Prepared by/for:
Modeling, Mapping, and Consequences

Appendix 4.1.5

Map Production Guide—Dam Breach Downstream Mapping

FY2023 Standard Operating Procedure for Dams

March 2022

Date	Principal Author	Comments
09/30/2019	MMC	FY20 Document
4/14/2021	MMC	FY22 Document
5/17/2021	MMC	FY22 Document/Technical Edits

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Section 1
Background

This document is designed to guide an MMC GIS/Mapping team member through all required steps to produce a map series conforming to the MMC Inundation mapping standards. In order to produce the mapping products for the MMC, the GIS/Mapping team member should fully understand the source of the inundation data they are mapping and the goals of the products that they are developing. This section describes each step in the standard MMC process preceding mapping and gives a rough description of the data produced by that step and how it impacts the mapping. For more information see the corresponding section of the MMC SOP.

1.1 PRE-MODEL DATA

During the pre-model data development phase of an MMC project, the MMC GIS/Mapping team is responsible for developing the vector and raster datasets used to set up the model. For further details regarding pre-model data development refer to Appendix 4.1.1, MMC Pre-Modeling Data Production Guide.

Elevation models derived from the National Elevation Dataset (NED) are provided to the modeler in both geographic projection and the MMC projection. These are used to extract elevations to model elements. During mapping, the DEM will be used to extract elevations to point data. Mapper should confirm with the modeler that no additional terrain sources were used in the modeling process. If new terrain was identified and used during the modeling process, the mapping team should obtain that terrain file for use in all map production steps.

1.2 MODELING

The modeling phase of any MMC project is where most of the analysis is performed. The Hydraulic Modelers take the pre-model datasets and build on them to produce complete models using separate modeling software. The majority of models developed for the MMC will use HEC-RAS modeling software.

The completed HEC-RAS model and output depth grids from the hydraulic modeling efforts are the primary datasets used in the mapping production.

Section 2
Production Requirements

2.1 SOFTWARE REQUIREMENTS

There are some specific software requirements that must be met in order to follow the steps in this guide:

- ESRI ArcGIS Pro
  - Spatial Analyst Extension
  - 3D Analyst Extension
- Connection to services arcgisonline.com
- HEC-RAS (version used in modeling)
- MMC Utilities Toolbox
- Adobe Acrobat Pro
- Microsoft Office
- ProjectWise Explorer
- Google Earth Pro

2.2 THE MMC UTILITIES TOOLBOX

The MMC Utilities Toolbox can be downloaded from ProjectWise at:

pw:\\PWINT-WPC.EIS.DS.USACE.ARMY.MIL:CE - MMC\Documents\Programs and Activities\MMC2\ProgramData\3_Mapping Branch\Documents-Templates\Mapping_Documentation\4.6_Automation\FY20\

To install the MMC Utilities Toolbox:

1. Copy the add-in file to this location on your computer: C:\Users\[USERNAME]\Documents\ArcGIS\AddIns\ Desktop10.4\
2. Double-click the add-in file, confirm the Install Add-In.
3. You will receive a success message.
4. Open ArcMap 10.4.1, you will see the add-in the top ribbon
5. Figure 2-1 displays the MMC Utilities Toolbox.

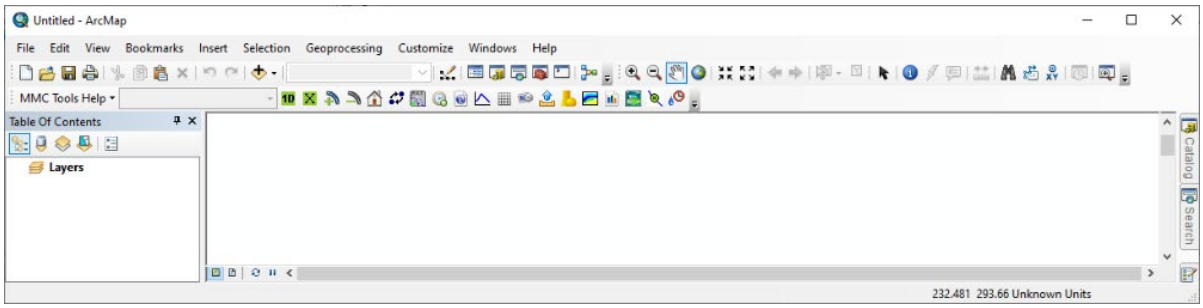


Figure 2-1. MMC Utilities Toolbar

2.3 QUALITY REQUIREMENTS

The work performed using this guide is subject to review as described in Appendix 4.3.7, MMC Mapping Review Guide. Reviews are to be performed by internal GIS team members, H&H team members and headquarters representatives as assigned.

2.4 TEMPLATE FILES

Files noted in Table 2-1 are used in the production of this mapping product. Templates are available to mapping team members on the ProjectWise at:

pw:\\PWINT-WPC.EIS.DS.USACE.ARMY.MIL:CE - MMC\Documents\Programs and Activities\MMC2\ProgramData\3_Mapping Branch\Documents-Templates\Mapping_Documentation\4.4_Map_Templates\FY21_Breach_Dam_Templates.zip.

Table 2-1. Map Template File Names

Product	File Name
Cover Page	4.4.20_MMC_Cover_Page_FY21.pptx
All ArcGIS Pro Map Templates	FY21_Breach_Dam_Templates.aprx
Map Notes I	4.4.21_MMC_MapNotesI
Map Notes II	4.4.22_MMC_MapNotesII
Map Notes III	4.4.23_MMC_MapNotesIII
Sheet Index	4.4.24_MMC_Sheet_Index
Standard Sheets	4.4.26_MMC_StandardSheets
Detail Sheets	4.4.28_MMC_DetailSheets
Critical Infrastructure Table	4.4.29_Critical_Infrastructure_Lookup_Table
Blank Insert	4.4.30_MMC_BlankInsert.pdf
Facing Page Blank Insert	4.4.31_MMC_FacingPageBlankInsert.pdf
Facing Page Blank Insert (Detail)	4.4.11_MMC_FacingPageBlank_DetailSheet.pdf
Intentionally Blank Insert	4.4.32_MMC_IntentionallyBlankInsert.pdf
Pertinent Data Table Notes II	4.4.33_MMC_NotesII_Table_FY21.xlsx
Breach Wave Point Table Notes III	4.4.34_MMC_Breach_Point_Table_FY21.xlsx

2.5 DELIVERABLE PRODUCTS

The MMC GIS/Mapping team is responsible for several deliverable datasets and products. Below is a brief summary of the products that the team is responsible for. This document describes how to develop the PDF

maps and the data that is used in the other deliverable products. Please refer to any referenced document for more information about a specific topic.

- Flat PDF files—map books in optimized and full resolution .pdf format for printing and digital distribution.
- Web Map—interactive online web mapping application serving the data produced in this process.
- GIS Geodatabase—Enterprise level geodatabase for storage of all spatial data generated by the MMC.
- Google Earth KMZ files—kmz files for use in Google Earth desktop applications using Google Earth Pro.

2.6 FILE STRUCTURE

All files resulting from the modeling, mapping, and consequence steps are uploaded to the RMCSTORAGE4 server. Final model deliverable data is found in the “Production” folder under “Dams” or “Levees” at \\wpc-netapp3.eis.ds.usace.army.mil\RMCSTORAGE4\Production.

Once Mapping is complete, deliver back to the same location on RMCSTORAGE4, updating only the folder that changed (Google, Mapping, and Review).

Section 3
Model Data Preparation

This section describes how to begin the mapping process with data derived using the HEC-RAS modeling software. The data will be delivered via RMCSTORAGE4 or external storage media in the MMC folder structure as described in Appendix 4.3.1, MMC File Schema Guide.

3.1 CREATE WORKING FILE GEODATABASE

1. Start a new ArcGIS Pro map session. Using the Catalog pane, create a new empty file geodatabase named Inundation_[Dam_Name] in the GIS_Data folder. This geodatabase will be referenced throughout this document as the working geodatabase.

3.2 CONSOLIDATE MODEL DATA INTO WORKING GEODATABASE

1. Data from HEC-RAS is stored in the GIS_Modeling\PostRAS folder in separate sub-folders for each scenario modeled. Each of these sub-folders should contain a shapefile containing all vector output data and any raster format outputs such as the depth grid.
2. Locate the depth grid for the low and high scenarios to be mapped and export these rasters to the mapping GIS_Data folder. These should be in GeoTiff format with an LZW compression, if not, export to the correct format. Ensure the data has an assigned projection.
3. Within this document, and in all the templates, normal high (NH) pool and maximum high (MH) pool are used to designate the two different scenarios. Name the rasters accordingly.

3.3 BREACH TIMES

The time of dam breach is important in calculating the relative time of arrival of inundation breach wave downstream. The breach times will be listed in CTS worksheet.

The report status should be set to “Final” before mapping production is started. For any questions about the breach times listed in the documentation or if the report status is not “Final” contact the mapping technical lead.

3.4 DATABASE POPULATION

Model geometry and model timing data will be extracted from the .hdf files provided in the RAS folder. Use the MMC Utilities Toolbar to extract this data. The data will be stored in an output geodatabase for scenario identified. This data will be used in the map production process and appended to the working geodatabase.

3.4.1 Convert RAS to Features Tool

The convert RAS to features tool is located on the MMC Utilities Toolbar and shown in Figure 3-3.

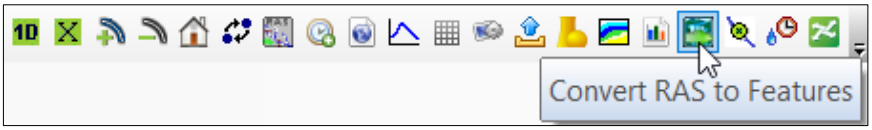


Figure 3-1. Convert RAS to Features

This tool generates the model geometry (centerline, cross sections, storage areas, 2D flow areas) and timing data (arrival time, arrival elevation, peak time, peak elevation) from the HEC-RAS model created. This tool is run for both the high and low scenarios (MH breach and NH breach) and exported data is delivered to designated geodatabases.

1. Create two file geodatabases (MHB.gdb, NHB.gdb) in the GIS_Data folder to store the output data for each scenario from the Convert RAS to Features tool.
2. Select the Convert RAS to Features tool from the MMC Utilities Toolbar. The convert RAS to Features tool window opens as shown in Figure 3-2. By default, the only populated value is the Flood Arrival Delta.

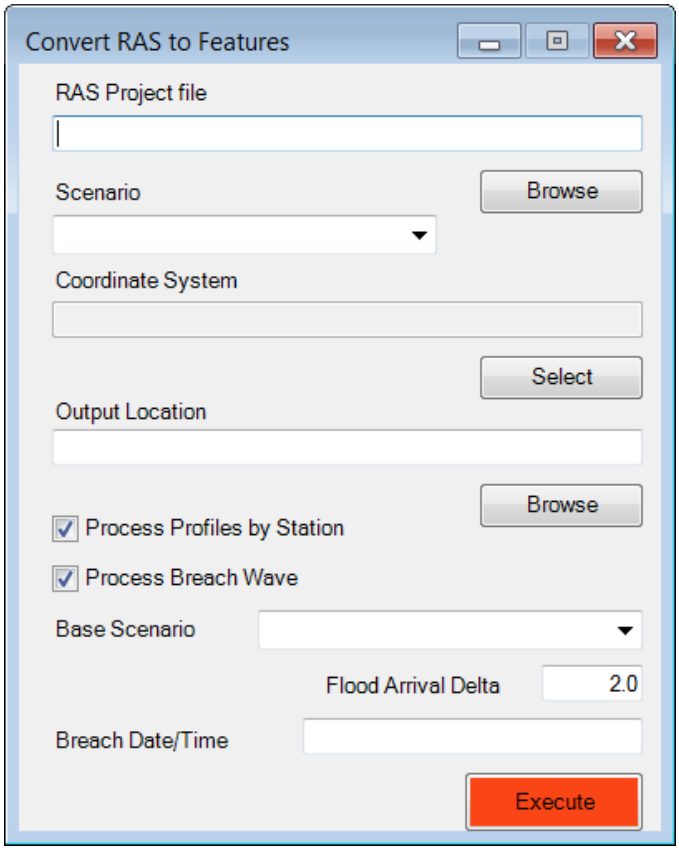


Figure 3-2. Convert RAS to Features Window

3. In the “RAS Project file” field, browse to the HEC-RAS .prj file within the RAS folder.
4. In the “Scenario” field, select the failure scenario that needs processed. Select the MH breach (MHB) scenario (these steps are repeated for the NH breach scenario).
5. Select the coordinate system to the projection defined in the model (typically the MMC projection).

6. Set the output location to the geodatabase created in Step 1 for the MHB scenario (MHB.gdb).
7. Leave Process Profiles by Station checked and Process Breach Wave checked.
8. In the "Base Scenario" field, select the non-breach scenario corresponding to the breach scenario selected in Step 4 (i.e., if MHB is selected as the scenario, the MH non-breach is the corresponding base scenario).
9. Set the "Flood Arrival Delta" field to 2.0 feet. If the tool results provide very little usable data with a 2.0-foot delta, contact the mapping technical lead for guidance.
10. Set the "Breach Date/Time" field to the breach time for the breach scenario selected in step 4 in RAS format (example RAS format 02FEB2099 2400). Use the breach times listed in the Model Report for Hydraulics (MRH) located at https://team.usace.army.mil/sites/NWK/pdt/MMC/DS/Forms/AllItems.aspx.
11. Figure 3-3 displays an example of the Convert RAS Tool with expected populated data.
12. Click Execute to run the tool.

    When the process is complete, a "Done" dialogue box pops up.

    This process creates the following feature classes:

    a. BoundingPolygons (Polygon)—The bounding polygon for the one-dimensional (1D) model data. Only populated if 1D model data is present.

    b. FlowAreas_2D_Boundary (Polygon)—The bounding polygon for the two-dimensional (2D) model data. Only populated if 2D model data is present.

    c. FlowAreas_Cells (Polygon)—The individual cells created for a 2D model, including the calculated timing data for each cell. Only populated if 2D model data is present.

    d. ProfilesByStation (Table)—Contains the water surface elevation time for all modeled cross sections. Only populated if 1D model data is present.

    e. River2D (Line)—Modeled centerline for the 1D model data. Only populated if 1D model data is present.

    f. runParameters (Table)—Stores all parameters entered into the Convert RAS to Features tool.

    g. StorageAreas (Polygon)—Storage areas created in the model.

    h. StudyExtent (Polygon)—Footprint of the modeled extent.[1]

    i. XSCutlines (Line)—Modeled cross sections, including the calculated timing data. Only populated if 1D model data is present.

13. Repeat the process for the NH breach scenario.

[1] This does not create a viable study extent with the current version of the mapping tool. If a study extent polygon is needed, it will need to be created from the depth grid or max water surface elevation grid.

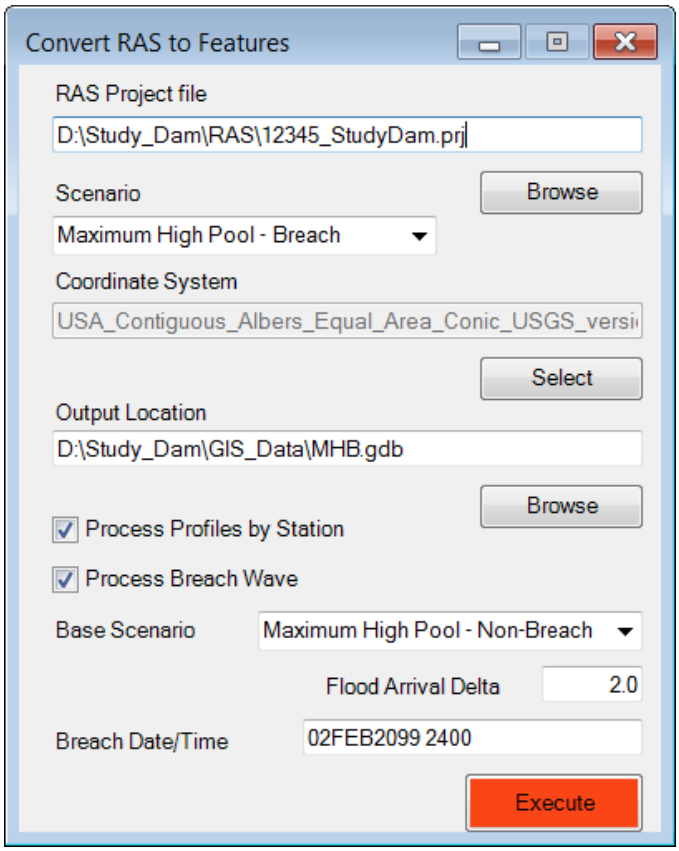


Figure 3-3. Convert RAS to Features Example

3.4.2 Working Geodatabase Population

1. Export data from the MHB output geodatabase, populated using the Convert RAS to Features tool. The MHB.gdb is located in the Mapping/GIS_Data. Export the listed feature classes listed to the working geodatabase by right-clicking on the layer name in ArcCatalog, and choosing Data, then Export Data, from the context menu. Save each as a feature class in the working geodatabase with the respective name:
    - River2D->River2D (only exists for 1D model areas)
    - XSCutlines->MH_XSCutlines (only exists for 1D model areas)
    - River2D->Centerline (unless the model has only 2D areas, then there will be no centerline)
    - FlowArea_Cells->FlowArea_Cells_MH (only exists for 2D model areas).
2. Load the listed feature classes from the NHB.gdb, located in the GIS_Data folder and export to the working geodatabase by right-clicking on the layer name in ArcCatalog, and choosing Data, then Export Data, from the context menu. Save each as a feature class in the working geodatabase with the respective name:
    - XSCutlines -> NH_XSCutlines (only exists for 1D model areas)

- FlowArea_Cells -> FlowArea_Cells_NH (only exists for 2D model areas).

3. Create an inundation extent from the MHB depth grid (if not included from modeling).

   j. Run reclassify on the MHB depth grid and place the resulting raster in a temporary folder to be deleted later.

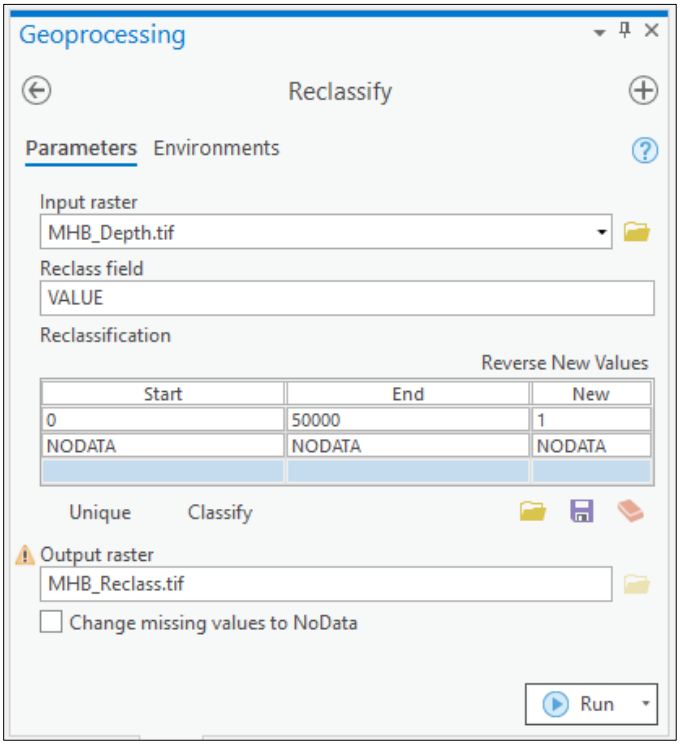


Figure 3-4. Reclassify Example

   k. Run the Raster to Polygon tool in conversion tools on the MHB_Reclass.tif. Save the shapefile in the GIS_Data folder. Simplify polygons will be unchecked and Create multipart features will be checked.

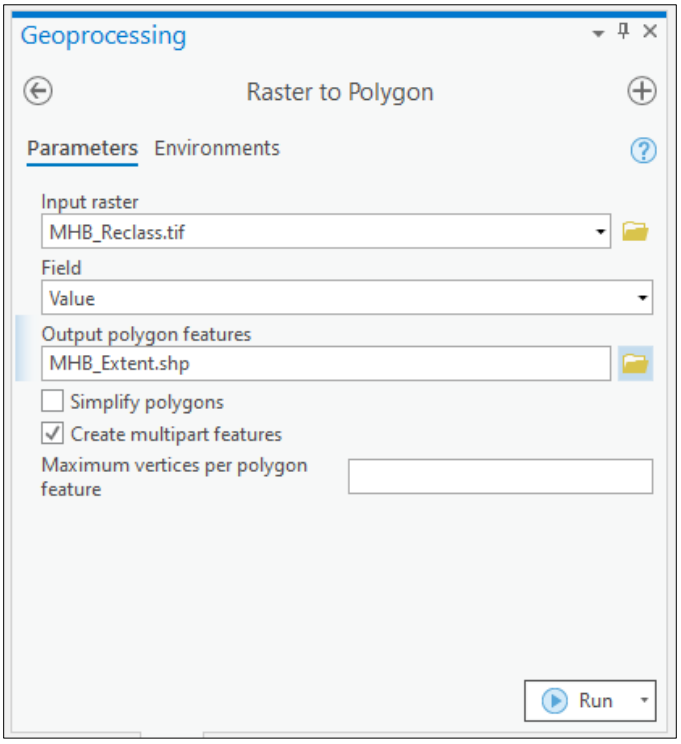


Figure 3-5. Convert Raster to Polygon Example

l. Delete the temporary MHB_Reclass.tif file.

4. Add the centerline feature class layer to the map session after exporting. Clean up and check the centerline feature class:
    a. Delete any tributaries from the centerline so only one line proceeds from the dam to the downstream extent of the model.[2]
    b. Make sure the centerline direction of flow is from the dam downstream, if not; reverse the direction.[3]
    c. Edit the upstream end of the centerline so it begins at the centerline of the study dam.
    d. Remove the original layers from the map.
5. Add the MHB_Extent.shp and Centerline feature class from the working geodatabase to the map session.
6. Add the following layers to the map session from the MMC_National_Data geodatabase[4]:
    - Natural_Gas_Pipelines
    - Cities_Area

[2] If there are multiple line features in the centerline feature class, they should be merged using the merge function in an editing session.

[3] Check the flow direction by adding an arrow head to the line in the symbology settings or entering an edit session, double clicking on the line so that the vertices are visible, the red vertex should always be at the downstream end of the line. Right click on the line and choose "Flip" to reverse the line direction.

[4] See 4.1.6, Map Data Spec, for sources of all national datasets, requires MMC National Database v.FY20, available in MMC support files.

- NID_Dams_NonUSACE
- NID_Dams_USACE
- Counties_Area
- mgrs_region
- MMC_DetailSheetExtents
- MMC_StandardSheetExtents
- Railroads
- States_Area
- USGS_Gages.

7. Add the following layers to the map session from the National Levee Database:
    - Closures
    - Floodwalls
    - Embankments.

The most recent copy of the NLD database can be found on ProjectWise: pw:\\PWINT-WPC.EIS.DS.USACE.ARMY.MIL:CE - MMC\Documents\Programs and Activities\MMC2\National Data Sets\NLD\FY21\.

8. Use the Select by Location tool located in the Selection menu to select features from the MMC_StandardSheetExtents layers that intersect the Study Extent from the calculated data for the MH scenario.

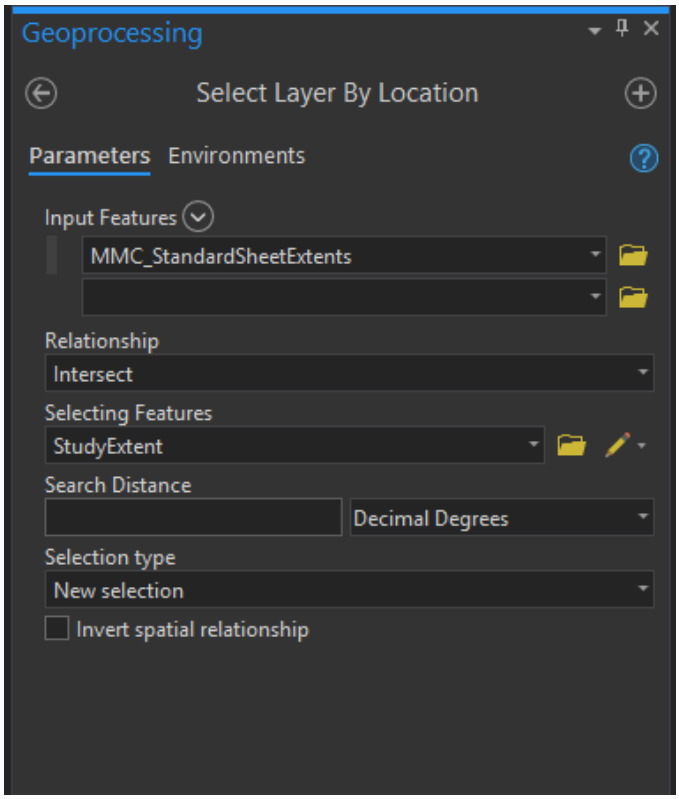


Figure 3-6. Select by Location Tool

9. Export the selected layers by right-clicking on the layer name, choosing Data, and then Export Data from the context menu. Save as a feature class in the working geodatabase named:

    - MMC_StandardSheetExtents->Standard_Sheets

    a. Add the new Standard_Sheets layer to the map after exporting.

    b. Review the Standard_Sheets against the MH depth grid. Delete any sheets that do not contain the depth grid.

10. Run a select by location for the MMC_DetailSheetExtents that intersect the Standard_Sheets. Export the detail sheet data to the working geodatabase as:

    - MMC_DetailSheetExtents->Detail_Sheets

11. Delete any Detail_Sheets that do not intersect the depth grid.
12. Use the Select by Location tool located in the Selection menu to select features from the NID_DAMS_USACE layer that intersect the Standard_Sheets layer.
13. Export the selected features by right-clicking on the NID_DAMS_USACE layer, choosing Data, then Export Data from the context menu. Save the layer to the working geodatabase as a feature class named USACE_Dams.

14. Use the Select by Location tool located in the Selection menu to select features from the NID_DAMS_NonUSACE layer that within a distance of 1 mile of the centerline.
15. Export the selected features by right-clicking on the NID_DAMS_NonUSACE layer, choosing Data, and then Export Data from the context menu. Save the layer to the working geodatabase as a feature class named Non_USACE_Dams.
16. Use the Select by Location tool located in the Selection menu to select features from the remaining layers that intersect the Standard_Sheets layer.
17. Export each of the selected layers by right-clicking on the layer name, choosing Data, then Export Data from the context menu. Save each as a feature class in the working geodatabase with the respective names:

    - USGS_Gages→USGS_Gages
    - closures→Closure_Structure_Line
    - floodwalls→Floodwall_Line
    - embankments→Levee_Centerline
    - Natural_Gas_Pipelines→Natural_Gas_Pipelines
    - US_Border→US_Border
    - Railroads→Railroads
    - States_Area→States_Area
    - Cities_Area→Cities_Area
    - Counties_Area→Counties_Area
    - mgrs_region→USNG_Grid.

18. The infrastructure points are added to the Inundation geodatabase using the Copy Critical Facilities to the Inundation Geodatabase tool on the MMC Utilities Toolbox in ArcMap 10.4.1.

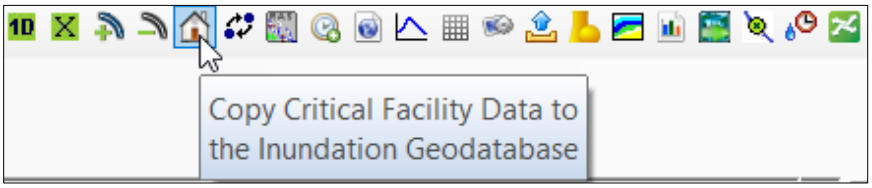


Figure 3-7. Copy Critical Facilities to the Inundation Geodatabase

19. Map to the FY20 MMC Geodatabase that contains the infrastructure points. All the feature classes in the Geodatabase that have “CIKR_” as the first 5 characters of the name will be found.
20. Map to the Standard_Sheets layer and press Copy.

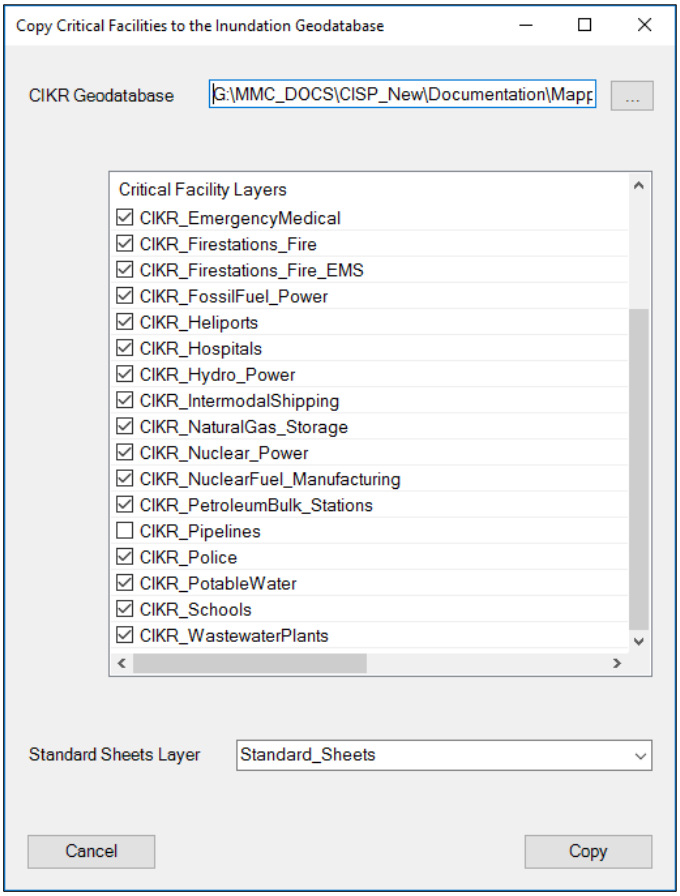


Figure 3-81. Copy Critical Facilities to the Inundation Geodatabase Tool

21. Look at the Standard_Sheets and Detail_Sheets against the depth grid layer. Find the location of the study dam and export the sheets that are the upstream portion of the depth grid as:

    a. Standard_Sheets_Upstream

    b. Detail_Sheets_Upstream.

22. Do not include these sheets in the downstream portion.

3.5 MAP GRID SET UP

The Map Grid scale is designed to be uniform for all study areas. Some extreme cases will warrant a different scale, but most of the study areas will use Standard Grids for use at a scale of 1:31,680 (1 inch=½ mile) and Detail Grids at a scale of 1:15,840 (1 inch=¼ mile).

The Standard Grids in the data provided are for use at a scale of 1:31,680 and the provided Detail Grids are for use at a scale of 1:15,840. Study areas that require a different scale will need to have new Grids created. The process of Standard

Sheet and Detail Sheet setup will be the same for all scales. A Map Grid scale should be determined for each study area individually based on the number of sheets required to complete mapping at a given scale.

The steps in this document assume standard sheets for use at a scale 1:31,680 and detail sheets for use at a scale of 1:15,840 are being used.

1. Add the Cities, Detail_Sheets, InundationArea, Standard_Sheets, and USNG_Grid feature classes from the working geodatabase to a new ArcMap session. It may be helpful to also add the World Street Map base map from the ESRI image service as well.
2. Detail sheets should be used in areas where the inundation affects densely populated areas, or areas where more detail is important. Use the select by location tool to select all detail sheets that intersect the Cities layer.

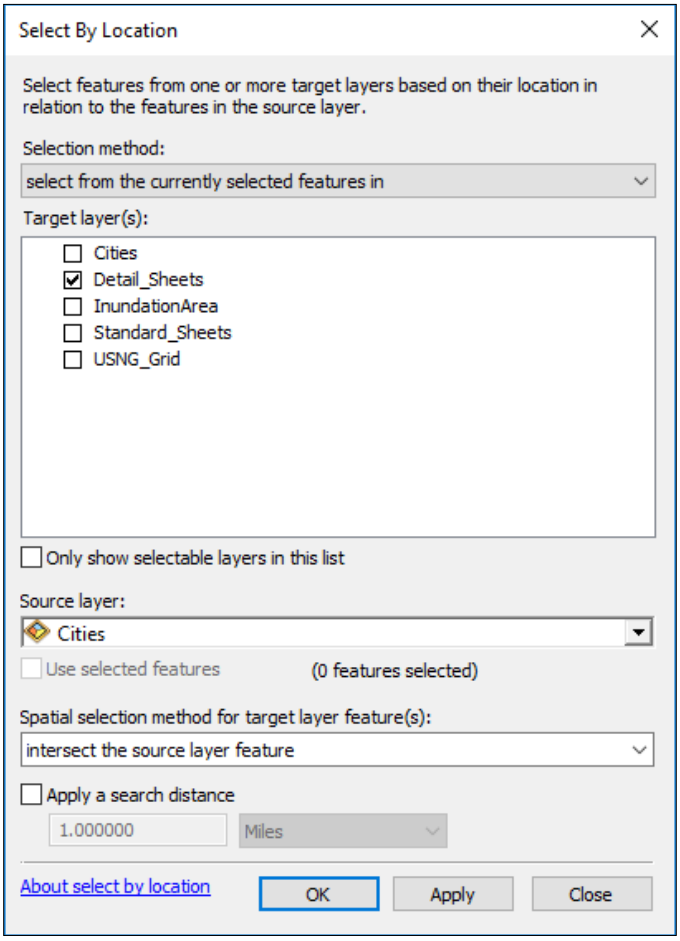


Figure 3-9. Select by Location from Current Selection

3. Export the selected features to a feature class in the working geodatabase with the name Detail_Sheets_Active.

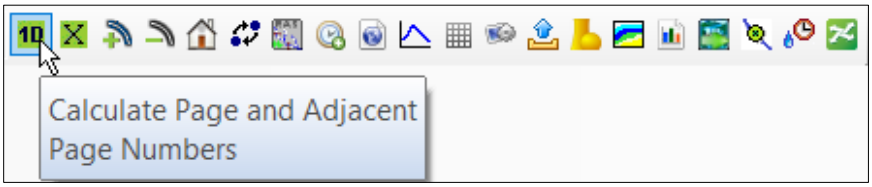


Figure 3-10. Calculate Page and Adjacent Page Numbers

4. Click the Calculate Page and Adjacent Page Numbers tool on the MMC Utilities Toolbox.
5. Click the check box to change the Dam, Dam Owner and NIDID Name.
6. Type in the Dam name, owner and the NIDID and select the Standard_Sheets for the Map Sheet Layer, Detail_Sheets_Active for the Detail Sheet Layer and USNG_Grid for the MGRS Layer.
7. Then Click “Calculate.” Ensure that the correct feature class is chosen for the remainder of the process. When the process finishes select “Yes” on the MMC Tools dialog box to refresh the map.

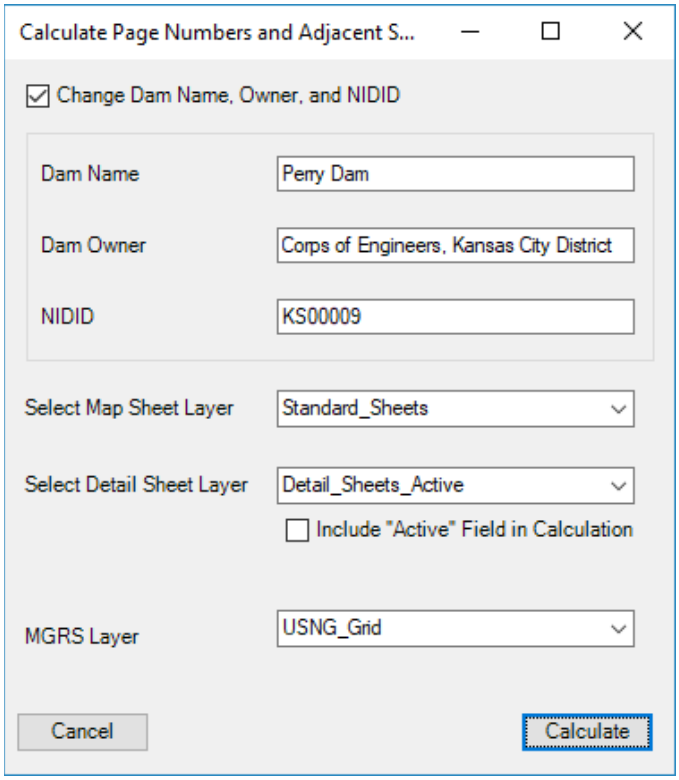


Figure 3-11. Calculate Page Numbers and Adjacent Sheets Tool

The Calculate Page Numbers tool assumes the page numbering scheme should start in the upper left corner and progress right, then down. This works well for some projects, but sheet numbers should begin at the dam and progress downstream in an ordered fashion. In the case where the standard numbering scheme does not work with the sheet

layout, the sheets will need to be numbered manually. This can be done completely manually, or the following steps can be followed:

1. Add the Standard_Sheets and Detail_Sheets_Active feature classes to your mapping session.
2. If not already done, run the Calculate Page Numbers Tool for the Standard_Sheets and Detail_Sheet_Active layers.
3. Manually update the Page_Nmbr field so that the map sheet numbers start at the dam and progress downstream.
4. From Toolboxes, use the Calculate Adjacent Fields tool (Cartography Toolbox, Map Series) to calculate the new adjacent page numbers. The tool will add 8 fields to the feature class (Page_Nmbr_NW, Page_Nmbr_N, Page_Nmbr_NE, Page_Nmbr_W, Page_Nmbr_E, Page_Nmbr_SW, Page_Nmbr_S, Page_Nmbr_SE,). (To access Toolboxes, click the Analysis Tab, Tools Button, and select Toolboxes in the Geoprocessing window)

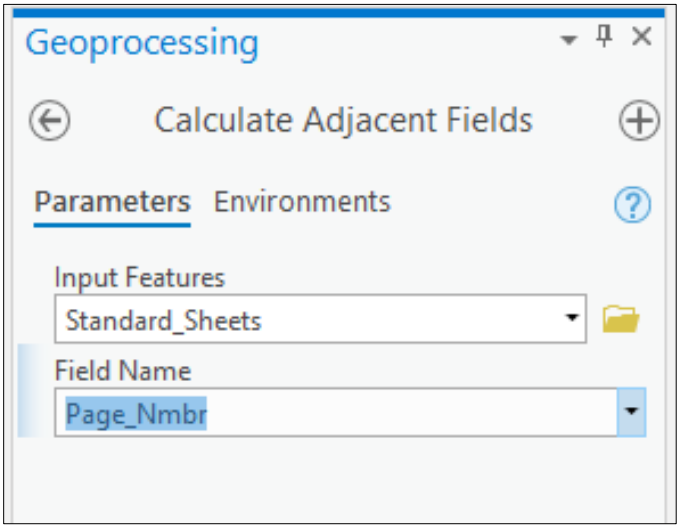


Figure 3-12. Calculate Adjacent Fields Tool

5. Click the Map Tab, and choose Select by Attributes Button in the Selection area.
6. From the Select by Attributes window, choose ‘Where North_Pg is not equal to No Join’ and click Run

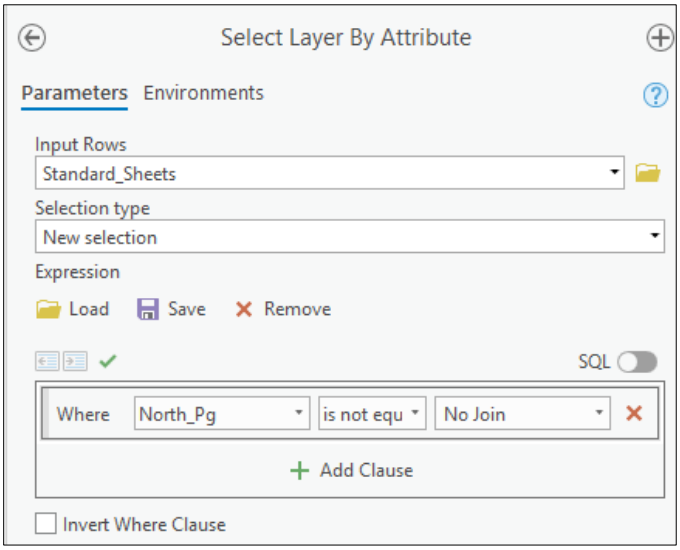


Figure 3-13. Select Layer by Attribute

7. Open the attribute table for Standard_Sheets.
8. Click the Calculate Button.
9. From the Calculate Field window, choose North_Pg for the Field Name and choose Page_Nmbr_N from the Fields list. You should see North_Pg=!Page_Nmbr_N! in the calculation box. Click Run to calculate.

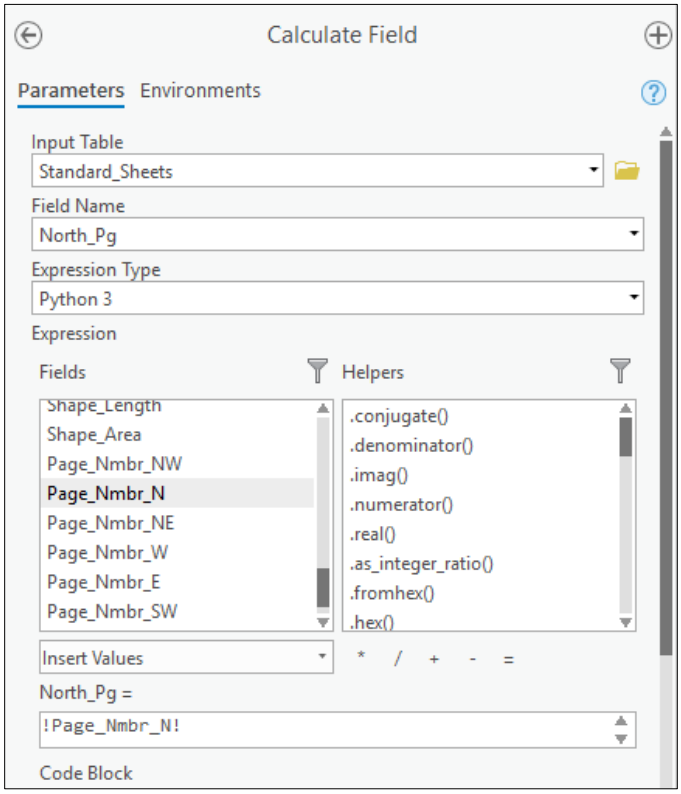


Figure 3-14. Calculate Field

10. Repeat steps 5-9 for South_Pg, East_Pg, and West_Pg
11. When finished, use the Delete Field tool (Data Management Toolbox, Fields) to remove the 8 fields created by the Calculate Adjacent Fields tool.

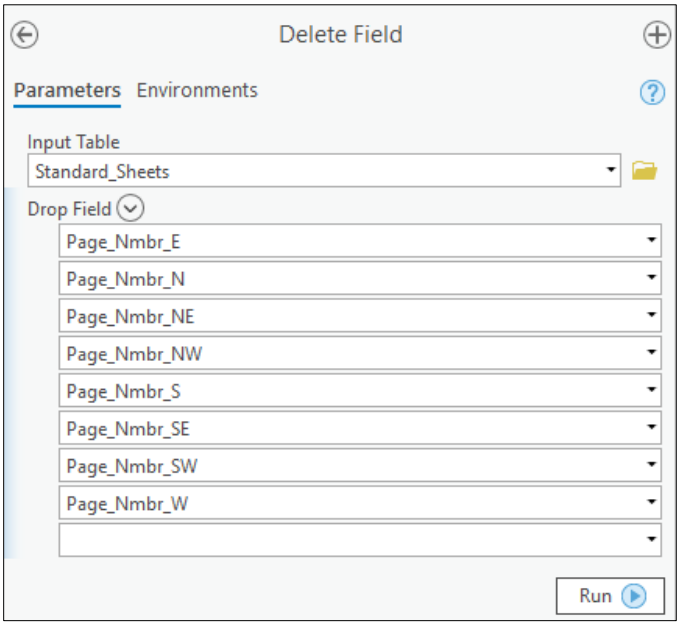


Figure 3-15. Delete Field

12. Repeat steps 3–11 for Detail_Sheets_Active. If there are too many detail sheets to update manually, use the following steps instead of repeating step 3.

    - Join the Standard_Sheets attribute table to the Detail_Sheets_Active attribute table using the FID_USGS_S field.
    - Use the following formula in the field calculator for the "Page_Nmbr" field in the Detail Sheets feature class:

      Python: !Standard_Sheets.Page_Nmbr!+!Detail_Sheets_Active.Page_Nmbr! [-1]

    - This will pull the new page number from the Standard_Sheets and append the detail sheet letter to the end of it.
    - Remove the Join from Detail_Sheets_Active.
    - Repeat steps 4–11 for Detail_Sheets_Active to calculate the adjacent page numbers.

Table 3-1. Joins Information

Field Name	Populate with
North_Pg	Sheet number North of the current sheet
South_Pg	Sheet number South of the current sheet
East_Pg	Sheet number East of the current sheet
West_Pg	Sheet number West of the current sheet

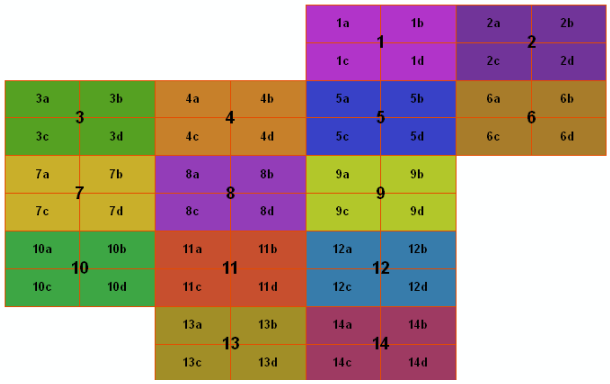


Figure 3-16. Sheet Numbering Example

3.6 LETTERED FLOOD INFORMATION DATA POINTS FOR MODELS WITH ONE- AND TWO-DIMENSIONAL AREAS

For each standard sheet that intersects inundation, a point will be displayed, and assigned a letter designator. This will provide flood breach data at that location on the map sheet. Production steps will differ based on how the model was created (2D areas for all inundation or 2D areas for only some inundation). Use the steps that apply to your modeled area.

1. Use the following steps for models with 2D areas and 1D areas:
2. Add the MH_XSCutlines, NH_XSCutlines, centerline and Standard_Sheets feature classes to a new ArcGIS Pro map session.
3. For each standard sheet select one cross section (selecting from both the MH and NH cross section layers at the same time). Choose cross sections that have valid arrival time values and are near places of interested whenever possible (places of interest include, major road crossings, bridges, highways).
4. Keep the selected cross sections and delete the other cross sections from the working geodatabase.
5. Add the FlowArea_Cells_MH and FlowArea_Cells_NH and Standard_Sheets to the ArcGIS Pro map session along with the selected cross sections from the MH_XSCutlines and NH_XSCutlines files in the working geodatabase.
6. For any standard sheet that does not have a selected cross section, select a cell from FlowArea_Cells_MH and FlowArea_Cells_NH (selecting cells from both flow area layers at the same time). If possible, choose cells with arrival time data for both scenarios and that are near places of interest (places of interest include, major road crossings, bridges, highways).
7. Keep the selected flow areas cells and delete the other flow areas cells from the working geodatabase .

8. Create a field in FlowAreas_Cells_MH and FlowArea_Cells_NH called XS_Letter (text, 25).
9. Convert the polygon cells to point features. Convert the FlowAreas_Cells_MH polygon to a point feature named Flood_Info_Points_MH. This feature will be used to display flood info points and later attribute the points in the map. Repeat for the NH data, names Flood_Info_Points_NH.
10. Create a field in the MH_XSCutlines and NH_XSCutlines attribute table called XS_Letter (text, 25).
11. Run the intersect tool for each of the XSCutlines layers with the River2D layer, with the outcome of points. This will convert any cross section area to a point feature see Figure 3-13.

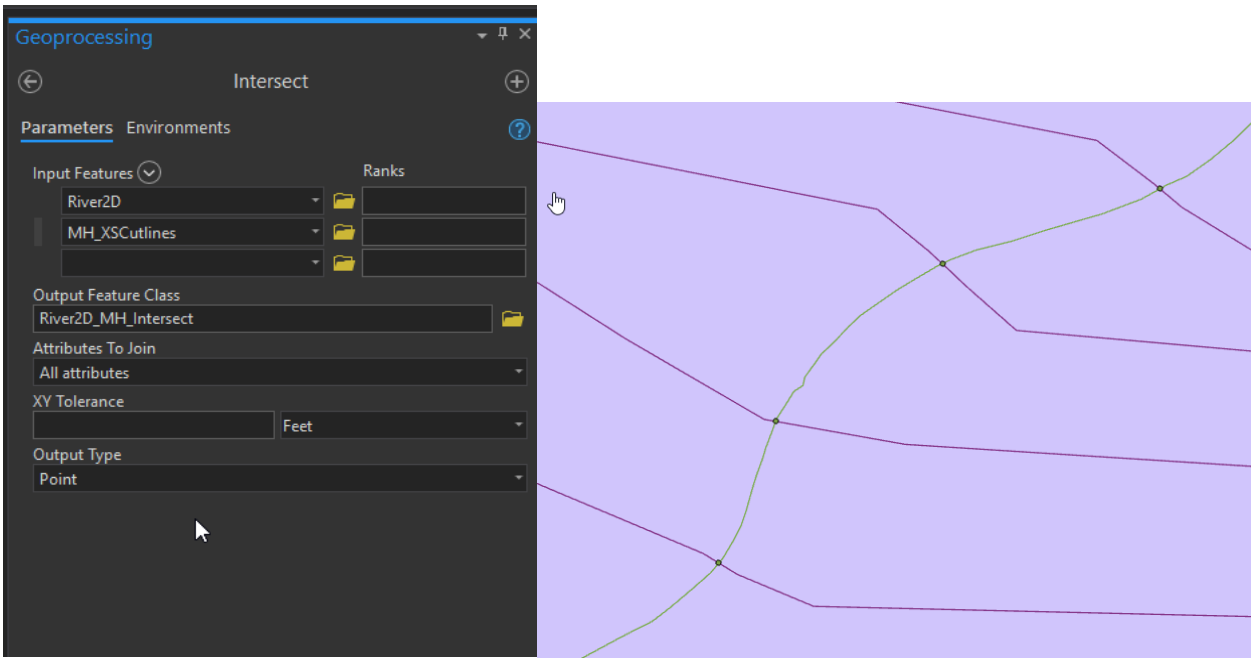


Figure 3-17. Intersect Tool

12. Repeat for the NH scenario.
13. Convert the River2D_MH_Intersect from a multipart to a single part point feature class called River2D_MH_Intersect_SP.
14. Repeat for River2D_NH_Intersect.
15. For each scenario, copy the newly created points from River2D_MH_Intersect_SP and River2D_NH_Intersect_SP data into the Flood_Info_Points_MH and Flood_Info_Points_NH datasets.
16. Assign letters to each point in Flood_Info_Points_MH in the XS_Letter field. Use the same point letter names for the Flood_Info_Points_NH layer. Flood info point letters will progress from A to Z then start again at BA through BZ and so forth until all of the flood info points have a unique letter or set of letters.
17. The following intermediate files are no longer necessary and can be deleted from your database: River2D_MH_Intersect, River2D_NH_Intersect, River2D_MH_Intersect_SP, and River2D_NH_Intersect_SP.

3.7 CALCULATE TIMING DATA FOR STANDARD SHEETS (FOR MODELS CONTAINING ONE- AND TWO-DIMENSIONAL AREAS)

1. To populate the XS_Ltr field in the Standard_Sheets create a spatial join in Standard_Sheets to Flood_Info_Points_MH and call it Standard_Sheets_SpatialJoin.
2. Join Standard_Sheets to Standard_Sheets_SpatialJoin using the FID_USGS_S field.

3. Calculate the XS_Ltr field equal to !Standard_Sheets_SpatialJoin.XS_Letter!
4. Remove the join to Standard_Sheets and delete Standard_Sheets_SpatialJoin
5. Use the field calculator to calculate the XS_Ltr field for sheets without a data point letter to be equal to the phrase 'No Data Point Assigned to Sheet'
6. Click on the Calculate Timing Data for Standard Sheets for New Format tool on the MMC Utilities toolbox.

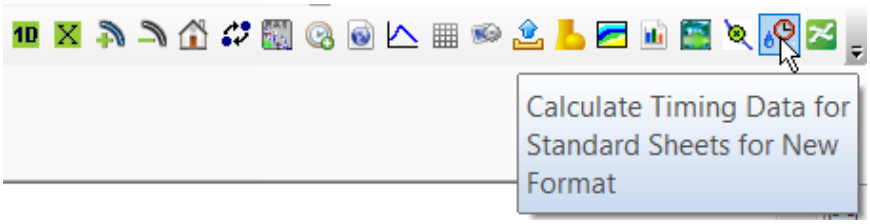


Figure 3-2. Calculate Timing Data for Standard Sheets Tool

7. This tool will copy and format timing data from the Flood_Info_Points_MH and Flood_Info_Points_NH datasets to the Standard Sheets.

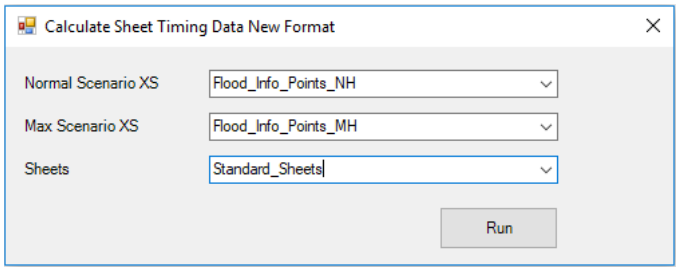


Figure 3-3. Calculate Standard Sheet Timing Data New Format Tool

3.8 DETAIL SHEET FLOOD WAVE DATA TABLE (FOR MODELS CONTAINING ONE- AND TWO-DIMENSIONAL AREAS)

1. Flood Wave Data Tables are created for the Detailed Sheets using the MMC Toolbar. If not yet available, use the following steps to calculate the data.
2. Add the Detail_Sheets_Active, Standard_Sheets, Flood_Info_Points_MH, and Flood_Info_Points_NH to your map session.
3. Join Detail_Sheets_Active to Standard_Sheets using the FID_USGS_S field.
4. Calculate the XS_Ltr field to be the data point letter for the corresponding standard sheet. Sheets without a data point letter to be equal to the phrase “No Data Point Assigned to Sheet”
5. Remove the Join.
6. Click on the Calculate Timing Data for Standard Sheets for New Format tool on the MMC toolbar.

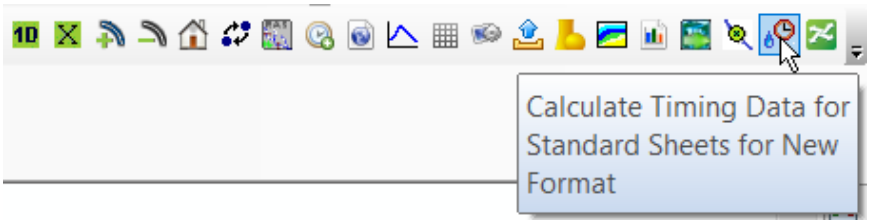


Figure 3-4. Calculate Timing Data for Standard Sheets Tool

7. This tool will copy and format timing data from the Flood_Info_Points_MH and Flood_Info_Points_MH to the Detail Sheets.

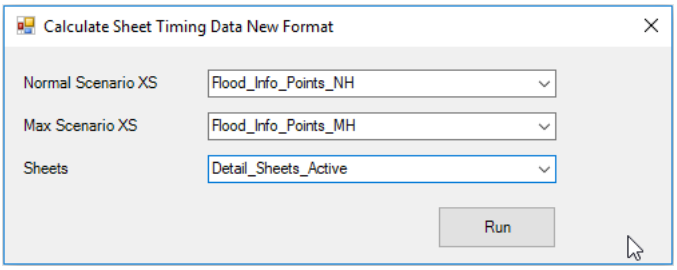


Figure 3-21. Calculate Detail Sheet Timing Data New Format Tool

3.9 LETTERED FLOOD BREACH DATA POINTS FOR TWO-DIMENSIONAL ONLY MODELS

For 2D models, a point will be displayed in each sheet containing flood wave arrival time data. For choosing 2D cells, consider the following:

- Select cells where all data is available for both scenarios if possible.
- Consider geographic features within the map sheet for selecting a cell. i.e., major road intersections, large grouping of critical infrastructure, railroad or bridge crossing, etc.
- Remember, arrival times may vary greatly as you move away from the main channel.

1. Start a new ArcGIS Pro map session
2. Add the FlowArea_Cells_MH, FlowArea_Cells_NH, depth grid and Standard_Sheet feature classes from the working geodatabase.

    a. A cell from each FlowAreas_Cells layer must be selected for each standard sheet.

        1) Make FlowAreas_Cells_MH and FlowAreas_Cells_NH the only selectable layers.

        2) With the Select Features tool activated, hold down the shift key and select one cell per sheet that intersects the depth grid layer.

        3) Once all the selections are complete, open the attribute table for the FlowAreas_Cells_MH and switch selection. Delete the cells that will not be used. Repeat this step with FlowAreas_Cells_NH.

4) Create a field in FlowAreas_Cells_MH and FlowAreas_Cells_NH called XS_Letter (text, 25).

3. Populate the field called XS_Letter (text, 25). This field will need to be manually attributed. The point closest to the dam will be assigned “A” and will continue downstream as follows: “B, C, D…Z, AA, AB, AC”. Continue the alphabetical naming convention while disregarding the sheets without assigned points.
4. Convert the polygon cells to point features. Convert the FlowAreas_Cells_MH polygon to a point feature named Flood_Info_Points_MH. This feature will be used to display flood info points and later attribute the points in the map. Repeat for the NH data, names Flood_Info_Points_NH.
5. Click on the Calculate Timing Data for Standard Sheets for New Format tool on the MMC Utilities Toolbox.

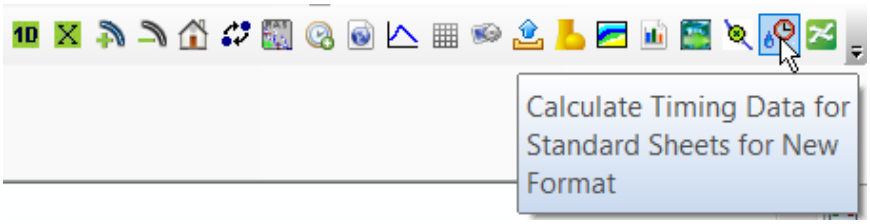


Figure 3-22. Calculate Timing Data for Standard Sheets

6. This tool will copy and format timing data from the Flood_Info_Points_MH and Flood_Info_Points_NH datasets to the Standard Sheets.

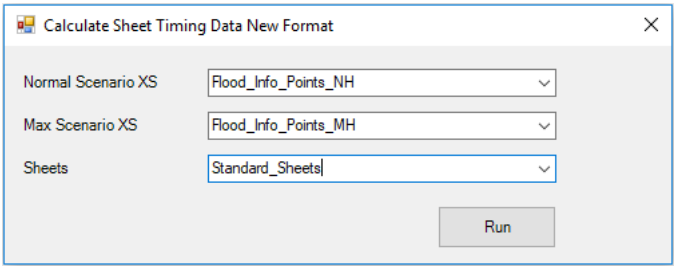


Figure 3-23. Calculate Standard Sheet Timing Data New Format Tool

7. If a lettered point was not assigned to a sheet, attribute the XS_Ltr field in the Standard_Sheets feature class as “No Data Point Assigned to Sheet”.

3.10 DETAIL SHEET FLOOD WAVE DATA TABLE (FOR TWO-DIMENSIONAL ONLY MODELS)

1. Flood Wave Data Tables are created for the Detailed Sheets using the MMC Toolbar. If not yet available, use the following steps to calculate the data.
2. Add the Detail_Sheets_Active, Standard_Sheets, Flood_Info_Points_MH, and Flood_Info_Points_NH to your map session.
3. Join Detail_Sheets_Active to Standard_Sheets using the FID_USGS_S field.
4. Calculate the XS_Ltr field to be the data point letter for the corresponding standard sheet. Sheets without a data point letter to be equal to the phrase “No Data Point Assigned to Sheet”
5. Click on the Calculate Timing Data for Standard Sheets for New Format tool on the MMC toolbar.

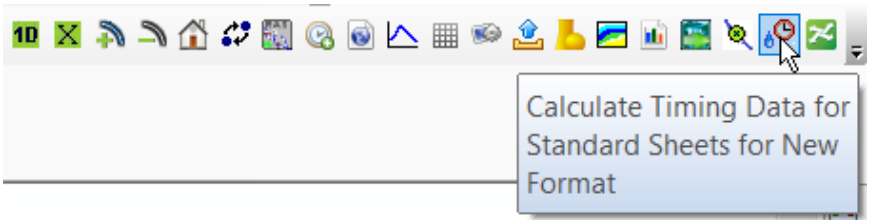


Figure 3-24. Calculate Timing Data for Standard Sheets Tool

6. This tool will copy and format timing data from the Flood_Info_Points_MH and Flood_Info_Points_MH to the Detail Sheets.

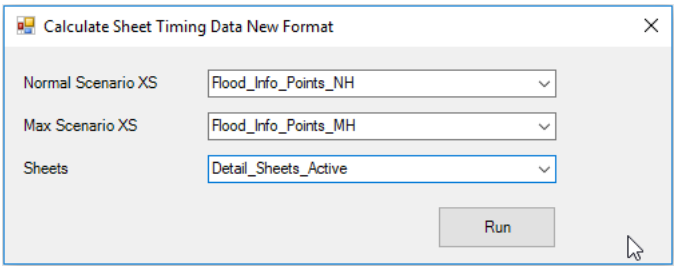


Figure 3-25. Calculate Detail Sheet Timing Data New Format Tool

This concludes the model data preparation for the maps.

Section 4
Standard Sheet Development

The first step to creating any of the maps is to copy all the template .aprx files from their location to the ArcGISMaps folder in the Mapping folder for the working study area.

The Standard Sheets are created by opening FY21_Breach_Dam_Templates.aprx, selecting the 4.4.26_MMC_StandardSheets tab, and re-setting the data sources for the various data layers. Once the template for the Standard Sheets is set up the Map Book can be generated, creating a map series for the study area. The map tabs in the FY21_Breach_Dam_Templates.aprx are designed to display information for either the Max High Breach scenario or the Normal High Breach scenario. The SCENARIO_CHOICE groups contain the layers that are divided into the two scenarios. Select the scenario.

4.1 SET DATA SOURCES

1. Open the map template. The layers will have a red exclamation point next to them; indicating the computer is not able to find a layer in the expected location.
2. Right click the layer name and choose Repair Data Source or go to the layer properties dialog and under the Source tab and set the data source. Point the layer source to the correct feature class, either in the MMC National Mapping Data database or in the working geodatabase created earlier.

   Make sure to check each layer and make sure that the correct feature class was selected.

3. The layer order for the base map layers is as follows:

- Annotation[5]
  - USNG_Grid_S_Anno
  - Cities_S_Anno
  - Flood_Information_Data_Point_S_Anno
  - USACE_Dams_S_Anno
  - Non_USACE_Dams_S_Anno
  - USGS_RTS_Gages_S_Anno
  - Detail_Sheets__Optional_Layer__S_Anno
  - Counties_S_Anno
  - States_S_Anno.

- Base Map Elements
  - Infrastructure
    - Airports
    - Broadcast Communications
    - Colleges and Universities
    - Electric Power Generation

[5] You will remove existing annotation references in the templates noting their order and generate your own.

        - Electric Substations
        - Emergency Medical Services
        - Firestations–Fire/EMS
        - Firestations–Fire Only
        - Heliports
        - Hospitals–General
        - Hydroelectric Power Generation
        - Intermodal Terminal Facilities
        - Law Enforcement
        - Natural Gas Storage
        - Non-USACE Dams
        - Nuclear Electric Power Generation
        - Petroleum Bulk Stations and Terminals
        - Schools
        - State/Local Correctional Facilities
        - USACE Dams
        - USGS_RTS_Gages
        - Wastewater Treatment Plants.

    - National Levee Database
        - Closure Structure Lines
        - Levee Centerlines
        - Floodwall Lines.

    - Boundaries/Lines
        - USNG_Grid
        - Standard_Sheets
        - Countries_Ln
        - States
        - Counties
        - Cities
        - Railway Lines
        - Natural Gas Pipelines.

- Flood_Inundation_Data
    - Flood_Information_Data_Point
    - Dike Breach (optional).

- SCENARIO_CHOICE
    - MAX_HIGH_BREACH_Scenario_Depth_Grid.tif
    - NORMAL_HIGH_BREACH_Scenario_Depth_Grid.tif.

- World_Street_Map

- Imagery Background

    - Reference/World Transportation

    - World Imagery.

4.2 SET DATA FRAME PROPERTIES

The Standard Sheet layer has a field that holds a rotation value for most of the UTM zones in the continental US. This value will rotate the data frame so the sheet is oriented correctly on the page. Map Book will apply this rotation to the main data frame when it is set up, however it is useful to set the rotation on the data frames at this point when setting up the map. A representative rotation value can be chosen from the attributes of the center-most Standard Sheet in the group to be mapped.

This rotation value should be used when setting up the index maps as well.

1. Right click on the Layers and choose Properties. In the Coordinate System tab select the coordinate system for the proper UTM Zone.

   If the study area crosses UTM Zones, the process for creating Standard Sheets and Detail Sheets will apply for all additional UTM Zones used. Each UTM Zone used will require a new map book set up and pdf export.

   Ensure the horizontal units are set to meters.

2. In the General Tab, set the rotation value to the rotation value from the Standard Sheet attribute table for the current UTM zone.

4.3 MAP SERIES SET UP

From the layout ribbon, select the Map Series tool.

1. Fill out the form, selecting the sheets for the layer, and page number for the name field as shown in Figure 4-1. Choose the rotation field based on the UTM used for the study and maintain the standard or detail scale.

2. Click OK to create the map series.

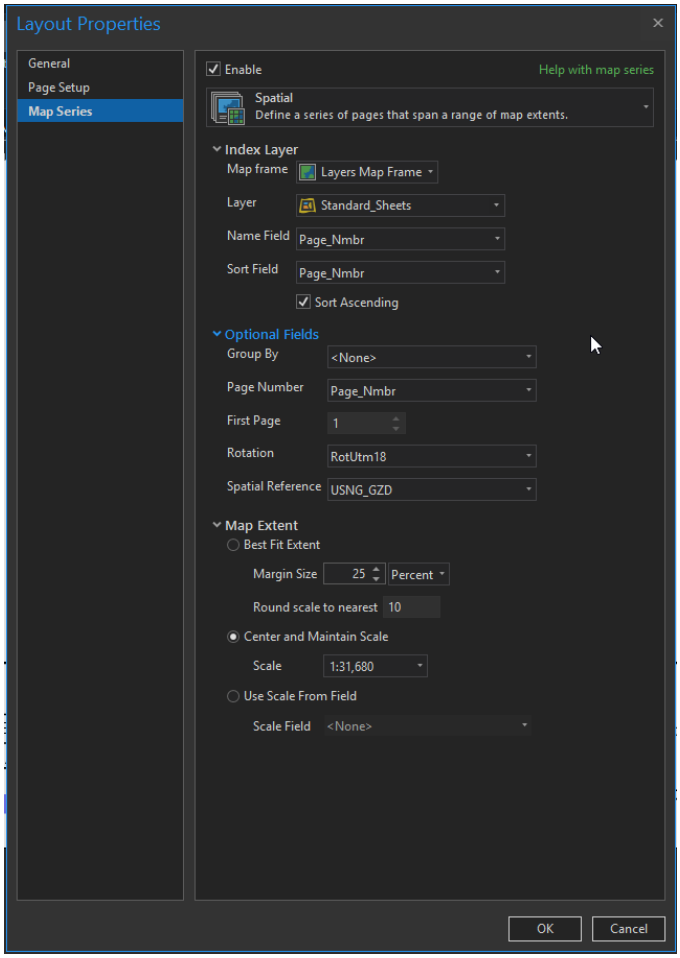


Figure 4-1. Setup Map Series

The map series is shown in the table of contents and is used to navigate between pages.

4.4 LINKED TEXT

Dynamic text elements are used for the map series. These dynamic text fields should automatically populate when using the template. If not, they can be manually adjusted.

Table 3 in the reference section, lists the text elements that must be linked to the index attribute table, the fields that they map to, and the rough location of the text element on the map panel.

4.5 ANNOTATION

The MMC maps use editable annotation feature classes to label features on the map. Annotation is created per study area.

Table 4 in the reference section and Appendix 4.1.7, MMC Graphics Spec, outline the layers that need annotation built and the format to be used. Annotation should be built at a scale of 1:31,680 and stored in the working geodatabase. The layers in the map template should have their label properties set to the correct anno properties, but double check to make sure.

3. Set the reference scale for the map layer to make sure that all labels display correctly.
4. Turn on the labels for features one at a time, by right clicking each layer name in the table of contents.
5. Use the labels to annotation tool in ArcGIS Pro, see figure 4-2. Make sure the extent is large enough to capture all labels (USNG_Grid extent).
6. Each annotation layer created is placed in a temporary location called GroupAnno. Move the annotation layer to the Annotation group before creating another annotation. If this is not done the next annotation created will overwrite GroupAnno and any annotation previously created will need to be added back to the map template.
7. Place annotation within the map sheet in an appropriate location without overlapping point features, avoid placing annotation in the inundation area if possible.
8. If possible, place annotation so that it does not overlap ESRI generated labels in the background. In some instances, annotation will have to overlap ESRI generated labels, this is known and expected.

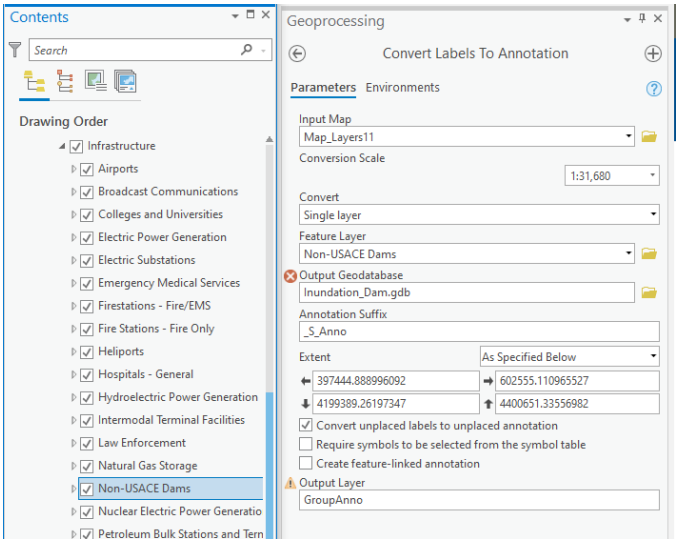


Figure 4-2. Labels to annotation

4.6 CHOOSE THE SCENARIO

There are two scenario choice groups that must be toggled in the 4.4.26_MMC_StandardSheets tab. The first group controls the information in the Flood Information Data Point Table. The second group specifies which depth grid to use.

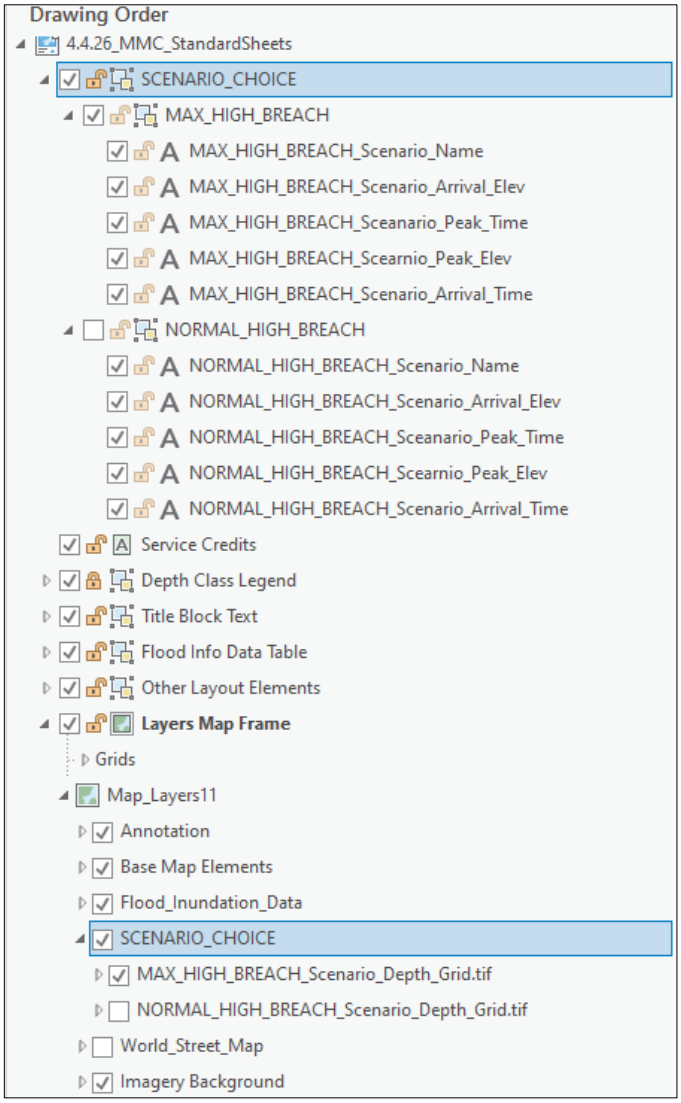


Figure 4-3. SCENARIO_CHOICE layers

4.7 EXPORT TO PDF

Once the map series is properly set up, export the map series to the AtlasPages folder under the FullResolution folder in the PDF Maps directory. Turn off or remove from the table of contents the base data feed that you are not including in the maps (World_Street_Map, or World_Imagery) prior to exporting.

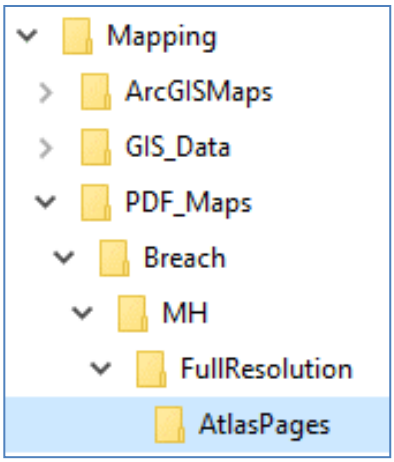


Figure 4-4. Folder Structure

Make sure all guides are turned off, labels are turned off, and selected features have been cleared before exporting to pdf.

1. From the Share ribbon, select layout export.
2. Use the file naming:
   DBIM_[Study Dam Fiscal Year]_[NIDID]_S_[Page Number].pdf (street view)
   DBIM_[Study Dam Fiscal Year]_[NIDID]_A_[Page Number].pdf (aerial view).
3. Choose to output as image.[6]
4. Select the export options and under PDF settings, under layers and attributes, choose 'None.'
5. Under map series, choose to export all as Multiple PDF Files (page names).

[6] Map sheets must be exported with the Output as image option checked so lines do not display in the inundation from raster transparency.

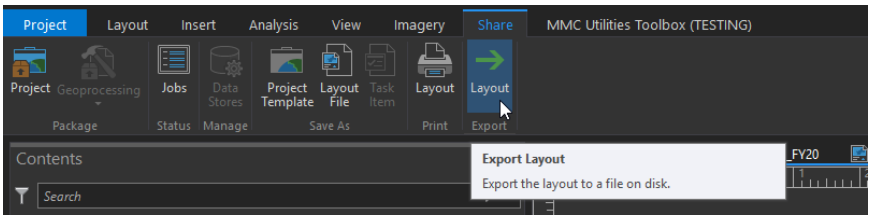


Figure 4-5. PDF Export

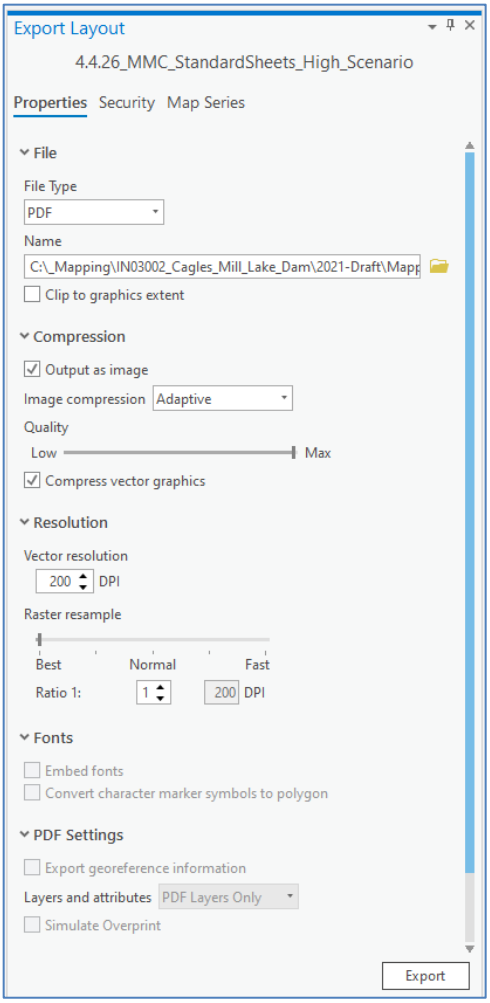


Figure 4-6. PDF Settings

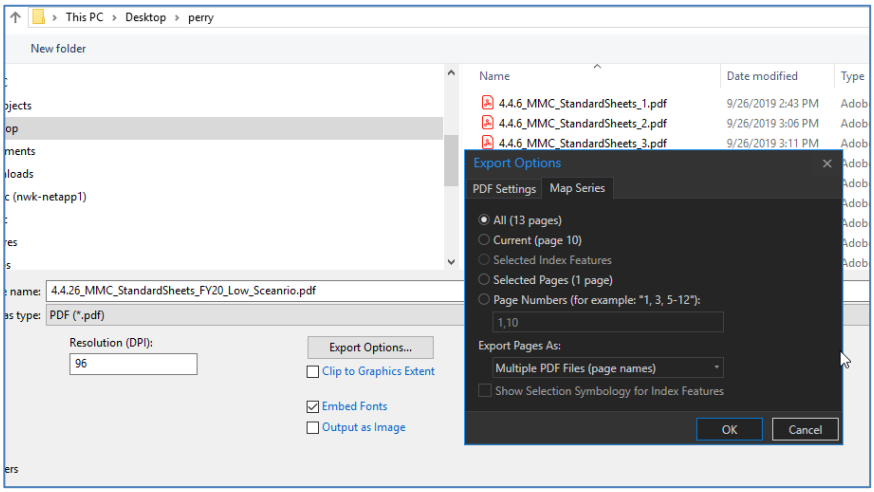


Figure 4-7. Map Series

6. Choose export to save the street series to the appropriate location as .pdf files and name accordingly. There is no need to add the Page Number onto the Standard Sheet export names, as the Page Number will automatically append to the end of the PDF name. Once the street series has passed the Mapping Review, and all edits have been made, the aerial series should also be exported.

Section 5
Detail Sheet Development

The Detail Sheets are created by selecting the 4.4.28_MMC_DetailSheets map tab and setting the data sources for the various data layers. Once the individual Detail Sheets are set up the Map Book can be set-up, creating a Sheet for each panel in the series.

5.1 SET DATA SOURCES

1. Open the map template. The layers will have a red exclamation point next to them; indicating the computer is not able to find a layer in the expected location.
2. Right click the layer name and choose Repair Data Source or go to the layer properties dialog and under the Source tab and set the data source. Point the layer source to the correct feature class, either in the MMC National Mapping Data database or in the working geodatabase created earlier (feature class sources are listed in Appendix 4.1.6, MMC Data Specifications document). Alternatively, you can click on the red exclamation point to set the data source for a single layer, automatically re-set the sources for all layers in the same workspace, given that the names of the feature classes are the same.
3. The layer order for the base map layers is as follows:

- Annotation[7]
    - Cities_D_Anno
    - USNG_Grid_D_Anno
    - Flood_Information_Data_Point_D_Anno
    - USACE_Dams_D_Anno
    - Non_USACE_Dams_D_Anno
    - USGS_RTS_Gages_D_Anno
    - Counties_D_Anno
    - States_D_Anno.

- Base Map Elements
    - Infrastructure
        - Airports
        - Broadcast Communications
        - Colleges and Universities
        - Electric Power Generation
        - Electric Substations
        - Emergency Medical Services
        - Firestations–Fire/EMS
        - Firestations–Fire Only

[7] You will remove existing annotation references in the templates noting their order and generate your own.

        - Heliports
        - Hospitals–General
        - Hydroelectric Power Generation
        - Intermodal Terminal Facilities
        - Law Enforcement
        - Natural Gas Storage
        - Non-USACE Dams
        - Nuclear Electric Power Generation
        - Petroleum Bulk Stations and Terminals
        - Schools
        - State/Local Correctional Facilities
        - USACE Dams
        - USGS_RTS_Gages
        - Wastewater Treatment Plants.

    - National Levee Database
        - Closure Structure Lines
        - Levee Centerlines
        - Floodwall Lines.

    - Boundaries/Lines
        - USNG_Grid
        - Standard_Sheets
        - Countries_Ln
        - States
        - Counties
        - Cities
        - Railway Lines
        - Natural Gas Pipelines.

- Flood_Inundation_Data

    - Flood_Information_Data_Point
    - Dike Breach (optional).

- SCENARIO_CHOICE

    - MAX_HIGH_BREACH_Scenario_Depth_Grid.tif
    - NORMAL_HIGH_BREACH_Scenario_Depth_Grid.tif.

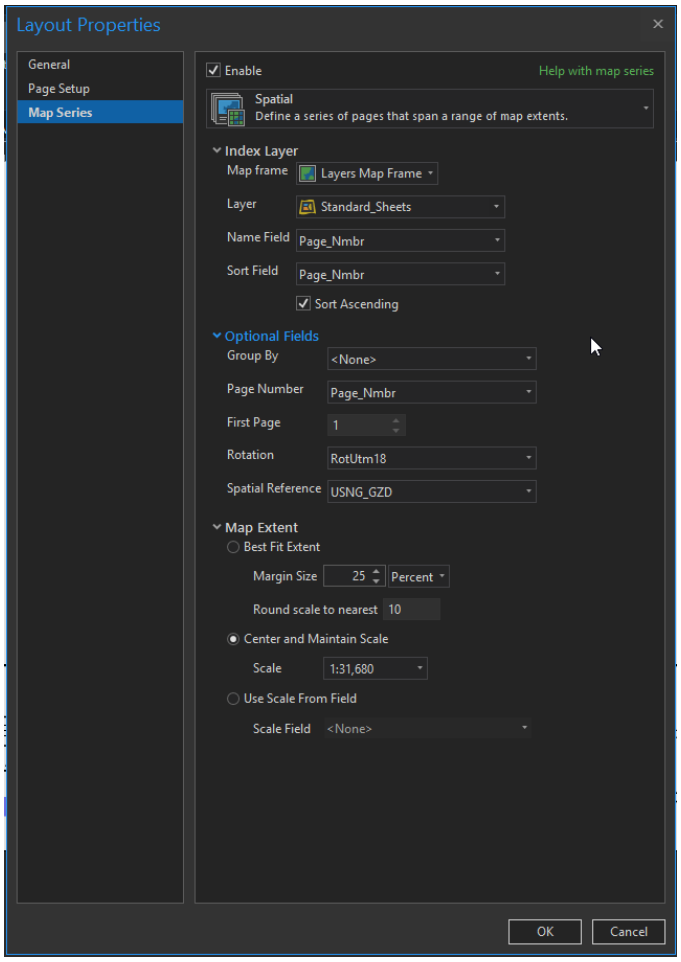
- World_Street_Map

- Imagery Background

    - Reference/World Transportation
    - World Imagery.

5.2 SET DATA FRAME PROPERTIES

The Detail Sheet layer has a field that holds a rotation value for most of the UTM zones in the continental United States. This value rotates the data frame orienting the sheet correctly on the page. Map Book applies this rotation to the main data frame when it is set up, however it is useful to set the rotation on the data frames



at this point when setting up the map. A representative rotation value can be chosen from the attributes of the center-most Detail Sheet in the group to be mapped.

Figure 5-1. Setup Map Series

1. Right click on the Layers and choose Properties. In the Coordinate System tab select the coordinate system for the proper UTM Zone. If the study area crosses UTM Zones, the process for creating Standard Sheets and Detail Sheets will apply for all additional UTM Zones used. Each UTM Zone used requires a new map book set up and pdf export. Ensure the horizontal units are set to meters.
2. In the General Tab, set the rotation value to the rotation value from the Detail Sheet attribute table for the current UTM zone.

5.3 MAP BOOK SET UP

From the layout ribbon, select the Map Series tool.

1. Fill out the form, selecting the sheets for the layer, and page number for the name field as shown in Figure 4-1. Choose the rotation field based on the UTM used for the study and maintain the standard or detail scale.
2. Click OK to create the map series.
3. The map series is shown in the table of contents and is used to navigate between pages.

5.4 LINKED TEXT

Dynamic Text element are used for the map series. These dynamic text fields should automatically populate when using the template. If not, they can be manually adjusted.

Table 3 in the reference section, lists the text elements that must be linked to the index attribute table, the fields that they map to, and the rough location of the text element on the map panel.

5.5 ANNOTATION

The MMC maps will use editable annotation feature classes to label features on the map. Annotation will be created per study area.

Table 4 in the reference section and Appendix 4.1.7, MMC Graphics Spec, outline the layers that need annotation built and the format to be used. Annotation should be built at a scale of 1:31,680 and stored in the working geodatabase. The layers in the map template should have their label properties set to the correct anno properties, but double check to make sure.

1. Set the reference scale for the map layer to make sure that all labels display correctly.
2. Turn on the labels for features one at a time, by right clicking each layer name in the table of contents.
3. Use the labels to annotation tool in ArcGIS Pro, see figure 4-2.
4. Place annotation in an appropriate location without overlapping point features. Avoid placing annotation in the inundation area if possible.

1. If possible, place annotation so that it does not overlap ESRI generated labels in the background. In some instances, annotation will have to overlap ESRI generated labels, this is known and expected.

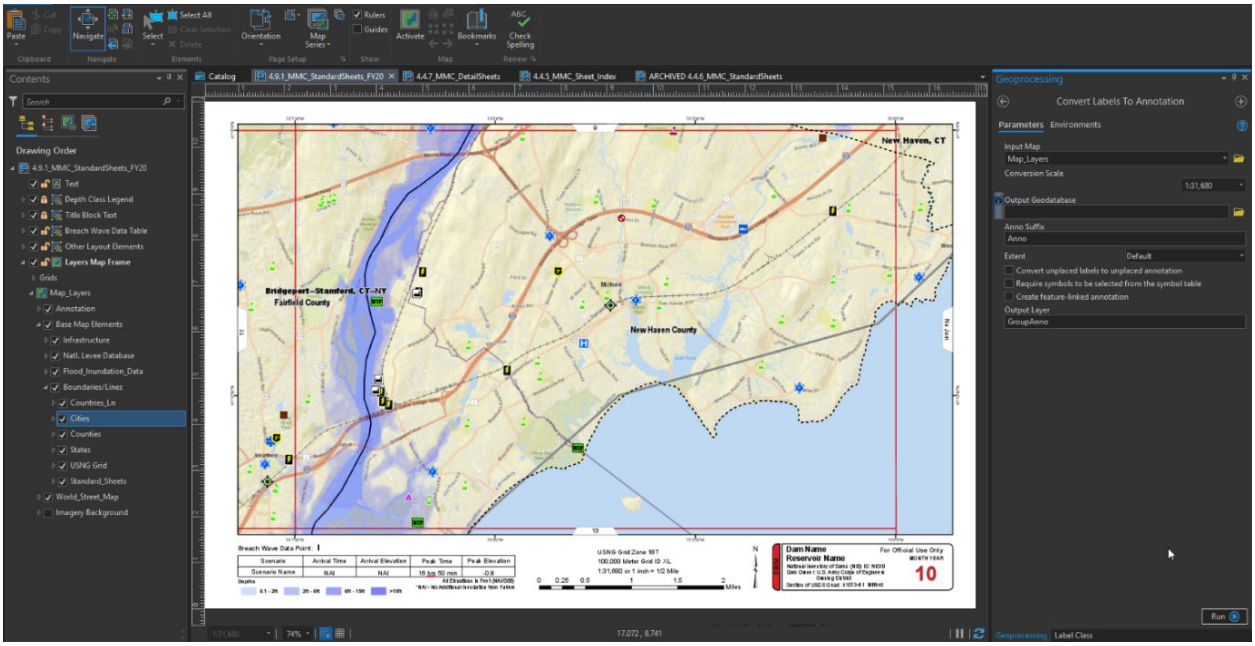


Figure 5-2. Labels to Annotation

5.6 CHOOSE THE SCENARIO

There are two SCENARIO_CHOICE groups that must be toggled in the 4.4.28_MMC_DetailedSheets tab. The first group controls the information in the Flood Information Data Point Table. The second group specifies which depth grid to use.

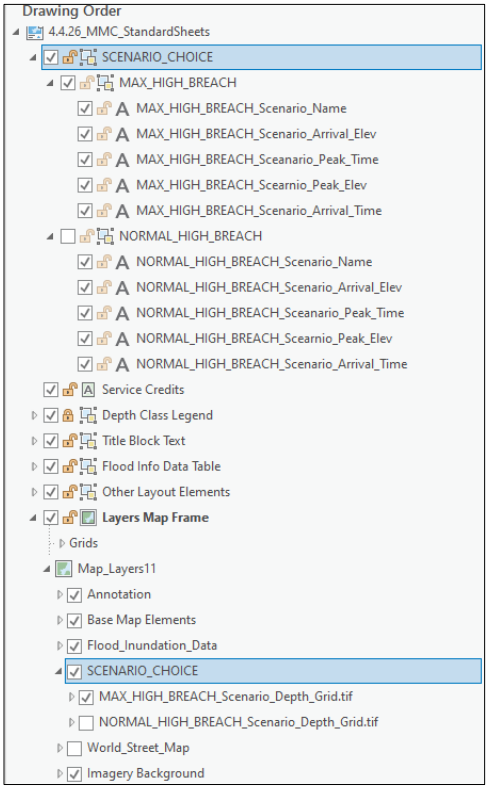


Figure 5-3. SCENARIO_CHOICE layers

5.7 EXPORT TO PDF

Once the map series is properly set up, export the map series to the AtlasPages folder under the FullResolution folder in the PDF Maps directory. Turn off or remove from the table of contents the base data feed that you are not including in the maps (World_Street_Map, or World_Imagery) prior to exporting.

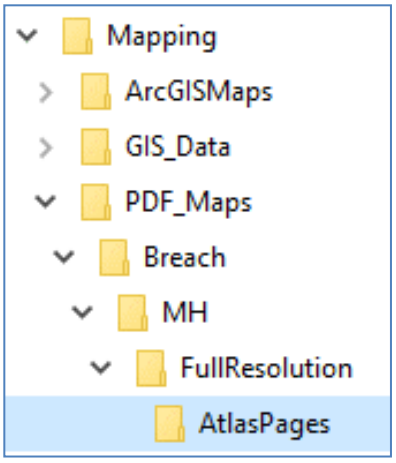


Figure 5-4. Folder Structure

Make sure all guides are turned off, labels are turned off, and selected features are cleared before exporting to PDF.

1. From the Share ribbon, select layout export.
2. Use the file naming:
   DBIM_[Study Dam Fiscal Year]_[NIDID]_S_[Page Number].pdf (street view)
   DBIM_[Study Dam Fiscal Year]_[NIDID]_A_[Page Number].pdf (aerial view)
3. Choose to embed all fonts.
4. Select the export options and under PDF settings, under layers and attributes, choose 'None.'
5. Under map series, choose to export all as Multiple PDF Files (page names).

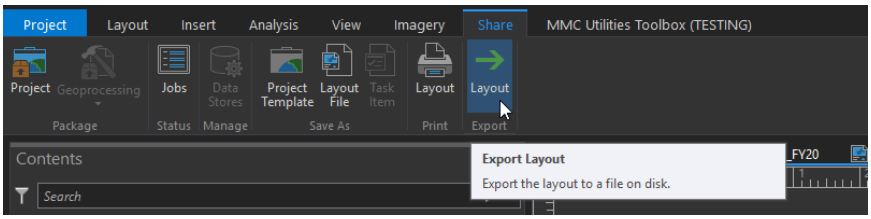


Figure 5-5. PDF Export

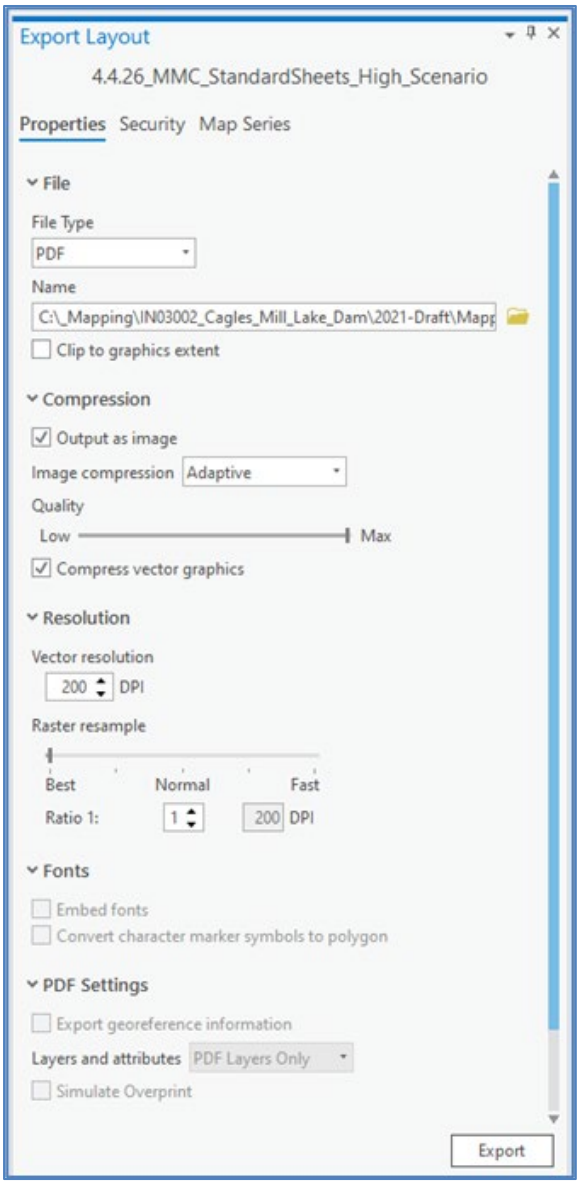


Figure 5-6. PDF Settings

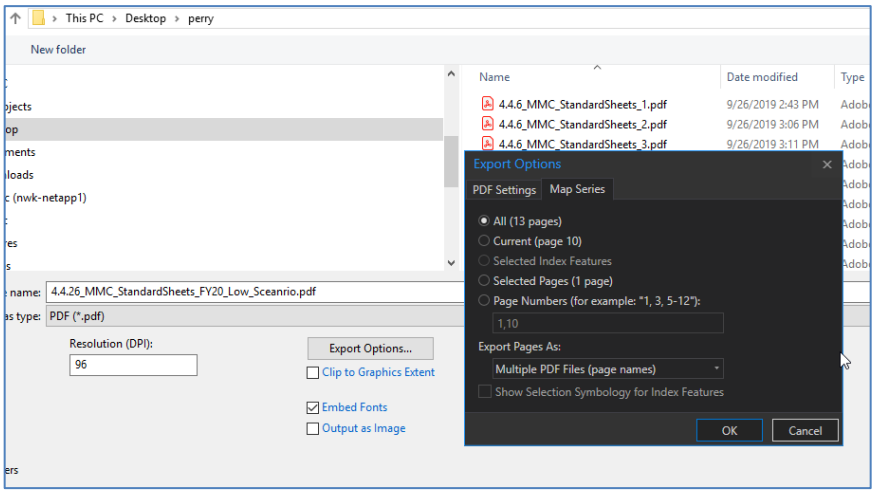


Figure 5-7. Map Series

6. Choose export to save the street series to the appropriate location as .pdf files and name accordingly. There is no need to add the Page Number onto the Standard Sheet export names, as the Page Number automatically appends to the end of the PDF name. Once the street series passes the Mapping Review, and all edits are made, the aerial series should also be exported.

Section 6
Critical Infrastructure Table

If a printed inundation atlas were opened on a tabletop with a map sheet on the right, or front side of the pages, the critical infrastructure page would be on the left, or back side of the pages. This is a lookup table of data for corresponding critical infrastructure on the adjacent page.

6.1 DATA SETUP

To populate the data in the critical infrastructure table, the following steps must be performed in a new blank ArcGIS Pro document.

1. Load the MH_Breach.tif, NH_Breach.tif, and Standard_Sheets feature classes from the Inundation geodatabase into the map.

2. Section 6.2 lists steps for 2D only models. Section 6.3 lists steps for 1D models. The steps in Section 6.4 create the critical infrastructure sheet regardless of the model type, all model types will have the same lookup sheet.

6.2 EXTRACT VALUES TO POINTS—TWO-DIMENSIONAL ONLY MODELS

These steps walk through a series of extracting values from the flow area cells to the point symbols for display on a lookup table.

1. Import the template Critical_Points feature class to your working geodatabase.
2. Load the existing critical infrastructure and key resources (CIKR) point data to the Critical_Points feature class (this retains the name, address, and point type for each point).
3. Run the extract values to points tool against the max depth high scenario. Copy the results into the depth_MH field.
4. Run the extract values to points tool against the normal high depth scenario. Copy the results to the depth_NH field.
5. Delete any points that did not populate either a MH or NH depth value (these points are outside of the inundation area).
6. Run a spatial join from the critical points feature class to the MHB.gdb FlowAreas_Cells polygon. Once the join is complete, field calculate over the arrival time, peak time, arrival elevation and peak elevation for the MH data. Repeat using the NH data.
7. Add the standard sheets layer to the ArcPro session. Run a select by location against the critical infrastructure points feature class. The highlighted sheets are areas where CIKR points exist. Export the selected features to a new feature class named Standard_Sheets_Lookup_MH_Breach.
8. Perform a select by attributes on the Critical_Points where Depth_NH is not null. Then, use the selected Critical_Points to select by location from the Standard_Sheets. The highlighted sheets will be areas where CIKR points exist for the normal high breach scenario. Export the selected features to a new feature class named Standard_Sheets_Lookup_NH_Breach.
9. This completes the data preparation for 2D models only for the critical infrastructure. Move to Section 6.4 for exporting critical infrastructure lookup sheets.

6.3 EXTRACT VALUES AND CREATE A TRIANGULATED IRREGULAR NETWORK DATASET—ONE-DIMENSIONAL ONLY MODELS

1. Import the template Critical_Points feature class to your working geodatabase.
2. Load the existing critical infrastructure points to the Critical_Points feature class (this will retain the name, address, and point type for each point).
3. Run the extract values to points tool against the max depth high scenario. Copy the results into the depth_MH field.
4. Run the extract values to points tool against the normal high depth scenario. Copy the results to the depth_NH field.
5. Delete any points that did not populate either a MH or NH depth value (these points are outside of the inundation area).
6. Convert the XSCutlines feature class from the MH_Breach.gdb to a triangulated irregular network (TIN) dataset using the Create TIN tool. Use all cross sections for the max scenario (steps will be repeated for the normal scenario). It is important that the TIN dataset cover completely the extent of the maximum inundation polygon.

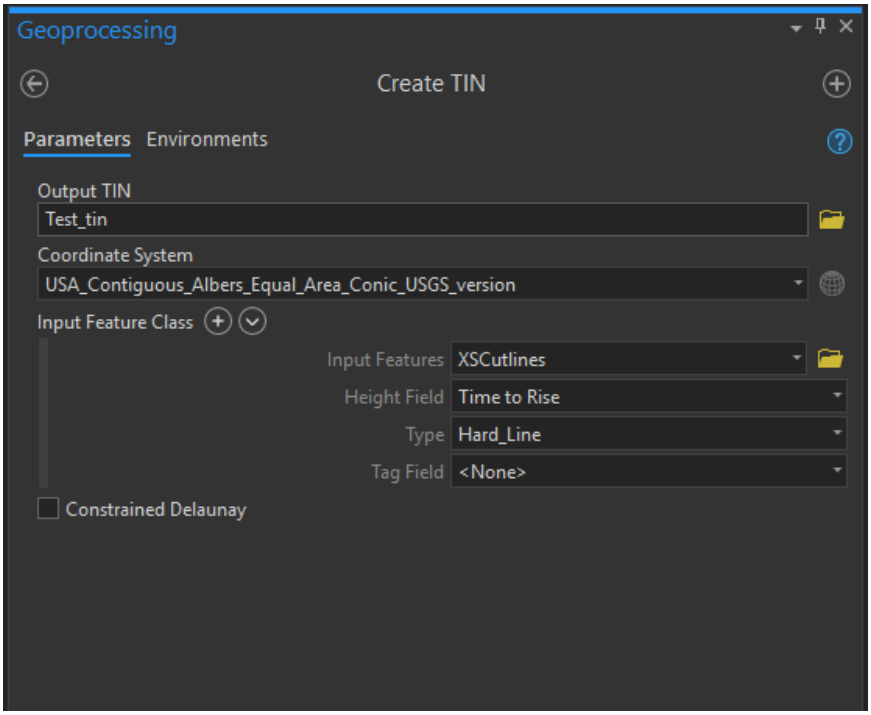


Figure 6-1. Create Triangulated Irregular Network

7. Convert the resulting TIN to a raster dataset using the TIN to Raster tool.

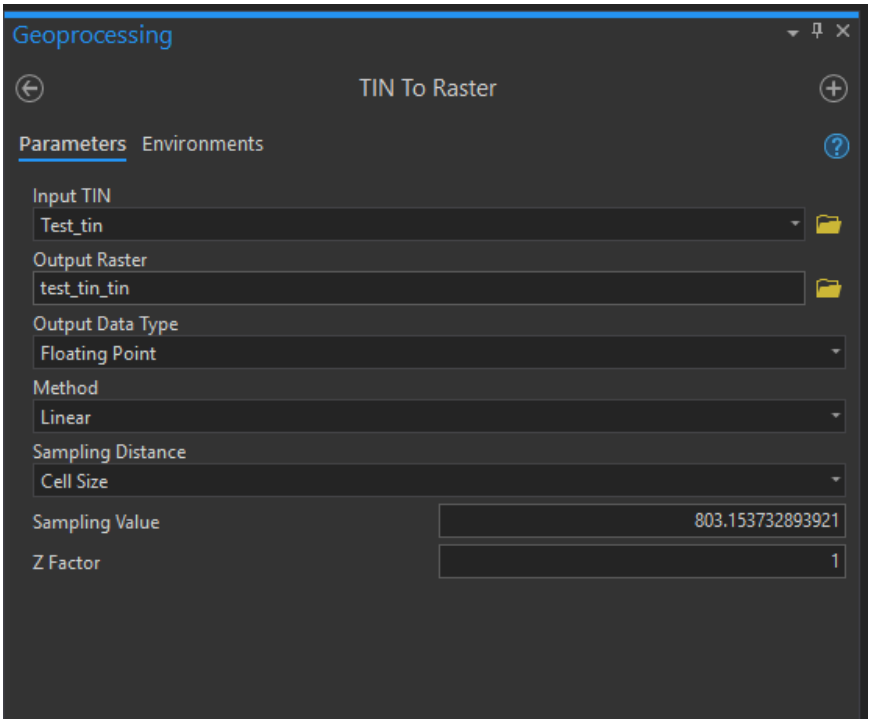


Figure 6-2. Create RefMileGrid Dataset

8. Repeat creating the TIN and Grid for arrival time, peak time, arrival elevation, and peak elevation for both scenarios.
9. Run the extract values to points tool against the new grids.
10. Copy the results into the appropriate fields in the Critical_Points feature class.

Note

The normal high breach scenario will likely not have depth values for all the critical points. Only copy normal high breach timing and elevation values for points with normal high breach depth values.

11. Add the standard sheets layer to the ArcPro session. Run a select by location against the critical infrastructure points feature class. The highlighted sheets are areas where CIKR points exist. Export the selected features to a new feature class named Standard_Sheets_Lookup_MH_Breach.
12. Perform a select by attributes on the Critical_Points where Depth_NH is not null. Then, use the selected Critical_Points to select by location from the Standard_Sheets. The highlighted sheets will be areas where CIKR points exist for the normal high breach scenario. Export the selected features to a new feature class named Standard_Sheets_Lookup_NH_Breach.
13. This completes the data preparation for 1D models only for the critical infrastructure. Move to Section 6.4 for exporting critical infrastructure lookup sheets.

6.4 EXPORT CRITICAL INFRASTRUCTURE LOOKUP TABLES

1. In the populated critical infrastructure points shapefile, update the format of the time and elevation data for presentation in the critical infrastructure sheets.
2. For the **elevation** and **depth** fields, round the data to one decimal points. Using the MMC2 toolbox for ArcGIS Pro:
3. Unzip the MMC2_Toolbox.zip file. In ArcPro catalog pane, source to the location of the tool.
4. In ArcCatalog, open the MMC2.tbx - Round Field Value script
5. For the depth, arrival elevation and max elevation fields, use the Round Field Value tool script provided to round the field values to a single decimal point format.
6. Run the tool. In the first parameter, choose your file location. In the second parameter, choose the input field name (RiseElev_NH, MaxElev_NH, RiseElev_MH, MaxElev_MH, Depth_NH, Depth, MH). Then hit run.

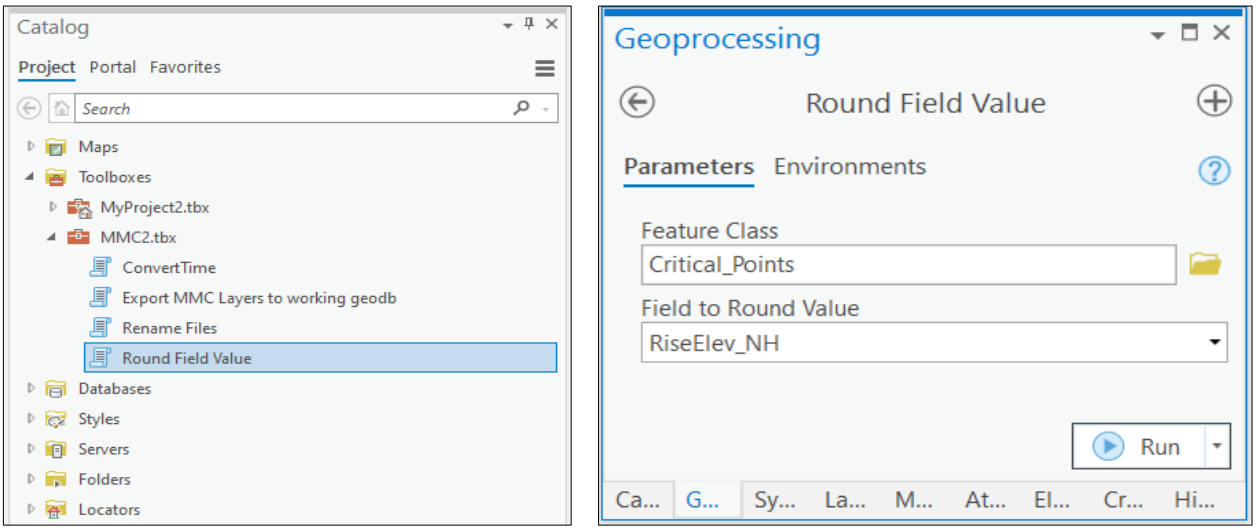


Figure 6-3. Round Values

7. For the arrival time and max time fields, use the ConvertTime tool script provided to convert the decimal times to hours/minutes format.
8. In ArcPro catalog pane, source to the location of the tool.
9. Run the tool. In the first parameter, choose your file location. In the second parameter, choose the input field name (Time2Rise_NH, Time2Rise_MH, Time2Max_NH, Time2Max_MH). Then hit run:

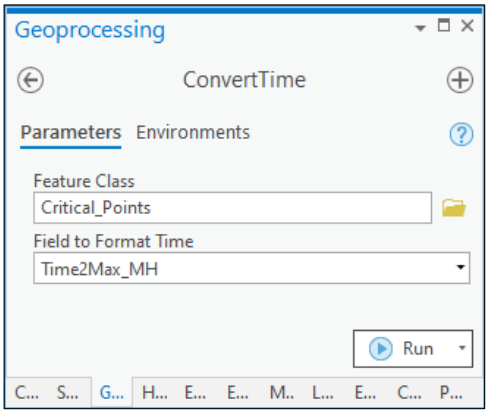


Figure 6-4. Convert Time

10. The data should now show all time data as hours/minutes and depth/elevation data rounded to one decimal point.
11. Open the FY21_Breach_Dam_Templates ArcPro project and go to the 4.4.29_Critical_Infrastructure_Lookup_Table tab.
12. Update the title block information with the Dam name, Reservoir Name, NIDID, Owning District, and month year.
13. Update the top of dam elevation from the consequences data.
14. Source the Standard_Sheets_Lookup_MH, Standard_Sheets_Lookup_NH, and Critical_Points layers to the working geodatabase.
15. Update the map series information to your standard sheets set.

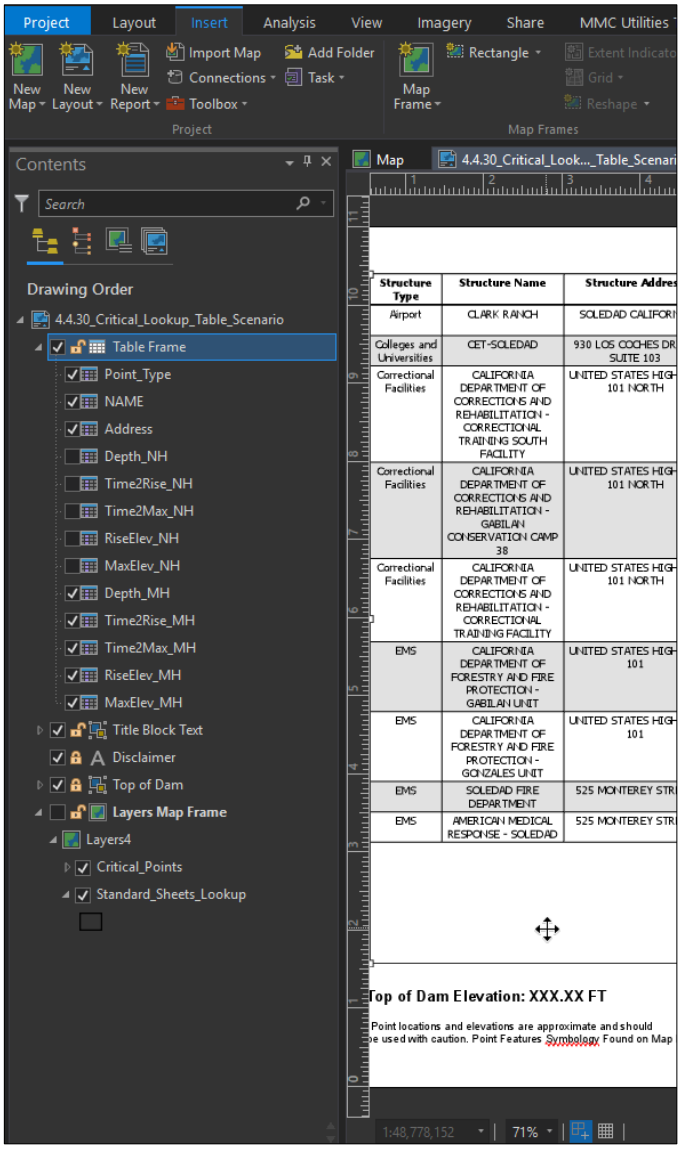


Figure 6-5. Table Frame Layers

16. Set the sorting to be by arrival time. Right click the table frame layer and select properties. Then, on the table frame window, choose arrangement. Verify the correct Time2Rise field is selected or update as needed.

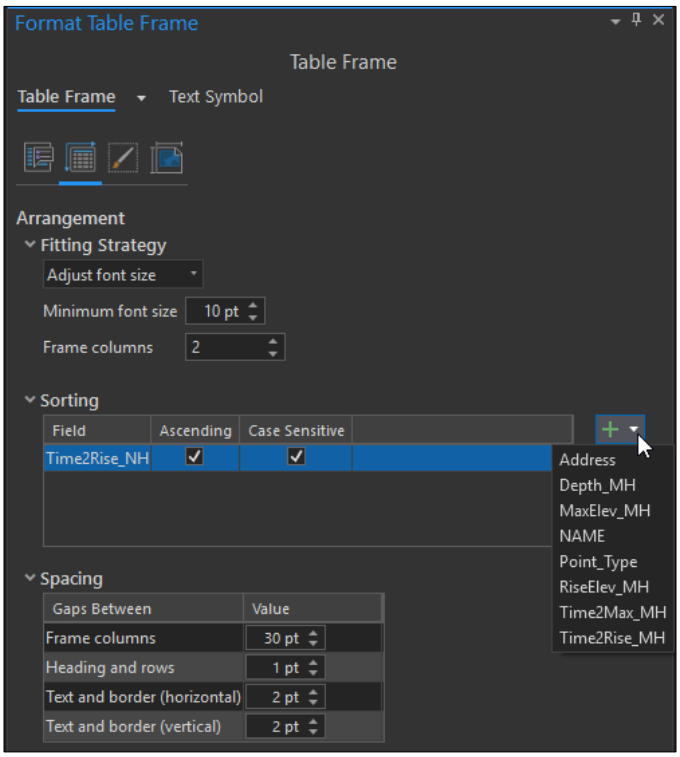


Figure 6-6. Table Frame Arrangement

17. Refresh the map series. The page number should update.
18. Check that the Table Frame data updates with the map series. The table fields may need to be resized for your dataset.
19. Under SCENARIO_CHOICE turn on the MAX_HIGH_BREACH or NORMAL_HIGH_BREACH layers for testing and exporting.
20. Select the Map Series Pages in the contents window and open the properties for the 4.4.29_Critical_Infrastructure_Lookup_Table.

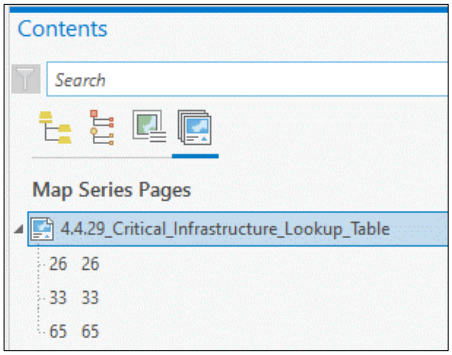


Figure 6-7. Map Series Pages

21. In the Layout Properties, select Map Series on the left and change the following fields based on the scenario.

    a. Under Index Layer the Layer should be either Standard_Sheets_Lookup_MH_Breach, or Standard_Sheets_Lookup_MH_Breach depending on which scenario is being mapped.

    b. Set the Name Field and Sort Field to Page_Nmbr

    c. Under Optional Fields set the Page Number to Page_Nmbr.

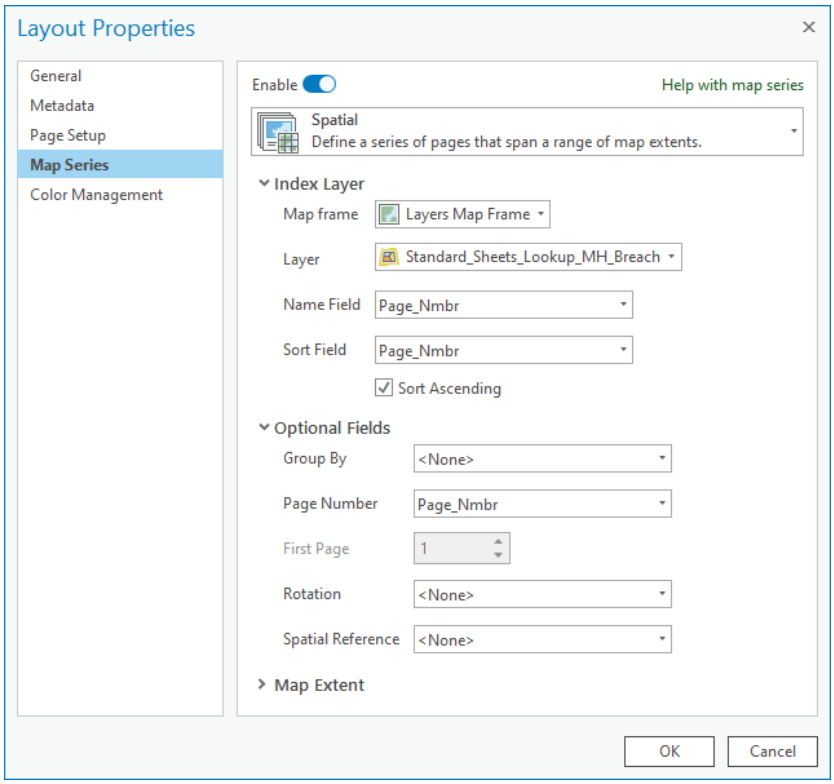


Figure 6-8.Map Series Layout Properties

22. Once the map series and table data is updating correctly, choose layout on the share ribbon.
23. Export the map series to PDF using the naming: DBIM_[Study Dam Fiscal Year]_[NIDID]_F_[Page Number].pdf.

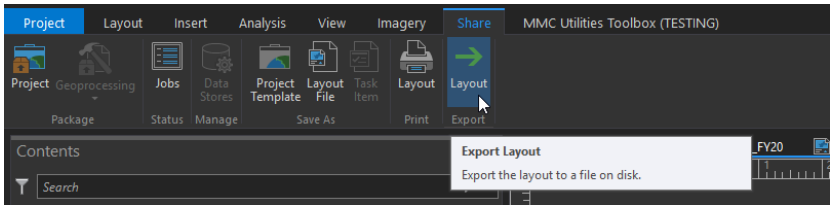


Figure 6-9. PDF Export

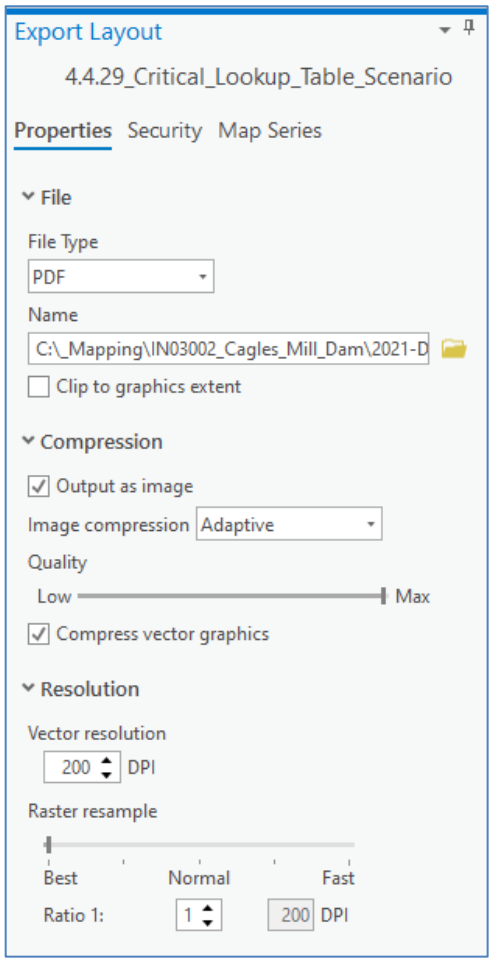


Figure 6-10. PDF Settings

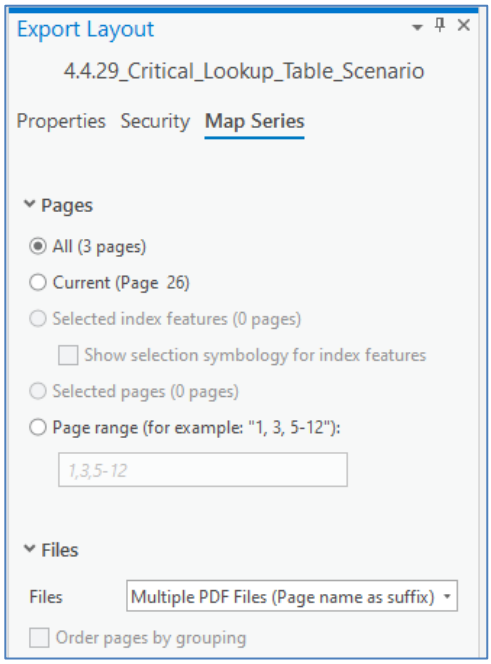


Figure 6-11. Map Series

24. Repeat steps 12–17 for the remaining scenario, remembering to update the selected layers under table frame and the sorting field in arrangement.

Section 7
Sheet Index Map Creation

The Sheet Index Map is a full-sized index for the entire study area. It consists of a main map data frame that shows the full extent of the study area and a locator map showing an even larger area. The map uses the same data sources as the Standard Sheets but is displayed at a different scale. The Sheet Index Map template is included as the 4.4.24_MMC_Sheet_Index tab. The Sheet Index Map may be modified from the template to improve the usability of the map and provide useful information. These updates should be discussed at the mapping kickoff meeting with the owning district. Data sources may be removed or added as needed, if they are listed in Appendix 4.1.6 as a standard MMC data source. Use judgment to choose a base map that looks best for that area. Update any changes to data sources in the legend appropriately. Examples of typical changes include: adding cities, adding both High and Low inundation scenarios, adding detailed sheets, revising base map, and adding counties to locator map.

7.1 SET DATA SOURCES

1. Open 4.4.24_MMC_Sheet_Index tab. The layers will have a red check mark next to them; indicating the computer is not able to find a layer in the expected location.
2. Reference each layer by either right clicking the layer name and choosing Repair Data Source or going to the layer properties dialog and under the Source tab, setting the data source.
3. Point the layer source to the correct feature class, either in a Corps-Map database or in the working geodatabase created earlier. The state and county lines should be used from the national data geodatabase to show data outside of the mapped extents.

7.2 SET DATA FRAME EXTENTS

1. Each of the data frames on the map need the extents set. Right click on the Standard_Sheets layer and select Zoom to Layer, to zoom the data frame to the study extents.
2. Set a reference scale that displays all the Standard_Sheets and some area outside of the Standard Sheets Grid. Each study dam will have a different reference scale depending on the number of sheets and size of study area.
3. Open the Data Frame Properties dialog box and under the “General” tab, paste the rotation value from the Standard_Sheets into the text box for rotation and change the coordinate system to the appropriate UTM for the study area.
4. For the locator map data frame, add an extent rectangle and zoom to the appropriate location of the study dam. Use the same coordinate system and rotation value as in the main data frame.
5. Set the reference scale so that the extent rectangle is in the center of the data frame.
6. In the locator map data frame, create annotation for states. Format for text is: Arial Narrow, size 14, black, bold, white halo 1 point. Adding counties and county names may be useful. Use best judgment in making the locator map useful.

7.3 SHEET INDEX MAP ANNOTATION

The required annotation for the Index Sheet Map can be found in Table 4 and more detail can be found in the MMC Graphics Specification document. Annotation should be built at Sheet Index Map scale and stored in the working geodatabase.

1. Label the appropriate features in the index, following the description in Table 4 in the reference section and the Graphics Specifications.
2. Right click the current layer and select Convert Labels to Annotation making sure the correct reference scale is set for the index.

Annotation should be placed in an appropriate location without overlapping other important features. If possible, place annotation so that it does not overlap ESRI generated labels. In some instances, annotation will have to overlap ESRI generated labels, this is known and expected.

7.4 CHOOSE THE SCENARIO

There are three SCENARIO_CHOICE groups that must be toggled in the 4.4.24_MMC_Sheet_Index tab. The first group controls the scenario name that will be displayed on the sheet. The second group displays the breach wave arrival time annotation. The third group displays the inundation area.

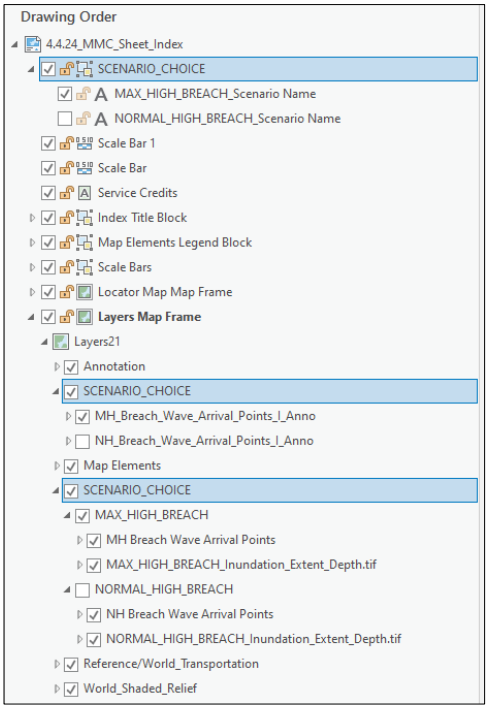


Figure 7-1. SCENARIO_CHOICE Layers

7.5 EXPORT TO PDF

Once the map is set up properly, export the map to the AtlasPages folder under the FullResolution folder.

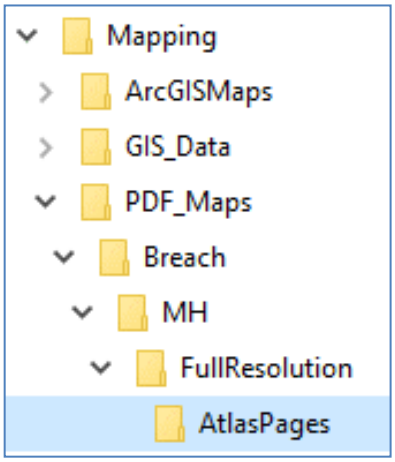


Figure 7-2. Folder Structure

Make sure all guides are turned off and selected features have been cleared before exporting to pdf.

1. Go to the Share tab→Export Layout
2. Under Properties, File Type is ‘PDF’, ‘Output as image’ is checked, Image compression is ‘Adaptive’, Quality is ‘Max’, check ‘Compress Vector Graphics’, Use the settings of 200 dpi, Best resample ratio (1:1).

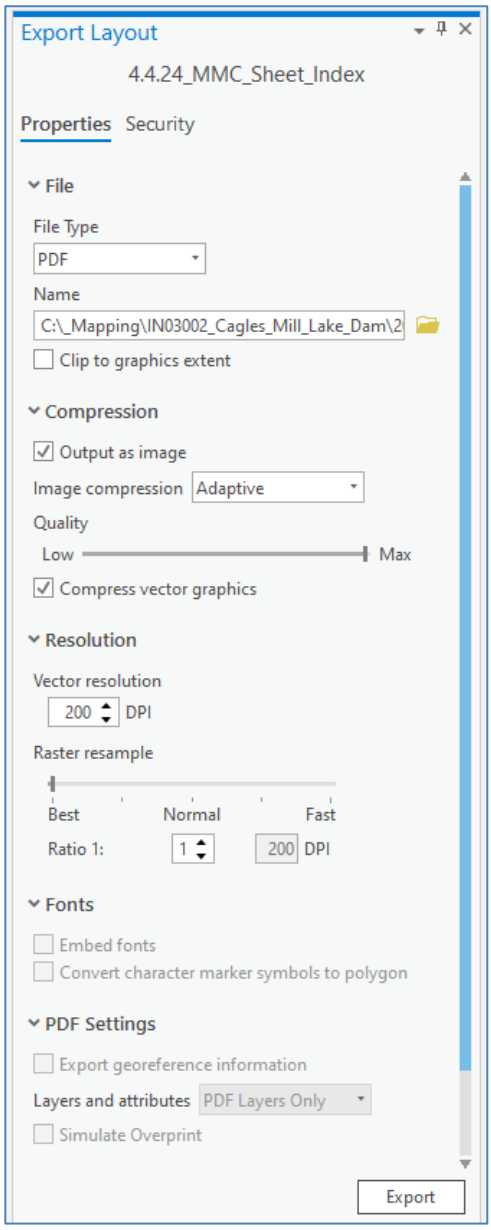


Figure 7-3. PDF Export Settings

3. Name the .pdf file: DBIM_[Study Dam Fiscal Year]_[NIDID]_Sheet_Index.pdf

Section 8
Cover Page Set Up

The cover page will be isstandard for all study areas, with the information on the title block changing for each study area. The cover page is provided and named 4.4.1_MMC_Cover_Page.pptx.

Appendix 4.1.7, MMC Map Graphics Specifications, shows an example of the cover page and title block. Follow the layout and format as described in the MMC Map Graphics Spec document.

1. Open the cover page template in PowerPoint. Update the title block:

    - Change the Study Dam photo to match the photo in the CAR/HMCAS
    - Study Dam Name
    - Map Series (Street or Aerial)
    - Production Date (Month and Year when map product is ready for 50% internal review)
    - Dam NIDID
    - Dam Federal ID
    - Dam Owner name, two lines.

2. After the title block information has been edited, print the cover page to a pdf file.
3. From the File menu, select save as Adobe PDF.
4. The output page size should default to Tabloid (11 by 17 inch). Save the pdf in the AtlasPages folder under the FullResolution folder.

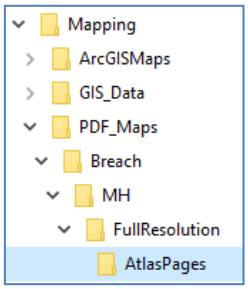


Figure 8-1. Folder Structure

5. Name the .pdf file:

    - DBIM_[Study Dam Fiscal Year]_[NIDID]_Cover_Page_Street.pdf
    - DBIM_[Study Dam Fiscal Year]_[NIDID]_Cover_Page_Aerial.pdf.

Section 9
Map Notes Page

The Map Notes Pages are standard for all study areas and will be provided in the FY21_Breach_Dam_Templates.aprx as tabs 4.4.21_MMC_MapNotesI, 4.4.22_MMC_MapNotesII and 4.4.23_MMC_MapNotesIII. If using the MH and NH scenarios, use the pre-generated MapNotesI.pdf file instead of re-exporting it.

9.1 MAP NOTES I

1. There is one SCENARIO_CHOICE group that needs to be toggled in the 4.4.21_MMC_MapNotesI tab. The Inundation Elements legend is update with the inundation scenarios and definitions with the appropriate naming conventions for your study area.
2. Save the template file for the specific study area.
3. Export the Notes Pages to a .pdf file in the Mapping\PDF_Files folder for the study area. Make sure all guides are turned off and selected features have been cleared before exporting to pdf. Export the pdfs in the AtlasPages folder under the FullResolution folder.
4. Name the pdf file: DBIM_[Study Dam Fiscal Year]_[NIDID]_MapNotesI.pdf.

9.2 MAP NOTES II

1. In the first column, under the section labeled ‘BREACH WAVE ARRIVAL TIME’ the difference between the non-breach simulation and the breach simulation hydrographs needs to be input. Typically, this is two feet. If a different breach wave delta time was used, that number should replace ‘2’ (this is rare and would have been approved by the mapping team lead).
2. Update the model lead and model date in the first paragraph.
3. A community lookup table is included in the excel file. Fill out communities and the sheets that include these communities. To find which communities are inundated on specific pages do the following:
    a. Use the MHB_Extent.shp to clip the Cities_Area.
    b. Take the Cities_Area_Clip and perform a spatial join with the Standard_Sheets layer.
    c. Some communities may fall
4. The pertinent data table needs to be filled out with information pertinent to the dam being mapped. This information is found in the CTS Worksheet on the SharePoint site at: https://team.usace.army.mil/sites/NWK/pdt/MMC/DS/Forms/AllItems.aspx

    If the information cannot be found in the CTS Worksheet, contact the team lead to find the missing data.

    a. The table needs to be filled out using the Excel template Table 2.1 and copy and paste into the Map Notes II page template as a picture.

    b. Typically, only scenarios being mapped need to be displayed in the chart.

[DAM NAME] Dam Pertinent Project Data						
Physical Data (ft, NAVD 88)						
Dam Type		Facility Info Tab, Dam Type				
Dam Length (ft)		Facility Info Tab, Dam Length				
Top of Dam Elevation		Facility Info Tab, Crest Elevatoin				
Spillway Crest Elevation		Facility Info Tab, Spillway Crest Elevation				
Spillway Type		Facility Info Tab, Spillway Type				
Spillway Width (ft)		Facility Info Tab, Spillway Width				
No. of Spillway Gates & Dimensions		Facility Info Tab, Spillway Outlet Gates				
Outlet Structure Description		Facility Info Tab, Outlet Work Gates				
Hydrology (ft, NAVD 88)						
Drainage Area (sq mi)		Facility Info Tab, Drainage Area				
PMF Pool Elevation		Facility Info Tab, Design Water Elevation				
Max. Historic Pool Elevation		Facility Info Tab, Historic Maximum Pool Elevation (date if available)				
Hydrologic Loading Condition	**Antecedent Elevation (ft, NAVD 88)**	**Peak Elevation (ft, NAVD 88)**	**Inflow Hydrograph**	**Peak Inflow (cfs)**	**Peak Outflow (cfs)**	**Storage (acre-ft)**
Scenario Name	Starting Reservoir	)ata Tab, Reservoir Pc	Inflow Hydrograph	Peak Inflow	NonBreach	H&H Data Tab, Storage
Vertical Datum Adjustment (ft NGVD 29 to (ft NAVD 88))		Facility Info Tab, Vertical Datum Adjustment				

Figure 9-1. Map Notes II Table

5. Insert any notes specific to the study area being mapped.
6. Delete any of the template text not used in the text elements for the notes.
7. Insert any supporting graphics needed for the notes.
8. Save the .aprx file for the specific study area.
9. From the Share tab, select Print Layout and choose the printer named Adobe PDF.
10. Click on the Properties button. In the Layout tab, set the layout to Landscape.
11. Set the output page size to Tabloid (11 by 17 inches). Save the pdf in the AtlasPages folder under the FullResolution folder.
12. Name the pdf file: DBIM_[Study Dam Fiscal Year]_[NIDID]_MapNotesII.pdf.

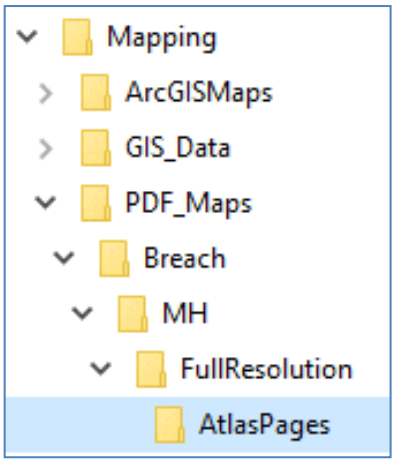


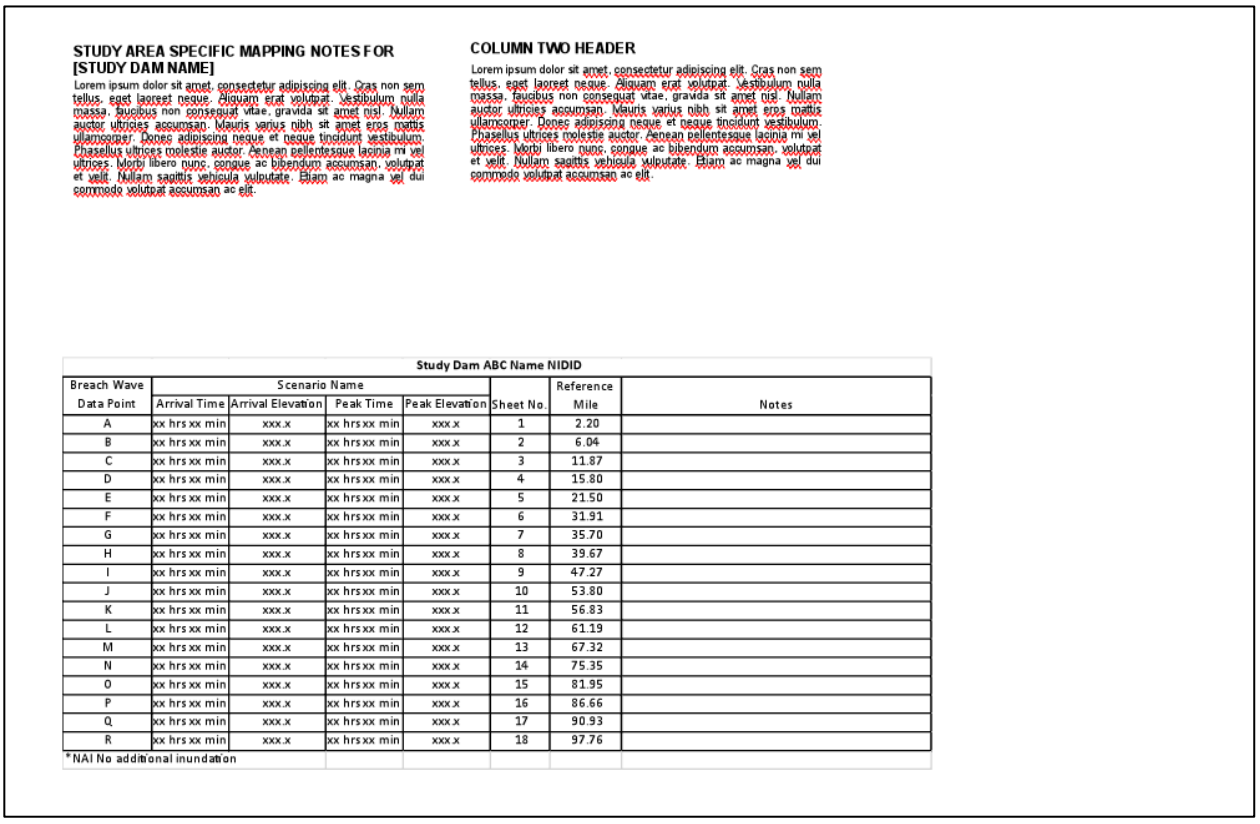
Figure 9-2. Folder Structure

9.3 MAP NOTES III

The third map notes page template is provided as tab 4.4.23_MMC_MapNotesIII. This template should be edited to include any notes to users that affect the individual study area being produced as well as the Lettered Breach Wave Data Point Timing Data Table. The page is made up of three columns, the template file has place holder text that should be removed and replaced with the notes that need to be included.

Screen shots or other illustrations can be added to the notes page as needed.

Figure 9-3. Notes III Page



STUDY AREA SPECIFIC MAPPING NOTES FOR [STUDY DAM NAME]

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Cras non sem tellus, eget laoreet neque. Aliquam erat volutpat. Vestibulum nulla massa, faucibus non consequat vitae, gravida sit amet nisl. Nullam auctor ultricies accumsan. Mauris varius nibh sit amet eros mattis ullamcorper. Donec adipiscing neque et neque tincidunt vestibulum. Phasellus ultrices molestie auctor. Aenean pellentesque lacinia mi vel ultrices. Morbi libero nunc, congue ac bibendum accumsan, volutpat et velit. Nullam sagittis vehicula vulputate. Etiam ac magna vel dui commodo volutpat accumsan ac elit.

COLUMN TWO HEADER

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Cras non sem tellus, eget laoreet neque. Aliquam erat volutpat. Vestibulum nulla massa, faucibus non consequat vitae, gravida sit amet nisl. Nullam auctor ultricies accumsan. Mauris varius nibh sit amet eros mattis ullamcorper. Donec adipiscing neque et neque tincidunt vestibulum. Phasellus ultrices molestie auctor. Aenean pellentesque lacinia mi vel ultrices. Morbi libero nunc, congue ac bibendum accumsan, volutpat et velit. Nullam sagittis vehicula vulputate. Etiam ac magna vel dui commodo volutpat accumsan ac elit.

Study Dam ABC Name NIDID

Breach Wave Data Point	Scenario Name				Sheet No.	Reference Mile	Notes
	Arrival Time	Arrival Elevation	Peak Time	Peak Elevation			
A	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	1	2.20	
B	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	2	6.04	
C	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	3	11.87	
D	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	4	15.80	
E	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	5	21.50	
F	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	6	31.91	
G	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	7	35.70	
H	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	8	39.67	
I	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	9	47.27	
J	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	10	53.80	
K	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	11	56.83	
L	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	12	61.19	
M	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	13	67.32	
N	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	14	75.35	
O	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	15	81.95	
P	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	16	86.66	
Q	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	17	90.93	
R	xx hrs xx min	xxx.x	xx hrs xx min	xxx.x	18	97.76	

*NAI No additional inundation

Figure 9-3. Notes III Page

1. Insert any notes that are specific to the study area being mapped.
2. Delete any of the template text if you do not use the text elements for your notes.
3. Insert the Breach Wave Timing Data Table. Leave the notes column blank. See Appendix 4.1.18 on building the Lettered Breach Wave Data Point Timing Data Table.
4. From the Share tab, select Print Layout and choose the printer named Adobe PDF. Save the .pdf file in the following folder for the study area:

    a. Mapping\PDF_Files\MH\AtlasPages\FullResolution.
    b. Make sure all guides are turned off and selected features have been cleared before exporting

to pdf. To get all the lines from the spreadsheet to display properly it might be necessary to print to pdf instead of export to pdf.

5. Name the .pdf file: DBIM_[Study Dam Fiscal Year]_[NIDID]_MapNotesIII.pdf

Section 10
PDF Inundation Atlas Creation

The MMC Map Atlas tool builds four Inundation Atlases from the individual pdf files for a study area.

10.1 BUILDING INUNDATION ATLASES

1. Run the MmcPdfAtlas_Builder.exe program inside the AtlasBuilder folder in the MMC2_toolbox.
2. In the window, click the source button to select the location of your pdf files for the study area.
3. Then click on “Check PDFs” this will check to see if all pdf files meet format standards for the tool to run. Scroll down the list of pdf files and verify that all files passed. If a file fails, see Section 11.3

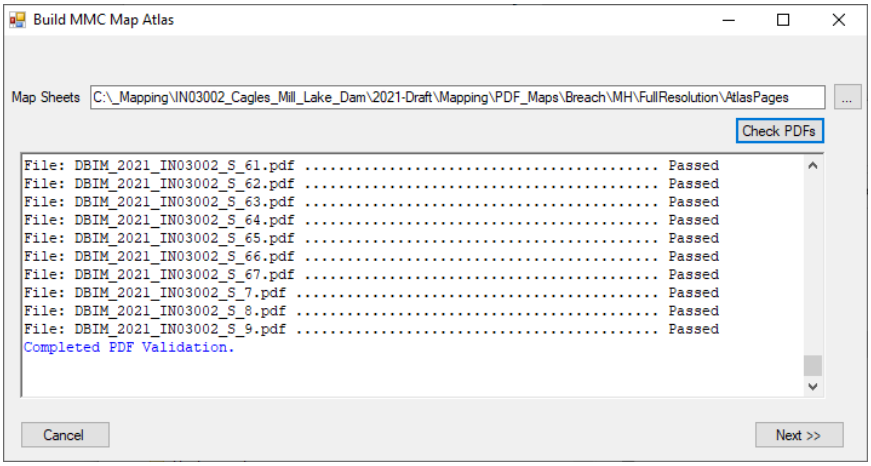


Figure 10-1. Build MMC Atlas

4. Repairing failed PDF files.
5. Once all PDFs are checked, click next. Most of the files will automatically sort based on the name.
6. Verify that all files are correct and source any missing files, then click Next.
7. Select the location you want the Inundation Atlases to be stored in and the number of detailed sheets per standard sheet (usually 4). Click Run. Inundation Atlases should be stored in the “FullResolution” folder.

The tool will create the following Inundation Atlases:

- DBIM_[Study Dam Fiscal Year]_[NIDID]_[SCENARIO (MH or NH)]_A_DIGITAL_Atlas.pdf

  A digital hard copy of the aerial inundation atlas.

- DBIM_[Study Dam Fiscal Year]_[NIDID]_[SCENARIO (MH or NH)]_A_PRINT_Atlas.pdf

  The 11- by 17-inch aerial sheets assembled for printing.

- DBIM_[Study Dam Fiscal Year]_[NIDID]_[SCENARIO (MH or NH)]_S_DIGITAL_Atlas.pdf

  A digital hard copy of the street inundation atlas.

- DBIM_[Study Dam Fiscal Year]_[NIDID]_[SCENARIO (MH or NH)]_S_PRINT_Atlas.pdf

  The 11 by 17-inch street sheets assembled for printing.

- DFIM_[Study Dam Fiscal Year]_[NIDID]_Notes.pdf

  No longer used and can be deleted.

The atlases need to be renamed so they begin the following way:
DBIM_[Study Dam Fiscal Year]_[NIDID]_[SCENARIO (MH or NH)]…

10.2 OPTIMIZING PDF FILES

1. Open Adobe Acrobat DC.
2. Click on the File tab→Save As Other→Reduced Size PDF.

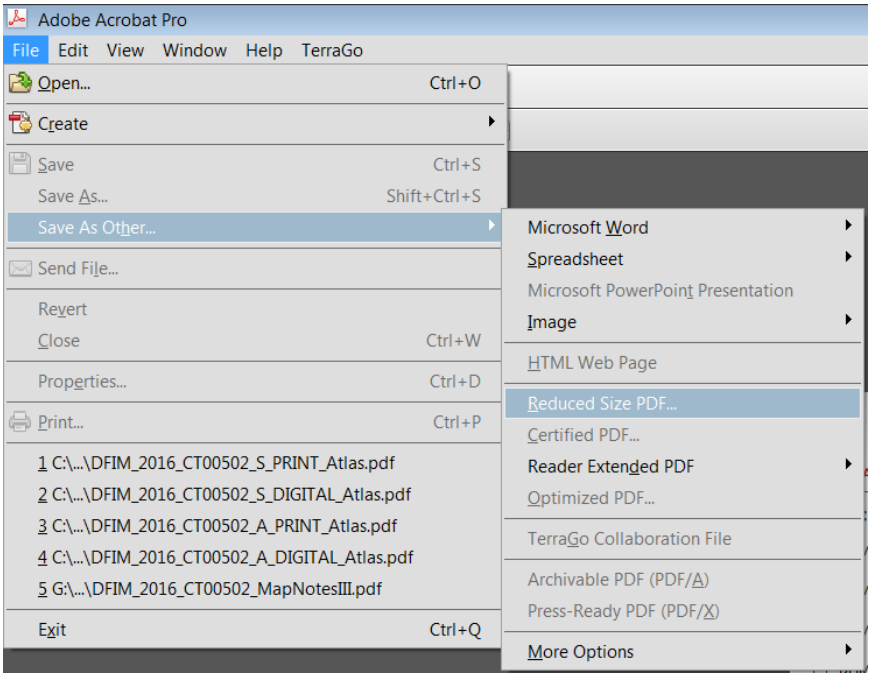


Figure 10-2. Reduced-size PDF

3. Click on Add Files and select Add Files. Open all the full resolution atlas pages.

4. Click Open.

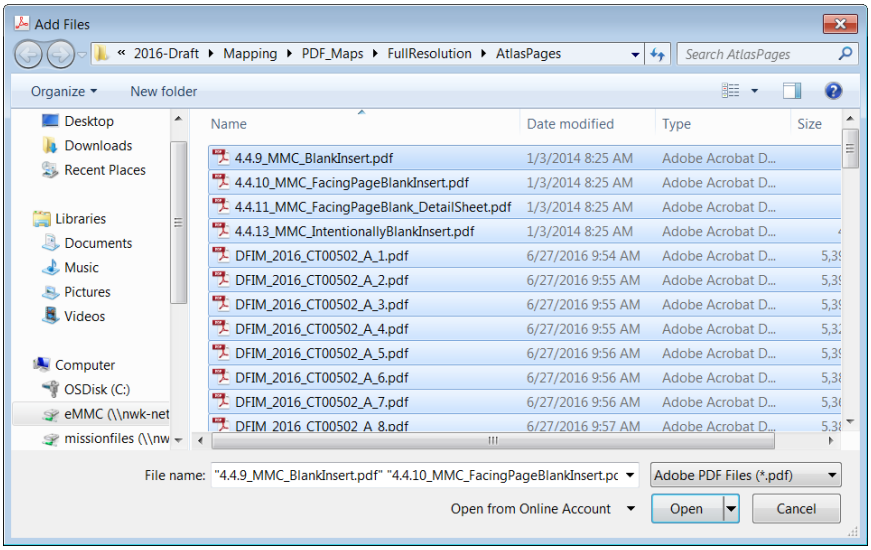


Figure 10-3. Select All Full Resolution Atlas Pages

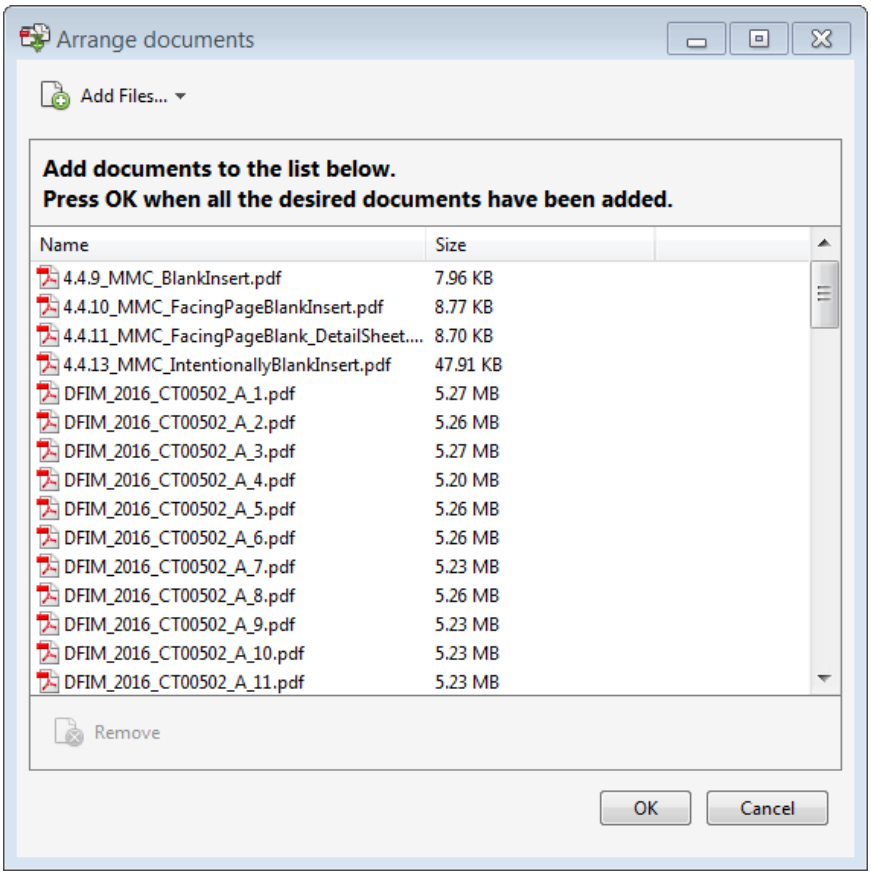


Figure 10-4. Document List

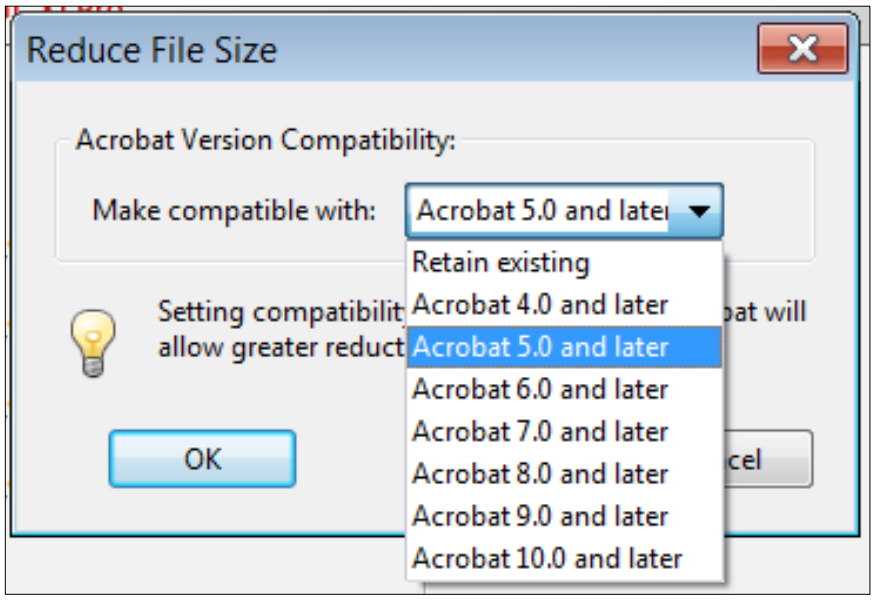


Figure 10-5. Reduced File Size Compatibility

5. Click OK once the document list populates.
6. In the Reduce File Size dialog box, select make compatible with Acrobat 5.0 and later and click OK.
7. A window with the Output Options will open. Select “A Folder on My Computer for the Target Folder” and navigate to the folder to output the optimized files.

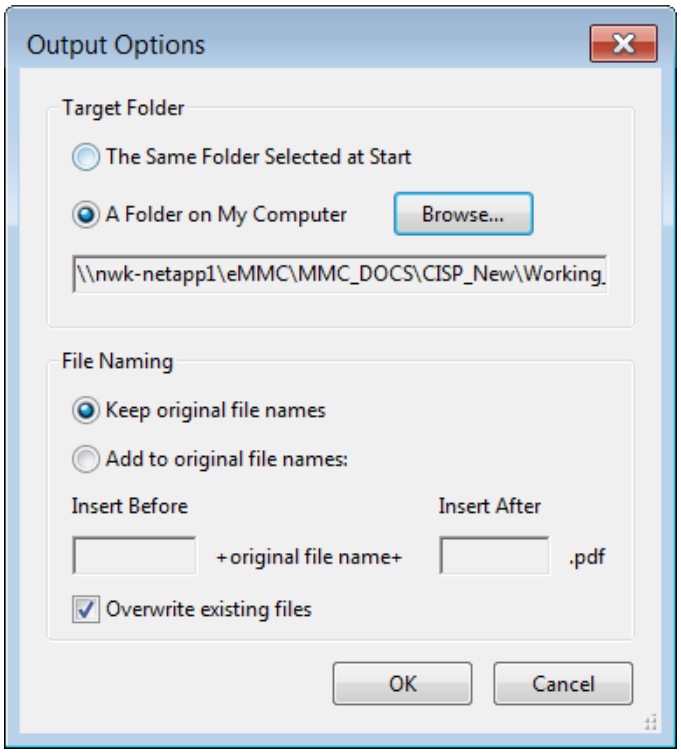


Figure 100-6. Output Options

8. Select the folder to output the optimized files and run the sequence. Click OK.
9. Repeat steps 1–8 for the map books.
10. Verify that files have been optimized by comparing the file sizes of the original pdfs to the newly created pdfs. The original file sizes will be approximately 25,000–30,000 KB while the new file sizes should be approximately 500–1,500 KB.

Section 11
Mapping Reviews

The mapping products produced for the MMC are reviewed at two levels within the MMC program and optionally outside the program. The initial review is an internal GIS/Mapping team review. An assigned member of the GIS/Mapping team reviews all products at this point. Refer to Appendix 4.3.7, MMC Mapping Review Guide, for details on the review process. This section provides descriptions of the mapping products at the review milestones.

Map Review 1:

- Optimized digital street view atlas should be reviewed by another mapper or the Mapping Technical Lead for the district.
- A review is conducted and the reviewed pdf file and review checklist are maintained in the Reviews/Mapping folder.
- The GIS/Mapping team member addresses all comments.

Map Review 2:

- The updated optimized digital street view atlas should be reviewed by the individual that initially reviewed it to ensure all comments were addressed.
- A review is conducted to verify all edits were completed from the first map review and no new edits are required. The completed review checklist is maintained under the Reviews/Mapping folder.
- The completed review checklist is saved in the Mapping subfolder under the Review folder.
- Final data is uploaded to ProjectWise or shipped on an external hard drive to the Kansas City District for storage.

MMC Review:

An optional review may be completed by any member of the MMC production center, MMC customer, or member of the MMC Steering Committee. This review is on an as-requested basis, not initiated by the GIS/Mapping team. The GIS/Mapping team lead delivers the entire study area file structure to the reviewer and any comments received in return are addressed by an assigned member of the GIS/Mapping team.

Section 12
KMZ Creation for Google Earth

12.1 CRITICAL INFRASTRUCTURE AND KEY RESOURCES KMZ CREATION

1. Add the CIKR layers to ArcMap and set the appropriate symbology for each point[8]:

    a. Airports
    b. Broadcast Communications
    c. Colleges and Universities
    d. Correctional Facilities
    e. Electrical Substations
    f. Emergency Medical Services
    g. Firestations–Fire Only
    h. Firestations–Fire/EMS
    i. Electric Power Generation
    j. Heliports
    k. Hospitals–General
    l. Hydroelectric Power Generation
    m. Intermodal Shipping Facilities
    n. Law Enforcement
    o. Natural Gas Storage
    p. Nuclear Electric Power Generation
    q. Petroleum Bulk Stations and Terminals
    r. Natural Gas Pipelines
    s. Schools
    t. Wastewater Treatment Plants
    u. USACE Dams
    v. Non-USACE Dams.

2. Group all CIKR features and name the group layer CIKR
3. Use the Layer to KML tool to convert the CIKR points to a KML file by selecting your group layer (CIKR) as the feature layer to convert.
4. Name the output file: [Dam_Name]_CIKR.kmz in the Google folder.

12.2 MODELING (DEPTH GRID) KMZ CREATION

1. Open Global Mapper to create the Depth Grid KMZ.
2. Open each scenario depth grid.
3. Global Mapper will prompt the user to load the grid as elevation data or other raster image. Click YES to load as elevation (see Figure 12-1).

[8] To save time the CIKR points from the standard sheets map can be used as the symbology is already set for these layers.

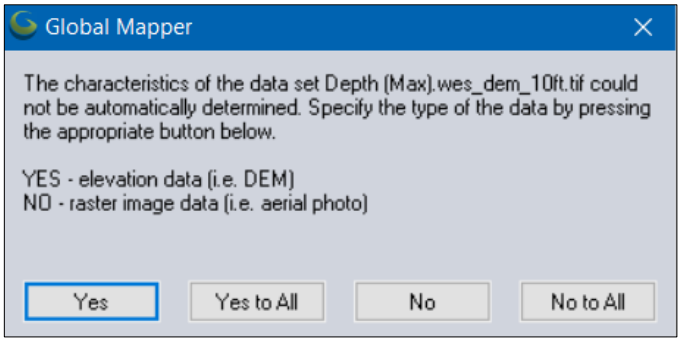


Figure 12-1. Global Mapper Load as Elevation data

4. Next, set the elevation units, choose Feet (See Figure 12-2).

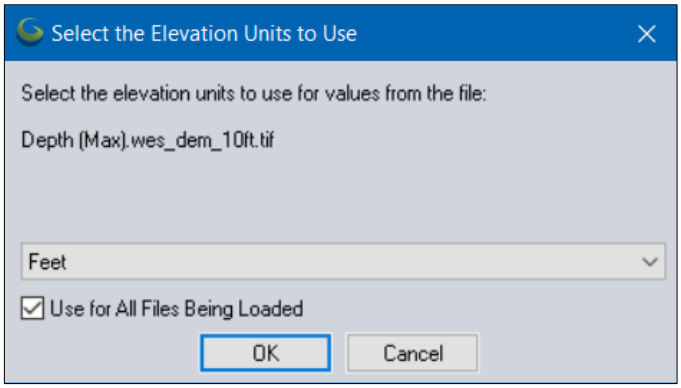


Figure 12-2. Global Mapper Set Elevation Units

5. After opening, name the layer to represent the proper scenario (e.g., MH_Breach, MH_NonBreach, etc.)
6. Create the MMC Depth ranges and color settings. (This only needs to be done once. It will then be saved in Global Mapper for future projects.)

    a. Click the Tools pulldown menu and choose Configure…
    b. Expand the 3D View Properties and click Shader Options.
    c. Under Custom Shaders, click New…
    d. Name the Custom Shader MMC.
    e. In the Height/Slope box enter 2 and choose Feet. Then, click the Add button.
    f. Highlight the added symbol and click the Change Color button.
    g. Enter the RGB values: 203, 242, 245 and click Add to Custom Colors. Click OK.
    h. In the Height/Slope box enter 6 and choose Feet. Then click the Add button.
    i. Highlight the added symbol and click the Change Color button.
    j. Enter the RGB values: 140, 190, 237 and click Add to Custom Colors. Click OK.
    k. In the Height/Slope box enter 15 and choose Feet. Then, click the Add button.
    l. Enter the RGB values: 100, 139, 217 and click Add to Custom Colors. Click OK.
    m. In the Height/Slope box enter 1000 and choose Feet. Then, click the Add button.
    n. Enter the RGB values: 84, 84, 179 and click Add to Custom Colors. Click OK.

o. If checked, uncheck the box for Blend Colors Between Elevation/Slope Values.

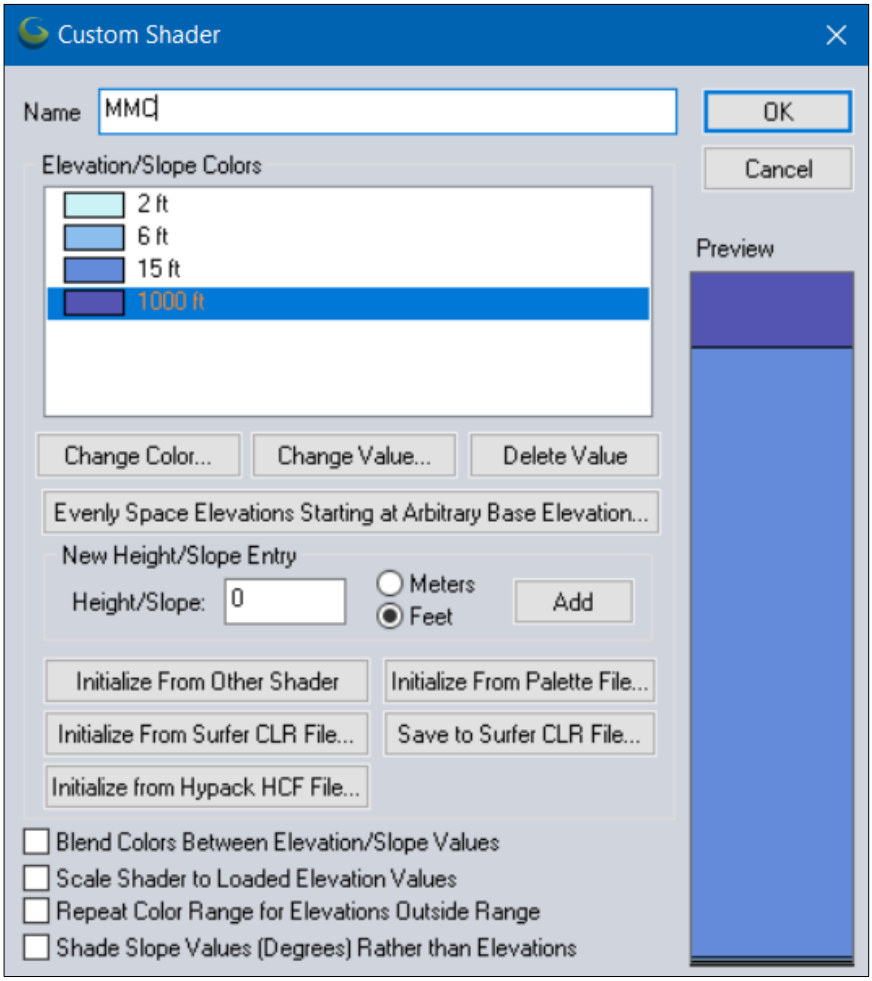


Figure 12-3. Create Custom Shader

p. Click OK to create the custom shader.

7. Double-click the first scenario. Click the Display Tab.

a. Set Translucency to 100 percent (opaque)
b. Set Blend Mode to No Blend
c. Set Resampling to Bilinear Interpolation
d. Set Shader to MMC
e. Turn off Hill Shading

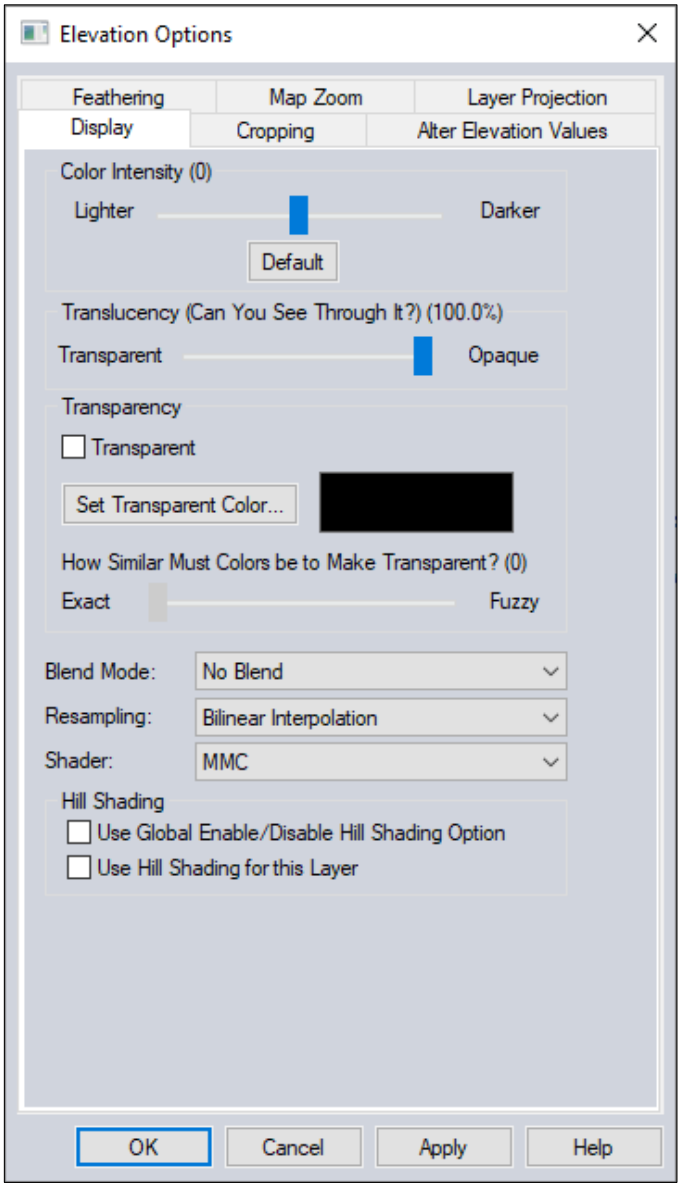


Figure 12-4. Elevation Options

f. Repeat for each additional scenario.

8. Display one scenario at a time and export to KMZ.

   a. With first layer displayed and highlighted, click the File pulldown and choose Export→Export Web Format…
   b. Choose KML/KMZ (Any Data as Images) option and click OK
   c. Under Export Image Format, choose JPG–Quality and check the box for ADVANCED: Export

PNG for Transparent Tiles

d. Click the box at the bottom for Create Compressed KMZ File and Click OK
e. Navigate to the Google Folder and name the output for your scenario (e.g., MH_Breach.KMZ, MH_NonBreach.KMZ, etc.)

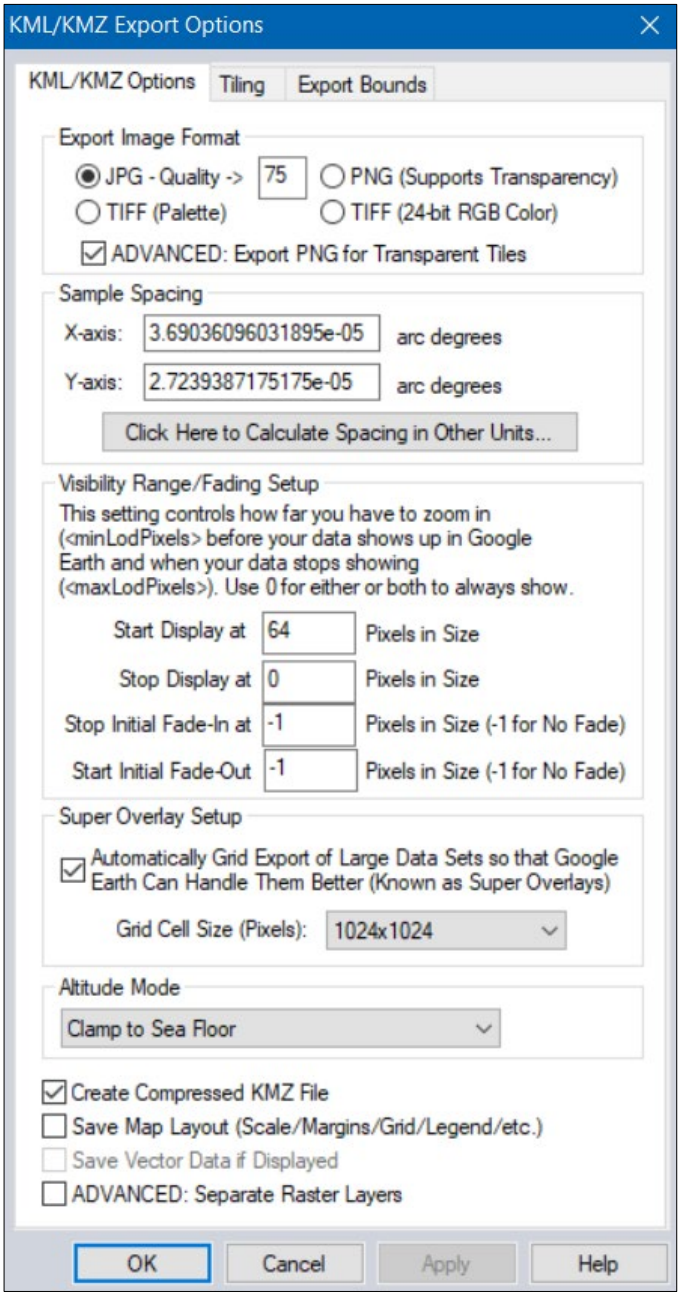


Figure 12-5. KMZ Export Options

f. Repeat for remaining scenarios.

9. Open Google Earth and add all your scenarios (click the File pulldown and choose Open…)
10. Select all your scenario KMZ files and click the Open button.
11. Make sure all scenarios are properly named. Turn off all scenarios except MH_Breach.
12. Create Modeling KMZ (right click on the folder and choose Save Place As).

    a. Name the file: [Dam_Name]_Modeling.kmz in the Google folder.

Section 13
Mapping Deliverable Checklist

13.1 CHECKLIST

1. The MMC Mapping Deliverable Worksheet is required to be filled out and included with the final deliverable of the mapping data.
2. Save in the Review\Mapping folder.

MMC Mapping Deliverable Worksheet
To be included with final deliverable of mapping data

Study Dam Name:
NIDID:
District:

Mapping Team:
Deliverable Contact:
(Person responsible for verifying all information is included and correct)

Deliverable Tracking Number:

Date Initial Data received for mapping:

Maximum High Failure Time:
Normal High Failure Time:
__ Fail times derived from DSSVue
__ Fail times provided by modeler

Version of HEC-RAS/Flo2D:

Model plan names used for
Maximum High Failure:
Maximum High Non Failure:
Normal High Failure:
Normal High Non Failure:

Failure Wave Arrival Time delta value:
__ Delta value updated in study notes page

Version of ArcGIS:
Date Internal Map Review Conducted:
Internal Reviewer Name:

Date of Initial MMC Map Review:
Date of Final MMC Map Review Complete:

Date Final Product Delivered (Hard drive shipped):

Hard Drive Deliverable Checklist
__ All data in proper file structure
__ Model Google Earth KMZ included
__ Mapping Google Earth KMZ included
__ All mxd files included
__ All GIS data files included
__ All files in geodatabase named according to mapping production guide
__ No working files included with drive
__ All full resolution map atlases included (4 versions)
__ All full resolution atlas pages included (individual)
__ All optimized map atlases included (4 versions)
__ All optimized atlas pages included (individual)
__ MMC Reviewed pdf atlases included in review folder
__ MMC mapping review checklist included in review folder

Figure 13-1. MMC Mapping Deliverable Worksheet

Section 14
Printing Requirements

14.1 PRINTING

When printed and assembled, the Inundation Atlas has a final size of 11- by 17-inches. Most pages in the Inundation Atlas are printed on 11- by 17-inch paper, but some pages are printed on larger paper and folded to fit the 11- by 17-inch book.

The final MMC Map Product is assembled with the following format:

- Map Cover Page
- Two (or three) Map Notes Pages
- Sheet Index Map
- Standard Sheets and Detail Sheets as per study area
- Facing Pages where applicable.

14.2 GENERAL PRINTING REQUIREMENTS

Most pages are printed on 11- by 17-inch paper, using double sided printing.

From the combined Inundation Atlas .pdf file created, print the .pdf file using double-sided printing.

Section 15
Inundation Atlas Hard Copy Map Product Assembly

The Inundation Atlas is an 11- by 17-inch bound book. The printed pages are assembled in the following order:

- Map Cover Page
- Two (or three) Map Notes Pages
- Sheet Index Map
- Standard Sheets and Detail Sheets as per study area
- Facing Pages where applicable.

A clear overlay is added to the top of the Map Cover Page and a black cardstock backing is added in the binding process.

See the provided hard copy sample for better understanding of the layout of the map product. More information on the binding process will be provided at a later date.

Section 16
Reference

Table 16-1. Linked Text

Text Element	Standard_Sheets Field	Location
Sheet No.	Page_Nmbr	Title Block
Section of USGS Quad	USGS_QD_ID and QUAD_NAME	Title Block
Cross Section Letter	XS_Ltr	Flood Wave Data Table
Max High Arrival Time	Time2Rise_MH	Flood Wave Data Table
Max High Arrival Elevation	RiseElev_MH	Flood Wave Data Table
Max High Time to Peak	Time2Max_MH	Flood Wave Data Table
Max High Peak Elevation	MaxElev_MH	Flood Wave Data Table
Normal High Arrival Time	Time2Rise_NH	Flood Wave Data Table
Normal High Arrival Elevation	RiseElev_NH	Flood Wave Data Table
Normal High Time to Peak	Time2Max_NH	Flood Wave Data Table
Normal High Peak Elevation	MaxElev_NH	Flood Wave Data Table
Left Joins Tab	West_Pg	Sheet
Top Joins Tab	North_Pg	Sheet
Bottom Joins Tab	South_Pg	Sheet
Right Joins Tab	East_Pg	Sheet
100,000 Meter Grid ID	GridID	Above Scale Bar
USNG Grid Zone	USNG_GZD	Above Scale Bar

Table 16-2. Annotation (Sheet 1 of 4)

Source Layer	Annotation FC Name	Map Scale	Font	Size	Color	Format	Special	Notes
Counties	Cnty_S_Anno	Standard Sheet	Arial Narrow	14	Black	Bold	• White Halo 1 pt • Leader Line • Width: 1.0 Pt • Color: R0, G0, B0	Parallel to county line *If table provides name only add "County" to text
Countries	Cntr_S_Anno	Standard Sheet	Arial Black	14	Black	Normal	White Halo 2 pt	Parallel to line
States	St_S_Anno	Standard Sheet	Arial Narrow	14	Black	Bold	• White Halo 1 pt • Leader Line • Width: 1.0 Pt • Color: R0, G0, B0	• Parallel to state line • All Caps
Reference Miles	Ref_S_Anno	Standard Sheet	Arial	8	Black	Bold	Black Square Unicode 41–size 25 X=0, Y=2, on top of Square Unicode 41–size 25, X=0, Y=2, color R115, G223, B255	On the point, horizontal See Graphics Spec for details
USACE Dams	USACE_Dams_S_Anno	Standard Sheet	Arial	11	Mars Red	Italics	White Halo 1 pt	All Caps
Non USACE Dams	NonUSACE_Dams_S_Anno	Standard Sheet	Arial	11	Cherrywood Brown	Italics	White Halo 1 pt	All Caps
Municipalities\Cities	City_S_Anno	Standard Sheet	Arial Black	12	Black	Italics	• White Halo 1 pt • Leader Line • Width: 1.0 Pt • Color: R0, G0, B0	
Lettered Cross Sections	XS_S_Anno	Standard Sheet	Arial Narrow	14	Black	Bold	• White Hexagon Unicode 37–size 35 • Halo 1 pt, black	On ends of the line, horizontal See Graphics Spec for details

Table 16-3. Annotation (Sheet 2 of 4)

Source Layer	Annotation FC Name	Map Scale	Font	Size	Color	Format	Special	Notes
mgrs_region\USNG_Grid	Grid_S_Anno	Standard Sheet	Arial	12	R0, G229, B255		Halo 1 pt, R178, G178, B178	Parallel to line on all outside edges of sheet See graphics spec for details
USGS Gages	Gages_S_Anno	Standard Sheet	Arial	12	White	Bold	• Halo 1 pt, R255, G0, B0 • Outline 1 pt R110, G110, B110	
River2D	River2D_S_Anno	Standard Sheet	Times New Roman	12	R0, G92, B230	Bold, Italics	White Halo 2 pt	Parallel to river line
Counties	Cnty_D_Anno	Detail Sheet	Arial Narrow	14	Black	Bold	• White Halo 1 pt • Leader Line • Width: 1.0 Pt • Color: R0, G0, B0	Parallel to county line *If table provides name only add "County" to text
Countries	Cntr_D_Anno	Detail Sheet	Arial Black	14	Black	Normal	White Halo 2 pt	Parallel to line
States	St_D_Anno	Detail Sheet	Arial Narrow	14	Black	Bold	• White Halo 1 pt • Leader Line • Width: 1.0 Pt • Color: R0, G0, B0	Parallel to state line All Caps
Reference Miles	Ref_D_Anno	Detail Sheet	Arial	8	Black	Bold	Black Square Unicode 41–size 25 X=0, Y=2, on top of Square Unicode 41–size 25, X=0, Y=2, color R115, G223, B255	On the point, horizontal See Graphics Spec for details
USACE Dams	USACE_Dams_D_Anno	Detail Sheet	Arial	11	Mars Red	Italics	White Halo 1 pt	All Caps
Non USACE Dams	Non_USACE_Dams_D_Anno	Detail Sheet	Arial	11	Cherrywood Brown	Italics	White Halo 1 pt	All Caps

Table 16-4. Annotation (Sheet 3 of 4)

Source Layer	Annotation FC Name	Map Scale	Font	Size	Color	Format	• Special	Notes
Municipalities\Cities	City_D_Anno	Detail Sheet	Arial Black	12	Black	Italics	• White Halo 1 pt • Leader Line • Width: 1.0 Pt • Color: R0, G0, B0	
Lettered Cross Sections	XS_D_Anno	Detail Sheet	Arial Narrow	14	White	Bold	• White Hexagon Unicode 37-size 35 • Halo 1 pt, black	On the point, horizontal See Graphics Spec for details
mgrs_region\USNG_Grid	Grid_D_Anno	Detail Sheet	Arial	12	R0, G229, B255		Halo 1 pt, R178, G178, B178	Parallel to line on all outside edges of sheet See graphics spec for details
River2D	River2D_D_Anno	Detail Sheet	Times New Roman	12	R0, G92, B230	Bold, Italics	White Halo 2 pt	Parallel to river line
USGS Gages	Gages_D_Anno	Detail Sheet	Arial	12	White	Bold	• Halo 1 pt, R255, G0, B0 • Outline 1 pt R110, G110, B110	
Counties	Cnty_I_Anno	Index	Arial Narrow	12	Black	Bold	• White Halo 1 pt • Leader Line • Width: 1.0 Pt • Color: R0, G0, B0	Level
Countries	Cntr_I_Anno	Index	Arial Black	12	Black	Normal	White Halo 2 pt	Parallel to line
USACE Dams	USACE_Dams_I_Anno	Index	Arial	12	Mars Red	Italics	White Halo 1 pt	All Caps
Non USACE Dams	Non_USACE_Dams_I_Anno	Index	Arial	12	Cherrywood Brown	Italics	White Halo 1 pt	All Caps

Table 16-5. Annotation (Sheet 4 of 4)

Source Layer	Annotation FC Name	Map Scale	Font	Size	Color	Format	• Special	Notes
States	St_I_Anno	Index	Arial Narrow	12	Black	Bold	• White Halo 1 pt • Leader Line • Width: 1.0 Pt • Color: R0, G0, B0	Parallel to state line All Caps
Detail Sheet Number	Detail_I_Anno	Index	Arial	12	R0, G92, B230	Bold	White halo 1 pt	Black Outline 0.4 pt
Standard Sheet Number	Stand_I_Anno	Index	Arial	12	R255, G 0, B0	Bold	White halo 1 pt	Black Outline 0.5 pt
Flood Wave Arrival Time (decimals)	Time_I_Anno	Index	Arial	8	White		White Pentagon Unicode 43 - size 30,on top of Mars Red Pentagon Unicode 36 - size 29	On the point, horizontal Whole Even numbers only
States	St_L_Anno	Index Locator	Arial Narrow	10	Black	Bold	• White Halo 1 pt • Leader Line • Width: 1.0 Pt • Color: R0, G0, B0	Horizontal
Countries	Cntry_L_Anno	Index Locator	Arial Black	10	Black	Bold	• White Halo 1 pt • No leader	Parallel to Line