August 4, 2014

Mr. Mike Cox, AIA
Architectural Design Studio
90 Church Street
Asheville, North Carolina 28801

Re: Seismic Refraction Survey
Proposed Montreat Town Hall
Town of Montreat, North Carolina 28757
ECS Project Number: 31-2648

Mr. Cox:

ECS Carolinas, LLP (ECS) has completed a geophysical exploration for the proposed Montreat Town Hall development, as described in ECS Proposal No. 31-3571-P. The project site is bounded by Arkansas Trail and Florida Terrace in the Town of Montreat, North Carolina.

EXPLORATION PROCEDURE

The purpose of this exploration was to provide general estimates of depth to rock at the site as well as a discussion of the excavation characteristics of the site subsurface materials as determined by the seismic refraction testing. A total of 4 seismic refraction lines were completed. ECS performed the seismic refraction testing at the approximate locations shown on the attached Location Diagram.

Data was collected utilizing a 24-channel exploration seismograph with geophones placed at a 7- and 10-foot spacing. Seismic refraction lines were conducted by recording the first arrivals of the energy wave created from the energy generated by the dynamic impact of a sledge hammer. Due to terrain conditions resulting in a dampening of signal strength, multiple energy impacts were conducted at the test locations and the resulting signals were mathematically stacked in order to provide a clearer indication of the seismic waves.

SEISMIC REFRACTION DESCRIPTION

The seismic refraction method of subsurface exploration is a non-invasive technique primarily used to determine the depth of soil, partially weathered rock (PWR), and competent rock layers. In addition to depth information, seismic velocity data provides an indication of material density or hardness and can be used in estimating excavation techniques that may be required for site development.

Compressive waves are timed from an initiation point on the surface of the ground to receivers (geophones) located some distance away. Wave velocities increase as they are refracted off harder layers. By increasing the source to receiver distance over a straight line, a graph of time versus distance is developed which is used to calculate velocities (densities) and depths of the underlying materials. The information obtained from a single seismic refraction line is limited to the material directly below the geophone array.

For the seismic refraction fieldwork, 98 or 140 feet of cable (line) was laid out on the ground surface. Geophones were placed at seven- and ten-foot intervals and connected to the cable that was connected to a Geode 24-channel Exploration Seismograph. For this study, 15 channels were used. The 98-foot cable array and 7-foot geophone spacing was used for survey line 1, and the 140-foot cable array and 10-foot geophone spacing was used for survey lines 2 through 4. Shot points (both end points and several points along the line) were selected. A sledgehammer blow at each shot point generates elastic body waves (p-waves or compression waves) that move down and outward as ever expanding hemispheres through the underlying horizons. The seismic energy that passes downward is bent or refracted at each change of density below the array and returns to the surface. The time required for these waves to move downward, refract and return to the surface is recorded at the surface by the vibration sensitive geophones. The arrival time data for each geophone/shot point combination is recorded in the field by the seismograph.

Computer and manual analysis of the field data is used to determine subsurface conditions. Seismic results are typically presented as computer drawn cross-sections showing shaded layers below the alignment. The average p-wave velocity (in feet per second) of each layer is printed on the cross-section and is indicative of the material's hardness and rippability. Maximum study depth is dependent on velocity distribution determined by algorithms used in the analysis. The maximum depth of reliable data acquired for this site varied from about 20 to 40 feet below existing ground surface. Attached are the acquired refraction data as a color shade on the Seismic Refraction Cross-Sections.

The following material definitions typically apply to the velocity ranges shown. As these velocity ranges are approximate, actual excavation techniques required will depend on the degree of weathering or fracturing, overall stratigraphy, type of equipment used, and skill of the equipment operator.

SEISMIC VELOCITY	INTERPRETATION OF MATERIAL COMPOSITION
0 - 2,500 ft/sec	Less dense materials generally consisting of soils and saprolites which can typically be excavated using backhoes and scrapers.
2,500 - 5,000 ft/sec	Partially weathered and fractured rock which can usually be ripped using large earth moving equipment in mass excavations. Trench excavation may require hoe ramming or blasting for removal.
> 5,000 ft/sec	Competent rock normally requiring blasting in trench and mass excavations.

The seismic refraction process is limited in some respect. The primary limitation is that if a layer of lower velocity (softer) material underlies a higher velocity (harder) material, the less dense material may not always be detected.

REGIONAL GEOLOGY

The project site is located in the Ashe Metamorphic Suite and Tallulah Falls Formation of the Blue Ridge Physiographic Province of North Carolina. The Blue Ridge consists of a variety of high-grade metamorphic and metasedimentary rocks with numerous igneous rock intrusions. According to the 1985 Geologic Map of North Carolina, the bedrock at the site consists of metagraywacke. The residual soils in this area are the product of in-place chemical weathering of the parent bedrock which consists of metamorphic rocks. The residuum can be found in both weathered and unweathered states. Although the surficial materials normally retain the structure of the underlying parent bedrock, they typically have a much lower density and exhibit strengths and engineering properties of soil. The soils are generally found to be finer grained near the surface where more extensive weathering has occurred. With increased depth, the particle size becomes more granular and gradually changes to partially weathered rock and ultimately to unweathered bedrock. The mineral composition of the parent rock and the environment in which the weathering occurs is largely responsible for the residual soil's engineering properties.

SUBSURFACE CONDITIONS

We have not been provided an estimated finished floor elevation (FFE) for the proposed building at this time. However, based on the site layout, we anticipate that construction of the building would require cuts and fills on the order of 10 to 15 feet. Based on our review of the refraction profiles, the preliminary site plan, and our estimate magnitude of cuts and fills, we anticipate rock to be encountered on the order of 20 to 25 feet below the surface within the footprint of the proposed building and cut areas for the parking lot. It should be noted that possible shallow rock or boulders are shown in the extreme western end of the profile for line 3. This possible shallow rock should be confirmed with soil test boring data.

The soil and rock zones can be interpreted as medium stiff to stiff soils generally transitioning to rock. Based on our past experience, we anticipate that p-wave velocities of more than 4,000 to 5,000 ft/sec generally correlate to the surface of the refusal material. The attached figures display the interpreted cross-sections of the performed seismic refraction lines. Our interpretation of the velocity zone indicating the transition to rock is shown as a dashed line on the profiles.

Please note that our survey locations are based on approximate elevations and locations. The elevations and locations provided on the attached profiles were estimated from the topographic contours on the provided survey and should be considered approximate. Please also note that we anticipate that boulders could be encountered within the residual soil but would not be detected by the refraction survey.

It is important to note that variations in subsurface conditions should be expected away from the seismic refraction arrays. Additionally, the client should be aware that the actual depths and excavation characteristics of the layers depicted on the cross sections may vary somewhat upon actual elevations of the materials. Seismic velocities can vary for various rock types. Therefore, some variations in the excavation characteristics of subsurface materials should be anticipated. We recommend a follow-up geotechnical study that includes soil test borings be performed by ECS in order to correlate 'ground truth' data with our data provided herein.

CLOSURE

This report was prepared in accordance with generally accepted geotechnical engineering practice. No other warranty is expressed or implied. The data and analysis presented in this report are based on the available project information, as well as on the results of the limited non-invasive field exploration. Variations in subsurface conditions should be expected away from the seismic refraction arrays. No third party is given the right to rely on this report without express written consent by ECS.

We appreciate the opportunity to be of service to you during this phase of the project. If you have any questions concerning the information and recommendations presented in this report, and when we can be of further assistance, please do not hesitate to contact us.

Sincerely,
ECS CAROLINAS, LLP represented by;

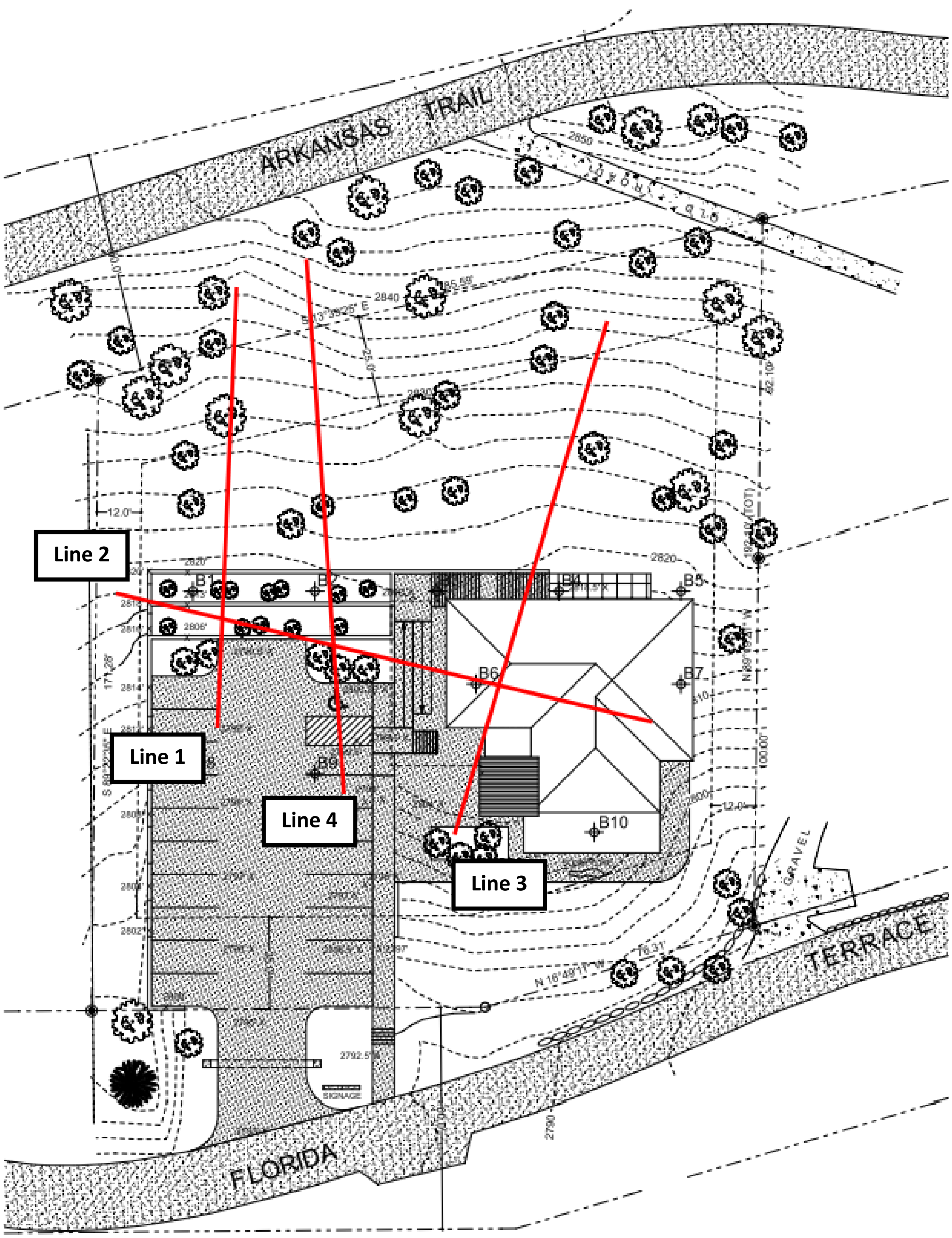
David G. Marsh, P.E.
Senior Project Manager

Matthew S. Fogleman, P.E.
Principal Engineer

Attachments: Refraction Survey Location Diagram
Refraction Profiles

NORTH CAROLINA PROFESSIONAL SEAL 041645 ENGINEER DAVID G. MARSH

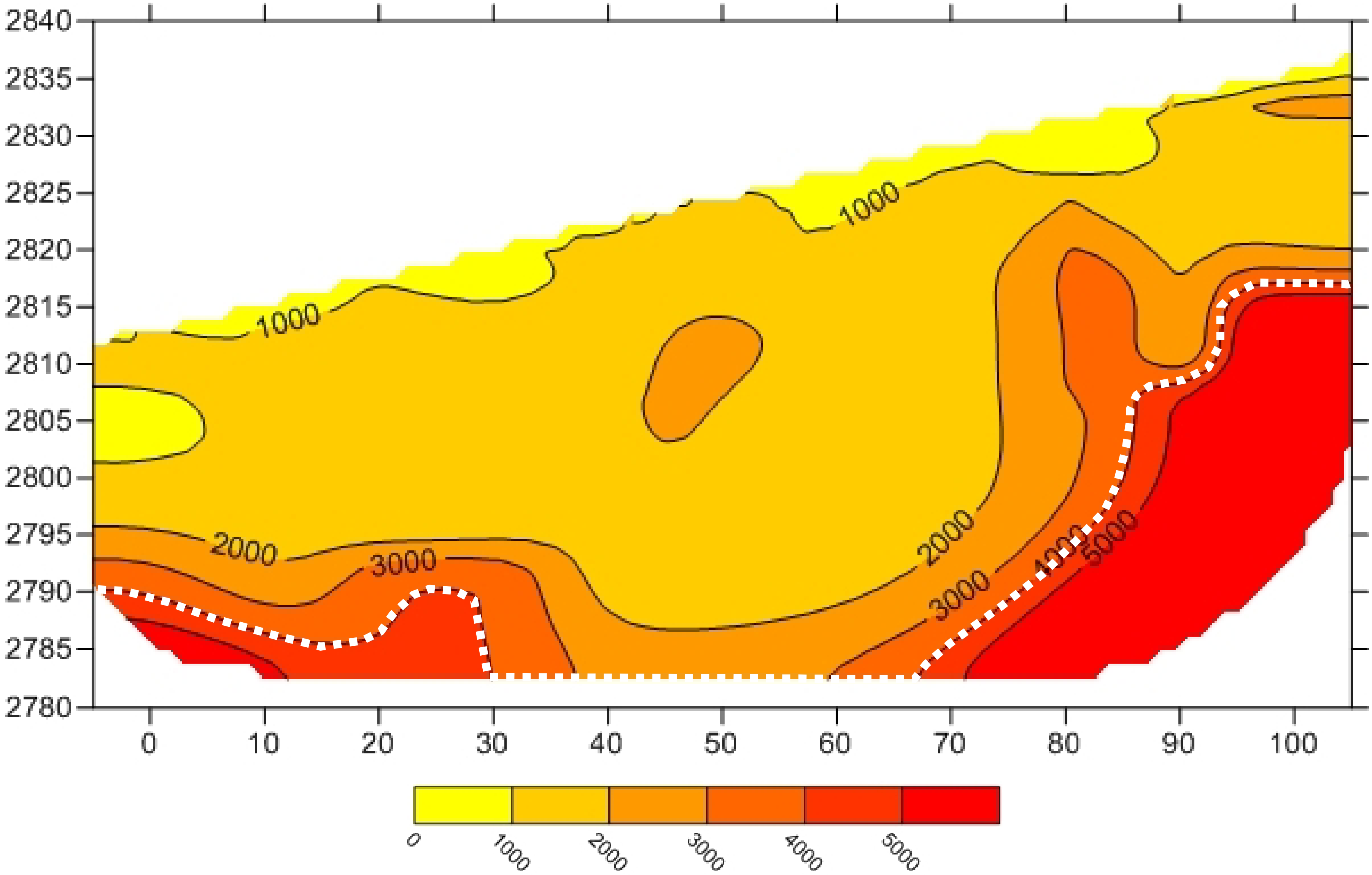
8/5/2014



LEGEND

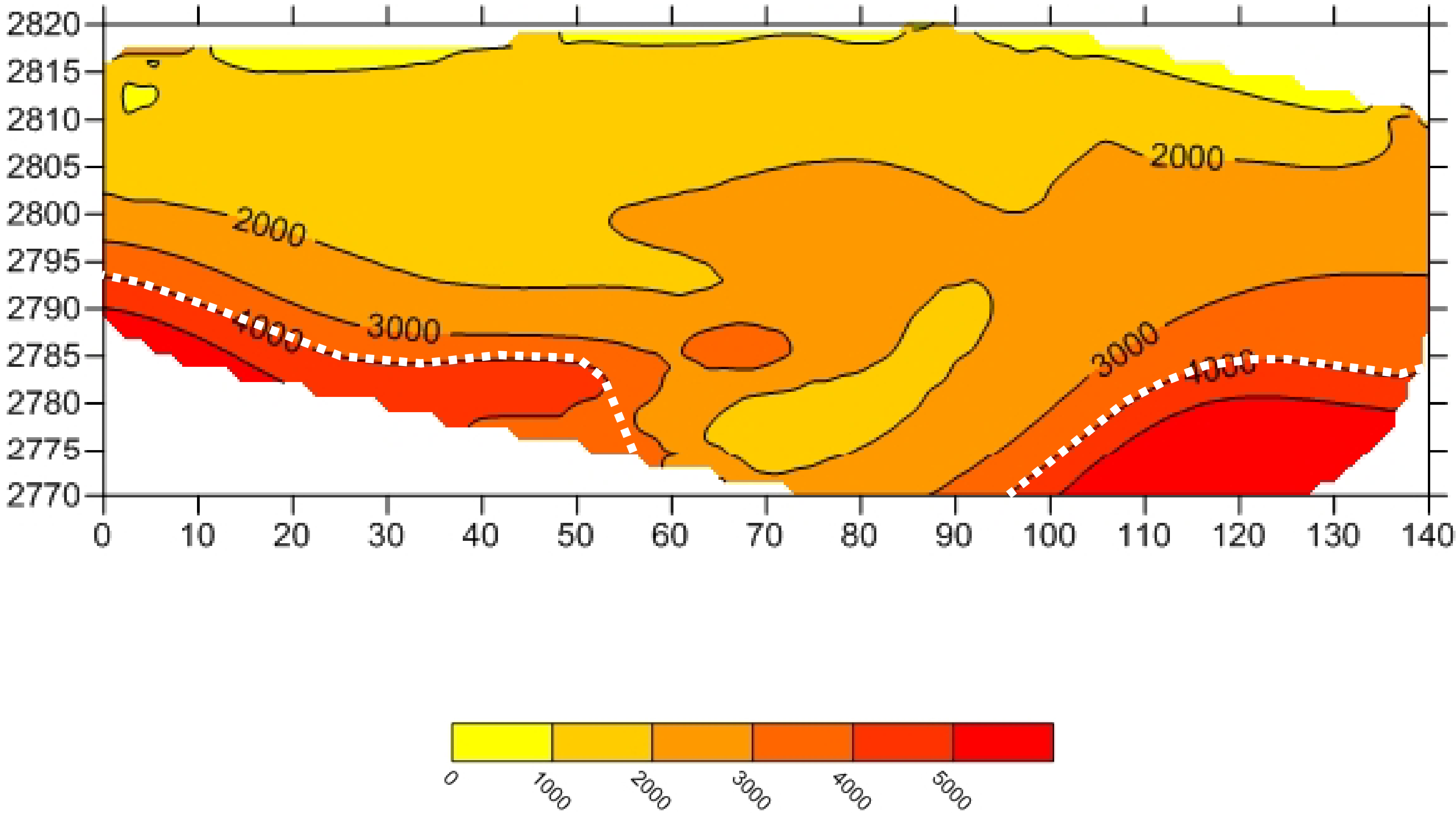
Line 1 — Approximate Survey Line Location

REFRACTION SURVEY LOCATION DIAGRAM
MONTREAT TOWN HALL
Town of Montreat, North Carolina
ECS Project No. 31-2648



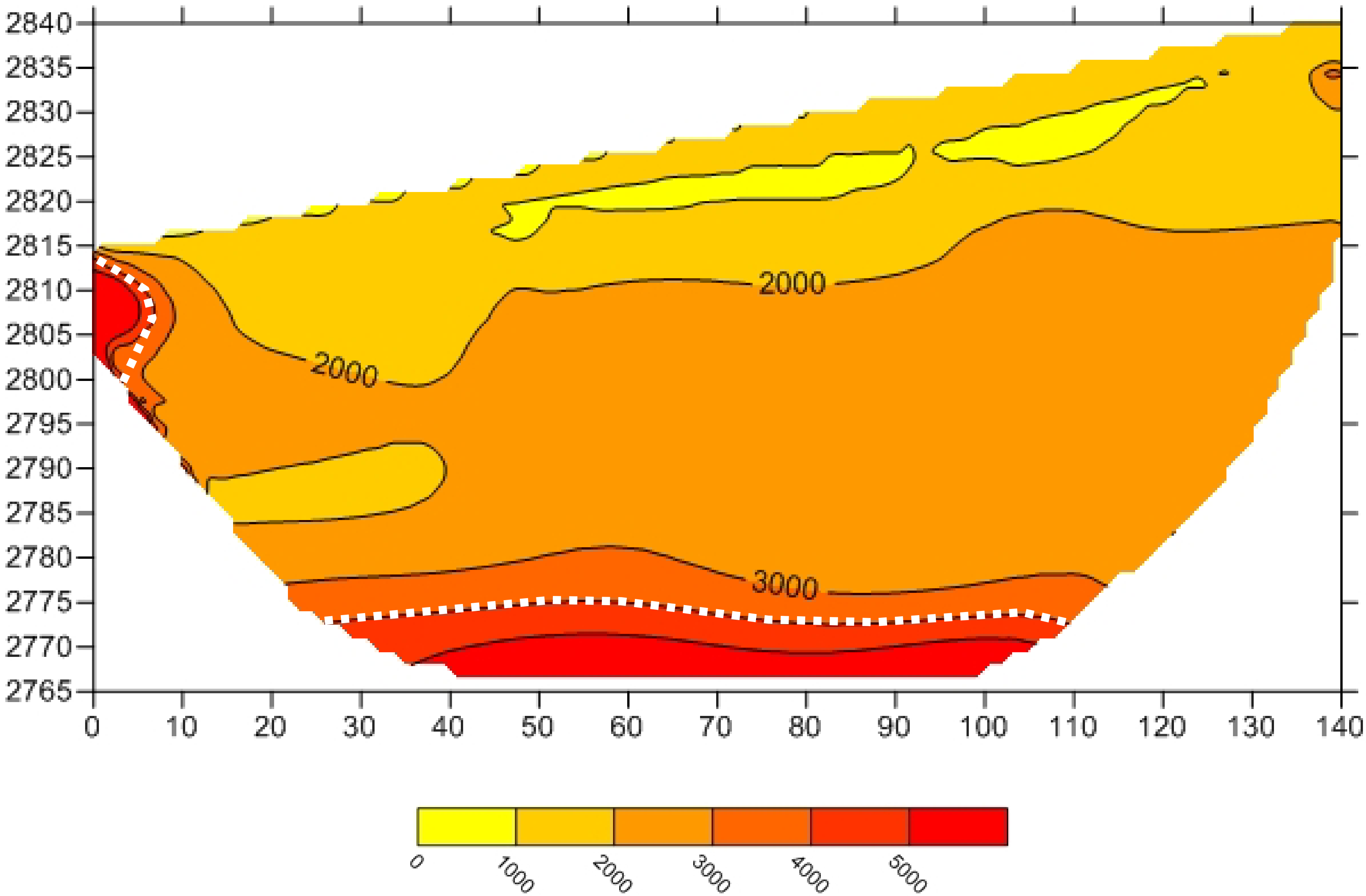
NOTE: Figure not to scale. Elevations and distances shown are approximate.

LEGEND			
▪▪▪▪▪▪▪▪▪▪ 4000 FT/S	ECS		REFRACTION SURVEY LINE 1 MONTREAT TOWN HALL Town of Montreat, North Carolina ECS Project No. 31-2648



NOTE: Figure not to scale. Elevations and distances shown are approximate.

LEGEND			
■■■■■■■■■■	4000 FT/S		REFRACTION SURVEY LINE 2 MONTREAT TOWN HALL Town of Montreat, North Carolina ECS Project No. 31-2648

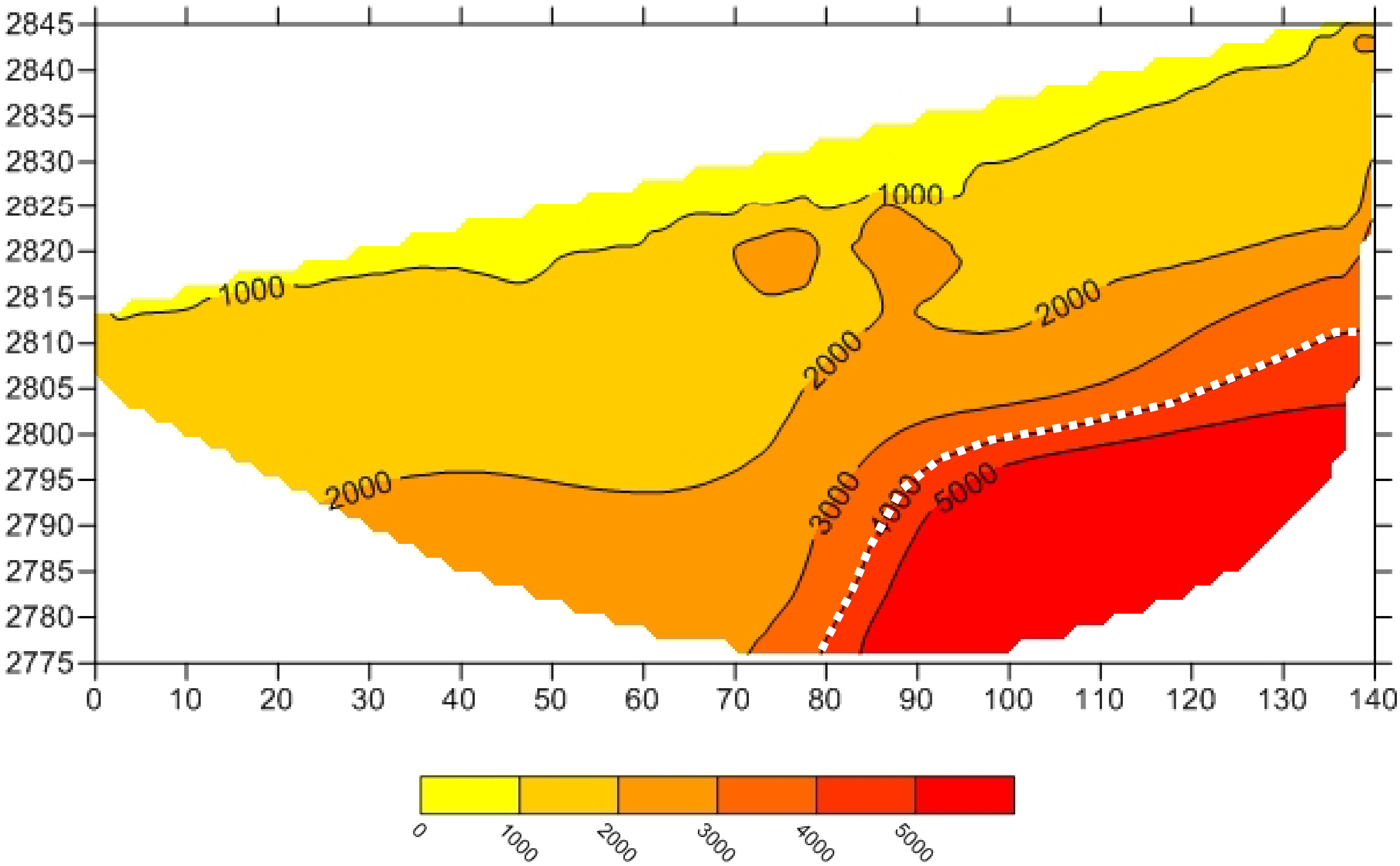


NOTE: Figure not to scale. Elevations and distances shown are approximate.

LEGEND

4000 FT/S

REFRACTION SURVEY LINE 3
MONTREAT TOWN HALL
Town of Montreat, North Carolina
ECS Project No. 31-2648



NOTE: Figure not to scale. Elevations and distances shown are approximate.

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▪▪▪▪▪▪▪▪▪▪ **4000 FT/S**

REFRACTION SURVEY LINE 4
MONTREAT TOWN HALL
Town of Montreat, North Carolina
ECS Project No. 31-2648