



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-20-057

August 12, 2020

10 CFR 50.90

ATTN: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Sequoyah Nuclear Plant, Units 1 and 2  
Renewed Facility License Nos. DPR-77 and DPR-79  
NRC Docket Nos. 50-327 and 50-328

Subject: **Application to Revise Sequoyah Nuclear Plant Units 1 and 2 Updated Final Safety Analysis Report Regarding Changes to Hydrologic Analysis - Partial Response to Additional Request for Additional Information (TS-19-02) (EPID L-2020-LLA-0004)**

- References:
1. TVA Letter to NRC, CNL-19-066, "Application to Revise Sequoyah Nuclear Plant Units 1 and 2 Updated Final Safety Analysis Report Regarding Changes to Hydrologic Analysis (TS-19-02)," dated January 14, 2020 (ML20016A396 and ML20016A397)
  2. TVA Letter to NRC, CNL-20-026, "Supplement to Application to Revise Sequoyah Nuclear Plant Units 1 and 2 Updated Final Safety Analysis Report Regarding Changes to Hydrologic Analysis, (TS-19-02) (EPID L-2020-LLA-0004)," dated February 18, 2020 (ML20049H184)
  3. NRC Electronic Mail to TVA, "Sequoyah Nuclear Plant, Request for Additional Information Regarding the Hydrologic Analysis LAR (EPID L-2020-LLA-0004)," dated April 14, 2020 (ML20106F104)
  4. TVA Letter to NRC, CNL-20-032, "Application to Revise Sequoyah Nuclear Plant Units 1 and 2 Updated Final Safety Analysis Report Regarding Changes to Hydrologic Analysis - Response to Request for Additional Information (TS-19-02) (EPID L-2020-LLA-0004)," dated May 14, 2020 (ML20135H065)
  5. NRC Electronic Mail to TVA, "Sequoyah Nuclear Plant, Units 1 and 2 - Request for Additional Information Regarding Hydrologic UFSAR Update (EPID L-2020-LLA-0004)," dated July 1, 2020 (ML20189A211)
  6. NRC meeting notice, "Meeting with Tennessee Valley Authority to Discuss Response to Requests for Additional Information Re: License Amendment Request on Updated Final Safety Analysis Report Hydrologic Analysis for Sequoyah Nuclear Plant, Units 1 and 2," dated July 6, 2020 (ML20188A366)

7. TVA Electronic Mail to NRC, "RE: Sequoyah Hydrologic UFSAR RAI Response," dated July 29, 2020

In Reference 1, Tennessee Valley Authority (TVA) submitted a request for an amendment to Renewed Facility Operating License Nos. DPR-77 and DPR-79 for Sequoyah Nuclear Plant (SQN), Units 1 and 2, respectively. This license amendment request (LAR) revises the SQN, Units 1 and 2, Updated Final Safety Analysis Report (UFSAR) to reflect the results from the new hydrologic analysis. TVA determined that the proposed changes to the SQN UFSAR require prior Nuclear Regulatory Commission (NRC) approval.

In Reference 2, TVA provided a response to a request for information to support the NRC acceptance review of the LAR. In Reference 3, the NRC provided a request for additional information (RAI), which TVA responded to in Reference 4. In Reference 5, NRC provided an additional RAI and requested that TVA respond by August 15, 2020.

A public meeting with the NRC regarding the proposed TVA responses to Reference 5 was held on July 16, 2020 (Reference 6). Based on this meeting, TVA has determined that additional time is required to respond to NRC Question 2 of Reference 5. Accordingly, the enclosure to this letter provides the response to NRC Question 1 of Reference 5, only. As noted in Reference 7, TVA plans to respond to NRC Question 2 of Reference 5 at a later date agreed to by TVA and NRC.

This letter does not change the no significant hazard considerations nor the environmental considerations contained in Reference 1. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and the enclosure to the Tennessee Department of Environment and Conservation.

There are no new regulatory commitments associated with this submittal. Please address any questions regarding this submittal to Gordon Williams, Senior Manager (Acting), Fleet Licensing at 423-751-2687.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 12<sup>th</sup> day of August 2020.

Respectfully,



James Barstow  
Vice President, Nuclear Regulatory Affairs & Support Services

Enclosure: Response to NRC Additional Request for Additional Information, Question 1

cc: See Page 3

U.S. Nuclear Regulatory Commission  
CNL-20-057  
Page 3  
August 12, 2020

cc (Enclosure):

NRC Regional Administrator - Region II  
NRC Senior Resident Inspector - Sequoyah Nuclear Plant, Units 1 and 2  
NRC Project Manager - Sequoyah Nuclear Plant  
Director, Division of Radiological Health - Tennessee State Department of  
Environment and Conservation

## Enclosure

### Response to NRC Additional Request for Additional Information, Question 1

#### NRC Introduction

*By letter dated January 14, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20016A396), as supplemented by a letter dated February 18, 2020 (ADAMS Accession No. ML20049H184), Tennessee Valley Authority (TVA) submitted a license amendment request (LAR) for Sequoyah Nuclear Plant related to a new hydrologic analysis. The U.S. Nuclear Regulatory Commission (NRC) staff issued requests for additional information (RAIs) (ADAMS Accession No. ML20106F104) related to the software tools used in the new hydrologic analysis. By letter dated May 14, 2020 (ADAMS Accession No. ML20135H065), TVA submitted responses to the NRC staff's RAIs. The NRC staff is continuing to review the application and has identified areas where it needs additional information to support its review.*

#### NRC Question 1

*Title 10 of the Code of Federal Regulations (10 CFR) 50.34(b)(6)(ii) requires information to be provided regarding the managerial and administrative controls to be used to assure safe operation, including a discussion of how applicable requirements within Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," are satisfied. In TVA's May 14, 2020 response to RAI Question 1b regarding how the output of one software tool (Quantum Geographical Information System (QGIS)) is used to verify the output of another software tool (ArcGIS), TVA credited the use of different calculation methods as one of the diverse means used to prevent both software tools from having the same erroneous output. The NRC staff requests TVA provide the following information to demonstrate that the procurement and acceptance of the ArcGIS tool meet the requirements of Appendix B to 10 CFR Part 50.*

- 1. TVA stated that the ArcGIS software uses gridded shapefile data to create a Triangular Irregular Network (TIN) surface that is used via a polygon volume tool to compute the sub-basin average Probable Maximum Precipitation (PMP) depths. In contrast, the QGIS alternate methodology utilizes the nearest neighbor geoprocessing tool to generate a raster surface that then uses a grid statistics tool to generate the nearest neighbor geoprocessing tool. It is unclear what the technical difference is between methodologies used to create a TIN surface and a raster surface and between the polygon volume tool and nearest neighbor geoprocessing tool used to create the sub-basin average PMP depths. Therefore, the NRC staff requests TVA to clarify how these two methodologies are technically different such that the use of these alternate calculation methodologies can be credited to prevent the same erroneous outputs in both GIS tools.*

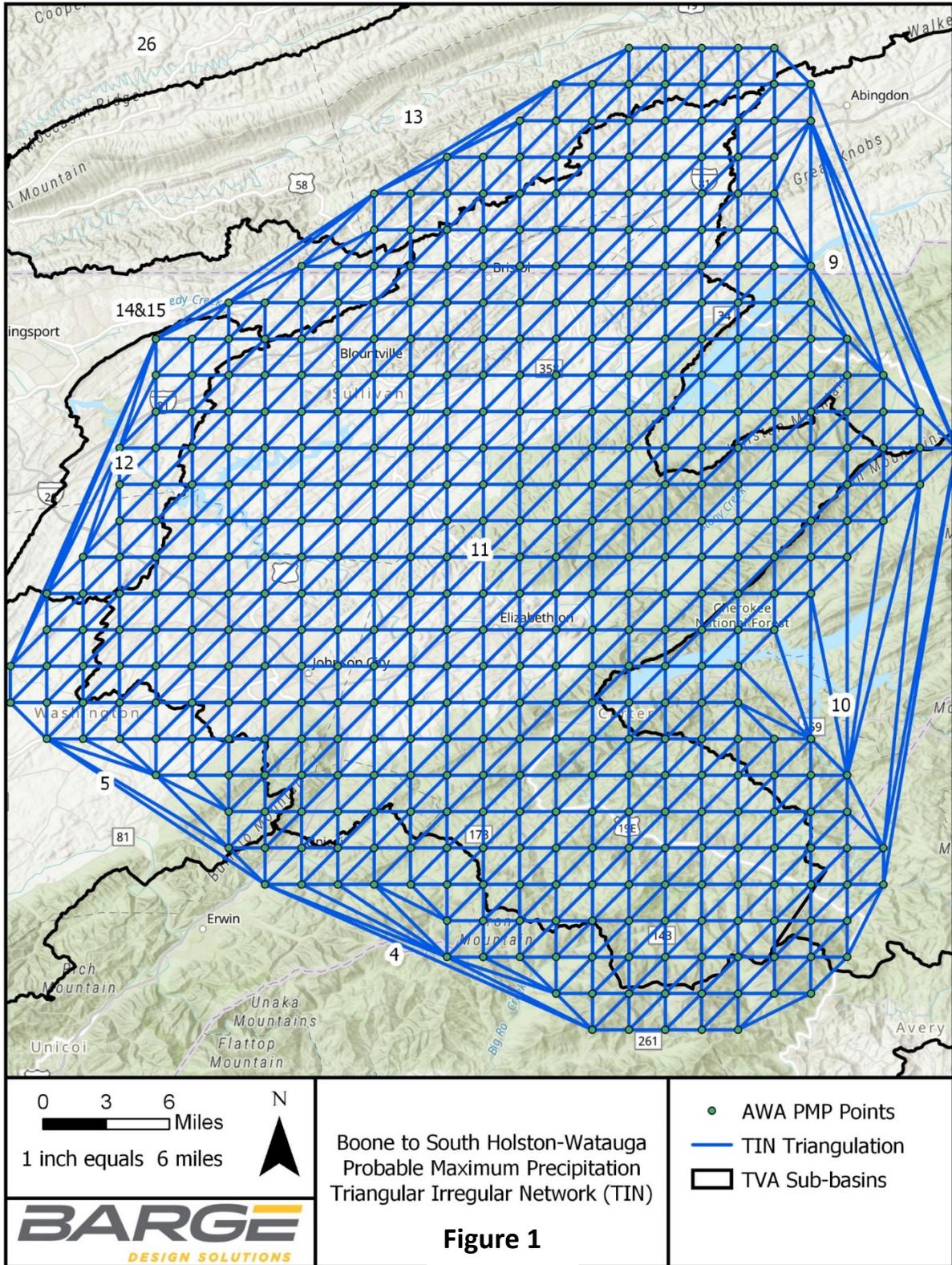
#### TVA Response to Question 1.1

The Applied Weather Associates (AWA) PMP Evaluation Tool outputs PMP depths along a uniform grid with a resolution of 0.025 by 0.025 decimal degrees or 90 arc-seconds. Figure 1 below graphically displays the Delaunay triangulation utilized between points to develop a surface of PMP depths across the project area. The centroid of each grid cell is connected by triangles where the surface, in this case PMP depths, is represented by a plane. The polygon volume tool utilized in ArcGIS then calculates the volume between the surface of PMP depths across the project area and a constant height of zero thereby providing the PMP volume. Conversely, the QGIS processing takes the same PMP depth grid and uses the nearest

## Enclosure

neighbor analysis to create a raster surface representing the PMP depths across the project area by discrete pixels, each representing the depth for an area of 0.025 by 0.025 decimal degrees thereby matching the analysis grid utilized by AWA when generating the PMP depths, as shown below in Figure 2. The grid is further subdivided by use of the resampling tool in QGIS where the grid is divided into discrete pixels each representing 0.0025 by 0.0025 degrees to provide a smooth PMP depth surface across project area, as shown below in Figure 3. The resampling tool utilizes a bilinear interpolation to further subdivide the PMP depth pixels. Grid statistics for polygons is utilized in QGIS to simply average the PMP depths of each pixel within a polygon representing the project area watersheds. Bilinear interpolation performs a linear interpolation in both the x and y directions whereas the Delaunay triangulation performs a linear interpolation along the triangle edges connecting the PMP depth points. The information above demonstrates ArcGIS and QGIS use different algorithms to compute basin average rainfall using PMP depth points. Therefore, these two alternate calculation methodologies can be credited to prevent the same erroneous outputs in both GIS tools.

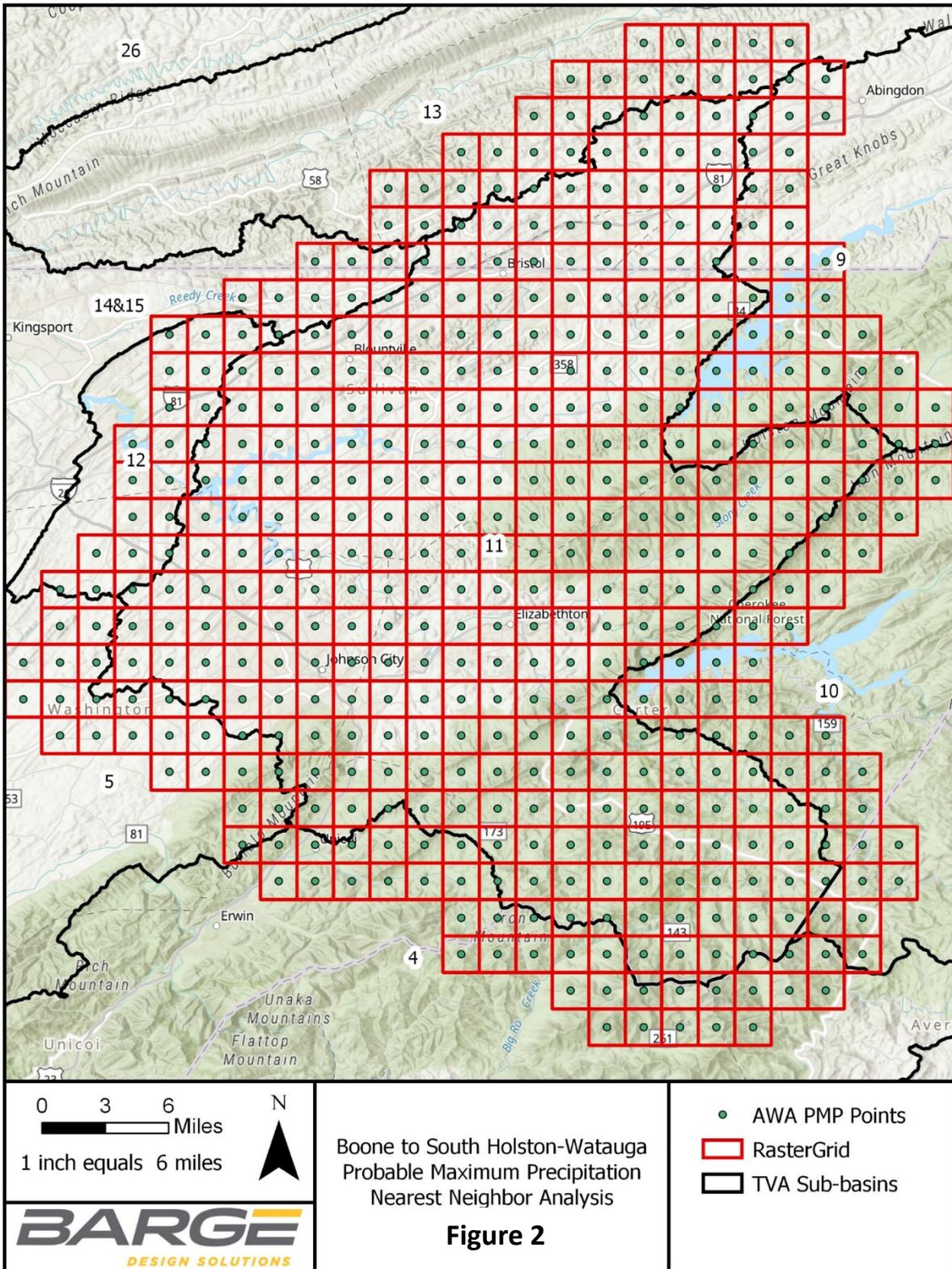
Enclosure



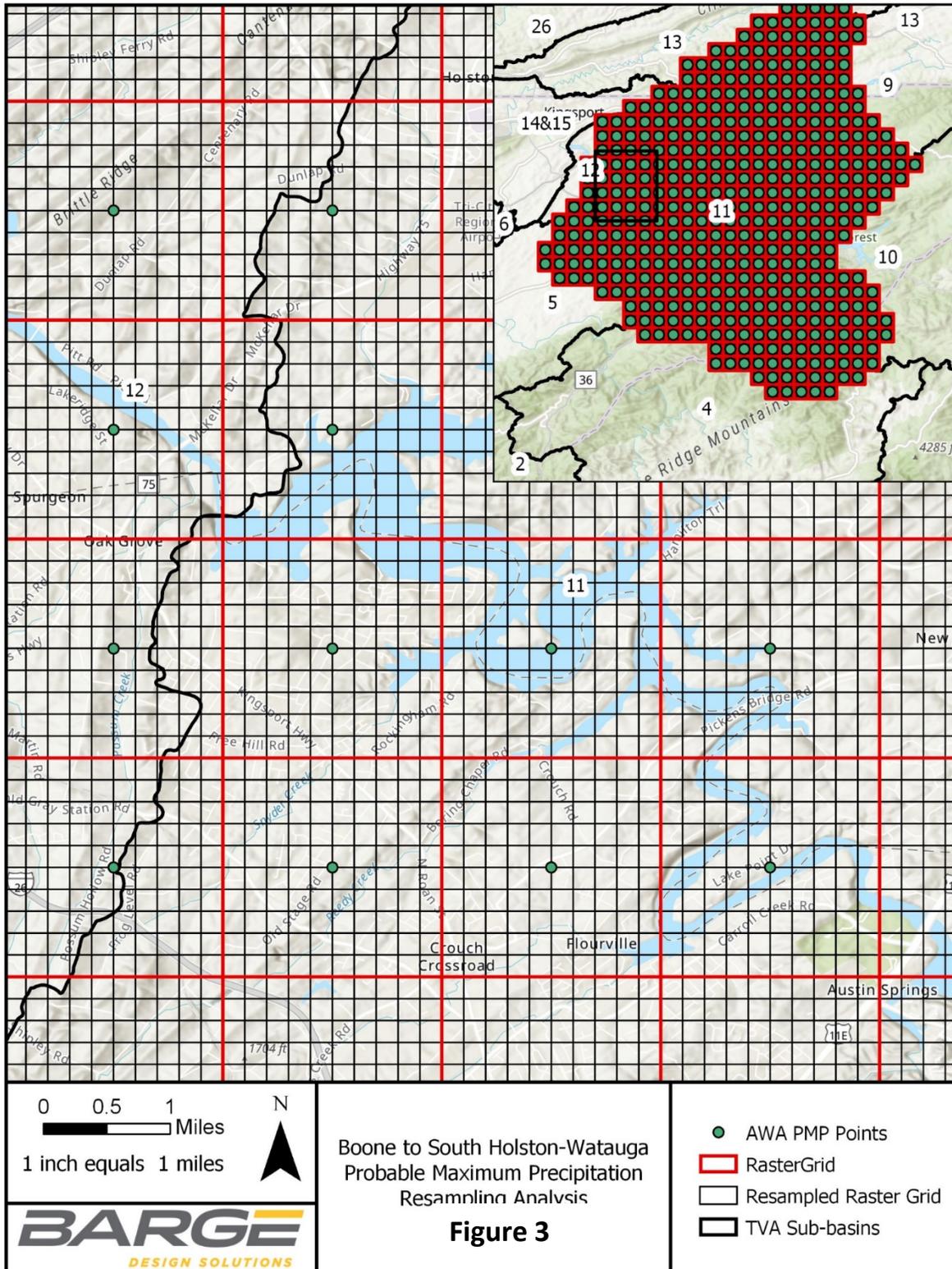
Boone to South Holston-Watauga  
Probable Maximum Precipitation  
Triangular Irregular Network (TIN)

Figure 1

Enclosure



Enclosure



2. *In Enclosure 3, "Gridded PMP Development Calculation" of the RAI response, Appendix A "GIS PMP Event Depth Computations," Section 6.5, states "Review of computed PMP depths across the ArcGIS and QGIS platforms identified a project PMP depth above Chatuge as an outlier. Analysis indicated areas around the sub-basin boundary with zero depth as the PMP points from the [Applied Weather Associates (AWA)] tool did not provide adequate coverage during TIN creation for the single sub-basin. PMP depths utilized for Chatuge are based on QGIS analysis to eliminate results without the complete PMP coverage." Since QGIS is used to verify the results of ArcGIS and their results are dissimilar for Chatuge, it is not clear what the basis is for using the output of QGIS instead of ArcGIS for this area. In addition, since the TVA determined that ArcGIS did not provide adequate coverage for Chatuge, it is not clear how the output of QGIS is determined to be correct for this area. Therefore, the NRC staff requests TVA to justify the use of the QGIS output for the Chatuge sub-basin.*

### TVA Response to Question 1.2

For the TVA domain drainage basins, QGIS software was used as an alternate calculation to check the average basin PMP depth results of ArcGIS software for the Chatuge basin. The slight [less than one percent (%)], but greater than expected variance in the comparison of the Chatuge basin results for the two calculation methods (QGIS method was slightly higher than the ArcGIS method) led to an additional review of the results.

The determination of the Chatuge project area PMP depths when utilizing the Delaunay Triangulation feature in ArcGIS covered nearly 100% of the basin area, as graphically shown in Figure 4 (see the slight lack of coverage shown at the southern tip of the basin). The portion of the Chatuge watershed without the PMP TIN coverage is approximately 0.88 square miles equating to less than 0.5% of the total Chatuge watershed area.

The grid statistics for polygons tool within QGIS calculates an average of the 0.025 by 0.025-degree grid areas whose centroid is within the basin polygon of interest. As shown in Figure 5, although a number of PMP points output from the PMP tool are outside the basin boundary, the resampling tool used by QGIS further discretizes the raster to 0.0025 by 0.0025 decimal degrees, which provides full coverage over the project basin (Figure 6). The full coverage produced and subsequent use of the grid statistics for polygons tool in QGIS results in full coverage PMP depth for the Chatuge watershed.

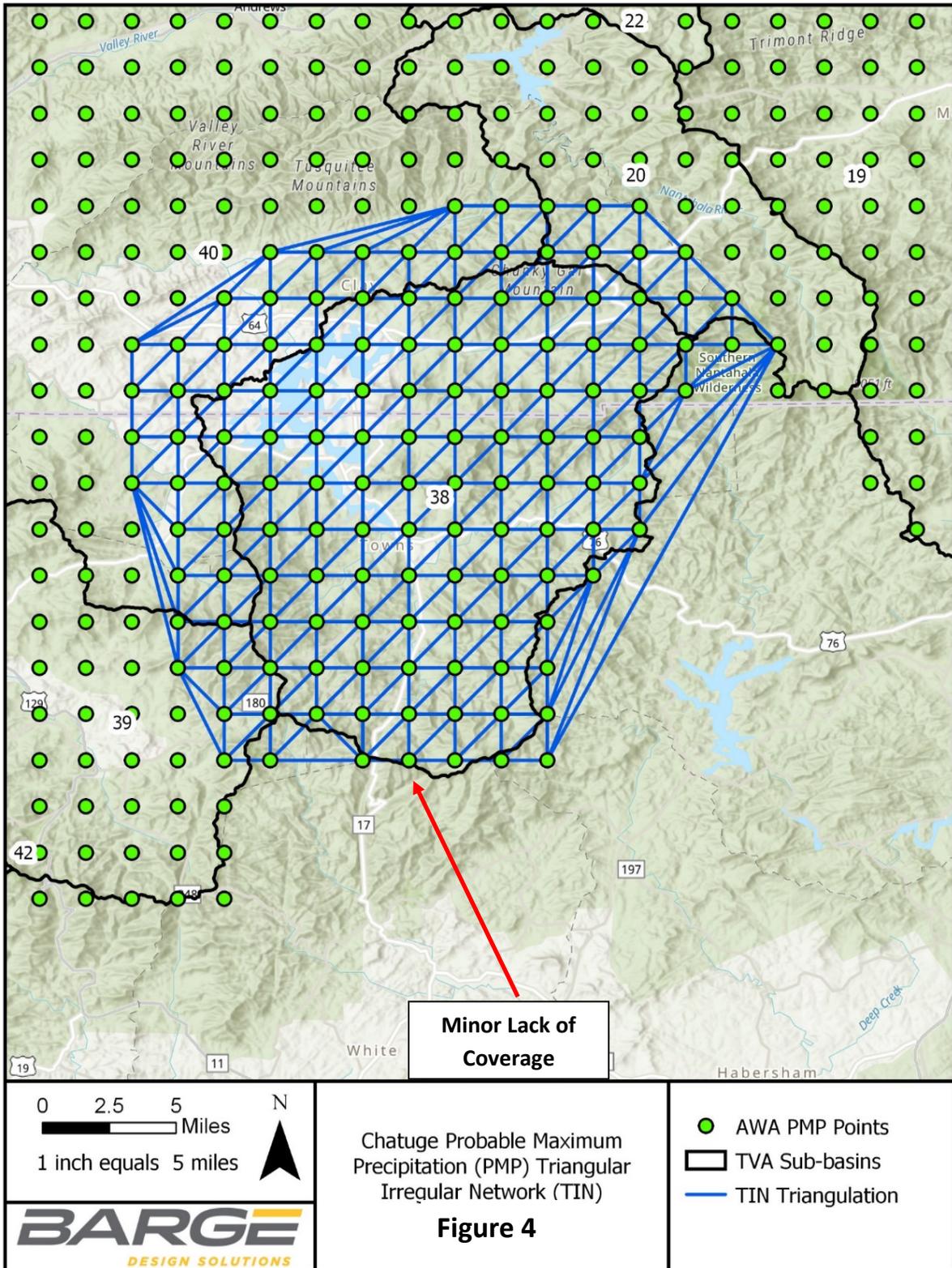
The use of QGIS as an alternate calculation to check the results of the ArcGIS basin average PMP depth in the Chatuge watershed demonstrates the adequacy of the alternate calculation process. The slight, but more than expected variance in the two methods, led to further examination of the QGIS and ArcGIS methods for the basin. Adding the adjacent PMP depth in the small uncovered area to the ArcGIS method result approximates the QGIS result and provides the alternate calculation comparison. Adding the adjacent PMP depth in the small uncovered area to the ArcGIS method result would approximate the QGIS result, providing the alternate calculation comparison. For Chatuge, the calculated QGIS average PMP depth was used in the PMP determination. Flooding of the Chatuge basin was not the controlling PMP scenario for the Watts Bar or Sequoyah Nuclear Plants PMF analysis.

The alternate calculation check on ArcGIS computations by use of the alternate methodology in QGIS was performed for 288 unique PMP events for a number of different durations, each duration having a separate PMP depth surface created using the TIN and Raster processes within ArcGIS and QGIS, respectively. Over 2,500 individual PMP surfaces were checked in ArcGIS and QGIS with only those surfaces associated with Chatuge centered PMP resulting in

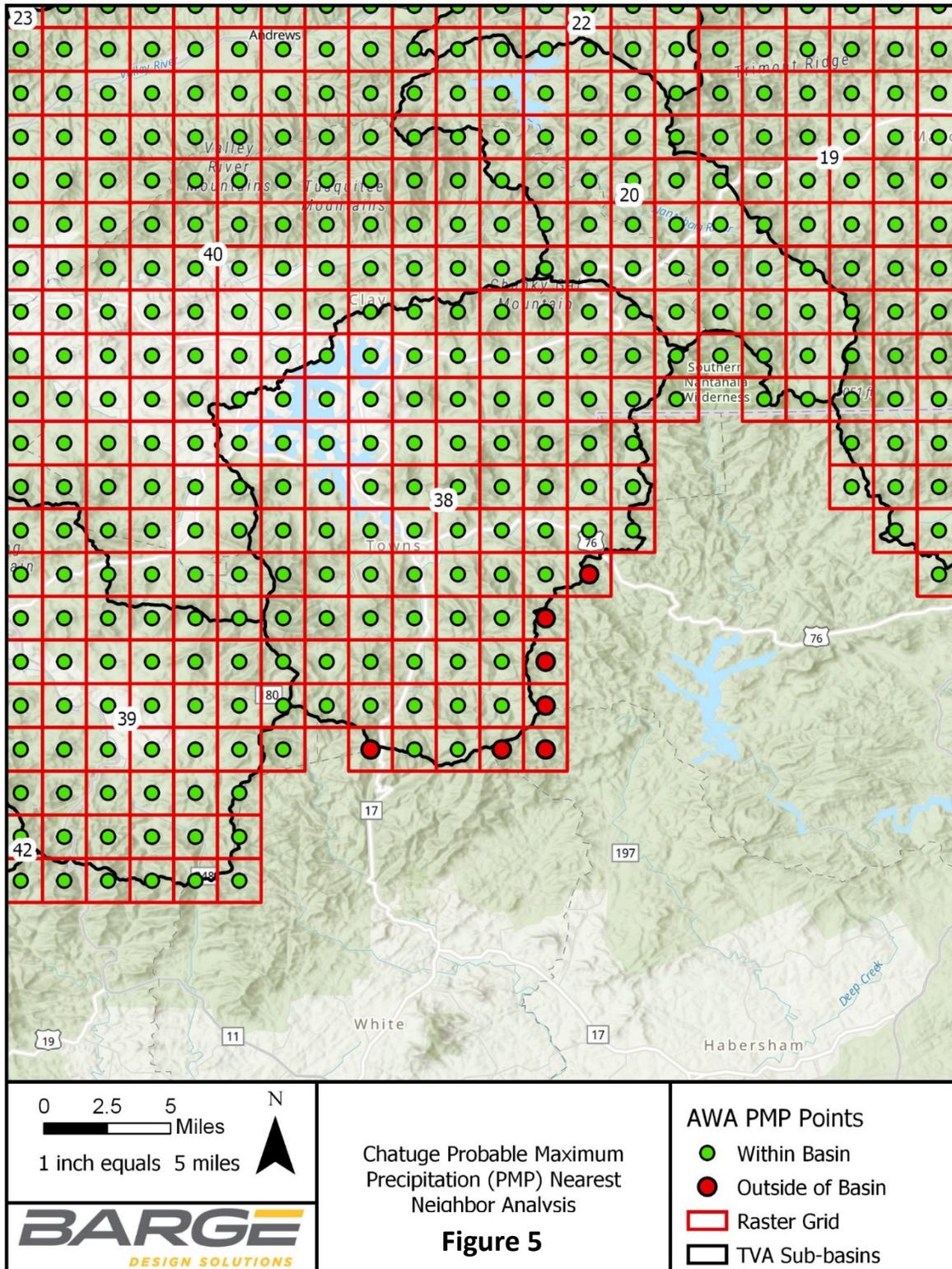
## Enclosure

differences greater than 0.6% for the Chatuge sub-basin average. Therefore, based on the review of differences between the ArcGIS and QGIS geoprocessing calculation of sub-basin average PMP depths when there is complete coverage of a basin by the TIN produced in ArcGIS, the computed average depths are equivalent between the two methods. The QGIS process was shown to have full coverage; therefore it is acceptable to utilize the depths determined through QGIS for the Chatuge basin.

Enclosure



Enclosure



Enclosure

