

## UNH WEST STADIUM - SOUND SYSTEM EVALUATION BY WJHW INC.

WJHW is a multi-discipline design firm for sound systems, acoustics, and communications technology that often consults on environmental noise projects. They have done numerous sound level studies, for other universities like Tulane University and Colorado State University. They have also worked with many municipal clients for amphitheaters and other music venues. You can see the range of services they provide and the portfolio of their work at their website <http://www.wjhw.com/about.htm>

Below is a summary of the evaluation they have provided for the University of New Hampshire West Stadium project. Included are three maps that illustrate three sound system configuration options.

From: Gary White [<mailto:gwhite@wjhw.com>]  
Sent: Wednesday, March 04, 2015 4:09 PM  
To: Bencks, Doug; John Harper ([john.harper@lbpa.com](mailto:john.harper@lbpa.com))  
Subject: RE: UNH West Stadium - sound system follow up materials

Doug-

We have extended the modeling out as far as the topographical maps will allow. Any farther out and the data becomes less precise because the sound system level and the ambient levels become closer together and it would be difficult to isolate the sound system from the ambient.

To predict sound levels at properties surrounding the proposed stadium, we have utilized the internationally recognized, Sound Plan software program. This software develops sound level contours based on user inputs including sound sources (speakers), sound levels, building construction, and terrain. Specific inputs for the UNH model include the following.

- The speaker directionality patterns input to the UNH sound model were based on representative 2-speaker and 3-speaker arrays, and noise levels were calibrated to 90 dBA through most of the seating areas. The frequency content of the speakers was based on a typical pop music spectrum. No enclosures were included around or behind the speaker arrays.
- Campus buildings within 1000 ft. of the stadium were included within the model, with building heights estimated from Google Earth images. The stadium itself was input from the current architectural models.
- Terrain was input to the model from GRANIT topographical information with a 1 mile radius of the stadium, provided to WJHW by the civil engineer.
- Other environmental factors, such as foliage, were not included within the model in order to provide a worst case scenario which is not dependent on season.

The Sound Plan computer model depicts sound levels as contours, with each line representing a different dBA sound level. The three contours maps present the sound levels in the community using three different

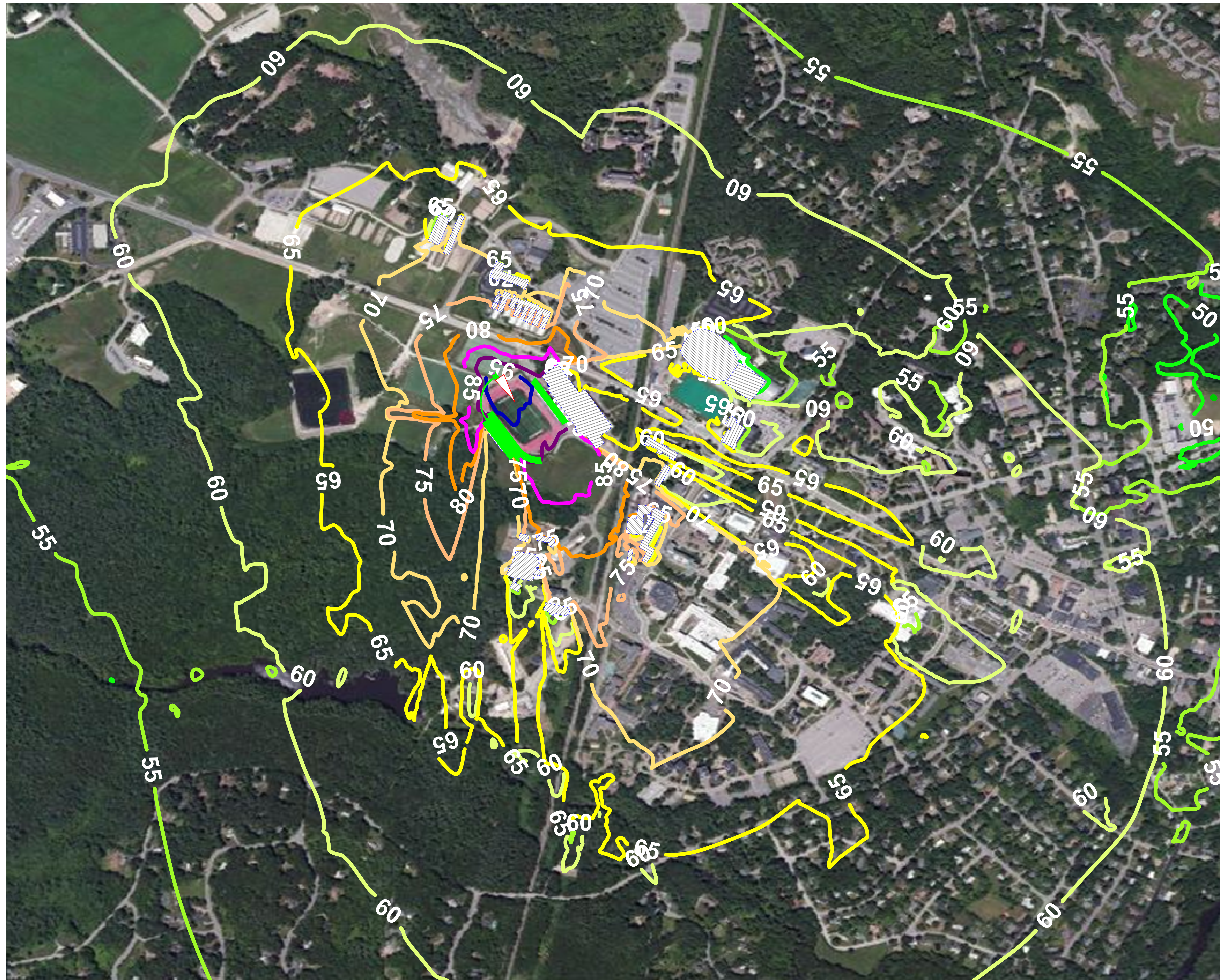
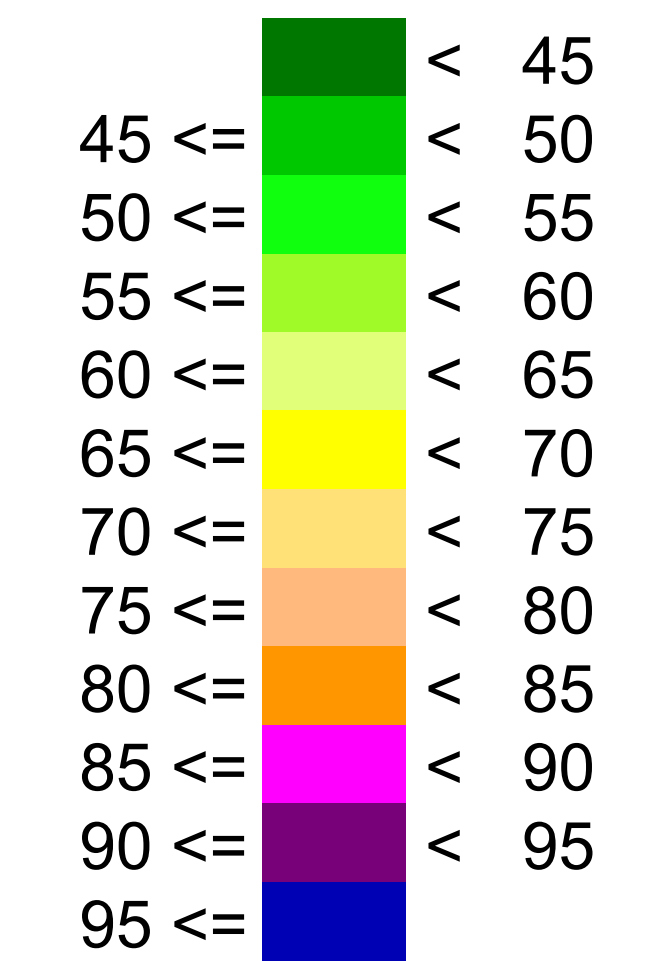
configurations of speakers: a north end zone cluster similar to what is currently in use at the stadium, a sideline speaker cluster on the roof of the field house, and a speaker cluster in the south end zone, facing north. It is worth noting that the sound levels shown within the contours are representative of the maximum noise levels over a short time during stadium events and are not sustained, continuous noise levels.

The computer model for the north endzone cluster corresponded to the relative levels WJHW measured during our visit to the University. Although our measurements used a lower level source in the stadium (85 dB versus 90 dB) the relative levels in the neighborhood were similar. The south endzone model showed similar sound levels north and west of the stadium compared to the levels in the south and east areas from the north endzone system. As expected, the sideline cluster provided the best overall option for the sound system in order to limit the level of sound in neighborhoods around the University. Most of the higher levels of sound are concentrated in the wooded area directly west of the stadium and the thick trees and vegetation do help reduce sound levels. Sound levels in the south neighborhood areas approach the measured ambient levels. WJHW recommends the sideline cluster as the preferred speaker system configuration.

It is important to realize that even if the measured sound system level is at or near the ambient noise level, residents are likely to still comment that the sound system is clearly audible. WJHW acknowledges those comments and offers that the spoken word or other sound system program is so completely different than the ambient noise (wind, insects, birds, etc.) that it will be easy to clearly hear what is being said, even in community locations where the stadium sound is no louder than the ambient noise.

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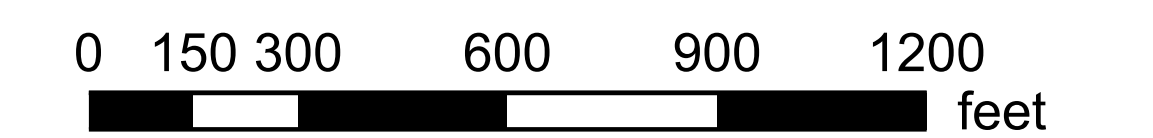
Noise levels dBA



Signs and symbols

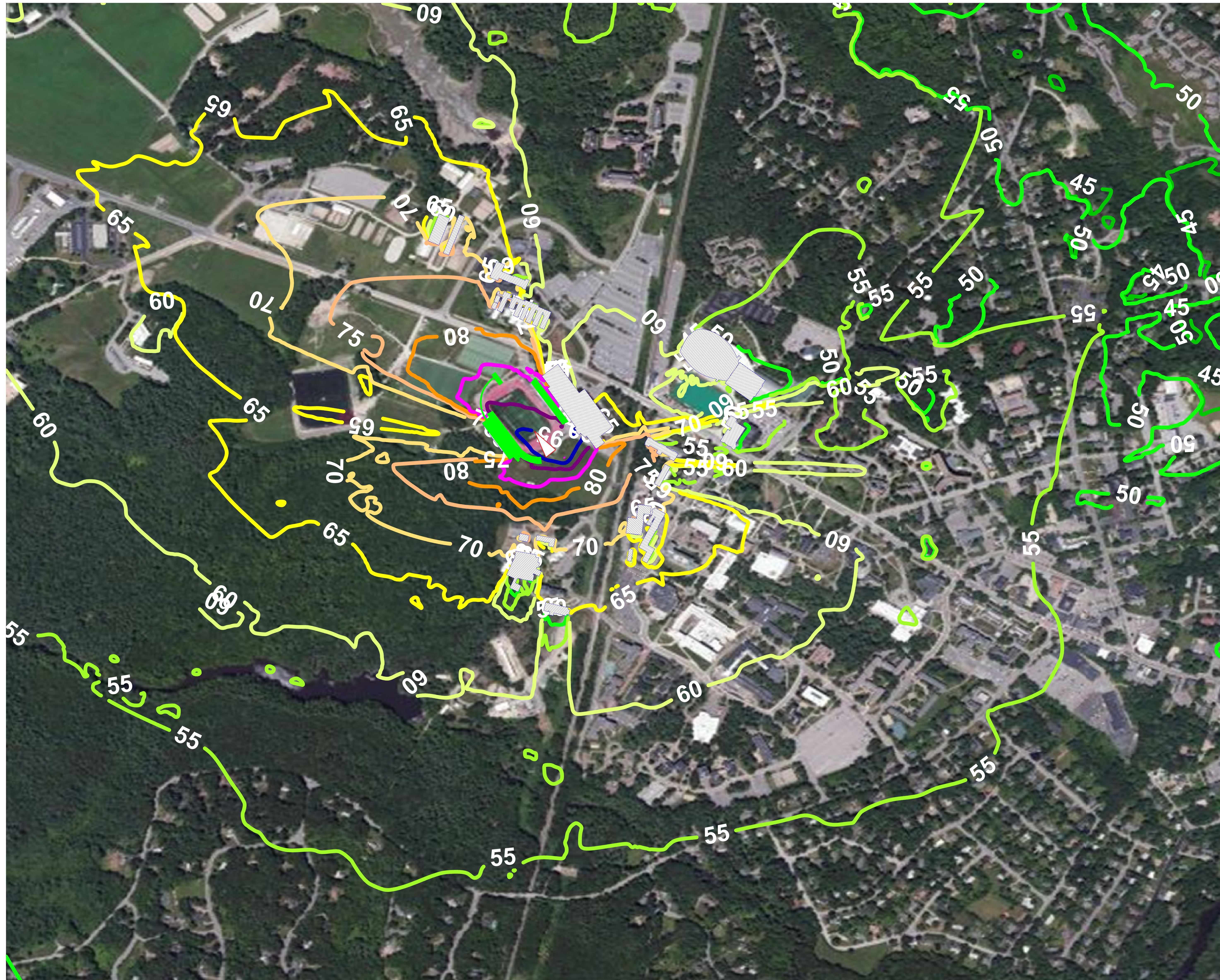
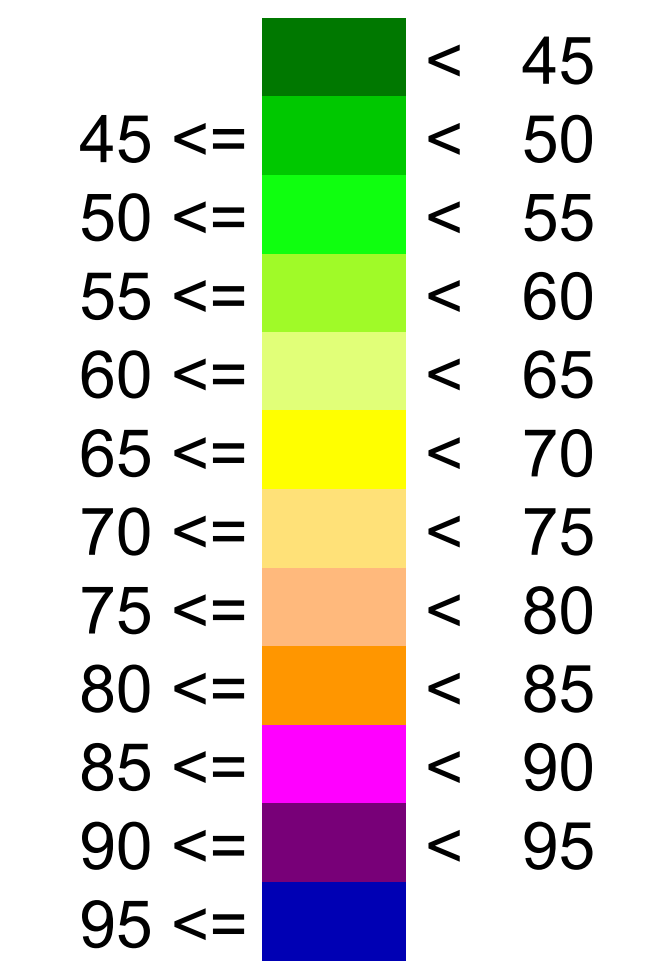
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- Nearby Campus Building
- Seating Areas

Length Scale 1:275



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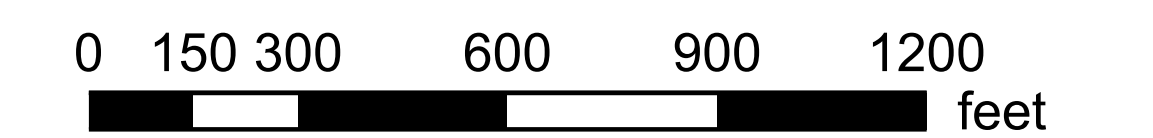
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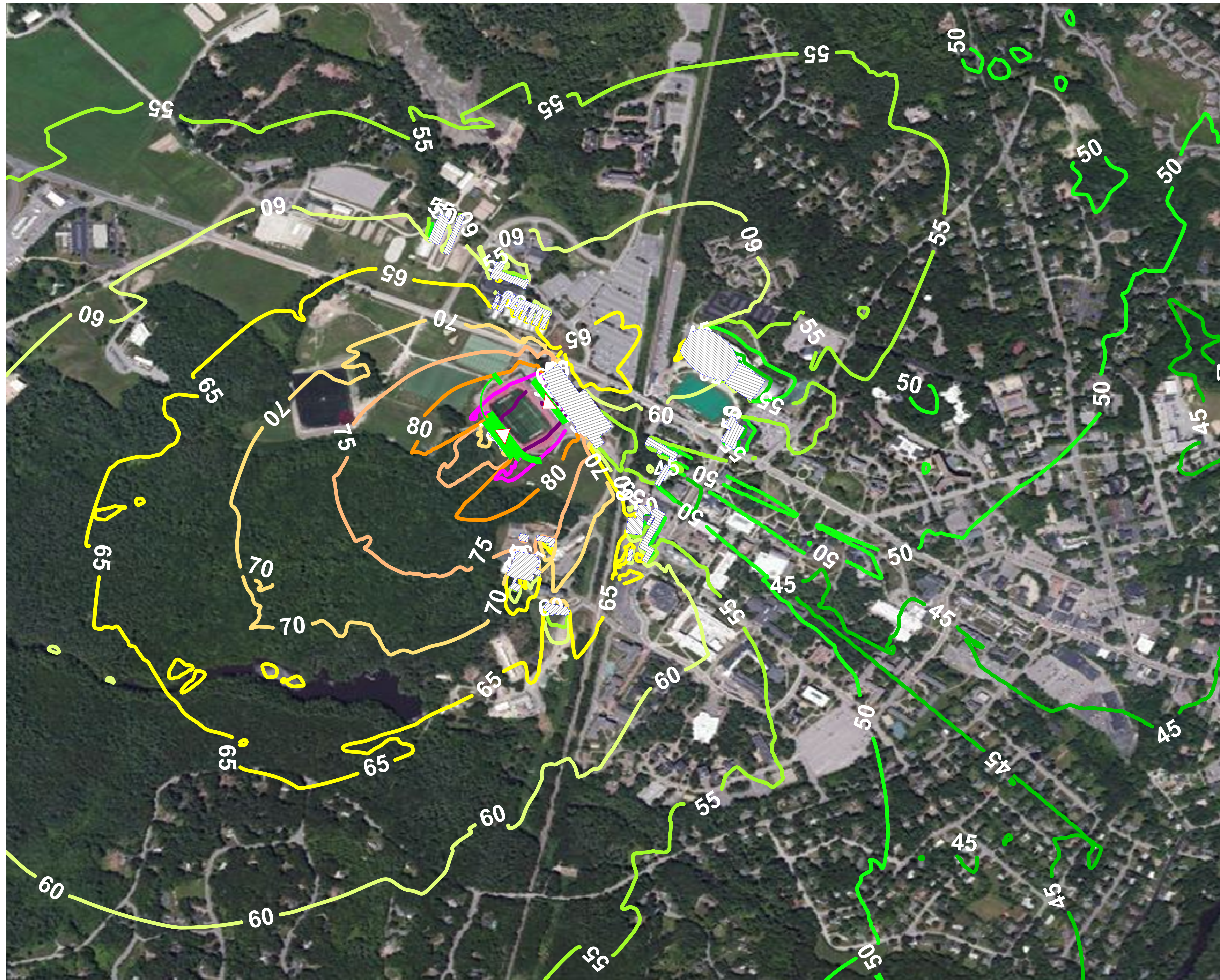
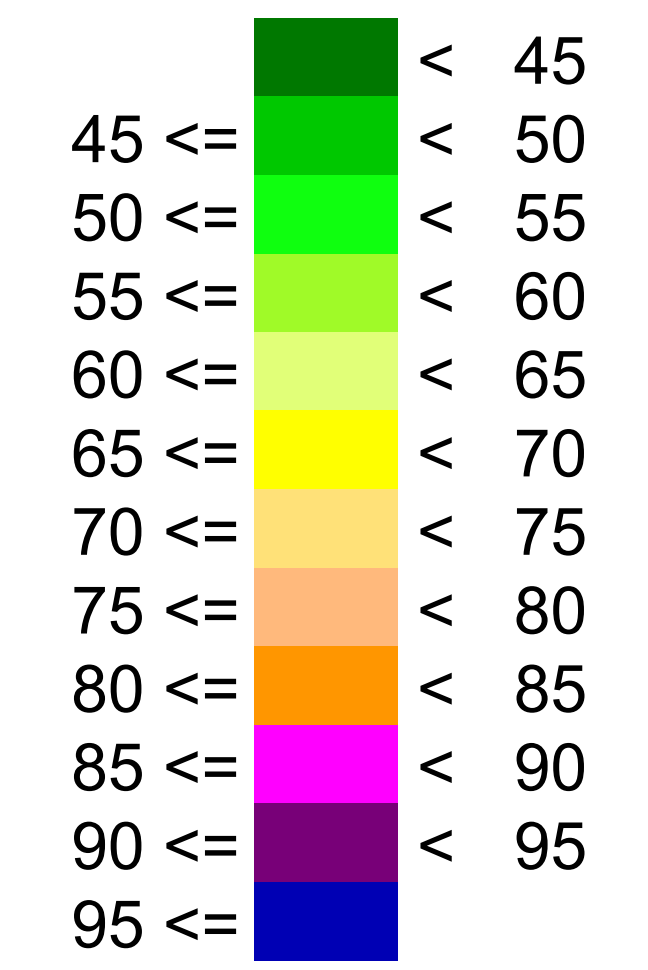
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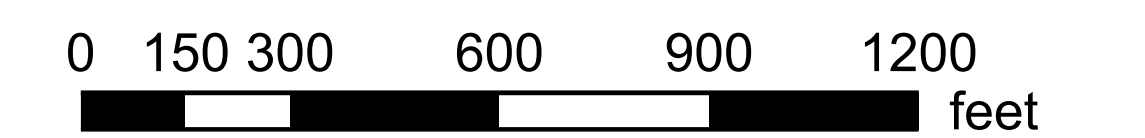
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