



APPENDIX B: DATA GOVERNANCE AND STANDARDS

DEVELOPING AN INTEGRATED APPROACH TO PROGRAMMATIC DATA GOVERNANCE AND STANDARDS

December 2024

TABLE OF CONTENTS

Overview.....	4
Data Governance Strategy.....	7
Background.....	7
Roles and Responsibilities.....	8
Deliverables Guidance.....	11
Task Order 1 (Data Gap Analysis) Data Deliverables.....	11
Task Order 2 (H&H Modeling for Series I HUC8s) and Task Order 3 (H&H Modeling for Series II HUC8s) Data Deliverables.....	11
Model, GIS, and Metadata Deliverables.....	13
Data Management Plan Deliverables.....	14
Data Manifest.....	15
Metadata.....	15
Storage Architecture.....	17
Organization of Storage Locations.....	17
AWS S3 File Organization.....	18
Geospatial Data Standards.....	21
Geospatial Data Requirements.....	21
General Programmatic Geospatial Guidance.....	21
Required GIS Layers.....	23



HEC-HMS Geospatial Data Requirements	23
Required GIS Layers	24
Topological Correctness	26
HEC-RAS Geospatial Data Requirements	27
Required GIS Layers	27
Field Schemas	32
Common Field Attributes for GIS Data	32
Layer-Specific Field Attributes for GIS Data	34
Appendix A: Data Management Plan Example.....	48
Appendix B1: Geospatial Feature-Level Metadata	52
Appendix B2: Updates and Previous Guidance Summary	59
Updates Table.....	59
Guide to Data Management Plan Development	60
Context.....	60
Evolution.....	61
LWI Watershed Modeling Guidance: Appendix B: Technical Memorandum on GIS Deliverables.....	62
Context.....	62
Evolution.....	62
LWI Watershed Modeling Guidance: Attachment B.1: Technical Memorandum on Amazon Web Services Folder Structure and ArcGIS Online Linkage.....	62
Context.....	62
Evolution.....	62
LWI Guidance on Modeling Methodology Addendum 3: Technical Memorandum on Model Data Naming Conventions Revision	63
Context.....	63
Evolution.....	63



INDEX OF FIGURES

Figure 1. Conceptual relationship of original guidance, note the separation and misalignment of important data governance and standards documentation.....	5
Figure 2. Conceptual relationship of revised and aligned programmatic data governance and data standards.....	6
Figure 3. Anticipated user roles associated with likely responsibilities and interactions with data, models, and tools....	10
Figure 4. Create an EnDMC account.....	16
Figure 5. Upload data to EnDMC dataset.....	17
Figure 4. Short-term data discovery application developed in AGOL. Users can interact with this mapping interface to discover data, models, and tools located in the AWS-based storage layer.....	Error! Bookmark not defined.
Figure 7. Extract geospatial data from HEC-HMS.....	26

INDEX OF TABLES

Table 1. Deliverables and requirements for each deliverable.....	11
Table 2. Peak water surface elevation raster naming schema variables.	30
Table 3. Naming convention example lookup table for various design storm derivations.....	31
Table 4. Common field attributes for GIS data.	32
Table 5. Layer-specific field attributes for channels.	34
Table 6. Layer-specific field attributes for bridges.....	35
Table 7. Layer-specific field attributes for culverts.....	37
Table 8. Layer-specific field attributes for levees and floodwalls (polyline features).	39
Table 9. Layer-specific field attributes for levees and floodwalls (point features).....	41
Table 10. Layer-specific field attributes for hydrologic control structures.....	43
Table 11. Layer-specific field attributes for reservoirs and storage areas.....	45
Table 12. Layer-specific field attributes for dams.	46
Table 13. Layer-specific field attributes for pump stations.	47



OVERVIEW

The purpose of this document is to provide data management guidance for the Louisiana Watershed Initiative (LWI). Three dimensions of data management are considered:

1. Data Governance
2. Data Standards
3. Metadata Requirements

To maintain the authoritativeness of this document, excerpts from prior programmatic data management documentation are included directly within this document and are provided to contextualize the status and evolution of LWI data governance and standards.

This document is intended to supplant all prior documents in favor of one, unified location for all data management guidance. New additions and edits that are not found in prior versions of the source documents referenced are denoted throughout with footnotes. Figure 1 summarizes the LWI documents released to-date which discuss or map components of data management guidance across the program needs. Figure 2 depicts a revised program paradigm.



Guide to Data Management Plan (DMP) Development
August 2020

LWI Watershed Modeling Guidance
Addendum 1 (ROM) 5/4/2021
Addendum 2 (software version) on 11/15/2021
Addendum 3 (naming convention) 4/1/22
Addendum 4 (survey guidance) 5/23/2022, but dated as 3/9/2022

Appendix A.
Data Management
Plan Template

Appendix B.
Data Management
Plan Example

Appendix C.
Geospatial Metadata
Field Requirements

Appendix A.
Stream Naming
Appendix
Revised June 2021

Appendix B.
Technical
Memorandum on
GIS Deliverables
Revised June 2021

Appendix C.
Survey Guidance
Revised May 2022
(N/A this discussion)

Attachment B.1.
Amazon Web Services
Folder Structure and
ArcGIS Online
Linkage
April 2021

Figure 1. Conceptual relationship of original guidance, note the separation and misalignment of important data governance and standards documentation.



Figure 2. Conceptual relationship of revised and aligned programmatic data governance and data standards.



DATA GOVERNANCE STRATEGY

BACKGROUND

LWI requires the creation of a Data Management Plan (DMP) for each LWI hydrologic and hydraulic (H&H) modeling region during the first generation of LWI model construction (Task Orders 1–4). Future uses of LWI models may also require DMP development. Meeting the near- and long-term data-related goals of the LWI program requires consistencies in data collection, compilation, and management among the modeling consultants (the consultants) who are completing related activities in support of the first-generation model creation efforts in different LWI regions. A template for the LWI DMP can be found in Attachment A and is intended to align the data management processes across regions and document obligatory roles and responsibilities within regions.

Task Orders 1, 2, and 3 were issued by the Louisiana Department of Transportation (DOTD) under indefinite delivery/indefinite quantity (IDIQ) contracts for LWI regional H&H modeling and required consultants delivering first generation models to develop region-specific DMP that contained information relevant to data management and delivery. The DMP template should be the basis for the development of region-specific DMPs to create consistent workflows and products across regions during model construction through Task Order 4 and afterward during model use. LWI acknowledges that there may need to be exceptions made in the DMP regarding specific elements contained in this guidance because of the range of data types to be compiled. To ensure appropriate data management, all consultants working on first generation model construction will be required to submit a DMP for review and approval prior to approval of invoices for services rendered under task orders. As task orders progress from 1, 2, and 3, to Task Order 4, under which design storms and consequence modeling are executed, the region-specific DMP should be updated to reflect the evolution of the data compilation, acquisition and management processes funded through the IDIQ contract.

In addition to the development of H&H models, a desired outcome of the LWI program is the development of a long-term data repository that is both easily accessible and scalable. The LWI data repository will store and register the data used in H&H model development and all data generated by running those models. The long-term LWI data repository is envisioned to be a centralized data and model repository utilizing cloud storage, such that data will be easily tracked and shared broadly.

The primary components of the LWI's data vision in developing a DMP are:

1. Data management constitutes a comprehensive end-to-end process including compilation, acquisition, quality control, metadata cataloging, validation, reprocessing, storage, retrieval, dissemination and archiving of data.
2. LWI program partners are developing an approach for long-term storage of relevant data, as well as a process for data retrieval, dissemination, updating and archiving.



3. As the LWI data repository vision matures and program partners implement platforms to meet long-term needs, each region-specific DMP is intended to ensure that data are compiled, organized, and delivered consistently across regions in a manner that provides ample flexibility in meeting LWI's long-term data management objectives.

ROLES AND RESPONSIBILITIES

The LWI program, through outreach with regional watershed coordinators and other program stakeholders in the user interface (UI)/UX development process is defining use cases for federal, state, regional and local users such that maintenance workflows can be specified and incorporated into governance and IT infrastructure plans.

As the LWI program's data management needs evolve and program stakeholders progress toward holistic management of watersheds, the state should incorporate flexible data governance policies that meet user needs. To this end, there are two dimensions to data, model and tool usage that need definition: 1) specific user roles for governmental entities leveraging programmatic data, models, and tools; and 2) specific use cases for the varying typologies of data, models, and tools collected and managed by the program.

User roles for a federated data management structure can be summarized to the level of governmental jurisdiction and specified based on usage and permissions within the data management system. Users in this instance are likely to be the LWI modeling consultants constructing the program's first generation of H&H models as well as planners, engineers, floodplain managers, government program managers and others supporting planning, design, and/or regulatory processes for all levels of government in the future. The specific tiers of jurisdiction will be based on framing of the federated data governance structure but can be thought of initially as being tied to governmental functions once the LWI's first generation of H&H models are fully functional:

- **Local users:** Most likely to use data, models and tools at the municipal, parish, or watershed level, including leveraging the state-managed data to support use cases (e.g., drainage analysis applying local drainage models managed within the system by the local entity itself).
- **Regional users:** Anticipated to utilize data, models and tools at a watershed or multi-watershed scale (e.g., long-term planning within a watershed).
- **State users:** Anticipated to leverage data, models and tools at multiple levels depending on a specific project's scope of work ranging from an individual watershed up through multiple LWI regions (e.g., to fulfill objectives expressed in LWI's *Operational Guidance for State Agencies*).
- **Federal users:** Anticipated to have the most variable data, models, and tools utilization in terms of spatial extent ranging from the sub-watershed to multi-watershed scales and across state boundaries (e.g., reservoir or levee design for the U.S. Army Corps of Engineers or Federal Emergency Management Agency modeling and/or mapping).



From a data management system standpoint, user roles can be specified based on data, model and tool usage, management responsibility, and permissions given to access and modify stored data, models, and tools. Five general user types are anticipated as described below. Figure 7 defines the anticipated users' interactions with the hybrid cloud-based IT infrastructure and federated data governance structure:

- 1) **System administrators:** Responsible for global parameters and user definition and approval. This user type is unlikely to use data, models, and tools in a meaningful way but is afforded full control to manage the underlying IT infrastructure. System administrators would likely be comprised of only a few centralized staff from state-level agencies and the cloud or hybrid cloud location hosts.
- 2) **Data/model stewards:** Responsible for updating data, models, and tools and managing quality once the LWT's first generation of H&H models are fully functional. Users of this type are likely to be thematic experts in the use and applicability of data, models, and tools (e.g., planners, engineers, modelers). Data/model stewards are proposed at two levels.
 - a) **Regional stewards:** Local subject matter experts responsible for updating and ensuring quality for data, models, and tools located within their region. This region-specific user role affords regional control and ownership of governance for maintenance activities of data, models, and tools while maintaining a common interface for end-users. Regional stewards will interact with the central system partition and ensure data and model quality in their autonomous (region-level) partition if the regional entity elects to create one. Regional stewards will also be authorized to name local stewards within their autonomous partition.
 - b) **State stewards:** Specialists charged with reviewing regional data, models, and tools to ensure they comply with state standards. State stewards are responsible for promoting data, models, and tools to state approval after modifications are checked and will only interact with the central system partition.
- 3) **Developers:** Likely to create tools and improve data, models, and tools once the LWT's first generation of H&H models are fully functional (note, the program consultants building the first generation of the LWT's H&H models would also fall into this user category). This user type is likely to exist at all jurisdiction levels.
- 4) **Analysts:** Likely to create models and improve data, models, and tools once the LWT's first generation of H&H models are fully functional. This user type is likely to exist at all jurisdiction levels.
- 5) **Public users and decision makers:** Will explore interface and download, but not alter, data, models, and tools once the LWT's first generation of H&H models are fully functional. Note that access points for public users and decision makers may ultimately be different, although that determination will come as part of the assessment of users and through alignment with the development of the publicly available resources.



	System administrators	Data/model stewards		Developers	Analysts	Public users and decision makers
		Regional	State			
Manages users and roles	✓	✗	✗	✗	✗	✗
Manages tags and categories	✓	✗	✗	✗	✗	✗
Manages infrastructure configurations	✓	✗	✗	✗	✗	✗
Uploads data	✗	✓	✓	✓	✗	✗
Defines models, tools and metadata	✗	✓	✓	✓	✗	✗
Ensures models and metadata fits regional needs	✗	✓	✗	✗	✗	✗
Ensures models and metadata fits state needs/standards	✗	✗	✓	✗	✗	✗
Publishes models	✗	✓	✓	✗	✗	✗
Promotes published models to state approval	✗	✗	✓	✗	✗	✗
Deletes unpublished models	✗	✗	✗	✓	✗	✗
Deletes published models	✗	✗	✗	✗	✗	✗
Marks models as obsolete	✗	✓	✗	✗	✗	✗
Develops and publish decision support tools	✗	✗	✗	✗	✓	✗
Searches for published models, data and tools	✗	✓	✓	✓	✓	✓
Adds feedback to published models and tools	✗	✓	✓	✓	✓	✗
Downloads published information	✗	✓	✓	✓	✓	✓

Figure 3. Anticipated user roles associated with likely responsibilities and interactions with data, models, and tools. The roles and responsibilities presented in this graphic are preliminary in nature and will be finalized according to the detailed definition.

Data management’s primary focus is to create value for future programs by properly identifying and storing data, as well as creating an accessible interface by which to access the data. Any datasets that provide future value to the state or its partners could be considered as part of this effort, with H&H model, consequence model and decision support tool-related data forming the nucleus of this program.



DELIVERABLES GUIDANCE

TASK ORDER 1 (DATA GAP ANALYSIS) DATA DELIVERABLES

As described in Task Order 1, Section 2.10, the consultants shall provide the following deliverables:

- “[A] Data Management Plan, based on a template provided by DOTD, for review and approval by DOTD.”
- “Both raw and processed data (including any databases, GIS or otherwise, that are developed) must be stored by the Consultant and delivered to the LWI program in a timely manner.”

TASK ORDER 2 (H&H MODELING FOR SERIES I HUC8S) AND TASK ORDER 3 (H&H MODELING FOR SERIES II HUC8S) DATA DELIVERABLES

As described in Task Order 2, Sections 11 and 12, the consultants shall provide the following deliverables:

- “[A] Data Management Plan, based on a template provided by DOTD, for review and approval.
- “[A] Geodatabase and submit the required data as per LWI Guidance on Modeling Methodology.

More specifically, Attachment 1 of Task Order 2 specifies the following data-related deliverables:

Table 1. Deliverables and requirements for each deliverable.

Deliverable	Requirements
Survey Plan	1. Supporting information such as, but not limited to: <ol style="list-style-type: none"> As-built plans Ground photos Spatial data of survey points in GIS format referenced to the project data
Hydrologic Model Setup	2. Supporting information such as, but not limited to: <ol style="list-style-type: none"> Source data in GIS format Parameter calculations and/or geoprocessed data in GIS format Hydrologically processed DEM
Hydrologic Model Calibration	3. Supporting information such as, but not limited to: <ol style="list-style-type: none"> Source data in GIS format Reference data in GIS format included in RAS-Mapper
Hydrologic Model Validation	4. Supporting information such as, but not limited to: <ol style="list-style-type: none"> Source data in GIS format Reference data in GIS format included in RAS-Mapper



Deliverable	Requirements
Hydraulic Model Setup	5. Supporting information such as, but not limited to: a. Source data in GIS format b. Parameter calculations and/or geoprocessed data in GIS format c. Hydrologically processed DEM
Hydraulic Model Calibration	6. Supporting information such as, but not limited to: a. Source data in GIS format b. Reference data in GIS format included in RAS-Mapper
Hydraulic Model Validation	7. Supporting information such as, but not limited to: a. Source data in GIS format b. Reference data in GIS format included in RAS-Mapper
Data Management Plan	(this document)
Geodatabase	Refer to LWI Guidance on Modeling Methodology Appendix B: Technical Memorandum on GIS Deliverables

*Task Order 3 does not specify data deliverables. Task Order 4 has not been issued at this time. This section will be updated and re-released to consultants upon issuance of Task Order 4, as necessary.

TASK ORDER 4 DATA DELIVERABLES

For the first generation of LWI models, consultants shall submit all project-related data to DOTD for Task Orders 1–4. As noted formerly in Appendix B of LWI’s *Guidance on Modeling Methodology*, which has now been subsumed by this document:

“Task Order 1 and its accompanying Data Management Plan notes that all modeling consultants are not required to turn in data deliverables to the program at the end of the Task Order. Furthermore, it is likely that Task Order 2 and immediate subsequent Task Orders for modeling consultants will instruct the same. As such, the present expectation is that at the end of all modeling for a given HUC8¹, modeling consultants will work with the LWI management team to revise Data Management Plans and use the AWS/AGOL² system described herein to deliver data once, as opposed to multiple incremental times during Task Orders 1–3. It is expected that the data will be submitted once by the modeling consultants; however, its tenants should be considered and followed throughout the series of task orders as data are collected, refined, and organized by LWI modeling

¹ Hydrologic Unit Code

² Amazon Web Service/ArcGIS Online



consultants internally. These deliverables shall include data relevant to the hydrologic or hydraulic modeling efforts; these data are not intended to generate universal catalogues of infrastructure that is not germane to the model development (e.g., if a culvert is not needed to be defined in a model or if it was not deemed relevant to this effort such that field data collection of any type was necessary, it need not be catalogued according to the specifications herein).”

MODEL, GIS, AND METADATA DELIVERABLES

Data delivery for modeling consultants generating the LWI’s first generation models will include the following:

1. A completed DMP and a Data Manifest³ for each Task Order and region. See Data Management Plan Deliverables.
2. Geospatial data delivered in an HUC8-specific geodatabase file containing unique feature classes broken down by classification (e.g., bridge crossings, culverts, levees, etc.) as specified in Field Schemas, which specifies the feature classes and schema. Delivery is intended to occur via upload to the AWS S3 cloud storage repository in the correct region-specific bucket within an appropriate directory.
3. Model data and metadata for each HEC-RAS, HEC-HMS, HEC-FIA, and Go-Consequences. Model executables, prescribed deliverables from the LWI Guidance on Modeling Methodology and LWI Consequence Modeling Guidance should be delivered through the EnDMC portal and accompanying metadata should be generated for each submission. For more information on the LWI Environmental Data Management Catalog (EnDMC) please visit: Help – LWI EnDMC (https://lwi.endmc.org/help/help_index). Metadata for model and geospatial data, as described in the Data Management Plan Deliverables and Metadata Requirements sections below.
4. Source data supporting the features in a deliverable geodatabase retained and organized by each unique data source. Source data refers to any intermediate or ancillary data resources that directly supported model development. Examples of source data tagged for preservation include survey data associated with model creation or validation and manipulations of existing data sources (e.g., a cleaned, hydro enforced Digital Elevation Model (DEM) developed from publicly available LiDAR). Where possible, all source data shall be submitted in digital, machine-readable and non-proprietary formats.⁴

³ Previously referred to as “collection and compilation log.”

⁴ DOTD acknowledges some data may be considered sensitive. Parties should coordinate with DOTD prior to collecting sensitive data and/or uploading sensitive data to the LWI repository.



- a. Survey Data is often used for refining structures in model development. Raw formats such as point cloud survey data is not required for delivery, as it can be very large, and also the amount of data used may only be a small subset. Survey data in other formats besides raw point cloud data that is used in the models should be referenced. This includes any refined survey data formats such as: pdf, csv, excel, dwg, or other drawings, or exhibits. To capture this metadata, the use of EnDMC datasets can be used.

DATA MANAGEMENT PLAN DELIVERABLES

A DMP shall be created and maintained by each consultant delivering first generation LWI models. When finalized, each DMP needs to be approved by DOTD. The development and updating of each DMP consists of the development of two documents for each task order.

1. The development/updating of a region-specific DMP overview document, outlining critical project information and the roles and responsibilities of consultant team members.
2. The development/updating of a Data Manifest (see Appendix A: Data Management Plan Example), to be developed in a consistent format by each region, to document information about data that are compiled or collected as part of the LWI program. The intent of this table is to create an LWI programmatic inventory of data compiled and collected and the data's file pathways/links.
 - a. Compilation of existing data should be logged via a two-step process:
 - i. The first step will be to outline the data that are intended to be collected and evaluated for use in the program. These data will be reviewed in coordination with DOTD to
 - i) Ensure consistency in data collection and compilation, as appropriate, across regions.
 - ii) Align data requests to state and federal agencies across regions.
 - iii) Document the datasets that will be collected or have been collected through the creation of a DMP and a Data Manifest.
 - ii. Following the evaluation of data, the second step will be to update the data manifest to document those existing data which will be leveraged within the LWI program, including documentation of data manipulations necessary for program use and delivery to the LWI.
 - i) Field collection data logs will be provided by DOTD for use in task orders that require survey funded through LWI.



LWI consultants creating the first generation LWI models are required to create DMP documents which will be updated as necessary with each relevant task order under the LWI program's first generation of model construction. These DMP documents are:

- DMP overview document (See **Appendix A: Data Management Plan Example** for an example.)
- Data Manifest

Data Manifest

As a part of the development of a DMP or a Data Manifest needs to be developed/updated with each task order or use of LWI models after their creation. Data downloaded from the web does not need to be included unless it has been processed or changed in any way. This will be in tandem with metadata entries. The example table for a data manifest can be found in **Appendix A: Data Management Plan Example**.

Metadata

Metadata information should be collected for each dataset or model output that is completed within a task. Two main types of metadata will be delivered with the first generation LWI model delivery:

- Geospatial metadata
- Model and dataset metadata

Previously this information could be found in the Metadata Requirements section, but consultants delivering first generation LWI models and data should now refer to [Help - EnDMC](https://lwi.endmc.org/help/help_index) (https://lwi.endmc.org/help/help_index) on the LWI instance of EnDMC. This link contains all information required to get started. For more information on how to use EnDMC Desktop⁵ please go to [Releases · waterinstitute/EnDMC Desktop](https://github.com/waterinstitute/EnDMC_Desktop/releases) (https://github.com/waterinstitute/EnDMC_Desktop/releases)

- b. A user will need an account to view data on the LWI EnDMC website. After, creating an account you can see an example of a dataset that has been uploaded for Bridge Survey Points here: lwi.endmc.org/view/dataset/65e8c7fdb6e82281370fd742.
- c. To create new data on EnDMC, a user will need to request to have an Editor Role. This request occurs at the time of signup, or by contacting an administrator.

⁵ Previously referred to as the Metadata Creation Tool.



Create Account
Let's get started...

Name
Your full name

Email
Your email address

Password
Must have at least 6 characters

Requested Role

User	▼
User	
Authorized User	
Editor	
Admin	

Figure 4. Create an EnDMC account.

- d. Once an account is made as an Editor, the user will be able to create data using the menu. Create a new dataset, enter all pertinent information. After creating the dataset, the user can upload data associated with the entry.



Resource Files

 Combined_BridgeCrossSection_Data.cpg	Download
 Combined_BridgeCrossSection_Data.dbf	Download
 Combined_BridgeCrossSection_Data.prj	Download
 Combined_BridgeCrossSection_Data.sbn	Download
 Combined_BridgeCrossSection_Data.sbx	Download
 Combined_BridgeCrossSection_Data.shp	Download
 Combined_BridgeCrossSection_Data.shx	Download
 file_listing.json	Download

Upload Files

Upload files to the resource. You can upload single files by using the drag and drop, or select a directory using the browse link to upload all its content.

Drag and drop or [upload from computer](#)

Powered by POINA

Figure 5. Upload data to EnDMC dataset.

STORAGE ARCHITECTURE

Standardization is a key data architecture strategy adopted by the LWI program. Standardized data architecture is needed not only for consistent deliverable organization and easily searchable data, but also because the web-based storage platforms in use by the program often charge per upload/download instance, and thus, searchability is directly related to cost control.

Organization of Storage Locations

Currently, LWI employs two web-based data storage platforms:

- AWS S3 for bulk data transfers, housing of collected field survey and other data deliverables for Task Orders 1–4; and
- AGOL for geospatial data working files and deliverables developed by the program.

In 2024, a new storage platform will be delivered:

- The long-term IT infrastructure solution will be EnDMC with AWS Open Data storage backing. The AWS cloud environment hosts data, models, and tools, including large files associated with H&H models. All LWI-



generated data deliverables will be migrated to this location and will be hosted free of charge to the state for data that is released under an open license to the public through the Amazon Open Data Sponsorship.

Data from Task Orders 1–4 are or will be hosted on AWS S3 using a defined folder structure established for all users. Data are anticipated to consist of a variety of formats, collected from a variety of sources, including existing model input and output data, as-built and survey data, and tabular timeseries data. Metadata is the cornerstone of data integration within the project, providing the backend with a flexible field-dependent discoverability mechanism to find and retrieve relevant data based on user input filter queries.

AWS S3 FILE ORGANIZATION

A consistent hierarchy of directories or folders is required due to the number of LWI consultants and program partners (including state and federal agencies). This strategy ensures that data are stored in the same fashion across each of the LWI's regions and consultants. The hierarchy was generated to facilitate consistent and thorough data delivery by the consultants anticipated at the end of Task Orders 2 and 3 of the program. The hierarchy listed below is intended to be comprehensive. However, program partners are not obligated to populate data into every subdirectory if relevant data has not been collected or is not available. The hierarchy was simplified to remove redundancy and limit confusion resulting from pilot work with Regions 2 and 3 in 2022–2023.

Within the AWS directories, there is a “deliverables” subdirectory intended to be used by the modeling consultants building the first generation of LWI's H&H models.⁶ Within each region's deliverables directory, there is a series of subdirectories which should be utilized to store data as applicable when delivering the first-generation models. There are two hierarchies options below illustrating the options for the deliverables directory folder structure and includes models, data outputs and reference material for the HEC-HMS and HEC-RAS models being submitted. This example is available on the LWI S3 bucket at: `/lwi-common/deliverables/Example/`. Notice the data is not zipped. Please do not compress any uploaded data on the AWS S3 because it will limit the ability to search for particular data types and the automation metadata extraction.

MODEL FILE STRUCTURE REQUIREMENTS (HEC-RAS AND HEC-HMS) IN AWS

At the beginning phase of model development, the client should name the parent folder with the version name in the title (example: “HECRASv6.3.1”). All other folders and file names within that parent folder should use naming conventions with no spaces but if needed can use underscores (example: “DSS_InputFiles”).

When the model builds and simulations are completed, prior to uploading, the consultant is required to check that all files used to simulate the model are under the parent directory model folder. This means that all DSS files (flow, precipitation, wind, stage, etc.) any terrains, landcover, and shapefiles referenced in the model domain must be

⁶New or updated requirement for deliverables directory and subdirectories.



checked for their local connectivity. As best practice, this is completed by zipping up the entire model, placing it on a local drive and opening the model on a new machine. The model should be checked that all DSS files plot, all shapefiles are visible and most importantly, that the model can run. Full model simulations do not need to be rerun during this test, initializing each model simulation without errors is sufficient. Option 1 (old):

- Region #(1–9)
- Model Name (HUC8 name or code)
- Data Deliverables
- HMS
- GIS
- RAS
- LULC
- Output Rasters
- Projection
- Terrain
- Reference
- HMS
- Soil Survey
- SSURGO
- RAS
- Description of model development and list of datasets used.
- Models
- HMS
- RAS

Option 2 (new):

- Region #(1–9)
 - HUC8(name or code), repeating as needed
 - ModelName_HMS (Ex: Amite_HMS)
 - GIS
 - ModelName_RAS (Ex: Amite_RAS)
 - LULC
 - OutputRasters
 - Projection
 - Terrain
 - Reference
 - HMS



- Soil Survey_NRCS Soils_files
 - SSURGO
- RAS
 - Description of model development and list of datasets use



GEOSPATIAL DATA STANDARDS

GEOSPATIAL DATA REQUIREMENTS

The LWI program distinguishes between GIS data generated in direct support of modeling efforts versus GIS data which could be more broadly accessible and useful to a greater range of non-modeling stakeholders from the planning, scientific, regulatory, and engineering professions. Examples could include data to help parish planners map infrastructure, data to provide updates to the National Hydrography Dataset (NHD), data to assist state agencies in other non-HEC modeling or planning efforts, et cetera. While some of this data will be present in exports from HEC-RAS and HEC-HMS, the formats and field requirements have been altered in this section to communicate a specific series of information about each feature class. These features were informed by DOTD's *Survey Feature Code Guidebook* fields, as well as other datasets commonly requested by LWI stakeholders. The intent of this dataset is to capture and organize all data collected in support of LWI's first generation H&H model construction as well as future modeling efforts in a manner which is easily understood to a broader audience than strictly HEC-knowledgeable technicians. It is not intended to be a requirement for cataloguing all specified features in a given HUC even if unrelated to model development; thus, if a feature is not important to a given modeling effort, it need not be catalogued in GIS deliverables. This section details a series of geodatabase layers and requisite attributes (as necessary) required for submittal upon completion of all modeling task orders related to model construction, calibration, and validation for the first generation of the LWI's H&H models. The state and watershed regions within the federated data management approach will need to update any such requirements for model use and updates beyond the delivery of the first generation LWI models. Detailed metadata are required for each feature class in the deliverable geodatabase. Mandatory metadata fields are detailed in Appendix B1: Geospatial Feature-Level Metadata.

General Programmatic Geospatial Guidance

This section discusses the required creation of a geodatabases for model data and deliverables.

There are two types of deliverables: the Required GIS Layers for RAS and HMS (direct software exports documented on pages 27/28 and 30/31); and the additional information requested to be populated in template geodatabases discussed in Table 3 through Table 12. The requests have different purposes. The direct exports are intended to provide quick-reference information about aspects of the modeling work for persons or situations where HEC-HMS and HEC-RAS are unavailable or inaccessible. They are intended to help inform others on model development specifics and do not need to adhere to the explicit field schemas document in Table 3 through Table 12. The supplemental geodatabase documented in Table 3 through Table 12 is intended for much broader purposes beyond modeling, such as assisting agencies in building or maintaining inventories of features.

The following guidelines shall be used when incorporating geospatial data:

- GIS data shall be in the LWI specified horizontal and vertical datums, geoid, projection, and coordinate



system for all variables. Data shall be delivered with the following datum formats (refer to Section 4 of the LWI *Guidance on Modeling Methodology*):

- Horizontal datum: North American Datum of 1983 (NAD83) (2011), EPSG 1116
- Projected Coordinate System: NAD83 (2011) State Plane Louisiana US Survey Feet (Louisiana North EPSG: 6477; Louisiana South EPSG: 6479)
- Vertical datum: North American Vertical Datum 1988 (NAVD 88), GEOID12B
- Contractors should use the correct State Plane for the portion of the state their features are in (Louisiana North: EPSG 6477, Louisiana South: EPSG 6479).
- For features overlapping the two State Plane projections, contractors delivering first generation LWI H&H models should select the projection that contains most of the features in question.
- Detailed metadata are required for each feature class in the deliverable geodatabase. Mandatory metadata fields are detailed in Appendix B1: Geospatial Feature-Level Metadata.
- For linear or polygonal features that intersect multiple watersheds, the 8-, 10-, or 12-digit HUCs assignments detailed in Table 3 should be determined based on the downstream-most HUC that the feature intersects with.

The following guidelines shall be used for each geodatabase feature class:

- Each feature class in the geodatabase deliverable shall include data compiled for all data collection locations (i.e., individual infrastructure assets or observation locations) of a given classification within each HUC8 (e.g., a unique geodatabase feature class will be created for all relevant culverts within a given HUC8 and a separate, unique feature class will be created for all bridge crossings within the same HUC8).
- Each feature class in the geodatabase deliverable will have its own unique field attribute schema. Field attribute schemas are defined in Field Schemas.
- A required attribute for each infrastructure asset within the feature class geodatabase will be a unique identifier. The unique identifier will be used to track assets and the source data used to define their other attributes on an asset-by-asset level.
- In some instances, such as observational data (e.g., High Water Marks [HWMs]), a unique identifier may be applied to a set of data, rather than to individual measurement/observation locations, in instances where a single data source can be referenced for all data. DOTD anticipates that observational data may require unique treatment when assigning identifiers to field classes. Additionally, DOTD recognizes that some data types, such as HWMs, may be appropriate to store at a regional scale rather than for each HUC8.



- There may be cases where the first generation of LWI models employ HEC-RAS and HEC-HMS strategies such as 1-D/2-D connections or structures to ensure the model behaves in a certain way but are not representative of a physical man-made feature on the ground. Only man-made features are intended to be captured in GIS deliverables.

REQUIRED GIS LAYERS

The geodatabase data required for submittal by consultants creating the LWI's first generation H&H models include the following layers and attributes. In addition to the default attribute fields exported from HEC-HMS, other LWI program attributes are required. This common attribute field guidance for all point/line/polygon file types are provided in the section titled **Common Field Attributes for GIS Data**. Specific layer and attribute data can be found in the **Layer-Specific Field Attributes for GIS Data** section.

LWI recognizes that frequently, only partial information will exist for required layers or attributes in this section. Program consultants are only required to populate the readily available information from their data collection and model construction activities; unavailable or unknown information should be left blank. All units should be in imperial units (feet, square feet). The list of layers includes:

- Channels/Flow Lines
- Stream Junctions
- Bridges
- Culverts
- Levees and Floodwalls
- Hydrologic Control Structures
- Reservoirs and Storage Areas
- Pump Stations

HEC-HMS Geospatial Data Requirements

Geospatial data has become essential for the proper understanding, management, and maintenance of hydrologic models. This geospatial information allows for visualization of the modeling data, verification of changes in the geometry of the models, and spatially oriented storage and retrieval of modeling information. The naming of all model elements and data, where applicable, shall be in accordance with the guidance specified Appendix A of the Guidance for Modeling Methodology.

The purpose of this subsection is to describe the requirements for geospatial data that shall be submitted in support of the LWI's first generation of HEC-HMS models. When submitting a hydrologic model, the consultants shall submit all geospatial information in ESRI file geodatabase format and shall include appropriate metadata. The state and watershed regions within the federated data management approach will need to update any such requirements for model use and updates beyond the delivery of the first generation LWI models.



The following guidelines shall be used when submitting geospatial information:

- Submittals shall include geospatial information representing the elements of a HEC-HMS model and/or used to generate the parameters in HEC-HMS. GIS data submittals shall be in ESRI file geodatabase format with each feature class clearly named.
- GIS data shall be in the proper horizontal projection, vertical datum and geoid, and unit system for all variables (refer to Section 4 of the *LWI Guidance on Modeling Methodology*).
- The subbasin polygon layer and the stream network shall meet the topology requirements stated in the section titled **Topological Correctness**.
- All submitted geodatabases shall include metadata that meets the minimum International Organization for Standardization (ISO) requirements.

REQUIRED GIS LAYERS⁷

The geospatial characteristics of hydrologic models shall be fully defined. The model schematic is composed of all the connectivity elements of the model (reaches, basin to junction or reach connections, etc.). It is not required that the full schematic detailing connectivity be exported. However, there should be a geospatial element to represent each component of the submitted HEC-HMS basin model. All relevant hydrologic model elements shall follow the naming conventions specified in Appendix A of the *Guidance for Modeling Methodology*.

The following GIS geodatabase layers are required for submittal of new hydrologic modeling by consultants creating the first generation of LWI models. Include the following datasets and any others that are relevant to the HMS model geometry:

- HMSSubbasin (Polygon)
- HMSReach (Line)
- HMSJunction (Point)
- HMSDiversion (Point)
- HMSDetentionBasin (Point)
- HMSSource (Point)
- HMSSink (Point)

⁷ New or updated requirement for geospatial data (fields streamlined from prior version)



- Original and edited/preprocessed TIF files:
 - Digital elevation model for each HUC8 watershed
 - Soil type
 - Imperviousness
 - Canopy, if applicable

Files (sources, diversions, and reservoirs) are not required if these elements are not used in the HEC-HMS model. In addition to the basic HEC-HMS elements, the consultants creating the LWT's first generation H&H models shall submit additional geodatabase feature classes used to define parameters for subbasin time of concentration and routing (T_c &R) calculations as applicable.

The required feature classes for the length of the longest water course and subbasin centroid are listed below, as well as soils and land-use/land-cover (LULC) data used to calculate time of concentration, cross section, and routing, etc. The following datasets, and any others, relevant to HMS model geometry shall be included:

- LongestStream (Line)
- SBCentroid (Point) sub basin centroid
- SoilType (Polygon)
- LULC (Polygon)

Geospatial data can be extracted from HEC-HMS basins to ESRI shapefiles by using the GIS toolbar as shown in Figure 8.

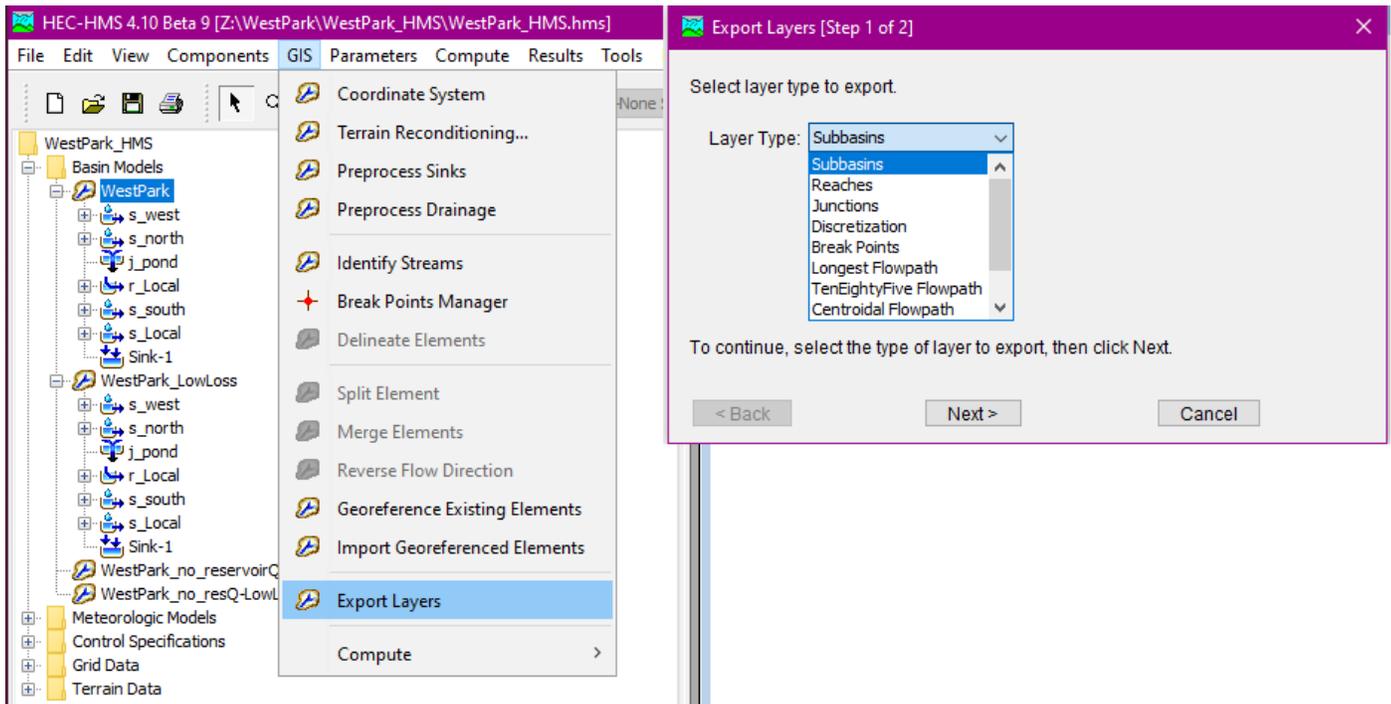


Figure 6. Extract geospatial data from HEC-HMS.

In addition to the default attribute fields exported from HEC-HMS, other LWI program attributes shall be required.

TOPOLOGICAL CORRECTNESS

All submitted geospatial data shall be topologically correct internally to the study watershed. For adjacent watersheds, modeling consultants creating the LWI's first generation H&H models shall coordinate potential discrepancies with adjacent watersheds to the extent practicable prior to submittal.

The following guidelines shall be used when submitting geospatial data:

- Watershed boundaries shall not overlap or leave shortfalls between adjacent watershed boundaries.
- HEC subbasin boundaries shall not overlap or leave shortfalls between each other. Any “sliver” polygons due to subbasin boundary inconsistencies shall be eliminated prior to submittal.
- Reaches and schematic connection end points shall be snapped to connecting junctions, sources, sinks, diversions, reservoirs, or other reaches.



- Schematic connections linking subbasins with other elements shall be snapped to the centroid of the subbasin (the centroid of a subbasin shall be adjusted to be within the subbasin if it would otherwise fall outside of the basin).

HEC-RAS Geospatial Data Requirements

The purpose of this subsection is to describe the requirements for geospatial information that shall be submitted in support of new HEC-RAS models. The consultants creating LWI's first generation H&H models shall incorporate this data directly into the HEC-RAS model. Any non-publicly available, or edited geospatial data referenced in the model shall be submitted in geodatabase format for vector data, and geotiff (.tif) format for raster data. The state and watershed regions within the federated data management approach will need to update any such requirements for model use and updates beyond the delivery of the first generation LWI models.

The following guidelines shall be used when incorporating geospatial data:

- Snap the ends of reaches to a vertex of an upstream or downstream connecting reach to ensure geospatial connectivity without overlap for all reaches.
- Export and submit cross section and streamline data as GIS data layers from the HEC-RAS model.

The consultants creating LWI's first generation H&H models shall incorporate the metadata associated with HEC-RAS models directly into any Geometry file used in the model using the description field, and shall include the following:

Include adequate information to identify the data (LiDAR and Survey) used to create the cross sections.

- Include the modification date for altered cross sections and the creation date for any new cross sections.

Include information related to any realignment of the original stream centerline (Reach Schematic Line). The consultants creating LWI's first generation H&H models shall include metadata with all geospatial information submitted in support of hydraulic modeling. The metadata shall include all available fields outlined in the Field Schemas section of this report.

REQUIRED GIS LAYERS⁸

The consultants creating LWI's first generation H&H models shall fully define the geospatial characteristics of the hydraulic model. There shall be a geospatial element to represent each component of the submitted HEC-RAS model. When available, additional properties like reach lengths, bank stations, levees, et cetera. shall be selected for export as attributes in the resulting GIS layer; however, it is not necessary to export flow distribution items such as velocity,

⁸ New or updated requirement for geospatial data (fields streamlined from prior version)



shear stress, or stream power fields. The following GIS geodatabase layers shall be required for submittal of new hydraulic models:

- RASRiver (Line)
- RASReach (Line)
- RASCrossSections (Lines)
- RASStructures (Line) [most commonly culverts]
- RASBridges (Line)
- RASBC (Line) boundary conditions
- RAS2DFlowAreas (Polygon)
- RASStorageAreas (Polygon)
- RASConnections (Lines)
- RAS2DCells (Polygon)
- RASBreakLines (Line) including attributes such as spacing, etc.
- Evaluation line (1-D cross sections) feature class, as applicable, containing peak water surface elevation and discharge values. Please note, rasters (/tif file type) containing peak water surface elevation and velocity data are acceptable substitutes.
- Evaluation line (2-D transects) rasters (/tif file type), as applicable, containing peak water surface elevation and velocity data.
- Original and edited/preprocessed .tif files.
 - Digital elevation model used for each HUC8 watershed.
 - Land use/land cover (LULC), if edited from baseline national dataset
 - Manning's n/roughness
 - Soil type (if edited from baseline national dataset)
 - Combined/edited Terrain file (.tif and any .vrt's) including a Readme file listing any other important information not captured in the metadata (such as datum transformation information, and subsequent major modifications applied to original downloaded data (from USGS or elsewhere).
- Rasters (.tif and any .vrt's) containing 2-D peak water surface elevations and velocity components at all locations where a 2-D model was used; this raster information can also be derived from 1-D models. Final deliverable rasters should adhere to the following naming convention of variables relevant to design storm production for the first generation of LWI models utilizing Atlas 14, historical storms, or transposed storms. The bulleted list below describes Atlas 14 variables followed by an example naming



schema and a description of historical storm variables. A lookup table should be created for reference to include any additional comments or descriptions, such as for storm transpositions within a watershed. An example lookup table can be found in Table 2.

- If Atlas 14/HMR based: Region_Watershed Common Name Abbreviation (“LI” for Little Bayou in example below)_Source_Frequency_ValueSet_Type_PrecipDuration_DistributionArea_TemporalDistribution_ARF_RasterValue. [filetype]
 - Example: 09_LI_Atlas14_100yr_Upper90_Partial_PD1Day_V9A1_TD24hr_ARFTP40_RasterValue.tif
 - For HEC-FIA outputs, the naming convention should be similar: Region_Watershed Common Name Abbreviation _Source_Frequency_PrecipDuration_TemporalDistribution_RasterValue. [filetype]
- Historical storms: Region_ID_Watershed Common Name Abbreviation_EventName_Source_{if Shifted = "Shifted"}_{if Z Values altered, use multiple factor Ex: "x2"}_RasterValue.[filetype]
- Nontropical storms: EJPMOS_nTC_XXXX_YR_RasterValue.[filetype]
- Tropical storms: EJPMOS_TC_XXXX_YR_RasterValue.[filetype]
- Combined (Tropical and Nontropical Storms): EJPMOS_CMB_XXXX_YR_RasterValue.[filetype]



Table 2. Peak water surface elevation raster naming schema variables.

Variable	Details and Examples
Watershed Region	1–9 as of 2023
Exceedance Probability	[2yr...500yr]
Value Set	Upper 90% Confidence, Upper 90% Confidence, Median
Time Series Type	Partial Duration, Annual Duration
Precipitation Duration	[5min...60Day]
Temporal Distribution Area	Volume 9 - Area 1 for Louisiana (Divided along Western State Border at Sabine River)
Temporal Distribution Duration (cumulative percentages of precipitation totals)	6, 12, 24, 96 hr.
Area Reduction Values	Additionally, point values may be selected as the depth values, or gridded data may be used to create a spatially variable precipitation depth dataset. Either method presents challenges regarding Area Reduction Factors (ARF). ARF should be applied over a large watershed area because realistically a storm event will not create a particular frequency event uniformly over an entire watershed. The ARF values used should be specified.
Raster Value	Water Surface Elevation (WSE), Depth, or Velocity

In addition to the default attribute fields exported from HEC-RAS, other LWI program attributes shall be required. This common attribute field guidance for all point/line/polygon file types is provided in Table 3 below.



Table 3. Naming convention example lookup table for various design storm derivations.

ID	Event	Data Location	Shift Description	ARF Description	Additional Information
001	Hurricane Katrina 2005	Z:/Region_TWI/TWI_001_Katrina_AORC_Shifted_x2_Gridded.dss	Shifted to center over HUC8 of region TWI	NA	Values multiplied by 2 to generate Probable Maximum Flood using Katrina as a basis.
002	NTS Feb2004	Z:/Region_TWI/TWI_002_NTSFeb2004_AORC_Gridded.dss	NA	NA	Non-Tropical Storm Event for AORC data for Dates: 01Feb-28Feb 2004.
003	Atlas14 100yr	Z:/Region_TWI/TWI_003_Atlas14_100yr_Upper90_Partial_PD1Day_V9A1_TD24hr_ARFTP40_Gridded.dss	NA	TP40	ARF values provided by TP40. Elliptical Storm centered to maximize flow at USGS gage #000000



Field Schemas

COMMON FIELD ATTRIBUTES FOR GIS DATA⁹

This list of attributes is intended to document the minimum standard attributes fields which should be populated for each geospatial layer (points, lines, polygons) delivered as discussed in Geospatial Data. Fields that are not applicable should be populated with a null value (e.g., stream name for features not located in or associated with a stream, etc.).

Table 4. Common field attributes for GIS data.

Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning Date of Values	End Date of Values	Domain
HU_8_NAME	NHD HUC8 name	Hydrologic Unit Code 8-digit name (e.g., "Lower Yazoo")	USGS	String	Text	120	0	0			Text-based watershed identifier
HUC_8¹⁰	NHD HUC8 numeric identifier	HUC 8-digit identifier	USGS	String	Text	8	0	0			Text-based watershed identifier
HU_10_NAME	NHD HUC10 name	HUC 10-digit name	USGS	String	Text	120	0	0			Text-based watershed identifier
HUC_10⁹	NHD HUC10 numeric identifier	HUC 10-digit identifier	USGS	String	Text	10	0	0			Text-based watershed identifier
HU_12_NAME	NHD HUC12 name	HUC 12-digit name	USGS	String	Text	120	0	0			Text-based watershed identifier
HUC_12⁹	NHD HUC12 numeric identifier	HUC 12-digit identifier	USGS	String	Text	12	0	0			Text-based watershed identifier
State	State Name	State name(s) feature falls within (e.g., Louisiana, Mississippi, Arkansas, Texas)	n/a	String	Text	100	0	0			Unrepresentable text domain with state name
County	County/Parish Name	Name(s) of Counties/Parishes feature resides within, in alphabetical order	n/a	String	Text	100	0	0			Unrepresentable text domain with county name

⁹ New or updated requirement for data standards. NHD dependent fields have been removed excluding Fcode and Ftype.

¹⁰ For features that cross multiple HUC boundaries assign the identifier from the downstream-most HUC.



Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning Date of Values	End Date of Values	Domain
LWIHUC8	LWI HUC 8-digit Name	LWI naming convention for Hydrologic Unit Code 8-digit watersheds	LWI	String	Text	100	0	0			Textual 2-character watershed identifier
LWISubBasin	LWI Sub Basin Name	LWI naming convention for sub basins	LWI	String	Text	18	0	0			Alphanumeric 18-character field shall be comprised of the full LWI name of the stream that the subbasin contributes to
LWIStreamName	LWI Stream Name	LWI naming convention for stream names	LWI	String	Text	100	0	0			Alphanumeric 16-digit watercourse identifier
LWIReachName	LWI Reach Name	LWI naming convention for reach names	LWI	String	Text	100	0	0			Alphanumeric 16-digit watercourse identifier



LAYER-SPECIFIC FIELD ATTRIBUTES FOR GIS DATA

This list of attributes is intended to document the specific standard attributes fields which should be populated for each geospatial layer (points, lines, polygons) delivered as discussed in Geospatial Data . Fields that are not applicable should be populated with a null value.

LAYER: CHANNELS (POLYLINES OF CENTERLINES)

Table 5. Layer-specific field attributes for channels.

Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
StreamLngh	Stream Length	Stream centerline length (ft)	(calculation)	Double	Numeric	8	0	0			Numeric maximum 8-digit stream centerline length in feet



LAYER: BRIDGES (POLYLINE OF CENTERLINE OF FEATURE PERPENDICULAR OR SKEW TO FLOW DIRECTION FROM LEFT TO RIGHT)

Please note, this feature class also is to include items like pipeline bridge crossings of channels.

Table 6. Layer-specific field attributes for bridges.

Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
BridgeID	Bridge ID	Unique bridge ID from national bridge inventory (NBI), as applicable	NBI	String	Text	80	0	0			Unrepresentable text domain with NBI bridge ID
RecallNo	Bridge Recall Number	Unique bridge ID from DOTD's Bridge Recall numbering system, as applicable	DOTD	String	Text	6	0	0			Unrepresentable text domain with DOTD bridge ID
StructureNo	Structure Number	Unique structure ID from DOTD's Structure numbering system, as applicable	DOTD	String	Text	14	0	0			Unrepresentable text domain with DOTD bridge ID
ConstructDate	Construction Date	Date of bridge construction	DOTD/field data	Date	Date	8	0	0			Date domain with date of bridge construction
Owner	System Owner	Text field denoting entity charged with levee maintenance and improvements	FHWA/DOTD/Parish/Municipality	String	Text	100	0	0			Unrepresentable text domain denoting feature owner
SpanLgthn	Span Length	Bridge span centerline length in US feet from bank to bank	DOTD/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit bridge centerline length in feet
NoDecks	Number of Decks	Number of bridge decks	DOTD/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit number of bridge decks
DeckEl	Deck elevation	Deck average elevation (ft)	DOTD/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit average elevation of bridge decks in feet NAVD88 Geoid 12B
LowCord	Low Cord	Low Cord Elevation (ft)	DOTD/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit average elevation of bridge low cord in feet NAVD88 Geoid 12B
RailingType	Railing type	Text description of railing type	DOTD/field data	String	Text	100	0	0			Unrepresentable text domain with narrative description of bridge railing materials and type



Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
RailingHt	Railing height	Railing height above deck (ft)	DOTD/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit height of railing above deck in feet
Features	Other Features	Text description of other pertinent bridge features (wing walls, abutments, etc.)	DOTD/field data	String	Text	255	0	0			Unrepresentable text domain with narrative description of other ancillary bridge features
Piers	Pier Description	Text description of piers (presence, count, type, pile characteristics, etc.)	DOTD/field data	String	Text	255	0	0			Unrepresentable text domain with narrative description of other ancillary bridge features



LAYER: CULVERTS (POLYLINE OF CENTERLINE OF FEATURE PARRALLEL TO FLOW DIRECTION FROM UPSTREAM INVERT TO DOWNSTREAM INVERT)

Table 7. Layer-specific field attributes for culverts.

Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
BridgeID	Bridge ID	Unique bridge ID from national bridge inventory (NBI), as applicable	NBI	String	Text	80	0	0			Unrepresentable text domain with NBI bridge ID
RecallNo	Bridge Recall Number	Unique bridge ID from DOTD's Bridge Recall numbering system, as applicable	DOTD	String	Text	6	0	0			Unrepresentable text domain with DOTD bridge ID
StructureNo	Structure Number	Unique structure ID from DOTD's Structure numbering system, as applicable	DOTD	String	Text	14	0	0			Unrepresentable text domain with DOTD bridge ID
ConstructDate	Construction Date	Date of bridge construction	DOTD	Date	Date	8	0	0			Date domain with date of bridge construction
Owner	System Owner	Text field denoting entity charged with levee maintenance and improvements	FHWA/DOTD/Parish/Municipality	String	Text	100	0	0			Unrepresentable text domain denoting feature owner
CulShape	Culvert Shape	Text string denoting shape of culvert opening (circular, square, rectangular, elliptical, etc.)	DOTD/field data	String	Text	100	0	0			Unrepresentable text domain describing culvert geometry/shape
CulSize	Culvert Size	Text string denoting opening area dimensions (diameter, length/width, etc.)	DOTD/field data	String	Text	255	0	0			Unrepresentable text domain describing culvert dimensions
CulLength	Culvert Length	Culvert centerline length from upstream to downstream invert (ft)	DOTD/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit length of culvert centerline
UpInvertEI	Upstream Invert Elevation	Upstream Invert Elevation (ft)	DOTD/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit elevation of upstream invert elevation in NAVD88 Geoid12B
DwnInvertEI	Downstream Invert Elevation	Upstream Invert Elevation (ft)	DOTD/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit elevation of downstream invert elevation in NAVD88 Geoid12B



Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
Features	Other Features	Text description of other pertinent bridge features (wing walls, abutments, etc.)	DOTD/field data	String	Text	100	0	0			Unrepresentable text domain describing bridge features
NoBarrels	Number of Barrels	Number of culvert barrels present in feature	DOTD/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit number of culvert barrels
RailingType	Railing type	Text description of railing type	DOTD/field data	String	Text	100	0	0			Unrepresentable text domain with narrative description of bridge railing materials and type
RailingHt	Railing height	Railing height above deck (ft)	DOTD/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit height of railing above deck in feet



LAYER: LEVEES AND FLOODWALLS (POLYLINE OF CENTERLINE OF FEATURE CROWN)

Features, where information is available, should be split into named reaches corresponding to local levee district nomenclature (e.g., “Reach C-1”, etc.). Furthermore, polylines should only reflect a single structure type (e.g., a single line should not represent both levee and wall features; these features should have unique, separate line segments). This data should include all federal, state, local, and private levees and floodwalls to the extent possible and relevant to the modeling effort.

Table 8. Layer-specific field attributes for levees and floodwalls (polyline features).

Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
ProjName	Project Name	Federal or State project name (e.g., Lake Pontchartrain and Vicinity)	USACE/ CPRA/DOITD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain detailing project name
ReachName	Reach Name	Text field denoting name of levee reach, if applicable, as named by levee system owner (e.g., “Reach C-1”; “Oakville to St. Jude Back Levee”; etc.)	USACE/ CPRA/DOITD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain with levee reach name
SurveyDate	Survey Date	Date of most recent crown elevation survey	USACE/ CPRA/DOITD/Parish/Levee Authority	Date	Date	8	0	0			Date domain with date of most recent survey
ConstructDate	Construction Date	Completion date of construction of the feature	USACE/ CPRA/DOITD/Parish/Levee Authority	Date	Date	8	0	0			Date domain detailing date of levee construction
SupersededDate	Superseded Date	Completion date of most recent feature modification (lifts or other major feature improvement/maintenance)	USACE/ CPRA/DOITD/Parish/Levee Authority	Date	Date	8	0	0			Date domain detailing date of most recent modification
FeatureType	Feature Type	Text field denoting levee, floodwall, or other (e.g., sheet-pile and levee section, etc.)	Authority/field data	String	Text	100	0	0			Unrepresentable text domain detailing levee classification
Owner	System Owner	Text field denoting entity charged with levee maintenance and improvements	USACE/ CPRA/DOITD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain denoting feature owner
EmbankLength	Embankment length	Total embankment length of segment (miles)	USACE/ CPRA/DOITD/Parish/Levee Authority	Double	Numeric	8	0	0			Numeric maximum 8-digit embankment length in miles
WallLength	Floodwall length	Total wall length of segment (miles)	USACE/ CPRA/DOITD/Parish/Levee Authority	Double	Numeric	8	0	0			Numeric maximum 8-digit floodwall length in miles
ClosureStrs	Closure Structures	Number of closure structures in-line with levee segment	USACE/ CPRA/DOITD/Parish/Levee Authority	Double	Numeric	8	0	0			Numeric maximum 8-digit number of enclosure structures



Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
AverageHt	Average Height	Average height of segment above ground	USACE/ CPRA/DOTD/Parish/Levee Authority	Double	Numeric	8	0	0			Numeric maximum 8- digit average height of segment above ground
FEMANFIPInfo	FEMA/NFIP Information	FEMA/NFIP FIRM information denoting accredited/non-accredited levee system	FEMA	String	Text	255	0	0			Unrepresentable text domain denoting FEMA accreditation status



LAYER: LEVEES AND FLOODWALLS (POINTS AT INTERVALS ALONG FEATURE CROWN)

This data should include all federal, state, local, and private levees and floodwalls to the extent possible and relevant to the modeling effort.

Table 9. Layer-specific field attributes for levees and floodwalls (point features).

Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
ProjName	Project Name	Federal or State project name (e.g., Lake Pontchartrain and Vicinity)	USACE/ CPRA/DOTD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain detailing project name
ReachName	Reach Name	Text field denoting name of levee reach, if applicable (e.g., Reach C-1, etc.)	USACE/ CPRA/DOTD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain with levee reach name
SurveyDate	Survey Date	Date of most recent crown elevation survey	USACE/ CPRA/DOTD/Parish/Levee Authority	Date	Date	8	0	0			Date domain with date of most recent survey
ConstructDate	Construction Date	Completion date of construction of the feature	USACE/ CPRA/DOTD/Parish/Levee Authority	Date	Date	8	0	0			Date domain detailing date of levee construction
SupersededDate	Superseded Date	Completion date of most recent feature modification (lifts or other major feature improvement/maintenance)	USACE/ CPRA/DOTD/Parish/Levee Authority	Date	Date	8	0	0			Date domain detailing date of most recent modification
FeatureType	Feature Type	Text field denoting levee, floodwall, or other (e.g., sheet-pile and levee section, etc.)	Authority/field data	String	Text	100	0	0			Unrepresentable text domain detailing levee classification
Owner	System Owner	Text field denoting entity charged with levee maintenance and improvements	USACE/ CPRA/DOTD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain denoting feature owner
Station	Station	Native stationing of point used by the levee system	USACE/ CPRA/DOTD/Parish/Levee Authority	Double	Numeric	12	0	0			Numeric 12-digit native levee stationing point
CrownElev	Crown elevation	Surveyed crown elevation (ft) NAVD88 Geoid12B	USACE/ CPRA/DOTD/Parish/Levee Authority	Double	Numeric	8	0	0			Numeric maximum 8-digit surveyed crown elevation in feet NAVD88 Geoid12B
HorizDatum	Horizontal datum	Horizontal datum of survey	USACE/ CPRA/DOTD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain detailing horizontal survey datum



Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
HorizEpoch	Horizontal epoch	Horizontal epoch of datum	USACE/ CPRA/DOTD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain detailing epoch of horizontal survey datum
VertDatum	Vertical datum	Vertical datum of survey	USACE/ CPRA/DOTD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain detailing vertical survey datum
VertEpoch	Vertical epoch	Vertical epoch of datum	USACE/ CPRA/DOTD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain detailing epoch of vertical survey datum
SurveyVertAcc	Survey vertical accuracy	Survey vertical accuracy (ft)	USACE/ CPRA/DOTD/Parish/Levee Authority	Double	Numeric	8	0	0			Numeric maximum 8-digit vertical accuracy of survey
SurveyHorizAcc	Survey horizontal accuracy	Survey horizontal accuracy (ft)	USACE/ CPRA/DOTD/Parish/Levee Authority	Double	Numeric	8	0	0			Numeric maximum 8-digit horizontal accuracy of survey
BaseUnits	Base Units	Survey horizontal and vertical base units (ft)	USACE/ CPRA/DOTD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain detailing base units of horizontal and vertical survey
WetSlope	Wet slope	Slope of flood/wet side of feature at elevation point, as applicable (H:V)	USACE/ CPRA/DOTD/Parish/Levee Authority	Double	Numeric	8	0	0			Numeric maximum 8-digit ratio of wet slope
DrySlope	Dry slope	Slope of protected/dry side of feature at elevation point, as applicable (H:V)	USACE/ CPRA/DOTD/Parish/Levee Authority	Double	Numeric	8	0	0			Numeric maximum 8-digit ratio of dry slope
CrownWidth	Crown width	Width of feature crown (ft)	USACE/ CPRA/DOTD/Parish/Levee Authority	Double	Numeric	8	0	0			Numeric maximum 8-width of feature crown
Armoring	Armoring	Text field to describe presence of armoring, as applicable (e.g., concrete splash aprons, slope armoring, high performance fabrics, etc.)	USACE/ CPRA/DOTD/Parish/Levee Authority	String	Text	100	0	0			Unrepresentable text domain with narrative description of levee armoring



LAYER: HYDROLOGIC CONTROL STRUCTURES (POINTS)

This layer should include all structures such as operable hydraulic barriers such as gates (sluice, flap, tainter, etc.) and locks. This data should include all federal, state, local, and private control structures to the extent possible and relevant to the modeling effort.

Table 10. Layer-specific field attributes for hydrologic control structures.

Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
FeatureType	Feature Type	Text field denoting feature type (Dams, Spillways, Floodgates, Locks, Other Flow Control structure)	USACE/CPRA/DOTD/Parish/Other Authority	String	Text	100	0	0			Unrepresentable text domain detailing control structure type
GateType	Gate Type	Text field denoting gate type, if applicable (sluice, flap, tainter, etc.)	Authority/field data	String	Text	100	0	0			Unrepresentable text domain detailing gate type
Owner	Owner	Text field denoting entity charged with structure maintenance and improvements	USACE/CPRA/DOTD/Parish/Other Authority	String	Text	100	0	0			Unrepresentable text domain detailing feature ownership
ConstructDate	Construction Date	Completion date of construction of the feature	USACE/CPRA/DOTD/Parish/Levee Authority	Date	Date	8	0	0			Date domain detailing date of feature construction
UpInvertEl	Upstream Invert Elevation	Upstream Invert Elevation (ft)	Authority/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit elevation of upstream invert elevation in NAVD88 Geoid12B
DwnInvertEl	Downstream Invert Elevation	Downstream Invert Elevation (ft)	Authority/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit elevation of downstream invert elevation in NAVD88 Geoid12B



Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
UpCrestEl	Upstream Crest Elevation	Upstream Gate Crest Elevation (ft)	Authority/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit elevation of upstream gate crest elevation in NAVD88 Geoid12B
DwnCrestEl	Downstream Crest Elevation	Downstream Gate Crest Elevation (ft)	Authority/field data	Double	Numeric	8	0	0			Numeric maximum 8-digit elevation of downstream gate crest elevation in NAVD88 Geoid12B
GateDimen	Gate Dimensions	Text field describing opening area dimensions and number of opening areas (diameter, length/width, etc.)	Authority/field data	String	Text	100	0	0			Unrepresentable text domain detailing opening area geometry and dimensions



LAYER: RESERVOIRS, AND STORAGE AREAS (POLYGON)

This data should include all federal, state, local, and private storage features to the extent possible and relevant to the modeling effort.

Table 11. Layer-specific field attributes for reservoirs and storage areas.

Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
FeatureType	Feature Type	Text field denoting feature type (reservoir, detention facility, etc.)	USACE/ CPRA/DOTD/Parish/Other Authority	String	Text	100	0	0			Unrepresentable text domain detailing feature type
Area	Area	Surface area of facility (acres)	(calculated)	Double	Numeric	12	0	0			Numeric maximum 12-digit surface area of feature
Owner	Owner	Text field denoting entity charged with structure maintenance and improvements	USACE/ CPRA/DOTD/Parish/Other	String	Text	100	0	0			Unrepresentable text domain detailing feature ownership
ConstructDate	Construction Date	Completion date of construction of the feature	USACE/ CPRA/DOTD/Parish/Levee Authority	Date	Date	8	0	0			Date domain detailing date of feature construction



LAYER: DAMS (POINT)

This data should include all federal, state, local, and private dams to the extent possible and relevant to the modeling effort.

Table 12. Layer-specific field attributes for dams.

Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Domain
Owner	Owner	Text field denoting entity charged with structure maintenance and improvements	USACE/ CPRA/DOTD/Parish/Other	String	Text	100	0	0			Unrepresentable text domain detailing feature ownership
NIDID	NID ID	National Inventory of Dams (NID) identification number, as applicable.	USACE/DOTD	String	Text	100	0	0			Unrepresentable text domain detailing feature ID
NIDHt	NID Height	National Inventory of Dams (NID) dam height, as applicable.	USACE/DOTD	String	Text	100	0	0			Unrepresentable text domain detailing feature height
NIDStorage	NID Storage	National Inventory of Dams (NID) dam design storage, as applicable.	USACE/DOTD	String	Text	100	0	0			Unrepresentable text domain detailing feature storage
DamType	Dam type	Primary dam material (e.g., earthen, concrete, etc.), as applicable	USACE/DOTD	String	Text	100	0	0			Unrepresentable text domain detailing feature material
ConstructDate	Construction Date	Completion date of construction of the feature	USACE/ CPRA/DOTD/Parish/Levee Authority	Date	Date	8	0	0			Date domain detailing date of feature construction
StateRegDam	State Regulated Dam	Notation of state regulation of dam, as applicable	USACE/DOTD	String	Text	100	0	0			Unrepresentable text domain detailing feature regulation
NIDDate	NID Date	Date data last provided to NID, as applicable	USACE/DOTD	String	Text	100	0	0			Unrepresentable text domain detailing data date



LAYER: PUMP STATIONS (POINTS)

This data should include all federal, state, local, and private pump stations to the extent possible and relevant to the modeling effort.

Table 13. Layer-specific field attributes for pump stations.

Field Name	Alias	Definition	Definition Source	Data Type	Number Format	Width	Precision	Scale	Beginning date of values	End Date of values	Enumerated Domain
StaName	Station Name	Text field denoting station name, if applicable	USACE/ CPRA/DOTD/Parish/Other Authority	String	Text	100	0	0			Unrepresentable text domain detailing feature station name
Owner	Station Owner	Text field denoting entity charged with maintenance and improvements	USACE/ CPRA/DOTD/Parish/Other Authority	String	Text	100	0	0			Unrepresentable text domain detailing feature ownership
ConstructDate	Construction Date	Completion date of construction of the feature	USACE/ CPRA/DOTD/Parish/Levee Authority	Date	Date	8	0	0			Date domain detailing date of feature construction
PumpCount	Pump Count	Text field denoting number of duty and standby pumps, as applicable	USACE/ CPRA/DOTD/Parish/Other Authority	String	Text	100	0	0			Unrepresentable text domain detailing number of pumps
PumpType	Pump Type	Text field denoting count and types of pumps present	USACE/ CPRA/DOTD/Parish/Other Authority	String	Text	100	0	0			Unrepresentable text domain detailing type of pumps
Capacity	Station Capacity	Station discharge capacity (cfs)	USACE/ CPRA/DOTD/Parish/Other Authority	Double	Numeric	12	0	0			Numeric maximum 12-digit feature discharge capacity in cfs



APPENDIX A: DATA MANAGEMENT PLAN EXAMPLE

Title Page

H & H Consulting

Data Management Plan for Task Order #1 Contract Number:
0000000000



Project Information *(detailed instructions are italicized and can be deleted after filling out the fields)*

Project name: *(As shown on the contract documents)* Data Compilation for the LWI Program

Company or Party: H & H Consulting

Task order(s): #1

Data steward(s): *(Contact information for data stewards who will act as primary points of contact for all project related data management activities.)*

Regional Data Management Lead: John Smith, (123) 456-7777, john.smith@HH.com

HUC Data Management Lead: Deborah Jones, (123) 456-7778, deborah.jones@HH.com

Quality Assurance Lead: David Doe, (123) 456-7779, david.doe@HH.com

Brief element description: *(Brief element description (i.e., brief abstract on compiled data and purpose; ensure data compilation activities cover the data types detailed in each task order))*

As part of the LWI program, H & H Consulting is responsible for the modeling of the hydraulics, hydrology, and flood risk of the watersheds in northeast Louisiana at the HUC8 scale using the HEC suite of models (HMS, RAS, etc.). This current DMP is for Task Order 1 and relates to the compiled data that H & H Consulting will manage and deliver to the LWI program in support of the modeling effort.

Project location(s): *(A short description of the project location)*

LWI Region 12 (northeast LA), including HUC's of the U. S. Geological Survey (USGS) Lower Mississippi Region (08) Subregion 0804 – Lower Red – Ouachita: The Red River Basin below the Bayou Rigolette Basin; Accounting Unit 08040101 – Lower Ouachita: The Ouachita River Basin below and including the Two Bayou Basin; Cataloging Unit (HUC8(s) within the present data compilation effort) 08040205 – Bayou Bartholomew, Louisiana.



General description of data compilation activities: (Including, but not limited to: *(Data collection and compilation methods, the intended approach for interim data organization and storage prior to delivery, and the intended approach to protect any sensitive data gathered.)*)

Locate and compile existing datasets, studies, models, and other relevant resources for their respective HUC8's assigned within the LWI Region, indicating the source, original date(s) that data in each dataset were collected, date that each dataset was published/produced, original application scope, and justification for use. Source data will be furnished to DOTD at the completion of Task Order 1.

Horizontal datums should be the North American Datum of 1983 (NAD83) (2011),” i.e., ESPG 6477 for north and ESPG 6488 for south. The vertical datum of all vertical elevation data sources to be incorporated in the hydraulic model development will be noted and converted to the NAVD88 GEOID12B as required. The sources of elevation data and conversion factors will be summarized in the tabular data compilation log noting the original horizontal and vertical datums including the geoid designation and conversion source (e.g., VDatum).

Source data will be compiled throughout the task. A data compilation and collection log will be populated to document the lineage of the following data types to be collected:

- Previous watershed studies such as FEMA Base Level Engineering (BLE) data, other FEMA Flood Insurance Studies (FIS) deliverables, FEMA Annual Exceedance Probability (AEP) maps and H&H models and studies commissioned by other local, state, or federal agencies.
- LiDAR Digital Elevation Model (DEM) Data
- Existing survey data, including topographic and bathymetric surveys, which may include data from existing FEMA, U.S. Army Corps of Engineers (USACE), USGS or other data collected by local, state, or federal agencies.
- Hydraulic structure information, including field surveys, as-builts, design plans, etc.
- Historic flood information and High Water Marks (HWMs)
- Hydrometeorology and hydrography data, including precipitation data from the National Oceanographic and Atmospheric Agency (NOAA), National Weather Service (NWS) Stage IV Quantitative Precipitation Estimates (QPE) and/or Multi-Radar/Multi-Sensor (MRMS). The spatial and temporal resolution of such data, as well as the associated dates of the data will be described herein.
- Rain gage data
- Streamflow and stage data
- Land use and soils data



The data log will be reviewed with DOTD to coordinate data requests to federal and state agencies across regions. Data stewards will use a local file geodatabase for interim storage of geodata. Sensitive data will be managed in coordination with DOTD by [to be defined by Consultant and DOTD].

Data Manifest: *(Data Manifest and status of data compilation (e.g., start and end dates for the data compiled per task order) organized by region and HUC8 as necessary including location and status of datasets and model outputs.)*

Task order	HUC	Data description	Start date	Projected end date	Status	Location of Dataset/Model Output (file pathways)
1	08040101	High-resolution digital aerial photography (near-vertical, color)	9/15/2020	10/15/2020	In progress	
1	08040205	Stream high water marks	9/30/2020	10/31/2020	In progress	N/A
1	All	Stage-Discharge Curves, Stream Gage Data	9/8/2020	9/30/2020	Complete	
1,10	All	LWI Amite Calibrated HEC-HMS Model	9/8/2020	9/30/2020	Completed	https://metadata-creation-tool.herokuapp.com/model_application/63cec0e23b68dc1a2aea077a



APPENDIX B1: GEOSPATIAL FEATURE-LEVEL METADATA

This section details the **ISO 19115–3** metadata fields that are mandatory for feature-level geospatial LWI deliverables. This has been revised from and supersedes earlier guidance detailed in the *Guide to Data Management Plan (DMP) Development* issued by LWI to modeling consultants during Task Order 1.

The purpose of this subsection is to describe the minimum requirements for metadata that shall be submitted in support of the creation of new geodata related to hydrologic and hydraulic models for LWI. All submitted metadata shall meet minimum ISO standards. The following section outlines the minimum requirements.

These fields should be populated on a feature class basis using the metadata editor native to your desktop GIS software. Some exceptions may apply should older datasets such as BLE models have metadata in older formats (FDGC).



Item Description

Title:

Summary (purpose):

Credits:

Description (abstract):

Bounding box:

Topics and keywords

Topic categories:

- | | |
|---|--|
| <input type="checkbox"/> Farming | <input type="checkbox"/> Inland waters |
| <input type="checkbox"/> Biota | <input type="checkbox"/> Location |
| <input type="checkbox"/> Boundaries | <input type="checkbox"/> Oceans |
| <input type="checkbox"/> Atmospheric sciences | <input type="checkbox"/> Planning and cadastral |
| <input type="checkbox"/> Economy | <input type="checkbox"/> Society |
| <input type="checkbox"/> Elevation | <input type="checkbox"/> Structure |
| <input type="checkbox"/> Environment | <input type="checkbox"/> Transportation |
| <input type="checkbox"/> Geoscientific | <input type="checkbox"/> Utilities and communication |
| <input type="checkbox"/> Health | <input type="checkbox"/> Imagery and base maps |

Content type

- | | |
|--|--|
| <input type="checkbox"/> Downloadable data | <input type="checkbox"/> Geographic services |
| <input type="checkbox"/> Static map images | <input type="checkbox"/> Clearinghouses |
| <input type="checkbox"/> Other documents | <input type="checkbox"/> Map files |
| <input type="checkbox"/> Applications | |

Theme keywords:

Resource citation

Title:

Presentation form:

- | | |
|---|--|
| <input type="checkbox"/> Digital document | <input type="checkbox"/> Digital map |
| <input type="checkbox"/> Digital image | <input type="checkbox"/> Digital model |



- | | |
|--|---|
| <input type="checkbox"/> Digital profile | <input type="checkbox"/> Hardcopy map |
| <input type="checkbox"/> Digital table | <input type="checkbox"/> Hardcopy model |
| <input type="checkbox"/> Digital video | <input type="checkbox"/> Hardcopy profile |
| <input type="checkbox"/> Hardcopy document | <input type="checkbox"/> Hardcopy table |
| <input type="checkbox"/> Hardcopy image | <input type="checkbox"/> Hardcopy video |

Dates

Date created:

Data published:

Date revised:

Resource citation contacts

Resource contact name:

Resource contact organization:

Resource contact position:

Resource contact role:

- | | |
|--|---|
| <input type="checkbox"/> Resource provider | <input type="checkbox"/> Point of contact |
| <input type="checkbox"/> Custodian | <input type="checkbox"/> Principle investigator |
| <input type="checkbox"/> Owner | <input type="checkbox"/> Processor |
| <input type="checkbox"/> User | <input type="checkbox"/> Publisher |
| <input type="checkbox"/> Distributor | <input type="checkbox"/> Author |
| <input type="checkbox"/> Originator | |

Metadata details

Language:

Character set:

Hierarchy level:

- | | |
|---|-------------------------------------|
| <input type="checkbox"/> Dataset | <input type="checkbox"/> Software |
| <input type="checkbox"/> Series | <input type="checkbox"/> Service |
| <input type="checkbox"/> Non-geographic dataset | <input type="checkbox"/> Model |
| <input type="checkbox"/> Dimension group | <input type="checkbox"/> Tile |
| <input type="checkbox"/> Feature | <input type="checkbox"/> Initiative |
| <input type="checkbox"/> Feature type | <input type="checkbox"/> StereoMate |
| <input type="checkbox"/> Property type | <input type="checkbox"/> Sensor |



Platform series

Production series

Sensor series

Transfer aggregate

Metadata contacts

Metadata contact name:

Metadata contact position:

Metadata contact address:

Metadata contact organization:

Metadata contact email:

Metadata contact role:

Resource provider

Point of contact

Custodian

Principle investigator

Owner

Processor

User

Publisher

Distributor

Author

Originator

Metadata maintenance

Metadata update frequency:

Continual

Biannually

Daily

Annually

Weekly

As needed

Fortnightly

Irregular

Monthly

Not planned

Quarterly

Unknown

Maintenance contact name:

Maintenance contact position:

Maintenance contact address:

Maintenance contact organization:

Maintenance contact email:

Maintenance contact role:

Resource provider

Owner

Custodian

User



- Distributor
- Originator
- Point of contact
- Principle investigator
- Processor
- Publisher
- Author

Resource details

Status:

- Completed
- Historical archive
- Obsolete
- Ongoing
- Planned
- Required
- Under development

Credit:

Language:

Character set:

Spatial representation type:

- Vector
- Grid
- Text table
- TIN
- Stereo model
- Video

Processing environment:

Resource extents

Description:

Temporal period extent:

Bounding box:

Vertical extent:

Points of contact

Resource POC name:

Resource POC position:

Resource POC address:

Resource POC organization:

Resource POC email:

Resource point of contact role:

- Resource provider
- Custodian



- Owner
- User
- Distributor
- Originator
- Point of contact
- Principle investigator
- Processor
- Publisher
- Author

Maintenance

Resource update frequency (select one)

- Continual
- Daily
- Weekly
- Fortnightly
- Monthly
- Quarterly
- Biannually
- Annually
- As needed
- Irregular
- Not planned
- Unknown

Resource maintenance next update:

Spatial reference

Reference system authority citation:

Reference system code (e.g., 26915):

Reference system code space (e.g., EPSG):

Reference system version:

Spatial representation information

Vector representation: (e.g., 3d topology)

Grid spatial representation: (e.g., 2d area)

Georectified representation: (e.g., 3d area, cell center)

Georeferenceable representation: (e.g., 3d point from map)

Data quality

Scope level:

- Attribute
- Attribute type
- Dataset
- Series
- Non-geographic dataset
- Dimension group



- Feature
- Feature type
- Property type
- Software
- Service
- Field session
- Collection hardware
- Collection session
- Model
- Tile
- Initiative
- StereoMate
- Sensor
- Platform series
- Sensor series
- Production series
- Transfer aggregate
- Other aggregate

Lineage

Lineage statement (narrative format, sentence or longer):

Data source (narrative description, originating agency):

Process step (narrative description):

Distribution information

Distribution format name: (e.g., .gdb)

Distribution format version: (i.e., internal version number)

References

Aggregate information:

Portrayal citation:

Application schema information



APPENDIX B2: UPDATES AND PREVIOUS GUIDANCE SUMMARY

UPDATES TABLE

Updates Made	Date Completed
<ul style="list-style-type: none"> Updated and streamlined the document structure/data process. Moved overview of past documents to appendix. Addressed client comments. 	September 2023
<ul style="list-style-type: none"> Removed Figure 3 and replaced Figure 4 with an updated file structure. 	December 2023
<ul style="list-style-type: none"> Page 12, Bullet 3 and Page 52: added clarification on delivery of survey data. Page 15: Revision to Data Delivery folder hierarchy for HEC-RAS and HEC-HMS in AWS Page 16: Clarification on metadata delivery for GIS and model metadata Page 24: Clarification paragraph for GIS data deliverable types added. Page 25: Clarification paragraph for GIS data deliverables for structures added. Page 31: Removed certain GIS data deliverable classes. 	February 2024



<ul style="list-style-type: none"> • Page 32/33: Naming convention change from WSE to RasterValue and added a row in the Table 1 for clarity. • Table 3, Page 25: Added footnote detailing how HUC identifiers (8-, 10-, and 12-digit) should be assigned for features intersecting multiple watersheds. • Removed the Metadata section (Pages 48–69) and replaced with links on page 16 to the information • The Updates table has been moved to Appendix B2 • Moved Roles and Responsibilities after Background, so the data deliverables are followed by storage organization and then Geospatial Requirements. • Added headers to the Data Deliverables section for organizational purposes. 	
<ul style="list-style-type: none"> • Added language to Pages 18–19 concerning HEC-RAS and HEC-HMS file structure uploads to AWS. • Added additional text string field to production run raster naming guidance. • Added language to Page 20 of Appendix D: Consequence Modeling Guidance concerning HEC-FIA file naming convention for deliverables. 	<p>December 2024</p>

GUIDE TO DATA MANAGEMENT PLAN DEVELOPMENT

August 2020

Context

The Guide to Data Management Plan Development is a document that detailed the requirement for LWI consultants to create and adopt a Data Management Plan (DMP) for each LWI hydrologic and hydraulic (H&H) modeling region. Meeting the near- and long-term data-related goals of the LWI program requires consistencies in data collection, compilation, and management among all consultants as they complete activities in support of LWI modeling efforts. Each LWI DMP is intended to align the data management processes across the program’s regions and document obligatory roles and responsibilities within regions.

Appendix C of *The Guide to Data Management Plan Development* details the International Organization for Standardization (ISO) metadata fields that were marked as mandatory for LWI deliverables. Partners were originally advised to populate the required fields on a per feature class basis using the metadata editor native



to their desktop geographic information systems (GIS) software. **Significant evolution within the program has highlighted the need to revisit the required standard and evaluate ways to reduce the metadata creation burden on program partners by limiting the required metadata elements.** Upon suggestion from program partners, the requirement has been changed to create metadata on a watershed basis (e.g., if creating metadata for bridge survey information, to aggregate all survey information on a HUC8 basis, with one metadata entry per HUC8 for all relevant content).

Evolution

- Recommend an internal quarterly review cycle for each DMP by those generating the plans.
- Recommend the population of a data manifest to track resources collected by the program and be delivered to the LWI program upon delivery of tasked contract deliverables and to be stored on the program's Amazon Web Services (AWS) storage location.
- Update the feature-level metadata standard to ISO 19115–3.
- Reduce the number of required metadata fields to simplify the creation of feature-level metadata based on input received in piloting metadata generation and delivery with the Region 2 and 3 consultant teams in 2022 and 2023.



LWI WATERSHED MODELING GUIDANCE: APPENDIX B: TECHNICAL MEMORANDUM ON GIS DELIVERABLES

Revised October 2021

Context

The intent of the *Technical Memorandum on GIS Deliverables* was to provide a set of guidance for several aspects of geospatial file organization for delivery to the LWI. A standard series of file types, layers and attribute fields were listed in this document to generate clear, coherent guidelines for the multiple consultants and program partners of LWI.

Evolution

- Update documentation to reflect changes in other dimensions of programmatic data governance.
- Update GIS deliverable naming convention and file types to ensure files and formats support derivative uses such as web viewing, inputs to consequence modeling, etc.

LWI WATERSHED MODELING GUIDANCE: ATTACHMENT B.1: TECHNICAL MEMORANDUM ON AMAZON WEB SERVICES FOLDER STRUCTURE AND ARCGIS ONLINE LINKAGE

Revised August 2021

Context

This memorandum detailed guidance for several aspects of file organization across the cloud-based data storage platforms used by LWI and its relationship to the web GIS client used to house geospatial data. A standard series of data directories, folder names, and uses is established in this document to generate clear, coherent guidelines for the multiple consultants and program partners of the LWI.

Evolution

- Simplify the directory structure of the AWS Simple Storage Service (S3) bucket to remove redundancy and limit confusion resulting from pilot work with Region2 and 3 in 2022–2023.
- Modify the resource-level metadata standard protocol to a simplified representation.



LWI GUIDANCE ON MODELING METHODOLOGY ADDENDUM 3: TECHNICAL MEMORANDUM ON MODEL DATA NAMING CONVENTIONS REVISION

Revised April 2022

Context

This memorandum defined conventions for naming physical features (watersheds, streams) as well as hydrologic and hydraulic model elements to be incorporated in watershed models developed under the auspices of the LWI. These naming conventions are a key part of LWI modeling standards, along with the *LWI Guidance on Modeling Methodology* and its appendix detailing GIS data guidance. Faithful application of these standards is critical to ensuring that LWI models and their data are of high quality and are consistent with each other, to the greatest extent practicable. Consistency between models and data enables interoperability between geographies (e.g., coupled HUC8 watersheds) and across modeling frameworks (e.g., integrating HEC-RAS models with ADCIRC boundary data in the coastal zone).

Evolution

This document is to remain separate to Appendix A. Updates to this document will take the form of future addenda as needed. No changes to this document are proposed herein.