SOLICITATION ADDENDUM CTP2401
QUESTIONS AND ANSWERS

Date: November 5, 2024

To: All Bidders

From: Jamie L. Reinke, Project Manager,
Nebraska Department of Natural Resources (NeDNR)

RE: Addendum for Request for Proposal Number CTP2401
to be opened December 6, 2024 at 2:00 p.m. CST

Questions and Answers

Following are the questions submitted and answers provided for the above-mentioned solicitation. The questions and answers are to be considered as part of the solicitation. It is the responsibility of bidders to check the State Purchasing Bureau website for all addenda or amendments.

Question Number	RFP Section Reference	RFP Page Number	Question	State Response
1.	V. PROJECT DESCRIPTION AND SCOPE OF WORK F. General Recommendations	Page 25	Section F of the RFP states that the 2D BLE Guidance Document will be provided upon kickoff. In order to more accurately estimate level of effort, fee, and schedule, would the DNR provide the latest version of the guidance document for preparation of the proposal?	We had intended to delay the release until kickoff to allow time for NeDNR to incorporate necessary updates that were being tested. To accommodate this request, we expedited the changes, and the updated guidance is available as part of this addendum.

This addendum will be incorporated into the solicitation.

Nebraska Department of Natural Resources
Floodplain Management Division

2-Dimensional Base Level Engineering Guidance

November 2024

NEBRASKA

DEPT. OF NATURAL RESOURCES

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	September 2021	Draft guidance developed.
Rev. 1	May 2023	Revisions based on FEMA guidance and first two contract projects.
Rev. 2	November 2024	Revisions based on revised dam analysis procedures and updating mapping procedures.

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I. INTRODUCTION

Base Level Engineering (BLE) mapping involves large scale hydrologic and hydraulic modeling approach that combines high-resolution topography and advanced modeling techniques to develop flood risk data. These analyses can be conducted using 1-dimensional (1D) modeling or 2-dimensional (2D) modeling. The intent of this document is to provide the Nebraska Department of Natural Resources (NeDNR) Floodplain Management Division's guidance and best practices for completing 2D BLE mapping projects in HEC-RAS. Any deviation from this guidance, or suggestions for improvement, should be discussed with NeDNR prior to implementation.

BLE studies must include all Federal Emergency Management Agency (FEMA) required recurrence intervals, including the 10%, 4%, 2%, 1%, 1% plus, and 0.2% annual chance flood events. The 1% and 0.2% annual chance floodplain boundaries produced as part of a 2D BLE project shall be created meeting FEMA standards and for publication as Flood Awareness Area on the NeDNR Floodplain Management Interactive Map (http://ne.gov/go/floodriskmap).

II. 2D MODELING

A. Base Layers

Accurate and reliable base layers are the foundation of good hydrologic and hydraulic models and accurate floodplain boundaries. NeDNR has placed particular emphasis on the following layers and the consistency in developing these layers:

1. LiDAR

NeDNR creates a Digital Elevation Model (referred to as "Project DEM") during the Develop Topographic Data Task for every Risk MAP project. NeDNR will provide the Project DEM with the other project deliverables. The Project DEM will encompass the entire project area, with a 1-mile buffer, and will be hydro-enforced. The Project DEM must be used for all project work. If additional coverage is needed, please inform NeDNR and the necessary updates to the Project DEM will be made and an updated version will be provided.

2. Manning's "n" Layer

NeDNR will provide a Manning's "n" layer created the 2021 National Land Cover Database (NLCD) data for Nebraska.

3. Curve Number (CN) Layer

NeDNR will provide a CN layer created from SSURGO soil data and the 2021 NLCD layer.

4. **Transportation Layer**

   NeDNR prepares an S_Transport_Ln Layer as a part of the Develop Base Map task for every Risk MAP project. NeDNR utilizes street centerline data from Nebraska Map as well as the most recent version of the street centerline layer from the U.S. Census Bureau to create the S_Transport_Ln layer. This layer will be provided to any entity performing work for NeDNR or federally grant-funded project work being managed by the NeDNR Floodplain Management Division.

5. **Dam Analyses**

   NeDNR's Floodplain Management Division will provide a point layer containing all jurisdictional (total height of 25 feet or more or have an impounding capacity at the top of dam of 50 acre-feet or more) and all known non-jurisdictional dams in the project area. Jurisdictional dams should be modeled with a breakline across the crest and perpendicular to the auxiliary spillway (if present) and a terrain modification, through the dam crest, at the primary spillway. Non-jurisdictional dams shall be modeled with a breakline across the crest.

   An additional plan must be developed for the 1% and 0.2% with no terrain modifications through jurisdictional dam crests to be used to map dam pool.

6. **Breaklines**

   Breaklines should be defined along natural and manmade topographic restraints including, but not limited to, roads, railroads, levees, berms, dams, stream centerlines or bank lines and any other feature that may impact the flow of water during the 1% or 0.2% annual chance flood event.

7. **Hydro-enforcing Terrain**

   The Project DEM will be hydro-enforced at significant stream-road intersections and across jurisdictional dams. Additional hydro-enforcing can be applied at the contractor's discretion. NeDNR prefers that additional hydro-enforcing added in HEC-RAS be achieved via terrain modifications.

8. **Profile Baselines**

   NeDNR has a statewide stream network, digitized from LiDAR, for all streams draining more than 1 square-mile. This stream network will be provided to any entity completing project work funded by NeDNR or through federal grants that are managed by NeDNR. The stream network should be reviewed by users creating models to verify the profile baselines are reasonable on the Project DEM. While 2D BLE is not intended to be a regulatory product, NeDNR prioritizes the creation of updated regulatory products in initiated project areas that currently have data. 2D BLE is typically prepared meeting the requirements of a Zone A study and NeDNR prioritizes close review of the study and refinement in populated areas during the Risk MAP Data Development phase.

Streamlines within the stream network should be named in accordance with NeDNR's and FEMA's standard practice. In general, NeDNR uses the major flowlines from the National Hydrography Dataset (NHD) and the Hydrologic Unit Code (HUC) 10 names as a starting point for naming streams within a County or Watershed.

B. Model Development

- **Model Size**

  NeDNR provided approximate model boundaries in the Request for Proposals. These models are typically between 50-150 square miles to ensure the model is useable, to limit run times, and to allow for validation of water surface elevations, peak flows, and runoff volumes. These boundaries were delineated on less accurate terrain data than is currently available, therefore, the watershed perimeter should be verified using the project terrain data. Models may be adjusted from the HUC 10 boundaries, where necessary, based on this verification and with approval from NeDNR.

  Subbasins in-series shall include an area of overlap with adjacent subbasins where flow is mostly one-directional in nature. This overlap shall provide for smooth tie-ins across models and the ability to ensure the water surface elevations tie in within 0.5 feet. NeDNR generally includes a one-mile buffer to accommodate this requirement.

  Modelling and mapping results shall be provided at a HUC 10 basis. Models should not be split over a community.

- **Mesh Development**

  - Maximum nominal cell size: 200 ft x 200 ft.
  - Minimum nominal cell size: 50 ft x 50 ft.

  Refinement Regions

  - Stream corridor: 50 ft x 50 ft. NeDNR's goal is to define the stream corridor by no more than 2 cells.
    - A pseudo-bankline layer is created by copying the stream centerline 25 ft on both sides. If a 50 ft buffer does not clear the channel banks, a 100 ft buffer is allowed (copied 50 ft on each side).
  - Community boundaries or extraterritorial jurisdiction limits: 100 ft x 100 ft.
    - Focus on flowpaths rather than the entire political area.
  - Dense urban areas: 50 ft x 50 ft.
    - Focus on flowpaths rather than the entire political area.
  - Steep valleys / canyons: Will need to use courant equation to get initial estimate.

- Dams: breaklines shall be placed across the crest of all dams within the project area.
    - Jurisdictional dams: NeDNR will provide a list of all jurisdictional dams within the project area. A terrain modification will be placed at the primary spillway location to allow water to exit the dam.

Non-Refinement Regions

- Large water bodies using the edge of water shapefile.
- Cell sizes may be increased above 200 ft x 200 ft.

- **Hydrologic Considerations**

  NeDNR 2D BLE analyses are unsteady, rain-on-grid analyses. Other methodologies may be used, when justified, after discussion with and approval from NeDNR.

  - **Rainfall Distribution**

    NOAA Atlas 14 Volume 8 rainfall and temporal distributions should be used. Infiltration and interception losses must be accounted for. The NRCS nested distribution for the applicable Midwest Southeast (MSE) region, which is based on a regional analysis of NOAA Atlas 14 data should be utilized. The NRCS document should be used to determine the applicable region.

  - **Infiltration**

    NeDNR utilizes SCS Curve Number to account for runoff infiltration. Other methodologies may be used, with justification and NeDNR approval.

  - **Boundary Conditions**

    Inflow

    Inflow locations shall be entered for any stream with greater than a one square mile drainage area entering the modeled area. Inflow hydrographs may be applied for flow entering the model from upstream models or inflows shown in the stream network. All inflow parameters shall be well documented to accommodate efficient reviews by NeDNR staff.

    Outflow

    Outflow locations shall be entered for any stream with greater than a one square mile drainage area exiting the modeled area and in areas where water is exiting the modeled area outside of riverine areas. Outflow shall be defined using normal depth slopes. Normal depth slope definition shall be well documented to accommodate efficient reviews by NeDNR staff.

- **Model Connectivity**

  In the event there is an upstream model feeding into a downstream model, the upstream model / basin results shall be used as the inflow hydrograph for the downstream basin(s).

- **Computation Settings**

  A model plan file shall be created using a variable time-step option with the following options defined:

  - Computation Settings:
    - Duration: model duration should be set to ensure all peak flows are given time to travel through the system
    - Base time step: 5 seconds.
    - Mapping Output Interval: 15 minutes.
      - Can increase after model is finished to save on file size.
      - Only for 1% and 0.2%.
    - Hydrograph Output Interval: 6 minutes.
    - Detailed Output Interval: Max Profile.
  - 2D Flow Options:
    - Theta: 1
    - Equations: Diffusion Wave
  - Advanced Time Step Control:
    - Courant settings: Adaptive time step option.
    - Maximum Courant: 1 to 3.
    - Minimum Courant: 0.4 to 1 (must be less than half of Maximum Courant).
    - Number of steps below minimum before doubling: 5.
    - Maximum number of doubling base time step: 1 to 3.
    - Maximum number of halving base time step: 2 to 5.
      - Must give sufficiently low minimum time step to keep the model in the specified range of Courant numbers.
      - Check the results to make sure the minimum used time step is larger than the minimum allowable time step.
  - Additional Considerations:
    - Slopes approaching 10% are unable to produce a continuous floodplain extent. Having steep slopes, high velocities, and small cell

sizes results in fluctuating values. In these instances, larger cell sizes may be warranted.

- Post-Computation Review:
    - Volume Accounting Error:
        - Check the computation log file to verify the percent error is less than 0.1%.
    - Convergence Errors:
        - Check the run time messages for convergence errors at specific cells, any error over 0.2 ft needs to be corrected.

C. Model Calibration

With rain-on-grid methodology, the hydrology and hydraulics are completed concurrently, and the hydrology calibration will occur at the same time as the hydraulic model calibration occurs. The following data shall be used to calibrate the model:

- Major historic floods for stream reaches, where flood flows and water surface elevations are available. Input parameters, including roughness coefficients and land use values, can be modified to align with historic flood event records.

- Gage records, where available, or regression equations. In order to determine the most applicable regression equation for the project area a gage analysis for each HUC 8 watershed shall be completed and the regression equation that best aligns with the gage analysis shall be selected as most appropriate and used for the calibration comparison. In Nebraska there are currently five regression equations that can be used for the gage analysis comparison.

    1. NDOR Research Project Number SPR-1(2) P541, “Regression Equations”, Strahm & Admirraal, 2005.
    2. USGS Water-Resources Investigations Report 99-4032, “Peak-Flow Frequency Relations and Evaluation of the Peak-Flow Gaging Network in Nebraska”, Soenksen, et al, 1999.
    3. NDOR Research Project Number RES-1 (0099) P466, “Design Discharge of Culverts”, Cordes & Hotchkiss, 1993.
    4. USGS Water-Resources Investigations Report 76-109, “Magnitude and Frequency of Floods in Nebraska”, Beckman, 1976.
    5. U.S. Army Corps of Engineers Section 22 Planning Assistance to States, “Flood Flow Frequency Prediction Equations Sand Hills Region of Nebraska”, 2003.

It is not recommended to calibrate models to the exact regression flow at each location, but to use validation points ensuring the flows are within a defined tolerance, typically within one standard error of estimate for the chosen regression equation.

Care should be used in determining where calibration or flow verification occurs within the model. There should a wide distribution of drainage area sizes. For regression flows, calibration shall occur in large and small drainage basins, so the model is evenly calibrated throughout the HUC 10 watershed.

The following characteristics can be adjusted to calibrate flows. In order of preference:

1. **Areal Reduction Factor**: Per NOAA Atlas 14, Volume 8, Version 2.0: "Precipitation frequency estimates from NOAA Atlas 14 are point estimates, and are not directly applicable to an area. The conversion of a point to an areal estimate is usually done by applying an appropriate areal reduction factor to the average of the point estimates within the subject area. Areal reduction factors are generally a function of the size of an area and the duration of the precipitation. The depth-area-duration curves from the Technical Paper No. 29 (U.S. Weather Bureau, 1960) developed for the contiguous United States, can be used for this purpose.

2. **Curve Number (CN):** NeDNR recommends adjusting CN per reach, rather than a flat CN adjustment for the whole watershed. CN should not be adjusted by more than 10-15.

3. **Manning's N:** Manning's N values can be adjusted but shall remain within the range given in the HEC-RAS Hydraulic Reference Manual.

Any adjustments made to calibrate the model shall be documented in the validation spreadsheet and hydraulic report.

D. Floodplain Mapping

Floodplain boundary clean-up work needs to occur in order to produce FEMA compliant floodplain boundaries. There are multiple options for how the mapping and clean-up can be accomplished, however, care should be exercised in the amount of clean-up that occurs, especially if using automated methods. Use of a process/mode that differs from those listed below should be discussed with the project team at NeDNR and agreed upon before proceeding with task work. All floodplain boundaries shall be mapped on the terrain provided by NeDNR for the project.

- **Water Surface Rendering Mode**

  The mapping and rendering results from a 2D rain-on-grid model can produce significantly different extents and interpolations, despite the results matching at cell computation points. The floodplain boundary results are impacted by different model assumptions, as well as cell sizes and orientation.

  NeDNR utilizes the default, Sloping Water Surface Rendering Mode. Additionally, the 'Use Depth-Weighted Faces ("Precip Mode")' should be turned on.

- **Upstream Modeling Limits**

  Unlike traditional 1D modeling, 2D rain-on-grid modeling results depict both pluvial and fluvial flooding. Additionally, because the precipitation is applied across the entire model domain, not along 1-square mile lines, significantly more flooding is typically depicted. NeDNR uses 1-square mile lines as a guide to determine the minimum flooding to show, but does not attempt to remove excess flooding from streams. At minimum, all flooding connected to a 1-square mile line shall be retained (subject to the revisions, below).

- **General Processing of Floodplain Boundaries**

  NeDNR does not map flooding shallower than 0.25 feet. Additionally, NeDNR defines flood hazards that intersect the 1-square mile line or are classified as medium or greater flood hazard in Figure 31 and Table 1 of the Guidance for Flood Risk Analysis and Mapping: Flood Depth and Analysis Rasters (pages 34-35). In numerical terms, this is flooding with a depth greater than or equal to 1.31 ft, a velocity greater than or equal to 1.64 ft/s, and/or a depth * velocity greater than or equal to 2.2 ft^2/s. Flood polygons that meet any of these criteria are then cleaned by filling holes and removing polygons that are smaller than 40,000 square feet (based on an assumed map scale of 1:24,000 ft).

  Further explanation will be provided when the contractor begins the floodplain mapping task.

- **Dams**

  - Fill in the auxiliary spillway.

- **Additional Revisions**

  In addition to the floodplain editing that is required for 2D modeling there are several other clean-up items that need to occur prior to finalizing the floodplain mapping task. The following list should be used as a starting point for floodplain boundary edits. Additions or changes to the list can be made, based on project needs and engineering judgement.

  - For ponded, disconnected areas, retain floodplains that have an average depth of flooding greater than 1 foot and an area larger than 20 acres.
  - Connecting floodplains across roads, bridges, or other similar features along the 1 square mile line where model shows connectivity.
  - Removing disconnected floodplain that do not have a viable way for water to flow into the fluvial floodplain areas.
  - Ensuring floodplain boundaries tie-in to neighboring studies.

  The amount of floodplain boundary editing shall be limited to prevent unnecessary changes to the various grids that will be used to create flood risk products in the future.

NeDNR does not generalize or smooth floodplain boundaries to allow for better alignment with flood risk products.

E. Independent QA/QC

NeDNR will perform an impartial review of the technical and scientific data and any other information specific to the hydrologic analyses, hydraulic analyses, and floodplain mapping task to ensure the data and modeling are consistent with NeDNR and FEMA standards and standard engineering practice. For 2D modeling the reviews of the hydrologic and hydraulic analyses shall be conducted using 2D model review checklist template, to be provided by NeDNR. The review of floodplain boundaries shall be conducted in GIS and a feature class layer shall be provided with details on any items that need to be addressed prior to finalizing the task.

The 2D model review process shall consist of the following:

- Develop 0.2% model (or 1% plus model if flow values are higher) for one watershed.
    - Modeler shall review their model prior to review submittal.
    - Submit to NeDNR reviewer.
    - Address review comments.
    - Submit to NeDNR reviewer for final review.
    - Address any remaining comments.
- Develop 0.2% models (or 1% plus models if flow values are higher) for remaining watersheds.
    - Modeler shall review all models prior to review submittal.
    - Submit to NeDNR reviewer.
    - Address review comments.
    - Submit to NeDNR reviewer for final review.
    - Address any remaining comments.
- Develop 1% model.
    - Modeler shall review all models prior to review submittal.
    - Submit to NeDNR reviewer.
    - Address review comments.
    - Submit to NeDNR reviewer for final review.
    - Address any remaining comments
- Develop remaining recurrence intervals (10%, 4%, 2%, 1% plus (0.2% if 1% plus flows are higher)).
    - Modeler shall review all models prior to review submittal.

    - Submit all models to NeDNR reviewer.
    - Address review comments.
    - Submit to NeDNR reviewer for final review.
    - Address any remaining comments.

The floodplain boundary review process shall consist of the following:

- The 0.2% floodplain boundary shall be edited and provided to the NeDNR reviewer, along with the model and associated documentation.
- All comments shall be addressed and resubmitted for NeDNR review until the reviewer approves the boundary.
- Upon completion of the 0.2% annual chance floodplain boundary the same process shall be followed for the 1% annual chance floodplain boundary, again, submitting the boundary for review until the NeDNR reviewer approves the 1% annual chance floodplain boundary.
    - The project team shall ensure the 1% annual chance boundary does not extend outside of the 0.2% annual chance floodplain boundary.
- Upon completion of the 1% annual chance floodplain boundary the boundaries for all other recurrence intervals shall be reviewed for reasonableness and edited if required.

F. Deliverables

The deliverables for BLE studies shall follow the “Base Level Engineering (BLE) Analyses and Mapping” FEMA Guidance for Flood Risk Analysis and Mapping. The BLE studies shall follow the FEMA “Data Capture Technical Reference” and associated Risk MAP standards for hydrologic, hydraulics, and floodplain mapping tasks.

2D Modeling Deliverables shall include:

- HEC-RAS models.
- Spatial Data
    - Raw boundaries for all calculated recurrence intervals.
    - Edited 1% floodplain boundaries.
    - Edited 0.2% floodplain boundaries.
    - Profile baselines (to be provided by NeDNR).
    - Modeled water surface elevation grids.
    - Rendered water surface elevation grids.
    - Database files, meeting FEMA requirements for each specific task deliverable.

G. Standards

The 2D BLE deliverables shall meet the standards outlined in the applicable Mapping Activity Statement for the specific project being completed.