Deepwater Horizon
Louisiana Trustee Implementation Group

MONITORING AND ADAPTIVE MANAGEMENT ACTIVITY IMPLEMENTATION PLAN

Activity to fill a critical Programmatic MAM Need:
Louisiana Interactive Lessons Learned Database

Implementing Trustee: CPRA

1 Introduction

The Louisiana Trustee Implementation Group (LA TIG) Monitoring and Adaptive Management (MAM) Strategy provides guidance to support the LA TIG in identification of MAM activities that will maximize resource benefits and support assessment and reporting of Natural Resource Damage and Assessment (NRDA) funded ecosystem restoration (Deepwater Horizon Louisiana Trustee Implementation Group, 2021). SMART Objectives were developed for seven of the LA funded Restoration Types and additional MAM needs were identified to support multiple Restoration Types (Cross Restoration) as well as activities needed to support Programmatic MAM Needs (Deepwater Horizon Louisiana Trustee Implementation Group, 2021). Filling these identified MAM needs supports the commitment of Trustees to conduct monitoring and scientific support activities within an adaptive management framework (PDARP/PEIS Appendix 5.E; DWH NRDA Trustees, 2016) so that Trustees can evaluate restoration effectiveness, address potential uncertainties related to restoration planning and implementation, and provide feedback to inform future restoration decisions (Williams, 2011; Williams et al., 2009).

The programmatic objectives identified in the LA TIG MAM Strategy included development and implementation of a practical, accessible, and usable tool for capturing and accessing lessons learned. The activities in this proposed Monitoring and Adaptive Management Implementation Plan (MAIP) are to develop and implement an interactive, lessons learned database to meet this identified MAM need.

2 Purpose of this Document

For the Monitoring and Adaptive Management (MAM) activity "Develop and Implement an Interactive Lessons Learned Database" this Monitoring and Adaptive Management Implementation Plan (MAIP) will support the Louisiana Trustee Implementation Group (LA TIG) Strategy programmatic MAM objectives. The identified need and activities to address this fundamental programmatic MAM objective are stated within the LA TIG MAM Strategy (Table 1), and were previously identified within the Louisiana Adaptive Management Status and Improvement Report: Vision and Recommendations report (Deepwater Horizon Louisiana Trustee Implementation Group, 2021; The Water Institute of the Gulf, 2020).

Table 1. The identified need and associated activities to address the fundamental programmatic MAM objective related to capturing lessons learned from restoration projects. From Table 10 of the LA TIG MAM Strategy document.

#1 DWH NRDA Lessons learned are systematically captured and incorporated into future project selection, design, implementation, and evaluation accessed by Trustees and available for use by planners/ engineers/ consultants for DWF NRDA in coastal Louisiana
(1) Develop and employ a process for identifying lessons learned from LA TIG restoration projects and rationale for operation and maintenance decisions to inform future planning and objective setting
(2) Capture LA TIG restoration lessons learned (e.g., within DIVER or a database), where they can be accessed by project planners, implementers, and contractors
(3) Evaluate former projects conducted under other programs, as needed, to apply lessons learned to DWH NRDA restoration planning (AM Framework Report #59)

3 MAM Activity Description

3.1 Background

The objective of this project is to create an electronic repository for ecosystem restoration lessons learned during ecosystem restoration of coastal Louisiana, from planning to construction, at programmatic and project scales. It will use project reports to summarize recent lessons learned, provide a mechanism for entry of new lessons learned by project teams, and facilitate delivery of lessons learned knowledge back to restoration staff in a targeted and easily accessible way. To ensure the interactive lessons learned database is used as a standard part of ecosystem restoration project implementation, this project will focus heavily on input (surveys and direct input) from ecosystem restoration project team staff both in CPRA's Baton Rouge and field offices, project planners, project managers, and MAM staff from TIG Trustee agencies.

Between 2018 and 2020, the Coastal Protection and Restoration Authority (CPRA) led an effort to summarize current and historical approaches to monitoring and adaptive management of coastal ecosystem restoration in Louisiana, resulting in the Louisiana Adaptive Management Status and Improvement Report: Vision and Recommendations (The Water Institute of the Gulf, 2020). Through more than 100 meetings and webinars, that effort engaged more than 60 staff from CPRA and Trustees of the LA TIG to identify priorities to further MAM for coastal restoration in Louisiana. A part of that work was development of a prototype interactive 'handbook' for adaptive management, which provided the initial thinking and concept behind the interactive ecosystem restoration lessons learned database (Figure 1). One of the eight primary recommendations (Recommendation 2.0) from that effort was to develop a lessons' learned database; accessible through the current information management systems, such as CPRA's Coastal Information Management System (CIMS) or the National Oceanic and Atmospheric Administration (NOAA) Data Integration Visualization Exploration and Reporting (DIVER) (key findings: 42, 28, 85, 87). Regardless of the system selected, even if the database has an independent back end with front end access through CIMS and DIVER, additional resources (both personnel and funding) will be needed to maintain and update the database (key finding: 46). The database should also provide a searchable (key words/topics/locations) mechanism for agency staff Trustees and contractors to document and access lessons learned and information used in decision making (key finding: 31).

Through 2020 and 2021 CPRA and Trustees of the LA TIG developed SMART Objectives for monitoring and adaptive management for seven of the funded restoration types in coastal Louisiana, as well as cross restoration type objectives, and programmatic adaptive management. These were developed into the LA TIG MAM Strategy which includes a specific task to develop a Louisiana ecosystem restoration lessons learned database (Deepwater Horizon Louisiana Trustee Implementation Group, 2021); Table 10).

The interactive lessons learned database will support the most fundamental component of Adaptive Management – *improving future restoration outcomes based upon lessons learned during previous projects/programs.* It will identify and track critical knowledge gaps and data needs, so that project teams can track updates and new knowledge related to known uncertainties. It will be intuitive and simple to use, with minimal (or no) training or explanation needed for successful use, and controlled

vocabulary (such as pull-down menus) to assist with effective searching. An electronic platform and structure will be developed which will be a 'living database' that is dynamic so that it can be added to during the restoration project reporting cycle and evolve over time to best address changing MAM needs while using up-to-date technology. During the previous phases a *proof of concept* 'interactive MAM handbook' was developed (Figure 1). While it was never fully developed or implemented, it did provide the initial concept for the interactive lessons learned database

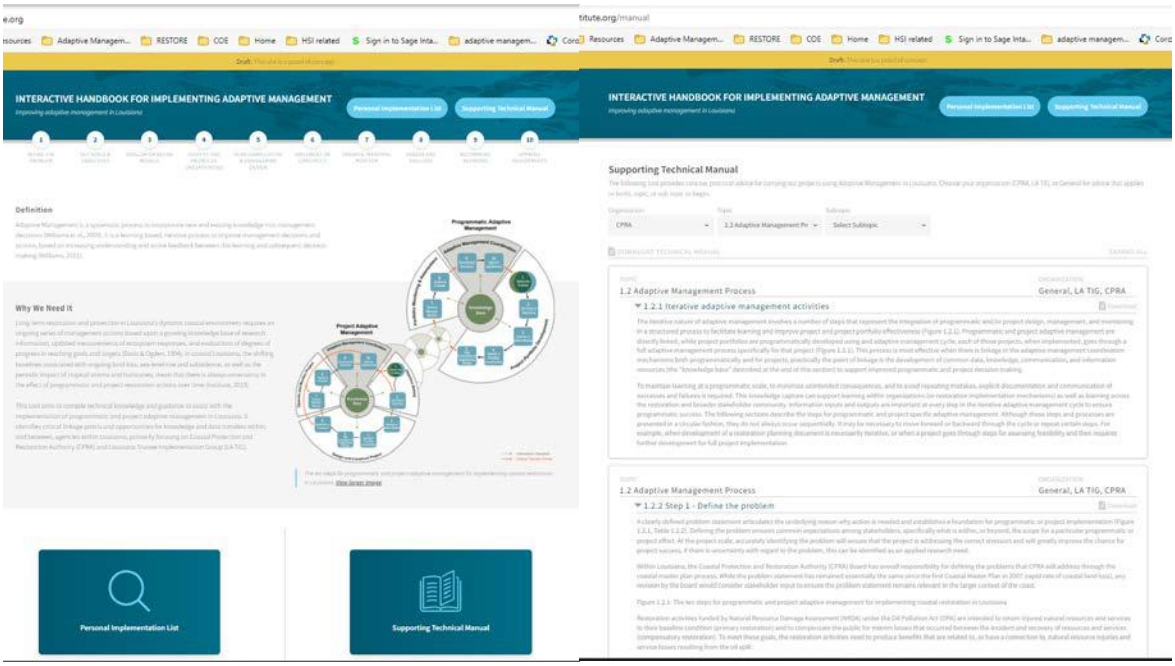

Figure 1. A *proof of concept* Adaptive Management Electronic Handbook (Adaptive Management (thewaterinstitute.org) developed as part of the Louisiana Adaptive Management Status and Improvement Report (The Water Institute of the Gulf, 2020).

This MAIP details all activities needed to achieve development and implementation of an interactive lessons learned database for ecosystem restoration in coastal Louisiana. It is recognized that there are some unknowns and tasks are outlined to answer those questions as part of the process of developing the interactive lessons learned database.

3.2 Objectives and Tasks

Objective: to develop and implement an interactive ecosystem restoration lesson learned database

Adaptive Management is defined as a systematic process to incorporate new and existing knowledge into management decisions (Williams et al., 2009). It is a learning based, iterative process to improve management decisions, and actions, based on increasing understanding and feedback between this learning and subsequent decision making (Williams, 2011). The objective of this MAIP is to develop and implement a practical, tangible, and easily accessible, interactive lessons learned database. It will include relevant historical lessons learned from project reports and documents, develop dynamic ways to access and search that information, and provide a repository for new lessons learned to be captured during current and future ecosystem restoration projects as well as programmatic scale ecosystem restoration planning.

While lessons learned are captured in project and programmatic MAM reports and the full documents deposited in DIVER, the lessons learned are not easily discoverable since they are spread between hundreds of reports that need to be scanned to find a relevant piece of information. Within CPRA, project assessment and evaluation provides' meaningful feedback on project performance and can document recommendations for improvements and lessons learned that can be used to improve future projects. The results of restoration assessments need to be communicated to managers and lessons learned from assessments and evaluations need to be readily discoverable. For CPRA projects, the output from a project assessment activity is a series of summary reports highlighting the main messages and any uncertainties that have (or have not) been resolved. Project assessment and evaluation provides meaningful feedback on project performance and can document recommendations for improvements and lessons learned that can be used to improve future projects. However, the documentation of these lessons learned are currently located in technical reports, within CIMS, so that discovery of these lessons learned is difficult and a small number of key individuals have become the practical repository of this knowledge. Not only is this inefficient with the increasingly large number of restoration projects being implemented in coastal Louisiana by CPRA, but it is highly susceptible to losing that knowledge when these key individuals retire or move to new positions. The results of project engineering reports and restoration assessments need to be communicated to managers with the lessons learned being readily discoverable and searchable.

The interactive lessons learned database will:

- **Have an intuitive, simple, and easy to use web based front end**
- **Have a state-of-the-art back-end database to support data association**
- **Include lessons learned during implementation of each ecosystem restoration project (e.g. planning and engineering reports), extracted from project/program documents of completed LA restoration projects/programs**
- **Be the location for documentation and storage of lessons learned from current and future restoration projects.**

Task 1: Investigate a vision and assess options for location, high level format, structure, associated ongoing maintenance costs, and utility, of the interactive lessons learned database to frame questions for broader survey in Task 2

Output: a draft vision and high level format and structure as well as key questions and input needed from a broader survey

The first step will be to investigate the functionality, development, and maintenance approaches of similar efforts including, but not limited to, NOAA's Marine Debris Monitoring and Assessment Program (https://mdmap.orr.noaa.gov/), RESTORE's CMAP, and the Chesapeake Bay Program adaptive management website.

To build a successful, innovative, and useable interactive lessons learned database and interface, a design-thinking approach (Figure 2) is recommended for problem-framing and solution development and refinement. A more in-depth explanation of this approach to problem solving can be found in *101 Design Methods: A Structured Approach for Driving Innovation in Your Organization,* by Vijay Kumar. This MAM activity will support initial discussions amongst CPRA and the other LA TIG Trustees to assess the technical options for locating the interactive database, as well as needs and processes for interactivity between current restoration databases and web sites. Common design thinking activities include user stories, user journey maps, sketching, storyboarding and prototyping.

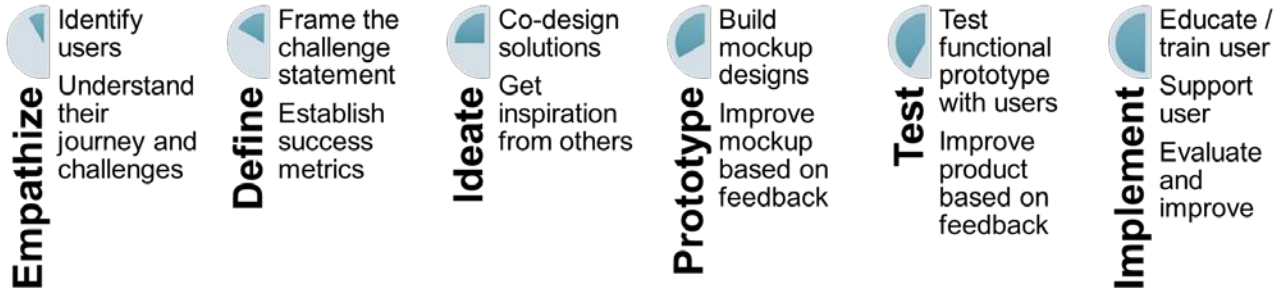

Figure 2. Overview of design thinking process.

Empathize and Define

In addition to understanding technical requirements for the database, this MAM activity will use a process "Empathizing" with users (e.g. LA TIG Trustees, CPRA restoration managers) to articulate a clear vision for the database, as indicated in the first step of Figure 2:

- Who needs to be able to access and use it?
    - What contexts, cultures, environments, and technology influence the behaviors of users?
- How will it integrate into existing systems and experiences?
    - Where does it fit in the project process?
    - What are their current pain points and challenges in the process?
    - How are users using current systems? (and what are they?)
- What problem(s) does it address?
    - Are we solving the right problem?
    - How can we frame the problem in a way that inspires the right solution?

Ideate and Prototype: Co-design a conceptual model of the Lessons Learned Database to utilize in preliminary prototyping and user research to inform the eventual solution

Figure 3. Users participate in a facilitated co-design workshop to design solutions in direct response to needs defined through problem framing.

For initial scoping of the interactive database, a co-design session is proposed to engage staff from across Divisions and offices at CPRA and other LA TIG Trustees that will use the platform. This will help the database development team to understand usage context for the database and the individuals that will be using it. The working session will be participatory and employ a range of activities designed to generate ideas and arrive at prototypes. The users will engage in various activities that are designed to help them share their positive experiences and pain points in obtaining and determining applicable lessons learned to their restoration projects (Figure 3). This user experience and feedback will serve as foundation for defining requirements and designing features and tools to be incorporated into the interactive database.

Through the co-design session, we will **Frame Insights** related to the following factors that will contribute to successful usability of the interactive database:

- User needs and expectations.
- User experience, both positive and negative.
- Understanding of existing systems and interpretation of available data.

Based on discussions and co-design session, a draft vision and mockup design will be presented to the LA TIG MAM small working group for input and review.

Task 2: Survey CPRA and ecosystem restoration project teams, including the other LA TIG Trustees, to determine what information would be most useful and what formats or platforms would be most likely to be utilized, when and how it would be most beneficial to capture the lessons learned, and when and how this information is needed in the project design, implementation, and assessment process

Output: compilation and analysis of responses to survey which will compile a substantive component of Task 3

As part of the Test and Implement steps of the design thinking approach, CPRA will design, distribute, and collate an online survey, working with the other LA TIG Trustees to identify survey participants. This will include questions to validate project types and how many years back to search documents and extract identified lessons learned (questions developed based on input from Task 1). The results will be summarized for discussion with those identified in Task 1.

In addition, the survey will be designed to explore concepts and specific aspects of the need for a Lessons Learned Database as framed in Task 1. The users' pain points, challenges and opportunities will serve as a metric to assess effectiveness of proposed functions, and the prototypes will be used to illustrate proposed solutions. An example of this is shown in Figure 4.

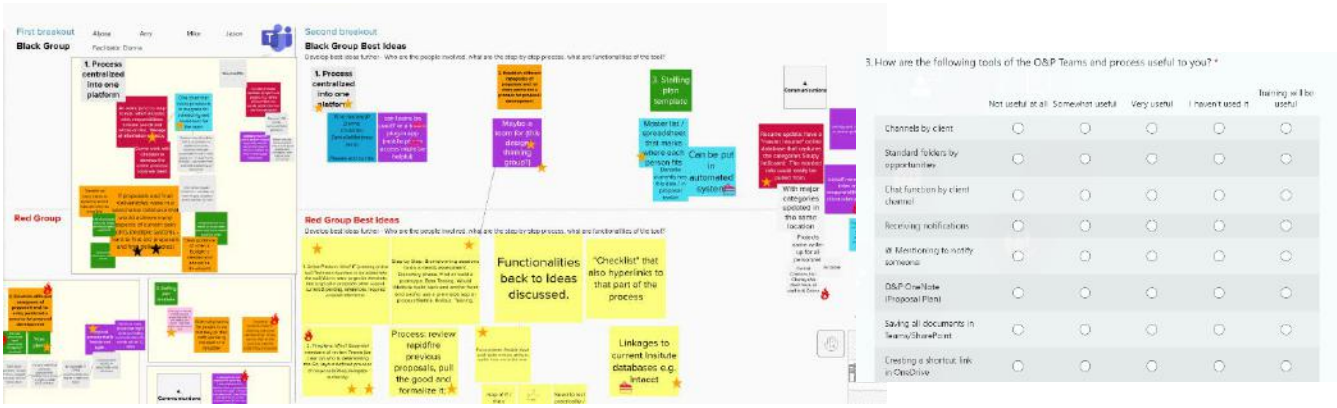

Figure 4. Example of a virtual design thinking workshop using MURAL (left), where user pain points, challenges and opportunities are used to summarize success metrics and use as basis for online survey questions (right).

Depending on the number of expected survey participants, questions will be developed for a balance of quantitative and qualitative feedback. Quantitative questions may take the form of multiple choice, rankings, scoring, and sorting, to evaluate and respond to a proposed database solution. Qualitative questions will take the form of more open-ended short answer inquiries, providing participants a chance to give deeper answers, propose alternative approaches, and even at this stage, uncover unaccounted for potential user needs.

The understanding gained through asking questions about project types and the analysis of quantitative and qualitative inquiries about a conceptual prototype will inform database and interface requirements and specifications to create a more usable and useful Lessons Learned Database.

Task 3: Develop a short plan document outlining the planned structure, location, and broad functionality of the Louisiana Ecosystem Restoration Interactive Lessons Learned Database and obtain approval from the LA TIG to proceed to implementation

Output: technical memorandum proposing structure, format, functioning, scope, and use of Louisiana Ecosystem Restoration Interactive Lessons Learned Database; this will form the draft data management plan

To ensure that this MAM activity results in a product that meets the needs of CPRA as the lead restoration implementation agency in Louisiana, as well as all Trustees of the LA TIG, review and refinement of the planned approach will be critical. Once the fundamental construct is developed (Task 1), and end user surveys carried out to clarify structure, format, and how and when project teams will be using and uploading lessons learned to the interactive database (Task 2), the process and technical details of the database will be documented in a short technical memorandum (tech memo) delivered to CPRA and then the LA TIG (Task 3). This tech memo will articulate key aspects and objectives of the database, technical structure and location, content, preferred usability, and summary analysis of the end user surveys and will represent an initial draft of a data management plan (Task 3). A suggested table of contents of the tech memo is provided below:

Example Table of Contents

1. Introduction
    a. Addressing the Programmatic Need for a Central Database to Document Lessons Learned
    b. Intended Use and Objectives of the Louisiana Ecosystem Restoration Interactive Lessons Learned Database
2. Technical structure and location, including long term maintenance costs
3. Database Development Methodology
4. Summary of End User Surveys
5. Framing of key content
6. Key Conclusions and Recommendations
7. References

The Louisiana Ecosystem Restoration Interactive Lessons Learned Database planning tech memo will first be reviewed for two weeks by key staff at CPRA representing the key CPRA divisions involved directly with ecosystem restoration project implementation. Subsequently, the modified planning tech memo document will be submitted for a 15-business-day review by the LA TIG MAM small working group with reach back within agency. The LA TIG MAM Trustee small working group representative will compile all comments from their agency into one consensus set of comments per agency. The Contractor will compile all agency comments and provide suggestions on how to address each comment, discussing any differences of opinion through facilitated discussion with the LA TIG MAM small working group to reach consensus as needed. Then the plan will be revisited and finalized by the Contractor. The Contractor will then assist CPRA, as needed, to present the Louisiana Ecosystem Restoration Interactive Lessons Learned Database to the LA TIG who will have a 15-business-day review period for final approval of the planning tech memo.

Task 4: Based on discussions with CPRA staff, other Trustees of the LA TIG, and user surveys, manually assemble/ extract lessons learned from current / previous project documents (type and period to be identified during Task 1 and Task 2), automating collation of lessons learned data where technically feasible

Output: lessons learned primary data and associated metadata fields for extracted and collated lessons learned, vetted with CPRA staff as appropriate, from current / previous project documents

This will involve an active process that will:

1. Reach out to relevant partners who have undergone this process previously (e.g. RESTORE's CMAP, Chesapeake Bay Program Office adaptive management website). Mine existing Louisiana coastal ecosystem restoration project documentation on CIMS and DIVER, such as design reports, lessons learned documents and/or presentations, and other sources, such as Avian Design Guidance documentation under development by CPRA and LDWF to build a database of lessons learned information across project types, geographies and time periods determined in Tasks 1-3. This step will require mining CIMS and DIVER, evaluation of the applicability of data, and capturing it within the database.
2. Analyze the database to identify the range of documents where lessons learned are frequently captured and common themes, as often, lessons learned from Louisiana coastal ecosystem restoration projects, most of which are implemented by CPRA, are found in numerous types of project documentation. Additionally, common lesson typologies will be generated to standardize the entries. This will include classifying lessons learned both by the phase of the project it occurred in (e.g., planning, design, procurement, construction, operations and maintenance, and monitoring) and the nature of the lesson (e.g., funding issues, design standards, stakeholder engagement, cost estimation, etc.).
3. Engage CPRA personnel and other LA TIG Trustee personel to confirm common themes and identify any others to be added, fill in the gaps of CIMS and DIVER data for all other projects executed in coastal Louisiana where such information exists, and identify key projects and documents to target for the most beneficial narratives and information. CPRA personnel required for this activity may include project managers, engineers, and planners with great institutional knowledge to best inform lesson types, data locations, and other key staff to involve. LA TIG Trustee personnel to engage may include project managers, engineers, and planners. Clarifying and capturing these lessons learned will require close and frequent engagement with person(s) familiar with and able to access CPRA's internal project servers since it is common for documents to not be discoverable on CIMS or DIVER. This task will require mining CPRA's servers for lessons learned documentation and extracting it.
4. Update the lessons learned database with refined information from CPRA and LA TIG Trustees and generate metadata for each entry (e.g., date, location, project type and other fields to be determined with input from the user surveys in Objective 2).
5. Refinement after consultation with CPRA and LA TIG Trustee project personnel engaged in Step 3 to eliminate unnecessary information, optimize the database organization for user-friendliness.

An example of a similar process is described below.

Example Process

Premise: The Avian Guidance Document development has identified lessons learned related to vegetative planting strategy for barrier islands.

Step 1: TWI team mines all barrier island project entries, design guidance documents, and vegetative planting project entries, and post-construction monitoring reports on CIMS for lessons learned documentation.

Step 2: Team creates list of all lessons learned captured, classifies them, and then sorts based on vegetation-related topics.

Step 3: TWI team engages CPRA personnel and CWPPRA and Trustee project managers most-associated with and most-frequently involved with barrier island restoration and monitoring to ask for documentation or projects that they may be aware of not found on CIMS or under other studies executed by CPRA that were not project-related, as well as to anecdotally capture other lessons learned they recall from project experience. Team then mines CPRA server locations for additional data.

Step 4: Update the database, generate metadata.

Step 5: Review comprehensive list of lessons learned related to vegetative plantings as catalogued by CPRA to ensure database is complete, accurate, and easily discoverable for this topic.

Task 5: Build interactive database including dynamic processes for searching information (e.g., AI approaches) and data management plan

Output: A back-end database that will run the data management of the Louisiana Ecosystem Restoration Lessons Learned Database; Fully develop data management plan

A knowledge management system aims to integrate and share knowledge from different sources and allows searches for required information. Sources can include adding content directly to the platform as well as taking information from existing documents. Such a system organizes a body of knowledge, adding categories, tags and allowing efficient searches for relevant information.

There are some commercial implementations of these kinds of systems, with different features and quality attributes. A couple of relevant examples are StackOverflow for Teams[1] and Atlassian Confluence[2]. StackOverflow, the most popular question-answering platform for software development, has a version called StackOverflow for teams, which builds on this platform, integrating with some existing communication tools in the enterprise. Atlassian Confluence is defined as a community wiki, but it integrates with other of the Atlassian products (such as Jira, one of the most used issue tracking and project management platforms) to become a central place to discover the enterprise organization.

Although these commercial platforms are widely used and provide some of the essential capacity of an interactive database, they do not fully deliver the requirements expected of an interactive ecosystem restoration lessons learned database. In part this is because they are proprietary, closed-sourced solutions and therefore impose vendor lock-in (each user needs to purchase the software). However, these applications can be used as examples of potential functionality of a lesson learned management system.

To successfully implement such a system, it will be essential to define the when (at the end of a project, as milestones during the project, or continuously during the project) and how (e.g., mining documents contents, using web forms, as free text entries) the lessons learned will be logged. It will also be necessary to define how the information will be searched for (e.g., browsing by categories, using keywords search, using full text search, using semantic search) and displayed (e.g., as documents, as pages, as graphs). And finally, a plan will be required for managing the lifecycle of the information (e.g., does the information become stale or superseded by new information? How and who determines a lesson learned is no longer relevant?).

On the architectural side of the design, it will be necessary to prioritize quality attributes (e.g., should the design prioritize maintainability over availability or performance?). Once both the functional requirements and the quality attributes have been defined, as well as any external restrictions, it will be possible to define a software architecture design to accomplish them.

[1] StackOverflow for Teams - https://stackoverflow.com/teams
[2] Atlassian Confluence - https://www.atlassian.com/software/confluence, https://www.atlassian.com/software/confluence/use-cases/knowledge-management-software

Concept

A generalized concept of functionality for an interactive lessons learned management system is presented in Figure 5. This example can be simplified into three distinct operational layers.

Starting with the foundation, any solution will require a method and location to house programmatic data, termed here as the "Storage Layer". At a fundamental level, this layer needs to be flexible enough to allow the overall system to evolve as changes in data needs and system requirements occur over time. Several cloud object storage platforms fit this system's flexibility requirements with Amazon Web Services (AWS) Simple Storage Service (S3) and Microsoft's Azure platform being immediately targetable candidates for any proposed storage obligations.

The next level in the lessons learned management system hierarchy would control how changes in stored data are tracked and governed. This "Lifecycle Layer" would be the primary mechanism that allows users to discover data as well as the internal driver allowing the system to collect additional data.

The uppermost functional level, the "Visualization Layer," would determine how users interact with the data located in the storage layer with governance oversight passed through the lifecycle layer. A web-based User interface (UI) would allow users to search, view, and download relevant lessons learned programmatic knowledge. At this level of the system hierarchy functionality is likely to vary based on user role (e.g., affording specific users groups the ability to interact with the data at a deeper level). Application Programming Interfaces (APIs) would allow data resources to be exposed externally, functionally allowing resources housed in the knowledge management system to be consumed by other programmatic database systems such as the CIMS or DIVER platform.

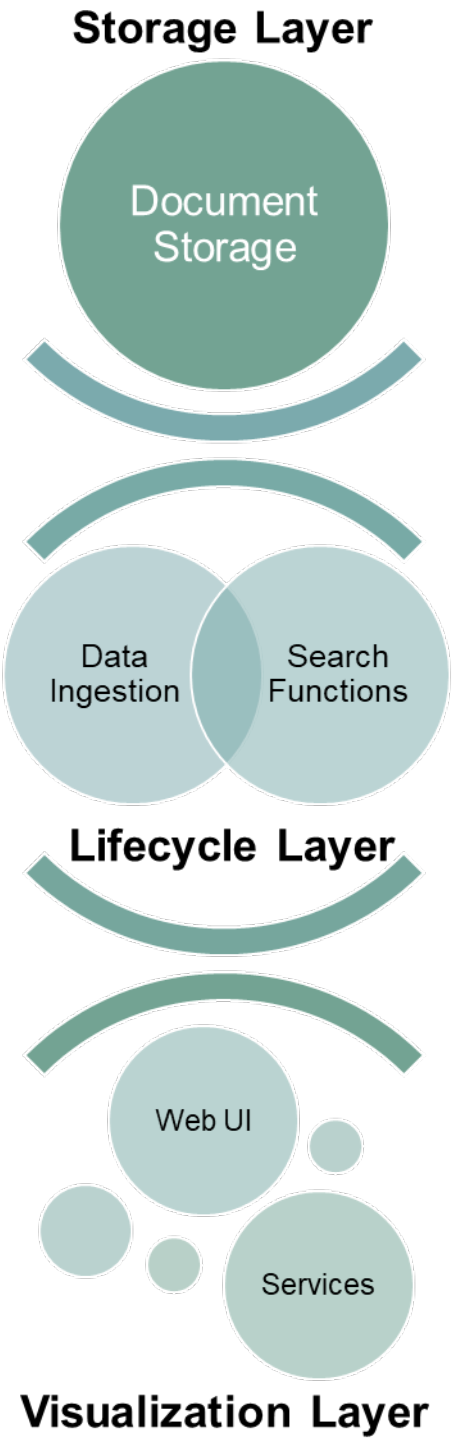

Figure 5. Conceptualized generalization of components and functionality.

Semantic Search

A traditional search function is structured to simply look for overlaps in search terms between different source documents. Under this method, if a search query specifies 5 words and 4 of those words are in a database document then the matching document is returned as the first output for the search. Language, however, is exceedingly complex. Words and phrases can have multiple meanings, driven by context and semantic dependence, and simply searching for matching query terms has the potential to overlook relevant resources that can only be detailed through linguistic and phraseological relationships.

To retrieve documents not just by simple word overlap, but rather by semantic overlap instead, one can employ 'Text Embeddings' such as BERT[3,4]. Embeddings are learned representations for words in text where words that have same meaning have a similar representation. These representations are simple arrays of numbers called vectors. BERT vectors could be pre-computed on all the documents in the database to serve as a query reference. BERT vectors for search queries could be computed and documents similar in meaning to query can be retrieved by employing 'Cosine Similarity'[5]. Thus, search quality can be enhanced using embeddings, eventually retrieving most similar documents for a specific search query. Note that tools like Elasticsearch[6]/Solr[7] & Lucene offer extensions to read in PDF documents and pre-compute BERT embeddings.

Topic Modeling and Topic Classification

In addition to augmentation of search functionality, there are several machine learning (ML) methods and tools that can help detail the relationship between documents with intersecting relevance. For this specific application, the concepts of topic modeling and topic classification are of interest. Both concepts could be applied once the knowledge management database is operational and after it is populated with at least 1000 documents.

Topic modeling[8] is an unsupervised ML technique that can be applied to retrieve topic vectors from a body of text and then group documents that reference the same topic. This could be performed on all the documents in the database to identify a fixed number of appropriate tags/topics[9] to cluster documents.

Topic classification is a supervised learning technique that uses documents with existing labels/tags to label/tag a new document that hasn't been classified. Conceptually, this method relies on a reference set of labeled/tagged documents. Based on contents, and applied against the reference set, a new incoming document can be assigned a particular set of tags based on its relevance to the labeled dataset.

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[3] BERT - https://arxiv.org/abs/1810.04805

[4] Sentence-Transformers - https://www.sbert.net/

[5] Cosine Similarity - https://en.wikipedia.org/wiki/Cosine_similarity

[6] Elasticsearch NLP - https://www.elastic.co/guide/en/machine-learning/current/ml-nlp-search-compare.html

[7] Solr - https://github.com/DmitryKey/bert-solr-search

[8] Topic Modeling - https://docs.aws.amazon.com/comprehend/latest/dg/topic-modeling.html, https://springerplus.springeropen.com/articles/10.1186/s40064-016-3252-8, https://towardsdatascience.com/topic-modeling-with-bert-779f7db187e6

[9] Topic Modeling Tags - https://dl.acm.org/doi/10.1145/3129676.3129709

Task 6: Develop interactive interface / website (front end) using input from prior tasks, specifically tasks 1 and 2

Output: a front-end user interface for the Lessons Learned database

An intuitive, simple, easy-to-use web-based interface will be developed for the Lessons Learned Database. This task will be conducted in close coordination with back-end developers to ensure that the front-end interface integrates all needs determined for access to and use of the database.

The development of the interface will be driven by input provided by CPRA staff and other LA TIG Trustees during Task 1, alongside survey results and additional information gathered during Task 2 from CPRA staff, ecosystem restoration project teams, and LA-TIG Trustees. Specifically, the front-end design and interactivity will be informed by user needs and expectations that are identified during the Design Thinking Workshop and will look to prototypes and examples provided during that time.

Task 7: Carry out on-line and interactive user testing by staff from all CPRA divisions, Trustees, and ecosystem restoration project teams to identify 'pain points' in using the interface and interactive database

Output: implement end user testing and collate and analyze the results to be used as basis to Task 8

Conduct on line and in person user testing of the front end of the database to evaluate and inform refinement of all aspects of the interface. A range of staff from different divisions at CPRA involved with ecosystem restoration project planning and implementation will be sought for this input. As relevant, LA TIG Trustee staff will also go through user testing. This process will include generating a list of tasks for users to execute within the interface and observing their experience. Users will be asked to share thoughts out loud while the testing team asks key questions and records observations of user pain points and successes. Outcomes of this series of user tests will be used to generate a list of change requests for the interactive database to be implemented in Task 8.

In addition to user testing, the front-end interface will have embedded evaluation scoring and change request functionality so that users can provide feedback on the interface and experience in an ongoing fashion.

Task 8: Revise interactive lessons learned database, develop a data management plan

Output: Functional and finalized version of the Louisiana Ecosystem Restoration Lessons Learned Database, with detailed documentation of all edits made and finalized data management plan

Revise back-end database, front end interface, search tools and machine learning components, and add additional project information as required. A change log will be developed to ensure that all requested changes or updates are addressed and logged. A data management plan will also be developed for the content of the database.

Task 9: Final approval process by LA TIG

Output: approval of the Louisiana Ecosystem Restoration Interactive Lessons Learned Database by the LA TIG

After a two week fatal flaw review by key staff at CPRA, the Louisiana Ecosystem Restoration Interactive Lessons Learned Database and data management plan will be subject to a 15 day fatal flaw review by the LA TIG MAM small working group with reach back within agency. The LA TIG MAM Trustee small working group representative will compile all comments from their agency to one consensus set of comments. All Trustee agency comments will be compiled and provide suggestions on how to address each comment, facilitating discussions about any differences of opinion with the LA TIG MAM small working group to reach consensus as needed. The Louisiana Ecosystem Restoration Interactive Lessons Learned Database will be revisited and finalized. The Louisiana Ecosystem Restoration Interactive Lessons Learned Database will be presented to the LA TIG who will have a 15-business-day review period for final approval of the interactive database for release.

Task 10: Implement public release of the Louisiana Interactive Ecosystem Restoration Lessons Learned Database and support mechanisms to increase usage

Output: public release of the final approved Louisiana Ecosystem Restoration Interactive Lessons Learned Database

Develop materials such as press releases, storyboards, fact sheets, web postings, and hashtags, for communicating the public release of the Louisiana Interactive Ecosystem Restoration Lessons Learned Database.

This task requires the development of a communication plan for disseminating the release of the database including a description of what the database includes, how it can be activated, as well as helping stakeholders and the public understand the database's usefulness. These messages and information must be shared through multiple mechanisms that effectively target and, ultimately, engage the necessary audiences within and beyond CPRA and LA TIG Trustees, including the general public.

To accomplish this, a communication plan will be developed to ensure the right content is accessible to the right people, including what material to include, how to visualize and present the results, and the most appropriate mechanism of delivery (i.e. press release, social media channels, YouTube, newsletters, presentations at public meetings such as CPRA board meeting, Coastal Advisory Commission on Coastal Protection, Restoration, and Conservation, Barataria-Terrebonne National Estuary Program management conference meetings, presentations at scientific coastal meetings such as State of the Coast or the Gulf of Mexico Conference.)

CPRA and the other LA TIG Trustees will provide input on the primary audiences and use that information to draft a plan including identification of content to include, how to disseminate information to different audiences, and the best mechanisms for ensuring the communication plan is successful in conveying information.

3.3 Budget

The anticipated budget for the MAM activity "Develop and Implement an Interactive Lessons Learned Database" is provided in Table 2.

Table 2. Anticipated budget for the proposed MAM activity "Develop and Implement an Interactive Lessons Learned Database".

Organization / Agency	Budget Amount
Contractor	$325,000
CPRA	$150,000
NOAA	$ 25,000
DOI	$ 11,596
Grand Total	**$511,596**

3.4 Activity implementation

3.4.1 Timeline

This proposed MAM Activity will require 2 years for completion, with work commencing July 1, 2022 and a completion date of June 30, 2024 (Table 3).

Table 3. Anticipated timeline for the proposed MAM activity "Develop and Implement an Interactive Lessons Learned Database".

	2022		2023				2024	
Activity	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**
Task 1								
Task 2								
Task 3								
Task 4								
Task 5								
Task 6								
Task 7								
Task 8								
Task 9								
Task 10								

- **Task 1:** Assess options for location, high level format, structure, and utility of the interactive lessons learned database
    - **Output: a draft vision and high-level format and structure as well as key questions and input needed from a broader survey**
- **Task 2:** Survey CPRA staff and ecosystem restoration project teams, as well as staff of the other LA TIG Trustees as appropriate, to determine what information would be most useful and what formats or platforms would be most likely to be utilized, when and how it would be most

beneficial to capture the lessons learned, and when and how this information is needed in the project design, implementation, and assessment process
    - **Output: compilation and analysis of responses to survey which will compile a substantive component of Task 3**
- **Task 3:** Develop a short plan document outlining the planned structure, location, and broad functionality of the Louisiana Ecosystem Restoration Interactive Lessons Learned Database and obtain approval from the LA TIG to proceed to implementation
    - **Output: technical memorandum proposing structure, format, functioning, scope, and use of Louisiana Ecosystem Restoration Interactive Lessons Learned Database as basis to data management plan**
- **Task 4:** Based on discussions with Trustees and user surveys, extract lessons learned from current / previous project documents (type and period to be identified with Trustees and user surveys), automating collation of lessons learned data where technically feasible
    - **Output: a database and associated metadata fields for extracted and collated lessons learned, vetted with CPRA staff as appropriate, from current / previous project documents**
- **Task 5:** Build interactive database including dynamic processes for searching information (e.g. AI approaches)
    - **Output: A back end database that will run the data management of the Louisiana Ecosystem Restoration Lessons Learned Database and data management plan**
- **Task 6:** Develop interactive interface / website (front end) using input from Objective 2
    - **Output: a front-end user interface for the Lessons Learned database**
- **Task 7:** Carry out on-line and interactive user testing by Trustees and ecosystem restoration project teams to identify 'pain points' in using the interface and interactive database
    - **Output: implement end user testing and collate and analyze the results to be used as basis to Task 8**
- **Task 8:** Revise interactive lessons learned database, develop a data management plan
    - **Output: Functional and finalized version of the Louisiana Ecosystem Restoration Lessons Learned Database, with detailed documentation of all edits made and a data management plan**
- **Task 9:** Final approval process by LA TIG
    - **Output: approval of the Louisiana Ecosystem Restoration Interactive Lessons Learned Database by the LA TIG**
- **Task 10:** implement public release of the Louisiana Interactive Ecosystem Restoration Lessons Learned Database and support mechanisms to increase usage
    - **Output: public release of the final approved Louisiana Ecosystem Restoration Interactive Lessons Learned Database**

3.4.2 Data management and reporting

This is fully a desktop project using currently available ecosystem restoration project documents and reports. Once the location, structure, and content of the interactive lessons learned database are clarified (Objectives 1 and 2) there will be opportunity for the LA TIG to review the plan and then the

final product, at which time the content will be sufficiently developed to establish a formal data management plan (Objective 8).

This project will result in a fully operationalized data management plan (DMP) documenting relevant project information including assignment of data stewards for overall data management as well as Quality Assurance/Quality Control (QA/QC). Reporting of data management activities will be aligned with the scientific data lifecycle 1) Data Collection, 2) Data Processing, 3) Data Analysis, 4) Data Publication.

1) Data collection reporting will include narrative descriptions of data collection activities as well as a catalog of specific datasets that are required produce any derived data products. A breakdown of input datasets, their native format, size, source location, and any use restrictions will be detailed and verified.
2) Data processing reporting will describe the range of data processing activities necessary for data synthesis. A summary of data types, description of processing requirements, and the software leveraged will be detailed. Project data stewards will be responsible for documenting the workflows used in the data processing pipeline.
3) Data analysis reporting will include descriptions of the range of analysis activities to synthesize processed data. A summary of data types, description of analysis requirements, and workflow details will be documented.
4) Data publication activities will include any important considerations regarding the publication of synthesized/derived data resources. Data stewards will document basic metadata elements, data volumes, points of contact, and access restrictions for each dataset destined for publishing.

In addition to data lifecycle documentation, the final DMP will detail data documentation standards, long-term maintenance requirements, archival procedures, and data security constraints. All of the listed data management activities and resulting documentation will be conducted in accordance with the following DWH Trustee Monitoring and Adaptive Management (MAM) Plan guidelines (DWH NRDA Trustees, 2017).

> **MAM Requirement:** *The project-specific MAM Plan should include information on how the data will be recorded, the type of data that will be collected, the data standards that will be followed, the timing and frequency of data collection and processing, the location of data collection, and the quantity of data that are expected. If data from an existing program will be utilized, a description of the relevance and usability of the data and how it will be obtained and utilized should be included.*
>
> **MAM Requirement:** *The project-specific MAM Plan should include information on the QA/QC, review, and clearance processes for the data. If needed, the QA/QC procedures may be provided in a separate document, such as a Quality Assurance Project Plan (QAPP) or a scope of work (SOW) and referenced in the MAM Plan.*
>
> **MAM Requirement:** *The Implementing Trustee(s) is responsible for reviewing submitted verified data and verified processed data and checking for suspected non-data entry errors.*
>
> **MAM Requirement:** *The Implementing Trustee(s) is responsible for creating an information package for public release.*

MAM Requirement: *The Implementing Trustee(s) is responsible for ensuring that documents and electronic data files are stored in a secure location in such a way that accessibility is guaranteed for as long as the agency requires. The Implementing Trustee(s) will provide MAM data and information to the DIVER Restoration Portal or similar outside data platforms as soon as possible and no more than one year from when data are collected, unless otherwise specified in the MAM.*

4 Consistency of MAM Activity with the PDARP/PEIS

The PDARP/PEIS establishes goals for adaptive management at project and programmatic scales across restoration activities in the northern Gulf of Mexico related to resources injured by the Deepwater Horizon oil spill. This activity is designed to support a primary component of Adaptive Management – improving future restoration outcomes by implementing lessons learned during previous projects by creating an electronic repository for programmatic and project ecosystem restoration lessons learned in Louisiana. This is also consistent with the Louisiana Adaptive Management Status and Improvement Report: Vision and Recommendations and the Louisiana Trustee Implementation Group Monitoring and Adaptive Management Strategy (Deepwater Horizon Louisiana Trustee Implementation Group, 2021; The Water Institute of the Gulf, 2020). Therefore, this MAM activity is consistent with the PDARP/PEIS.

5 Evaluation of NEPA Requirements

The proposed MAM activity is a desktop study only and no field or laboratory work is required.

The Trustees' approach to compliance with NEPA summarized in this section is consistent with, and tiers where applicable from, the PDARP/PEIS Section 6.4.14. Relevant analyses from the PDARP/PEIS are incorporated by reference. Such incorporation by reference of information from existing plans, studies or other material is used in this analysis to streamline the NEPA process and to present a concise document that briefly provides sufficient evidence and analysis to address the Louisiana TIG's compliance with NEPA (40 CFR 1506.3, 40 CFR § 1508.9).

As discussed in Chapter 6 of the PDARP/PEIS, a TIG may propose funding a planning phase (e.g., initial engineering, design, and compliance) in one plan for a conceptual project, or for studies needed to maximize restoration planning efforts. This would allow the TIG to develop information needed leading to sufficient project information to develop a more detailed analysis in a subsequent restoration plan, or for use in the restoration planning process. Where these conditions apply and activities are consistent with those described in the PDARP/PEIS, NEPA evaluation is complete and no additional evaluation of individual activities is necessary at this time.

a. NEPA Review of MAM Activity

The MAM activity would be limited to planning and data management activities for the development of a lessons learned database. None of the actions would negatively impact resources or have environmental consequences.

b. NEPA Conclusion

After review of the proposed activities against those actions previously evaluated in the PDARP/PEIS, the Louisiana TIG determined that these activities are consistent with the PDARP/PEIS evaluation of preliminary phases of restoration (planning, feasibility studies, design engineering, and permitting activities) provided in Section 6.4.14 of the PDARP/PEIS. Therefore, no further NEPA analysis is required at this time.

6 Compliance with Environmental Laws and Regulations

The proposed MAM activity is a desktop study only and no field or laboratory work is required.

The Louisiana TIG has completed technical assistance with the appropriate regulatory agencies for this MAM activity based on the description in the MAIP. Because all proposed activities are desktop activities, NOAA and DOI, on behalf of the LA TIG, determined that no effects to ESA-listed species and habitats, designated EFH and marine mammals protected under MMPA are expected. Thus, consultations and permits from NMFS and USFWS are not required.

Additionally, the proposed project was evaluated under the following statutes through a BE form review and it was determined that the following statutes do not apply based on the nature of the work (desktop analysis only):

- Migratory Bird Treaty Act (USFWS)
- Bald and Golden Eagle Protection Act (USFWS)
- Coastal Zone Management Act
- Coastal Barrier Resources Act (USFWS)
- Rivers and Harbors Act/Clean Water Act
- National Historic Preservation Act (Section 106)

Federal environmental compliance responsibilities and procedures follow the Trustee Council Standard Operating Procedures (SOP), which are laid out in Section 9.4.6 of that document. Following the SOP, the Implementing Trustees for each activity will ensure that the status of environmental compliance (e.g., completed vs. in progress) is tracked through the Restoration Portal.

Documentation of regulatory compliance will be available in the Administrative Record that can be found at the DOI's Online Administrative Record repository for the DWH NRDA (https://www.doi.gov/deepwaterhorizon/adminrecord). The current status of environmental compliance can be viewed at any time on the Trustee Council's website: http://www.gulfspillrestoration.noaa.gov/environmental-compliance/.

7 Activity Close Out

In accordance with Section 9.5.1.6 of the TC SOPs, the Implementing Trustee shall provide the LA TIG with a closeout report after all activities and expenditures have been accomplished. The Final Report shall include a description and any documentation of the completed activity, estimated benefits to project and programmatic adaptive management in Louisiana, the final funding balances and any transfers described in Section 7 of the TC SOPs, and any recommendations on further adaptive management for the activity. Upon request, the Implementing Trustee shall provide the LA TIG with additional information and supporting documents to complete the closeout report.

8 References Cited

Deepwater Horizon Louisiana Trustee Implementation Group. (2021). *Louisiana Trustee Implementation Group Monitoring and Adaptive Management Strategy* (Final) (p. 55). Baton Rouge, LA.

DWH NRDA Trustees. (2016). Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the Deepwater Horizon (DWH) Oil Spill. Deepwater Horizon (DWH) Natural Resource Damage Assessment Trustees.

The Water Institute of the Gulf. (2020). *Louisiana adaptive management status and improvement report: Vision and recommendations* (Technical Document No. Task Order 50.2, Contract No. 2503-12-58) (p. 202). Baton Rouge, Louisiana: The Water Institute of the Gulf. Prepared for the Coastal Protection and Restoration Authority (CPRA) and the Louisiana Trustee Implementation Group (LA TIG), funded by the LA TIG.

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