## Revised Visibility Analysis



## Introduction

North Atlantic Towers' proposal for a new wireless telecommunications facility ("Facility") at 62-64 Codfish Hill Road in Bethel, Connecticut, the subject of Connecticut Siting Council Docket 458, has recently been modified by reducing the heights of the tower within a two mile radius ("Study Area") of each of the two possible locations ("Site 1" and "Site 2") under consideration. As a result, All-Points Technology Corporation, P.C. ("APT") has prepared this analysis to re-evaluate those views associated with the lower Facility heights, using similar methodologies as those employed in the initial evaluations (se Application, Exhibit I).

The proposed Facility height at Site 1 would be reduced by 30 feet, from 150 feet above ground level ("AGL") down to 120 feet AGL. The proposed Facility height at Site 2 would be reduced by 20 feet, from 170 feet AGL down to 150 feet AGL.

## Methodology

To evaluate the proposed height reductions and their impacts on visibility, APT used the combination of its predictive computer models and photographs obtained during field test in 2013 and 2014.

The reduced heights were incorporated into the two computer modeling tools used in the initial analysis ${ }^{1}$ to calculate those areas from where the Facility may be visible. The remaining Project-specific data were unchanged, including each Site location and ground elevation, as well as the surrounding topography and existing vegetation. Information used in the model included LiDAR²-based digital elevation data and customized land use data layers developed specifically for this analysis. The LiDAR-based Digital Elevation Model ("DEM") represents topographic information for the state of Connecticut that was derived through the spatial interpolation of airborne LiDAR-based data collected in the year 2000 and has a horizontal resolution of ten (10) feet. In addition, multiple land use data layers were created from National Agricultural Imagery Program (USDA) aerial photography (1-foot resolution, flown in 2011) using IDRISI image processing tools. The IDRISI tools develop light reflective classes defined by statistical analysis of individual pixels, which are then grouped based on common reflective values such that distinctions can be made automatically between deciduous and coniferous tree species, as well as grassland, impervious surface areas, water and other distinct land use features. This information was manually cross-checked with the recent USGS topographic land characteristics to quality assure the imaging analysis.

Once the modified heights were incorporated with existing data layer, the image processing tools were applied and overlaid onto USGS topographic base maps and aerial photographs to achieve a revised estimate of locations where the Facility might be visible.

[^0]To supplement this information, the previously developed spatially-referenced models of the area were combined with the new Facility characteristics to regenerate photographic simulations portraying scaled renderings of the reduced Facility heights, using photographs obtained during previous balloon tests. Those photographs and renderings originally presented have been re-modeled with the reduced heights and presented herein for comparison. field data, site plan information and 3-dimension (3D) modeling software were used to develop, were generated and merged. The geographic coordinates obtained in the field for the photograph locations were incorporated into the model to produce virtual camera positions within the spatial 3D model. Photo simulations were then created using a combination of renderings generated in the 3D model and photo-rendering software programs. Photo-documentation of the balloon float and photo-simulations of the proposed Facility reductions are presented in the attachment at the end of this report.

## Visibility Analysis Results

The results of this analysis are graphically displayed on the visibility analysis maps provided in the attachment at the end of this report. The maps include a photolog, depicting the photo locations and corresponding simulations.

## Site 1

Areas from where a 120 -foot tall Facility at Site 1 would be visible above the tree canopy year-round comprise a total of approximately 77 acres, down from about 120 acres. When the leaves are off the trees, seasonal views through intervening tree trunks and branches are anticipated to occur over an additional $\pm 321$ acres (a reduction of approximately 172 acres compared to a 150 -foot tall tower). The reduced visibility occurs generally from locations 0.5 and farther from the Site location.

The proposed Facility height decrease of 30 feet would result in a substantial reduction in visibility, not only in terms of acreage (by $35 \%$ ), but also in the character of views from most locations where it would be seen. Most noticeable is the reduced visual impact from those select locations within 0.5 mile of the Site where the Facility may be seen seasonally; the modified tower would be buffered to a far greater extent by intervening trees. In the majority of areas where visible at distances beyond 0.5 mile, the tower would be closer to the tree line, reducing its vertical profile on the horizon.

Similar to the original proposal, near views to the north and east (within 0.5 mile or less) would be mainly restricted to that time of the year when the leaves are off the intervening deciduous trees and heavily obstructed. However, the 30 -foot reduction in height substantially diminishes the lines of sight towards the tower (see photos 7 and 8 as examples).

Farther to the north, across Route 302, (represented in photos 1 through 5), select areas of visibility are also reduced significantly and would be limited seasonally (visible in leaf-off conditions).

Visibility to the south would be limited to select locations within approximately 0.25 mile with minimal, seasonal views attained directly from Codfish Hill Road (see photo 10). Year-round views appear to extend over open fields to the southeast, but the reduced tower height drops below the canopy to the southwest such that any views would be heavily obstructed through trees or drop out of view altogether (see photos 11 and 12, taken from Ichabod Road).

Westward, year-round views would be attained from some locations along a short section of Wolf Pits Road (see photo 14). The profile of a reduced Facility height at Site 1 above the tree canopy in this area would be cut in half. In addition, the reduced Facility height would transition previously year-round views to seasonal (see photo 13), shortening the extent of visibility along this road. Similar conditions would occur at Bethel High School, at distances of a mile or more away, where both the overall extent of visibility and the Facility height above the tree line would be substantially reduced.

## Site 2

Areas from where a 150 -foot tall Facility at Site 2 would be visible above the tree canopy year-round comprise a total of approximately 139 acres, down from approximately 162 acres when compared to a 170 -foot tall tower at this location. When the leaves are off the trees, seasonal views are anticipated to occur over an additional $\pm 264$; this is a reduction of approximately 118 acres.

A 20 -foot reduction in Facility height at Site 2 would lower the overall visibility in terms of acreage (over $20 \%$ ). Nearby visible locations within 0.5 mile would benefit from the proposed drop in tower height, albeit not to the extent demonstrated at Site 1. From some locations, the lower height would bring the top of the tower closer to the tree line, reducing its profile against the sky. However, in the majority of areas at distance over 0.5 mile the overall character of the Facility would not change significantly.

The majority of year-round views would be limited primarily to areas within approximately 1,000 feet of the Site location and select areas approximately 0.75 mile and beyond to the north and west. To the north, across Route 302, isolated locations of year-round visibility occur along a short portion of Linda Lane (demonstrated in photo 19) and, to a lesser extent, from parts of Kellogg Road (see photo 20). Select elevated locations approximately one mile away to the northeast, in the Shelly Road and Boulder Creek Road area, may also have limited year-round views (photos 1 and 4) of the top of the tower at or near the tree line. Seasonal views would extend northward from the property towards Windaway Road, approximately 0.36 mile away, where upper portions of the Facility would be seen through the deciduous trees when the leaves are down.

Year-round visibility appears minimal to the south, with a portion of open fields south of Codfish Hill Road potentially attaining views. For the most part, areas south of the Host Property would have limited, seasonal views of upper portions of the Facility (see photo 11 through 14 as examples).

Visibility from areas west would be mostly limited to seasonal and partially obstructed views. However, intermittent year-round views would be attained from select locations along Wolf Pits Road (photo 15). Portions of Hoyts Hill Road farther to the west may also experience year-round views (see photo 16) but most of the views from this distance would be limited to those times of the year when the leaves are down. At higher elevations to the west with east-facing slopes, the Facility would benefit from the backdrop of rising topography to the east/northeast and be nestled into the hillside. At more than a mile away, the area in around Bethel High School would have year-round views of the Facility (photos 17 and 18).

## VIEW SHED MAPPING



Visibility Analysis - Topo Base
Proposed Wireless Telecommunications Facility
Bethel CT1155C - Site 1
62-64 Codfish Hill Road, Bethel, CT
Proposed facility height is 120 feet AGL
Existing tree canopy height estimated as 65 feet
Study area encompasses a two-mile radius and
includes 8,042 acres of land
Map compiled 7/6/2015

Only those resources located within the extent of the map are depicted. For a complete list of data sources consulted for this analysis, please refer to the Documentation Page.

## Legend

- Proposed Tower

Photo Locations

- Not Visible
- Seasonal Views

Year-round Views
Predicted Seasonal Visibility (321 Acres)
Predicted Year-Round Visibility (77 Acres)

## Towns

2-Mile Study Area
Open Space



Visibility Analysis - Aerial Base
Proposed Wireless Telecommunications Facility Bethel CT1155C - Site 1
62-64 Codfish Hill Road, Bethel, CT
Proposed facility height is 120 feet AGL.
Existing tree canopy height estimated as 65 fee
Study area encompasses a two-mile radius and
includes 8,042 acres of land
Map compiled 7/6/2015

Only those resources located within the extent of the map are depicted. For a complete list of data sources consulted for this analysis, please refer to the Documentation Page.

## Legend

## - Proposed Tower

Photo Locations

- Not Visible
- Seasonal Views

Year-round Views
Predicted Seasonal Visibility (321 Acres)
Predicted Year-Round Visibility (77 Acres)

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Towns
2-Mile Study Area
Open Space


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-POINTS


Visibility Analysis - Topo Base
Proposed Wireless Telecommunications Facility
Bethel CT1155C - Site 2
62-64 Codfish Hill Road, Bethel, CT
Proposed facility height is 150 feet AGL
Existing tree canopy height estimated as 65 feet
Study area encompasses a two-mile radius and
includes 8,042 acres of land.
Map compiled 7/6/2015

Only those resources located within the extent of the map are depicted. For a complete list of data sources consulted for this analysis, please refer to the Documentation Page.

## Legend

- Proposed Tower

Photo Locations

- Not Visible
- Seasonal Views

Year-round Views
Predicted Seasonal Visibility (264 Acres)
Predicted Year-Round Visibility (139 Acres)
Location

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$\square$Towns
2-Mile Study Area
-Open Space


Visibility Analysis - Aerial Base
Proposed Wireless Telecommunications Facility Bethel CT1155C - Site 2

## 62-64 Codfish Hill Road, Bethel, CT

Proposed facility height is 150 feet AGL
Existing tree canopy height estimated as 65 fee
Study area encompasses a two-mile radius and
includes 8,042 acres of land
Map compiled 7/6/2015

Only those resources located within the extent of the map are depicted. For a complete list of data sources consulted for this analysis, please refer to the Documentation Page.

## Legend

## - Proposed Tower

Photo Locations

- Not Visible
- Seasonal Views

Year-round Views
Predicted Seasonal Visibility (264 Acres)
Predicted Year-Round Visibility (139 Acres)


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$\square$Towns
2-Mile Study Area
verizonwireless Open Space

## DOCUMENTATION

## SOURCES CONSULTED FOR VIEWSHED MAPS

## 62-64 Codfish Hill Road

Bethel, Connecticut

## Physical Geography / Background Data

Center for Land Use Education and Research, University of Connecticut (http://clear.uconn.edu)
*Land Use / Land Cover (2006)
*Coniferous and Deciduous Forest (2006)
*LiDAR data - topography (2000)
United States Geological Survey
*USGS topographic quadrangle maps - Bethel, Botsford, Newtown and Danbury (1984)
National Resource Conservation Service
*NAIP aerial photography (2012)
Heritage Consultants
${ }^{\wedge}$ State Scenic Highways (based on Department of Transportation data, updated monthly)
${ }^{\wedge}$ Municipal Scenic Roads (by website, phone and/or email/fax - current)

## Cultural Resources

Heritage Consultants
${ }^{\wedge}$ National Register
${ }^{\wedge}$ Local Survey Data

## Dedicated Open Space \& Recreation Areas

Connecticut Department of Energy and Environmental Protection (DEEP)
*DEEP Property (May 2007)
*Federal Open Space (1997)
*Municipal and Private Open Space (1997)
*DEEP Boat Launches (1994)
Connecticut Forest \& Parks Association
${ }^{\wedge}$ Connecticut Walk Book West - The Guide to the Blue-Blazed Hiking Trails of Western Connecticut, 19th Edition, 2006.

## Other

${ }^{\wedge}$ ConnDOT Scenic Strips (based on Department of Transportation data)
*Available to the public in GIS-compatible format (some require fees).
${ }^{\wedge}$ Data not available to general public in GIS format. Reviewed independently and, where applicable, GIS data later prepared specifically for this Study Area.

## LIMITATIONS

The visibility analysis map(s) presented in this report depict areas where the proposed Facility may potentially be visible to the human eye without the aid of magnification based on a viewer eye-height of 5 feet above the ground and intervening topography and an assumed tree canopy height of 65 feet. This analysis may not necessarily account for all visible locations, as it is based on the combination of computer modeling, incorporating 2012 aerial photographs, and in-field observations of balloon tests from publicly-accessible locations (obtained 11/30/13 and $1 / 17 / 14$ ). No access to private properties beyond the host Property was provided to APT personnel. This analysis does not claim to depict the only areas, or all locations, where visibility may occur; it is intended to provide a representation of those areas where the Facility is likely to be seen.

The photo-simulations in this report are provided for visual representation only. Actual visibility depends on various environmental conditions, including (but not necessarily limited to) weather, season, time of day, and viewer location.

## SITE 1 PHOTOGRAPHS



Site 1 Location

## Legend

$\square$ Site $1 \bigcirc$ Year-Round Visibility







| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 3 | ADJACENT TO \#3 RACE BROOK DRIVE | SOUTHWEST | +/- 0.72 MILE | SEASONAL |

hnology corporation
north atlantic






| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| $\mathbf{6}$ | ADJACENT TO \#10 AUNT PATTY'S LANE EAST | NORTHWEST | $+/-\mathbf{0 . 8 9}$ MILE | YEAR ROUND |




SIMULATION
PROPOSED FACILITY AT 120 FEET

| PHOTO |
| :---: |
| $\mathbf{7}$ |

## PROPOSED FACIITY AT 120 FEET




PROPOSED FACILITY AT 120 FEET
SIMULATION

| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE |
| :---: | :---: | :---: | :---: |
| $\mathbf{8}$ | HILLSIDE COURT CUL-DE-SAC | VISIBILITY |  |
| SOUTH | +/- 0.24 MILE | SEASONAL |  |

north atlantic



| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 10 | ADJACENT TO \#37 CODFISH HILL ROAD | NORTH | +/- 0.25 MILE | SEASONAL |



| РНото | Location | orientation | distanceto site | VIIBLITY |
| :---: | :---: | :---: | :---: | :---: |
| 10 | ADJACENT TO \#37 Codish hill road | North | +/-0.25 MILE | SEASONAL |
|  |  |  | \#Al-Pints |  |





















## SITE 2 PHOTOGRAPHS



Site 2 Location
Base Map Source: 2012 Aerial Photograph (CTECO)
Legend

- Site $2 \bigcirc$ Year-Round Visibility




SOUTHWEST
+/- 1.02 MILES $\quad$ YEAR ROUND


| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 2 | ADJACENT TO \#10 LIME KILN COURT | SOUTH | +/- 0.82 MILE | NOT VISIBLE |

## DOCUMENTATION

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| PHOTO | LOCATION | ORIENTATION | DISTANCETO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 4 | BOULDER CREEK ROAD CUL-DE-SAC | SOUTHWEST | $+/-\mathbf{0 . 9 7}$ MILE | SEASONAL |




| PHOTO | LOCATION | ORIENTATION | DISTANCETO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| $\mathbf{6}$ | ADJACENT TO \#10 AUNT PATTY'S LANE EAST | NORTHWEST | $+/-\mathbf{0 . 8 3}$ MILE | NOT VISIBLE |

NORTH ATLANTIC TOWERS

 nology corporation




DOCUMENTATION

| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 10 | WINDAWAY ROAD | SOUTHEAST | +/- 0.36 MILE | SEASONAL |



SIMULATION

| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 10 | WINDAWAY ROAD | SOUTHEAST | +/- 0.36 MILE | SEASONAL |
|  |  |  | $\mathcal{F}_{\text {TECALLOLOOCOII }}$ | $\begin{aligned} & \text { North ithentic } \\ & \text { towers } \end{aligned}$ |









| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 14 | CODFISH HILL ROAD AND WOLF PITS ROAD | NORTHEAST | +/- 0.65 MILE | SEASONAL |



SIMULATION

| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBIIITY |
| :---: | :---: | :---: | :---: | :---: |
| 14 | CODFISH HILL ROAD AND WOLF PITS ROAD | NORTHEAST | +/- 0.65 MILE | SEASONAL |
|  |  |  |  |  |









| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 18 | ADJACENT TO \#11 JUDD AVENUE | SOUTHEAST | +/-1.35 MILES | YEAR ROUND |






| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 20 | ADJACENT TO \#20 KELLOGG ROAD | SOUTHEAST | +/- 0.60 MILE | YEAR ROUND |

Tall-POINT<br>ALL-POINTS

north atlantic towers


| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 20 | ADJACENT TO \#20 KELLOGG ROAD | SOUTHEAST | +/- 0.60 MILE | YEAR ROUND |


[^0]:    ${ }^{1}$ IDRISI image analysis program (developed by Clark Labs, Clark University) and ArcGIS ${ }^{\oplus}$, developed by Environmental Systems Research Institute, Inc.
    ${ }^{2}$ LiDAR is an acronym for Light Detection and Ranging. It is a technology that utilized lasers to determine the distance to an object or surface. LiDAR is similar to radar, but incorporates laser pulses rather than sound waves. It measures the time delay between transmission and reflection of the laser pulse.

