

22M - MONITORING AND POST PLANNING CONSIDERATIONS

Because of the relative newness of restoration science and uncertainty in ecosystem restoration planning, success can vary due to a variety of technical and site specific factors. Recognizing this uncertainty, it is prudent to allow for contingencies to address restoration problems early in the planning process. To accomplish this, a technique called "adaptive assessment" should be included in restoration projects. At the heart of adaptive assessment is a carefully designed monitoring program that measures effects of restoration, allows for incorporation of new information, and facilitates appropriate adjustments to the project.

PROJECT IMPLEMENTATION PLAN

This study assumes that the recommended plan will be designed and implemented to allow maximum flexibility by supporting the iterative use of models, research, and monitoring in conjunction with management to revise, improve, and fine tune restoration projects. Consensus on ultimate restoration goals should be achieved up-front. An incremental process will be followed due to the nature of the study area ecosystem and its problems, and because of the uncertainties regarding the ecological responses that will occur from alternatives.

Interagency/multi-disciplinary coordination meetings and workshops will be required at several points. The key to designing a recommended plan will be:

- (1) to clearly identify (and state) the study objectives and desired environmental and hydrologic responses;
- (2) achieve consensus on how to monitor ecological and hydrologic responses to project alternatives; and
- (3) develop a strategy on how to interpret and implement plans that can be responsive to monitoring/research findings.

Establish Basis for Monitoring/Research Plan - The ecological and hydrologic restoration goals will provide the basis for identifying what parameters will be monitored. The purpose of the monitoring and research program will be to provide the framework for designing the sequence of implementing restoration increments, and provide information on ecosystem responses as a basis for designing subsequent increments for achieving restoration. A monitoring plan will be developed that will test the restoration hypothesis. Development of a monitoring plan is discussed in the next section of this subaccount.

Development of Restoration Strategy - The development and implementation of a monitoring and research program is essential in designing the sequencing of restoration components (increments). This program should provide information on ecosystem responses

as a basis for designing and implementing subsequent increments toward achieving the restoration goal. Development of a strategy on how to interpret and adjust to monitoring/research findings will be required and accomplished through workshops. The major activities and decision points identified thus far include the following:

(1) *Establish long-range restoration goals.* The need for developing clearly defined goals is discussed above. For example, long-range ecological and hydrological restoration goals could be to restore historic plant and animal population levels, and desirable hydrologic conditions.

(2) *Establish interim goals for Plan (Increment) #1.* For example, an interim ecological goal could be oyster population levels increase by X % over the next X years (or population levels increase X out of X number of years). An interim hydrologic goal could be improve hydropatterns X % by X years. The first interim goal could be identified during the workshop for "a" above.

(3) *Establish monitoring/research plan for Increment #1.* Numerous actions concerning water quality monitoring and evaluation are on-going within the study area. All monitoring/research activities should be coordinated and analyzed to determine duplicative activities as well as to identify additional required activities. Also, exchange and use of data is critical to the decision-making process of project implementation. Pre-project baseline data collection would be initiated prior to project construction.

(4) *Implement Increment #1.* The first increment of the project would be implemented. Post-project monitoring activities would begin.

(5) *Monitor the results of Increment #1.*

(6) *Determine if goals are being met* and there are no unexpected adverse effects associated with the restoration project. Results of the monitoring plan would be evaluated to determine if the interim goals are being met.

(7) If goals are being met and there are no unexpected adverse effects associated with the restoration project and Increment #2 is dependent on Increment # 1, then *continue with Increment #2* by establishing interim goals (continue process by returning to (2)).

(7a) If Increment #2 is not dependent upon Increment #1, initiate establishment of interim goals for Increment #2 (continue process by returning to (2)).

(8) If goals are not being met or there are unexpected adverse effects associated with the restoration project, then *determine the problem* with meeting the goals. Project implementation and monitoring results should be verified and evaluated to identify why the goals were not being met. It should be determined whether the problem is "unmanageable"

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(refer to (9) or "natural" (refer to (12))).

(9) If failure to meet the goal is "unmanageable" (i.e. cannot be met by altering the design or operation of the current project or is due to an unanticipated natural phenomenon (for example, a 4 year drought occurs and results in the failure to meet both the hydrologic and ecological goals), then *re-evaluate and modify the hypothesis*, and *continue monitoring*. Determine if the goals are met (return to (6)).

(10) If goals are now met, then *continue with the next Increment that depends on Increment 1* (return to (2)).

(11) If goals are not being met, then return to (8) and *determine why the goals are not being met*.

(12) If failure to meet the goal is due to a design or operation problem of the current project, then *re-evaluate the goals and if necessary modify the Project Increment*. Again *monitor the effects* and determine if the goals are now being met.

(13) If goals are now being met, then *continue with the next Increment* (return to (2)).

(14) If goals are not being met, then return to (8) and *determine why the goals are not being met*.

MONITORING PLAN

The role of monitoring will be to measure two levels of responses during project implementation, and to use this information to improve the design of sequential iterations (increments) of the project. The responses to be evaluated will be influenced by the restoration goals but will likely include:

(1) Whether the characteristic species and communities in the wetland, upland, estuary and aquatic habitats are showing improvements in the direction of pre-drainage conditions, or improvements towards newly established restoration target conditions; and

(2) Whether the defining physical and ecological characteristics of either the pre-drainage systems or a newly target ecosystem are being recovered.

Conceptual models linking major environmental stressors to affected organisms or groups of organisms have been developed for each region of South Florida. The goal of these models is to identify environmental alterations, whose adverse affects could be reduced or eliminated by restoration. The resulting changes in the state of these stressors will need to be monitored to evaluate the success of restoration activities associated with CERP and the IRL N FS. In addition, the models identify biological indicators of the success of the

restoration effort that would also need to be monitored.

Routine, systematic analysis of the monitoring data will improve our understanding of the hydrologic and ecological relationships in the wetland, upland, estuarine and aquatic habitats by showing which of the structural and operational components of each project increment produce predicted as compared to unpredicted responses. It will also lead to improvements in the design of each increment by showing which components contribute to recovery of populations and communities of representative species and to the defining characteristics of the ecosystems. A comprehensive, regional monitoring program should be in place prior to the initiation of the restoration project increments, to establish the complete pre-project baseline condition, and should continue during and beyond the period of implementation of the project. Implementation of sequential increments of the restoration project should occur following analysis of each increment in the monitoring database.

Develop Monitoring Plan - An initial activity in support of developing a monitoring plan will be to evaluate the adequacy of existing monitoring protocols, both for the spatial and temporal features of each, and for the quality of the resulting databases for use in statistical treatments for trend analyses. Protocols for any new monitoring projects to be added to the comprehensive, regional program should also be developed. Coordination meetings would be held to identify monitoring objectives, existing data, additional parameters to be monitored, how data will be shared, and required actions based on monitoring findings. This study assumes that joint workshops will be held to insure that a comprehensive monitoring plan will be developed that will include any existing plans developed. Development of a monitoring plan will include several efforts and accomplishments. Many of these activities will be accomplished simultaneously as a result of meetings. Exchange of data and information will be on-going throughout the process.

Existing Hydrologic Data Evaluation - Requirements of the hydrologic modeling efforts will be evaluated to determine any necessary changes or modifications required for the existing data collection network. This will provide for identification of baseline hydrologic monitoring needs to support restoration activities.

Ecological Data Analysis and Evaluation - Data analysis and evaluation includes efforts needed to support model development and baseline monitoring in support of restoration activities.

Water Quality Data Collection and Evaluation - The scope of this effort will involve investigation and catalog of all available water quality data and databases in the region in support of model development, baseline monitoring to support future restoration activities, and water quality certification. The water quality data analysis effort will include a literature search, review of existing water quality data, identification of: point/non-point nutrient and contaminant sources; and on-going research studies of transport mechanisms. Additional water quality data needs and collection of essential data will be identified early in the

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feasibility phase. Any testing for nutrients, heavy metals, and toxic organic chemicals will be specified and agreed upon with the SJRWMD and other agencies.

Develop Matrix of Actions Based on Monitoring Findings - The results of monitoring activities should be evaluated and assessed. The monitoring databases will be used to evaluate the affects of the structural and operational components of project alternatives on the physical and ecological components and characteristics of the study area. If results are as predicted, then monitoring can proceed. However, if results are unexpected and/or unexplained, then the monitoring activities and hypothesis(es) should be re-evaluated and possibly modified. The monitoring program itself must be re-evaluated periodically for completeness and technical merit. The monitoring program should be designed to support the use of the monitoring results to modify or fine-tune the monitoring program as well as to determine implementation of future project increments.