	12.24	11.83
	1971	A	APR	11.83	11.40	10.96
	1971	M	MAY	10.88	10.62	10.43
	1971	J	JUN	10.78	10.50	10.29
	1971	J	JUL	11.63	11.19	10.81
	1971	A	AUG	12.22	11.91	11.62
	1971	S	SEP	13.68	13.25	12.27
	1971	O	OCT	14.22	13.94	13.56
	1971	N	NOV	14.44	14.33	14.20
	1971	D	DEC	14.17	14.01	13.86
	1972	J	JAN	13.91	13.78	13.71
	1972	F	FEB	13.71	13.64	13.50
	1972	M	MAR	13.49	13.20	12.89
	1972	A	APR	13.02	12.85	12.62
	1972	M	MAY	13.11	12.88	12.64
	1972	J	JUN	14.07	13.47	13.07
	1972	J	JUL	13.99	13.92	13.87
	1972	A	AUG	13.91	13.81	13.75
	1972	S	SEP	13.94	13.79	13.56
	1972	O	OCT	13.55	13.22	12.88
	1972	N	NOV	12.84	12.74	12.68
	1972	D	DEC	12.71	12.60	12.48
	1973	J	JAN	12.61	12.50	12.42
	1973	F	FEB	12.80	12.73	12.60
	1973	M	MAR	12.94	12.82	12.68
	1973	A	APR	12.99	12.88	12.66
	1973	M	MAY	12.57	12.43	12.21
	1973	J	JUN	12.31	12.23	12.16
	Monthly Lake Okeechobee water levels.					
						Island which consists mostly of woody vegetation, other non-willow woody species are found primarily in the upper elevations of the marsh. We agree that the woody character of Observation Island needs to be preserved and we should be able to detect changes in this region with our current methodology.
U.S. Sugar Corporation Comment 5	The draft EVPM does not discuss how it compares to the existing March 7, 2007 Lake Okeechobee Performance Measure Vegetation Mosaic. How do the two measures compare? The draft EVPM appears more well-defined and detailed than the March 7, 2007 Lake Okeechobee Performance Vegetation Mosaic. Key uncertainties were identified in Section 3.1.3.4 of the 2009 RECOVER CERP Monitoring and Assessment Plan that "prevent development of well-defined restoration goals" including water quality improvement rates, storage capacity, frequency of tropical storms and hurricanes, climate change,					The draft EAV PM is similar in design to the 2007 Vegetation Mosaic PM. However, more targets and target ranges have been added based on data collected over the past decade. This PM is intended to replace the 2007 Vegetation Mosaic PM.

	watershed development and water supply demands. These key uncertainties remain unresolved.[1] We look forward to further explanation by the agencies on how the well-defined restoration goal for emergent vegetation in the draft EVPM can be established when the USACE has not resolved these key uncertainties.	This PM is not an evaluation tool, it is an assessment tool for littoral region vegetation. Consequently, it is not intended for use in interpreting model output but only as a standard against which to measure routine monitoring results. Nevertheless, as our understanding of the relationship between hydrology and vegetation distribution has increased, our ability to predict how plant communities respond to hydrology has improved which has made it possible to refine the earlier performance measure in a meaningful way.
U.S. Sugar Corporation Comment 6	We recognize establishing and restoring beneficial vegetation in Lake Okeechobee is a laudable goal. For at least a decade, vegetation control has been part of the state of Florida's Lake Okeechobee Protection Plan, including an exotic species control program. With other efforts influencing emergent vegetation in Lake Okeechobee, how does the USACE intend to use the draft EVPM to measure performance of CERP Projects? The draft EVPM states only the desired restoration condition of the Lake, but it does not explain how the draft EVPM is "representative of a class of responses to implementation of [CERP] and compared with a level of output that is expected and desired during or following the implementation of [CERP]. " *See* 33 C.F.R. § 385.3 (definition of "performance measure").	This PM will become part of a suite of RECOVER PMs that are intended to establish targets and goals for Lake Okeechobee, to improve ecological conditions in the littoral region. The ecological health of the littoral region is directly tied to improved hydrology, which is one of the primary goals of CERP.
U.S. Sugar Corporation Comment 7	Numerous references illustrate this concern—the strongest influences on emergent vegetation in Lake Okeechobee are factors beyond the scope of CERP projects. Events and conditions beyond the scope of CERP that influence the type and extent of emergent vegetation in Lake Okeechobee include stochastic events, winds, hurricanes, rainfall, lake stage, lake water clarity, nutrients, exotic and invasive plant treatments, competition, herbivory, freezes, droughts, wildfire and prescribed burning, and hydrology. *See e.g.* Chapter 8 of the 2016 South Florida Environmental Report; Section 3 of the 2009 Revised CERP Monitoring and Assessment Plan. These events and conditions are not necessarily reflective of a response to	The littoral region vegetation community is most influenced by hydrologic conditions which includes stochastic events. The primary foci of the Yellow Book for Lake Okeechobee restoration are water storage based and directly influence lake hydrology and the ability to

	CERP. How is the emergent vegetation coverage in the Lake Okeechobee littoral zone an effective performance measure "as representative of a class of responses to implementation of [CERP]" when so many other factors influence emergent vegetation coverage?	deal with natural variations in climatology. Exotic/invasive vegetation control is a second major component of the CERP Yellow Book plan.
U.S. Sugar Corporation Comment 8	It remains unclear how the 1973 mapping effort was selected as the restoration goal for Lake Okeechobee. Is the 1973 mapping appropriate considering the changes that have occurred in the C&SF system? Pesnell and Brown reports from 1976 (containing the 1973 mapping effort) and from 1977 were cited in the draft EVPM and provide the basis for this draft EVPM, but these references were not provided. It is incumbent upon the agencies to provide the referenced documents when it is relying heavily on these citations, so that the public can review and provide meaningful comment.	The Introductory section of this PM makes it explicitly clear why the Pesnell and Brown data were used as a basis for this PM. As appropriate, the authors correctly provided the citations for the literature used in the development of the PM. However, given that the Pesnell and Brown work appeared as a technical publication rather than as a journal article, the authors would be happy to make a copy available to U.S. Sugar Corporation upon request.
U.S. Sugar Corporation Comment 9	Lake stage and hydrologic regime are recognized as influential on emergent vegetation coverage. The hydrologic regime that existed at the time the Pesnell and Brown 1973 mapping effort was conducted appears to be different from the existing, temporary LORS 2008 regime, and may differ from a future Lake Okeechobee regulation schedule that will be developed. The changes in the hydrologic regime may make it difficult to achieve the specific emergent vegetation coverages listed in the draft EVPM. As such, a more appropriate EVPM would be to maintain an increased spatial extent of native, and noninvasive plants in the littoral zone and limit performance vegetation targets to exotic and nuisance species.	The hydrologic regime that existed during the Pesnell and Brown 1973 mapping effort is very similar to the current LORS 2008 schedule. The targets developed for this PM represent the vegetation community that is considered to be the most beneficial for fish, birds and other taxa based on many years of monitoring and research and, in so far as possible, the hydrologic conditions that would support this community structure should be considered in the development of any new Lake Okeechobee operating schedule.

U.S. Sugar Corporation Comment 10	USSC respectfully requests the Corps provide additional time, beyond 10 days, to allow stakeholders to review the performance measure and references and engage with the agencies in a meaningful manner. Because no CERP project components exist, and none is likely for many years, no CERP-related, incremental improvement would be measured by this performance measure. Moreover, since LORS 2008 is a temporary regulation schedule, its effects are aberrational and should not serve as a base condition for this measure or any CERP performance measure. There is no urgency requiring approval of this performance measure now. It is therefore reasonable to allow the proposed EVPM to remain a draft until further analysis and opportunity for stakeholder input is provided.	The authors agree that extending the review period for an additional 30 days would not create any hardship; particularly since the PM is not going to be used for LOWP or any other model output evaluation. However, the authors would prefer to finalize this PM as expeditiously as possible so that it is available for use with the 2016-2017 Lake Okeechobee aerial mapping and sentinel site monitoring data. There is nothing in this PM that uses LORS 2008 or any prior regulation schedule as a base condition as this PM is not intended as an evaluation tool. The PM is based on a preferred range of Lake stages and on reducing the frequency and extent of extreme high and low stage occurrences.
FFWCC Comment 11	The FWC is a dedicated partner in the management of Lake Okeechobee and as the lead state agency responsible for vegetation management within Lake Okeechobee, this PM may directly impact FWC operations. A large volume of research has been conducted on vegetation communities in Lake Okeechobee over the past 40 years. The Pesnell and Brown study referenced in the PM document is important for reasons stated in the PM. That said, FWC recommends incorporating the 1973 vegetation map data into a more comprehensive view of vegetation communities. This could lead to a modified set of targets that could prove equally attainable and possibly more ecologically desirable. Total PM target acreage for vegetation communities' account for less than 50% of the entire littoral zone. Ecologically important plant communities and land covers mapped by Pesnell and Brown (1973) are absent from this PM, and these communities include: *Spartina*, sawgrass, mixed grasses and open water. The FWC encourages the PM authors to consider including targets for these communities.	The authors agree that sawgrass target should be added to this PM based on the quantitative numbers reported by Richardson and Harris in a 1995 manuscript. The revised PM document will contain a target for the sawgrass community. Most *Spartina* in the marsh is not monospecific and is found as clumps mixed with grasses and other EAV communities. Therefore, the proposed targets in this revised PM will lead to conditions also beneficial for *Spartina*.

FFWCC Comment 12	This PM does not adequately account for the ecological benefit of the habitat mosaic because the scoring is based solely on areal coverage. An ideal score could be achieved from one large block of bulrush, which would be an ecologically sub-optimal condition. A computation of average patch size from historic vegetation maps for each species and community for comparison to patch sizes from successive mapping efforts would strengthen the performance measure. It may be necessary to establish an intermediate assessment scale – e.g., regional targets, smaller than whole lake and larger than sentinel sites – that can be used to assess distribution.	The authors agree that vegetation patch sizes are of ecological importance. However, the objective of this PM is limited to looking at the overall big picture and assessing temporal trends, based on available data; which in most years will consist exclusively of our sentinel site monitoring. The authors agree that if sufficient data were available regarding patch size throughout the Lake O marsh, that the PM could be expanded to include this important characteristic.
FFWCC Comment 13	Especially important for littoral zone health is the maintenance of a bulrush band on the littoral zone's lake-ward edge. Based on FWC, U.S. Army Corps of Engineers (USACE), and historic Florida Department of Natural Resources Aquatic Plant Surveys mapping efforts, we find that the PM minimum of 900 hectares is far too small. FWC suggests a minimum of 3500 hectares of bulrush as a more ecologically desirable PM target (FWC 2003).	The 900 hectare target for bulrush has been increased to 1900 hectares after discussions with the FWC. The increased target is based on a Richardson and Harris 1995 manuscript where vegetative coverages in the littoral marsh were quantified between 1989 and 1992.
FFWCC Comment 14	The goal of less than 25 hectares of invasive exotics may be unattainable. The Lake Okeechobee Aquatic Plant Management Interagency Task Force's established goal of a maximum of 162 hectares (set for water hyacinth and water lettuce) is a challenging, yet achievable target. Given the wide variety of additional exotic invasive plant species (other than water hyacinth and water lettuce) present in Lake Okeechobee, the FWC recommends the PM authors consider a goal of less than 10% of the historic maximum coverage of invasive exotics, which would result in a target of a maximum of 360 hectares.	This goal only includes rooted emergent exotic and not native invasive species, not exotics or invasives that have their own targets in the PM.
FFWCC Comment 15	The FWC considers the establishment of acreage targets for littoral vegetation communities an important part of assessing both water level and habitat management impacts. The FWC staff is supportive of RECOVER developing a predictive evaluation tool for littoral habitat that is capable of using output from regional models. We also recognize there are challenges to mapping vegetation in Lake Okeechobee in a timely and cost	Thanks for this comment, we agree that interagency partnerships that increase the frequency and or spatial scale of littoral region vegetation mapping would

	effective manner and FWC staff is interested in partnering with SFWMD and USACE on these efforts. Partnerships may facilitate the mapping of Lake Okeechobee's littoral vegetation communities on more frequent and regular intervals.	be beneficial for vegetation management.
Joan Browder – 1 (RLG Review December 2017)	The Justification section seems incomplete because it doesn't explain the close relationship of Lake Okeechobee marsh area and vegetation composition with Lake water levels and their fluctuation that has been noted over the years.	We have expanded the first paragraph of the justification section, and please refer to following paragraphs in that section with specific examples of relationships between vegetation and lake stage.
Joan Browder – 2 (RLG Review December 2017)	It doesn't explain the ecological roles in the Lake of the various vegetation components that are included as achievement targets or avoidance targets.	We have expanded the Justification section to address your comment concerning the ecological roles.
Joan Browder – 3 (RLG Review December 2017)	Some relevant verbiage that could be appropriate for inclusion are in the responses to reviewers' comments in the Comment Response Matrix also provided to RLG members. For example, the tight relationship between water levels and marsh area and composition was not explained even briefly in the Performance Measure Documentation Sheet (how could that have been left out), but was explained to U.S. Sugar in response to comments. For example, responding to U.S. Sugar Comment y: "The ecological health of the littoral region is directly tied to improved hydrology,, which is one of the primary goals of CERP." And the response to U.S. Sugar Corporation Comment 5:: "..as our understanding of the relationship between hydrology and vegetation distribution has increased, our ability to predict how plant communities respond to hydrology has improved.....". and this one: "...The targets developed for this PM represent the vegetation community that is considered to be the most beneficial for fish, birds and other taxa based on many years of monitoring and research and, in so far as possible, the hydrologic conditions that would support this community structure should be considered in the development of any new Lake Okeechobee operating schedule." These explanations, as well as discussion of the ecological values of the various specific plant species, should be in the document itself, not just in responses to reviewers' comments. The question and response about sawgrass was especially relevant. Why have a lower level that is not zero for a species that, although a native, is known to be a nuisance. The answer was a good one and should be in the document itself. The two paragraphs I suggest would not make the document too long but would give it a stronger supporting rationale.	The authors agree and have included your recommended verbiage to the document.

Rebecca Elliott – 1 (RLG Review December 2017)	In general, it seems that PMs are now developed by a small group of scientist with limited input from interested parties and without a meeting open to the public or peer review process. There is a 2 week windows of opportunity to comment after the draft PM is released but it appears there is no opportunity for discussions before then.	This specific PM was developed by an interagency group of scientists and open to the public for comments on the draft.
Rebecca Elliott – 2 (RLG Review December 2017)	The document makes it clear in some sections that this PM is not for use as an evaluation protocol because regional model output does not provide the specific input data required to generate scores which are used for evaluation. Suggest adding "Assessment" or "Assessment Measure" to the title to avoid confusion.	The authors agree that the document states clearly that this PM is for assessment only and its title indicates it is a performance measure.
Rebecca Elliott – 3 (RLG Review December 2017)	The methodology for the 1.2 "Assessment Parameter and Target" is pass/fail for each component, “Achieving each vegetative component of the target results in a score of one. Failure to achieve any component results in a score of zero." This resulted in 826 acres of Beakrush/Spikerush in 2003 receiving a score of zero and 7, 546 acres of Beakrush/Spikerush in 2007 also receiving a zero when the target is 10,000 or greater. Without understanding the basis of why pass/fail is a good way to assess, I am not supportive of a methodology that cannot distinguish between ~ 10% or ~ 75% of a target being met.	The authors appreciate your comments and do believe that changes in aerial coverage in a positive direction for individual vegetation classes is always beneficial. However, to maintain simplicity and still detect changes in the marsh, we specifically used quantified coverages mapped in previous research as our PM targets. Even though individual coverages are pass/fail, trends can be detected when scores for all vegetation classes are combined. In addition, we included an interim goal which will show an improvement over existing conditions.
Rebecca Elliott – 4 (RLG Review December 2017)	Just an editorial note. Please provide the LO stages in the document in feet as well as meters since feet is typically used for the regulation schedule and model results.	Thank you for the suggestion. The authors have added Lake stages in feet.