E.8. Reduce Nutrient Loads to Coastal Watersheds & Reduce Pollution and Hydrologic Degradation to Coastal Watersheds: Monitoring Guidance

This guidance is intended to promote consistency in data collection among similar types of projects and allow for future analysis across TIGs and Restoration Types, (Section 10.6.2 of SOP; DWH NRDA Trustees, 2016). This guidance may also assist the TIGs by providing recommended methodologies for monitoring restoration projects, saving time and money spent developing suitable monitoring protocols for individual restoration projects. If adjustments from this monitoring guidance are needed for a particular project, these adjustments should be described in the project-specific MAM Plan and agreed to by the TIG (Section 10.6.3 of SOP; DWH NRDA Trustees, 2016). Project teams within each TIG will identify parameters applicable to the objectives for each individual restoration project when developing the project MAM Plan. In addition to the project monitoring guidance identified in this Manual, specific monitoring may be required to comply with permits granted by regulatory agencies. The TIGs are not restricted from adding additional parameters, and other project monitoring that may be needed for specific projects should be determined by the TIGs.

The Cross-TIG MAM developed this monitoring guidance by following the process described in the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0 (MAM Manual Version 1.0; DWH NRDA Trustees, 2017).

This guidance is intended to assist the TIGs in developing MAM Plans for restoration projects, as appropriate. Specifically, this document provides:

- Examples of Restoration Techniques
- Guidance on example restoration objectives, example drivers, and example uncertainties
- Guidance on core performance monitoring parameters for projects within the Restoration Approaches
- Guidance on supplemental performance monitoring parameters for specific restoration objectives.

The monitoring parameters identified within a project MAM Plan should be consistent with the recommended monitoring defined within this guidance document, wherever appropriate. Depending on the nature of the restoration project, TIGs may choose not to include some of the elements described in this guidance document (e.g., drivers, uncertainties). If adjustments from the monitoring guidance are needed, these adjustments should be described in the project-specific MAM Plan and agreed to by the TIG (Section 10.6.3 of SOP; DWH NRDA Trustees, 2016b). The guidance provided should not be considered exhaustive. Therefore, TIGs may develop project-level objectives, drivers, uncertainties, and monitoring parameters that have not been previously identified. The TIGs will develop MAM objectives and monitoring parameters

that pertain to their restoration activities; and will determine the frequency and duration of monitoring, and the associated budget they deem appropriate. Finally, this section is subject to change as new monitoring parameters, methods, and technologies are identified and/or developed.

The monitoring parameters recommended in this guidance document are further detailed in Attachment E Section E.3, which includes a complete list of core- and objective-specific monitoring parameters identified by the Cross-TIG MAM work group and guidance on measurement unit(s) and monitoring methods. Guidance on monitoring locations, frequencies, durations of sampling and potential analyses is also provided where appropriate.

E.8.1. Restoration Techniques

Restoration Techniques are specific restoration actions the Trustees identified for each of the Restoration Approaches. Restoration Techniques may be used individually or in combination. See Appendix 5.D of the PDARP/PEIS (DWH NRDA Trustees, 2016a). The following are example Restoration Techniques included in the PDARP for these Restoration Approaches. This list should not be considered exhaustive; additional Restoration Techniques may be developed and/or identified.

1. Agricultural conservation practices
2. Forestry management practices
3. Low-impact development practices
4. Traditional stormwater control measures
5. Erosion and sediment control practices
6. Hydrologic restoration practices.

E.8.2. Example Project-Level Restoration Objectives

Project-level restoration objectives should be specific to the resource injuries and clearly specify the desired outcome(s) of the restoration project (15 CFR § 990.55(b)(2)). See Section 2.4.1 of the MAM Manual Version 1.0 for guidance on establishing restoration objectives. The following are example project-level restoration objectives that may apply to one or more of the above-mentioned Restoration Techniques. This list should not be considered exhaustive; additional objectives may be developed and/or identified.

- Reduce nutrient, sediment, and/or pathogen (e.g., bacteria) concentrations and loadings
- Enhance dissolved oxygen concentration, turbidity, pH, salinity, and/or specific conductance.

E.8.3. Example Drivers

Drivers are outside forces, natural or anthropogenic, that have the potential to influence the outcomes of a restoration project. Drivers tend to be large-scale, long-term forces that are not easily controlled at the scale of a single restoration project (Harwell et al., 2016). See Section 2.4.2 of the MAM Manual Version 1.0 for guidance on establishing the conceptual setting for a MAM Plan, including identifying drivers. The following are example drivers that may be applicable to these Restoration Approaches. This list should not be considered exhaustive; additional drivers may be identified.

- Coastal development
- Changes in land use
- Land-use practices (e.g., application of fertilizer)

- Alterations to freshwater flows.

E.8.4. Example Uncertainties

Uncertainties or information gaps have the potential to affect adaptive management decisions for individual or multiple restoration projects. These decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as intended. See Section 2.4.3 of the MAM Manual Version 1.0 for guidance on identifying potential sources of uncertainty for a MAM Plan. The following are example uncertainties that may be applicable to these Restoration Approaches. This list should not be considered exhaustive; additional uncertainties may be identified.

- Willingness of landowners to participate
- Linkages between water quality improvements and ecosystem benefits
- Degree to which local improvements in water quality contribute to water quality improvements downstream
- Combination and placement of projects within a watershed to maximize benefits in receiving estuary
- Pollutant transport and freshwater flow through Gulf coastal watersheds
- Relationship between watershed pollutant loadings and occurrence of Gulf coastal ecosystem threats and human use impacts.

E.8.5. Guidance on Developing Parameters for Project-Level Performance

This section includes two types of monitoring parameters for consideration under the Reduce Nutrient Loads to Coastal Watersheds & Reduce Pollution and Hydrologic Degradation to Coastal Watersheds Restoration Approaches:

1. Core performance monitoring parameters applicable to projects within a Restoration Approach (core performance monitoring parameters are those used consistently across projects in order to facilitate the aggregation of project monitoring results and the evaluation of restoration progress for each Restoration Type; Appendix 5.E.4 of PDARP/PEIS; DWH NRDA Trustees, 2016a)
2. Objective-specific performance monitoring parameters that are only applicable to projects with a particular restoration objective.

Additional adaptive management and/or validation monitoring parameters for consideration have also been identified. These additional parameters may be helpful for resolving uncertainties, explaining outside drivers, optimizing project implementation, supporting decisions about corrective actions and other adaptive management of the project, and informing the planning of future DWH NRDA restoration projects. Tables E.8.1 and E.8.2 should not be considered exhaustive, and other parameters may be considered, as appropriate. See the complete list of core- and objective-specific monitoring parameters, Section E.3 above, for details on the core performance monitoring parameters including definitions, units, and other guidance.

Generally, in-situ water quality parameters will be collected at the same time as chemical (nutrients, sediments, pathogens, and others) and/or ecological/biological sampling; and at the same locations, frequencies, and depths.

Table E.8.1. Core performance monitoring parameters and additional parameters for consideration under the Reduce Nutrient Loads to Coastal Watersheds & Reduce Pollution and Hydrologic Degradation to Coastal Watersheds Restoration Approaches

Core performance monitoring parameters	Parameters for consideration (as appropriate)
• Number of water quality improvement practices implemented • Area of water quality improvement practices implemented (acres impacted)	• Ammonium nitrogen (NH_4-N) • Nitrite plus nitrate nitrogen (NO_2-N + NO_3-N) • Total Kjeldahl Nitrogen (TKN) • Loads (water level and flow)

Table E.8.2. Performance monitoring parameters and additional parameters for consideration for projects with specific restoration objectives. These would be collected in addition to the parameters listed in Table E.8.1.

Project-specific objective	Objective-specific performance monitoring parameters	Parameters for consideration (as appropriate)
Reduce nutrient concentrations and loadings	• Total nitrogen (TN) • Total phosphorus (TP)	• Soluble Reactive P (Orthophosphate phosphorus) • Chlorophyll *a* • Depth • Tidal cycle
Reduce sediment concentrations and loadings	• Total suspended solids (TSS) • Turbidity	• Suspended sediment concentration (SSC) • Loads (discharge and concentration) • Bedload/bed sediment • Water depth • Secchi depth
Reduce pathogen concentrations and/or exposures	• *E. coli* • Enterococci • Fecal coliform	• *Vibrio cholera* • *Vibrio vulnificus* • Coliphages
Improve in-situ water quality	• Dissolved oxygen (DO) • pH • Temperature • Salinity (surface water) • Specific conductance • Discharge or velocity (water flow) • Turbidity	• Chlorophyll *a* (biomass) • Phytoplankton (biomass and/or biovolume) • Pigments • Loading
Restore natural hydrology and/or reduce hydrologic degradation	• Salinity (surface water) • Discharge or velocity (water flow)	• Water level

References

DWH NRDA Trustees. 2016a. *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS). Available: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.

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