SBA Tower/Clearwire Acton Proposal Criterra Analysis

Optimized Wireless Communications Capability
Scientific, objective, automatic…

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Director, Products & Services

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Maglothin Credentials

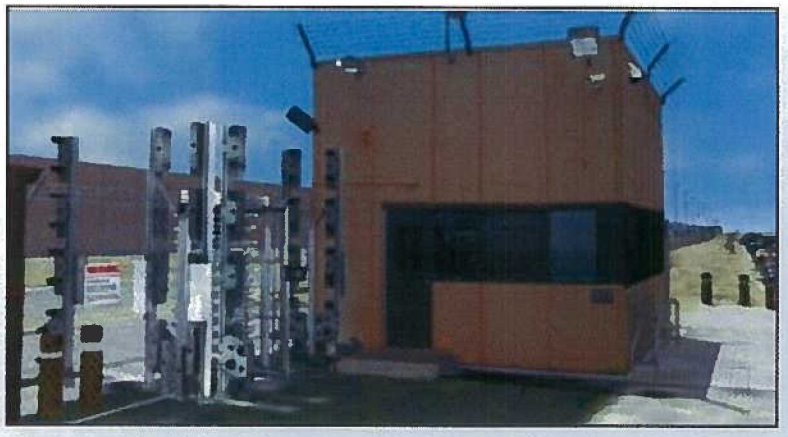
- Leader military's premier security system evaluation team
  - Analyzed design options through state-of-the-art modeling
  - DOD trained in Systems Engineering, GIS, M&S, and design
  - Designed wireless communications infrastructure
    - "Backhaul" bi-static microwave (MW) communications
    - Wireless Mesh Networks (WMN)
    - Employed technology similar to civilian cellular systems
  - Integral design team member for 19 DOD and DOE sites
  - Supported almost $1B total in system upgrades
  - Wireless long-haul video links to nuclear missile silos
  - Wireless security systems supporting national resources
  - Supported designs for 25 other sensitive sites and programs
  - Air Force and Marine One security systems
  - Nuclear storage and material handling
  - Classified Missile Defense Agency International sites
  - Space Shuttle Atlantis In Transit

Criterra

- Criterra software development began 2004; $8M invested
- Geospatially accurate, advanced deterministic analysis
  - Specializes in radio frequency (RF) attenuation analysis
  - Determines Propability of Reception (P_{Rx})
- Primary market is governments and large companies
- Criterra considers many factors not limited to:
  - Line of Sight (LOS) with RF attenuation (Fresnel, etc.)
  - Device-specific 3-D radiation propagation maps or "Lobes"
  - Antenna gain, frequency, tilt, field of view, XYZ, etc.
- Accurate and <u>precise</u> outputs
  - Optimum quantity, placement, and configurations
  - Graphic display of RF attenuation for ground-based receivers

Criterra Credentials

- USAF
- U.S. Border
- NATO
- Army COE
- PANYNJ
- MASSPORT
- Israeli Defense Forces
- Fortune 500 Co.'s



…and now supporting the residents of Acton

3-D Tour of Acton

Analyses and Assumptions

Criterra model based on 10m NED and Acton GIS data

1. **Applicant Proposed Tower Performance**
   - Based on RF coverage of "Target Circle" as defined in SBA Towers II, Inc. "5-7 Craig Road Alternative Analysis"
   - Apply manufacturer specs for antenna radiation patterns
   - Apply Eriksen's 1 April Clearwire enclosure parameters
   - Ensure Microwave "backhual" capability
2. **Determine best tower location(s) to cover target area**
   - Assume residential areas are not allowed for auto optimize
   - Consider all possible 2.6GHz tower/antenna configurations
3. **Analyze alternative locations recommended by others**

Antenna Manufacturer Specs

2300-2700MHz Remote Tilt Panel Antenna

Electrical Specifications

Frequency Range	2300 - 2700 MHz / 2300 - 2700 MHz
Gain	17.1 dBi 2.4 GHz 17.8 dBi 2.6 GHz
Return Loss	> 15 dB
Polarization	Dual Slant ± 45°
Horizontal Beamwidth	65°
Vertical Beamwidth	7° with null
Electrical Downtilt	0° - 10° independently continuously adjustable
Upper Sidelobe Level	< -18 dB
Front to Back Ratio	> 30 dB
Isolation Between Ports	> 30 dB
Power Rating	250W
Impedance	50 ohm
Lightning Protection	DC grounded
Connector Type	N-Type female
RET Type	Internal motor & manual override
RET Interface	AISG 2 Remotely upgradeable
RET Connector	Single AISG 8 pin male

Mechanical Specifications

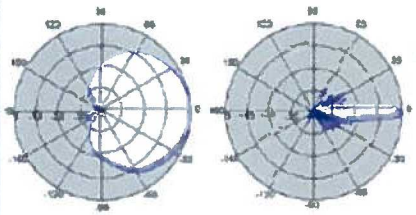
Antenna Dimensions	1070x300x115 mm
Packed Dimensions	1200x330x200 mm
Antenna Weight	13 kg
Radome Material	Polyester Fibreglass pultrusion

Maximum Environmental Ratings

Humidity	95% RH @ +30°C
Lateral Loading (Front)	0.45 kN @ 160 km/h
Lateral Loading (Rear)	0.48 kN @ 160 km/h
Rain	140mm per hour
Rated Wind Velocity	200 km/h
Temperature	-40°C to +70°C

Mounting Options

F-042-GL-E	Fixed Clamps
T-045-GL-E	Adjustable Clamps



Azimuth Elevation

Last U

AM-X-WM-17-65-00T

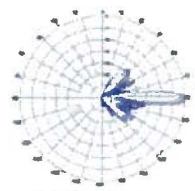
2496 – 2690MHz, X-pol., H65 °/ V7 °

Electrical / Mechanical Design Specification

Frequency Range	2496–2690MHz
Gain	17.5dBi
Horizontal Beam Width	65°
Vertical Beam Width	7°
Impedance	50Ω
VSWR	≤1.35:1
Polarization	Dual, Slant ±45°
Upper 1st Sidelobe Suppression	≥18dB (@downtilt 0°)
Front-to-Back Ratio	≥ 30dB
Adjustable Downtilt Range	0° – 10°
Port to Port Isolation	≥ 25dB
Passive Intermodulation, IM3	≤ -153dBc
Input Maximum CW Power	300 W
Control Interface	AISG

Mechanical Specification

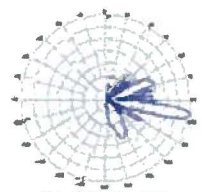
Dimension	Antenna (Without clamp)	6.54 x 2.6 x 48.00 inch
	RET	2.34 x 1.18 x 7.73 inch
Weight	Antenna (Without clamp)	14.2 lbs
	RET	1.2 lbs
	TTLNA (With BKT)	15.9 lbs
Connector		2 x 7/16 Din(F) / Rear Side
Max Wind Speed		150mph (67 m/s)
Wind Load (@ 100mph)		72.74lbf (323.48 N)



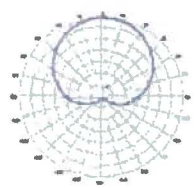
Vertical Pattern (Downtilt 0)

TTLNA Mechanical Specification

Dimension	Without BKT	7.32 x 3.50 x 11.69 inch
	With BKT	7.32 x 3.7 x 15.95 inch
Weight	Without BKT	15.2 lbs
	With BKT	15.9 lbs
Connector		4 x 7/16 Din(F)



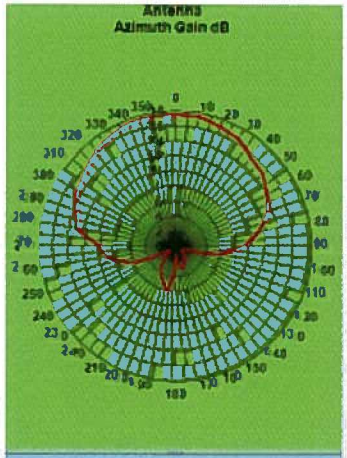
Vertical Pattern (Downtilt 10)

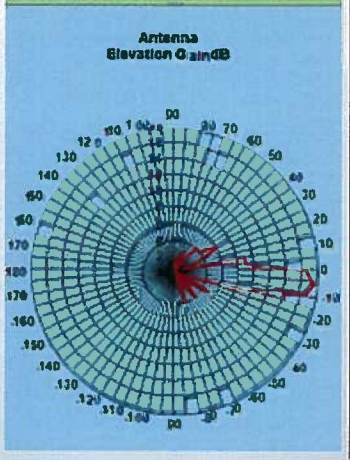


Horizontal Pattern

Technical Assumptions

Path Loss Exponent = 2.75 for low-density township





Name: Altr0001

Sensor Type: Relay

Mast Height(M): 48.00

Has communication

Antenna properties

Distance from top(m): 0.00

Path loss Exponent: Town_LoDens

Range limit(m): 3000.00

Select antenna: 1-LLPX310R: ACT

Activate antenna ☑

Type: LLPX310R

☐ Is a relay antenna

Frequency (GHz) 260 Power(dB) 18.00

Azimuth: 180.0 Tilt: -2.00

Accept

Point | 3D Objects | Effects | Wall Mounted

Name: NonRes_Zones

Deployment description:

Enter your description here

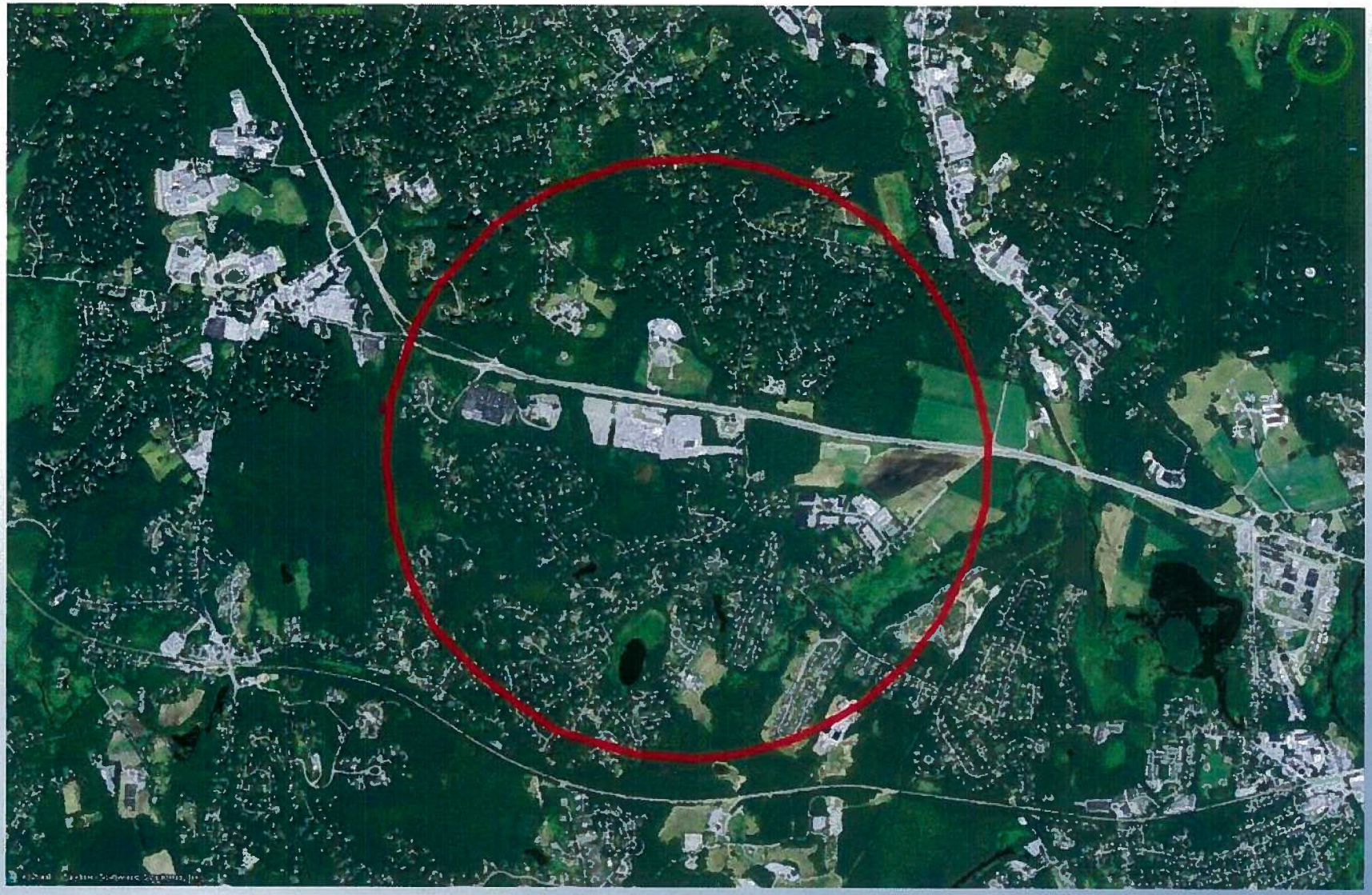
Reception antenna height (m): 2.00

Reception power threshold (dB): -73.00

Accept

Point | 3D Objects | Effects | Wall Mounted

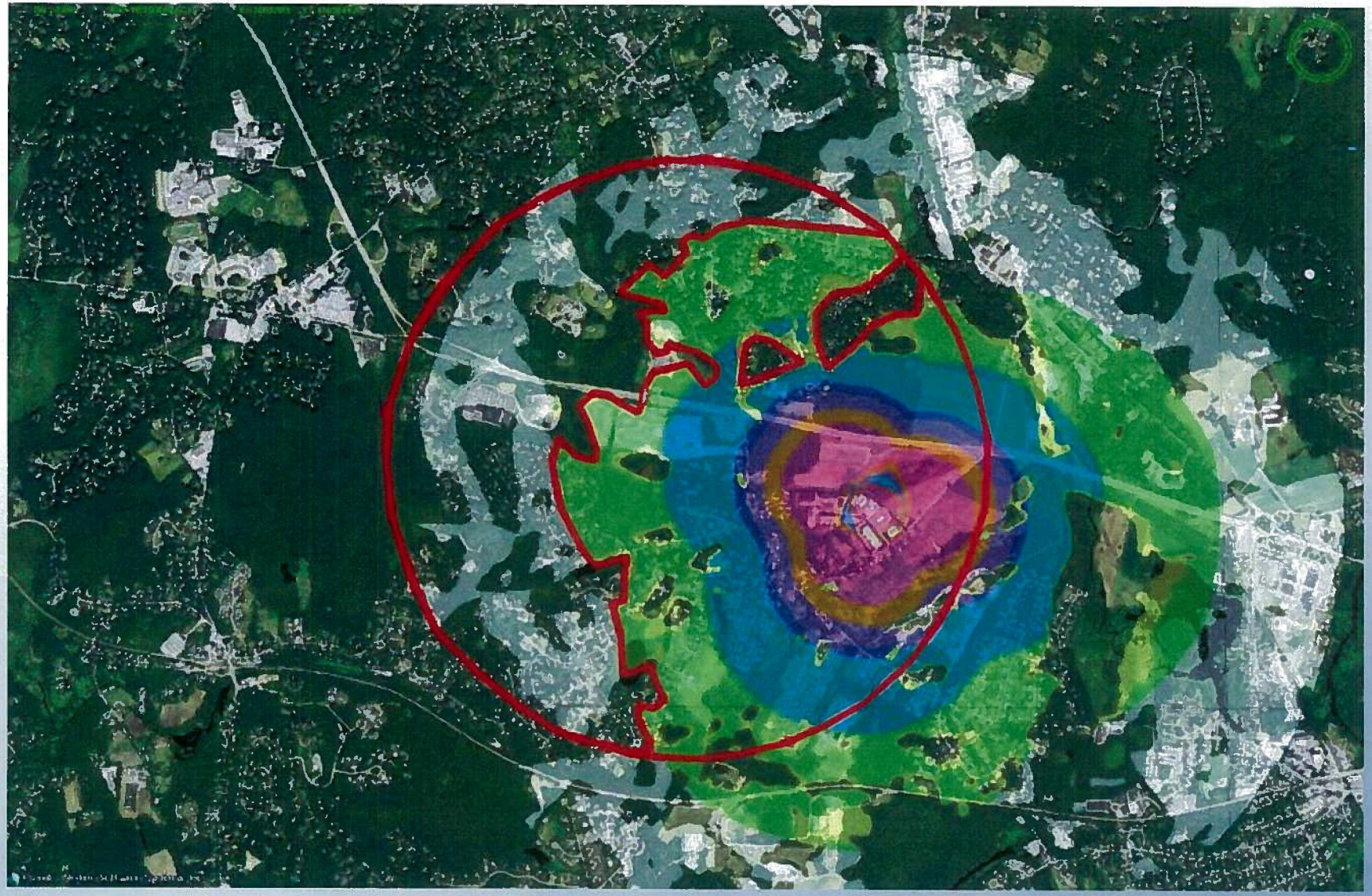
SBA Towers II, Inc Target Area



Analysis of SBA Towers II, Inc. Proposed Tower Plan

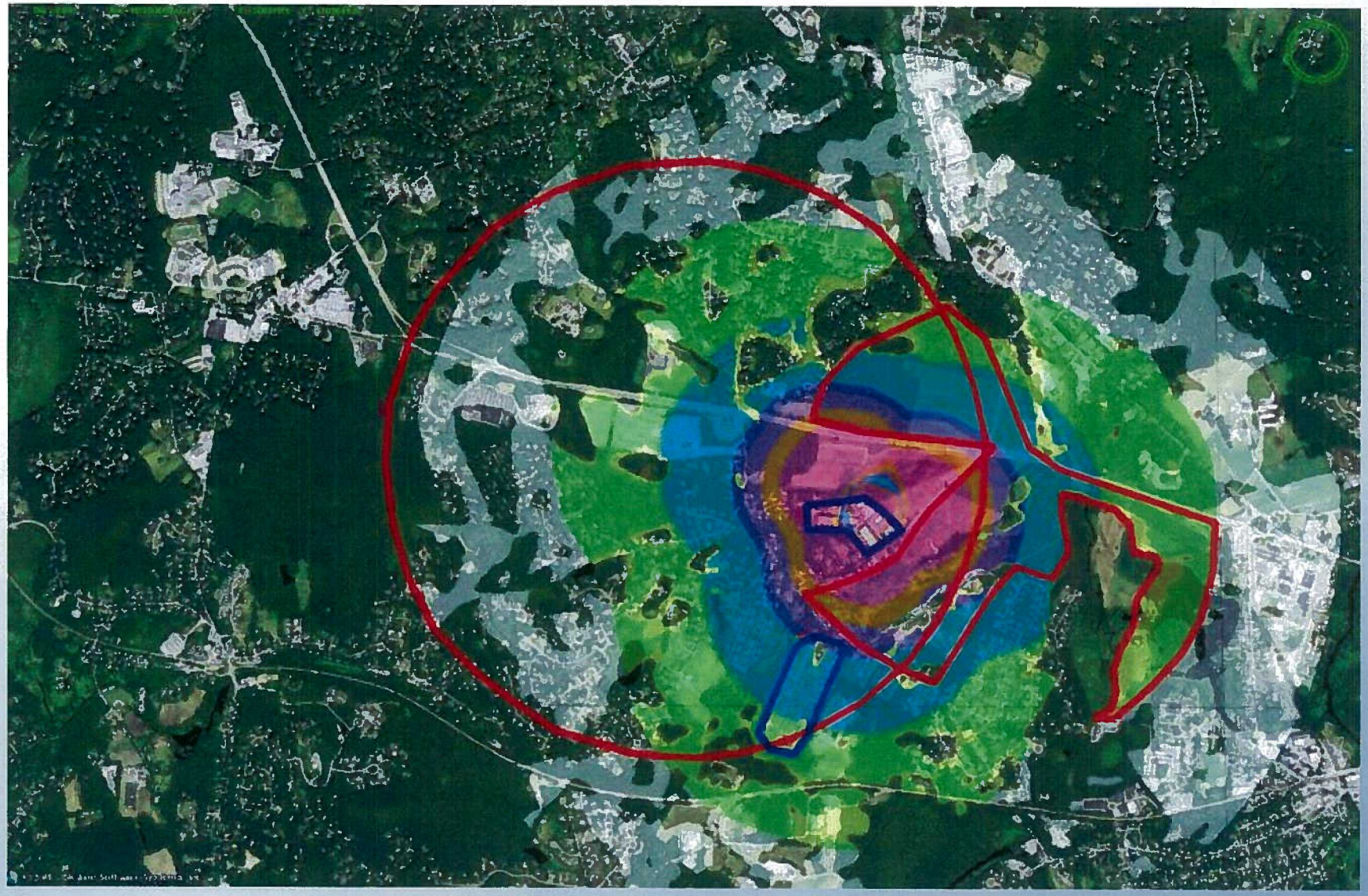
Proposed Craig Rd Tower 7244

Covers only ~56% of SBA target area



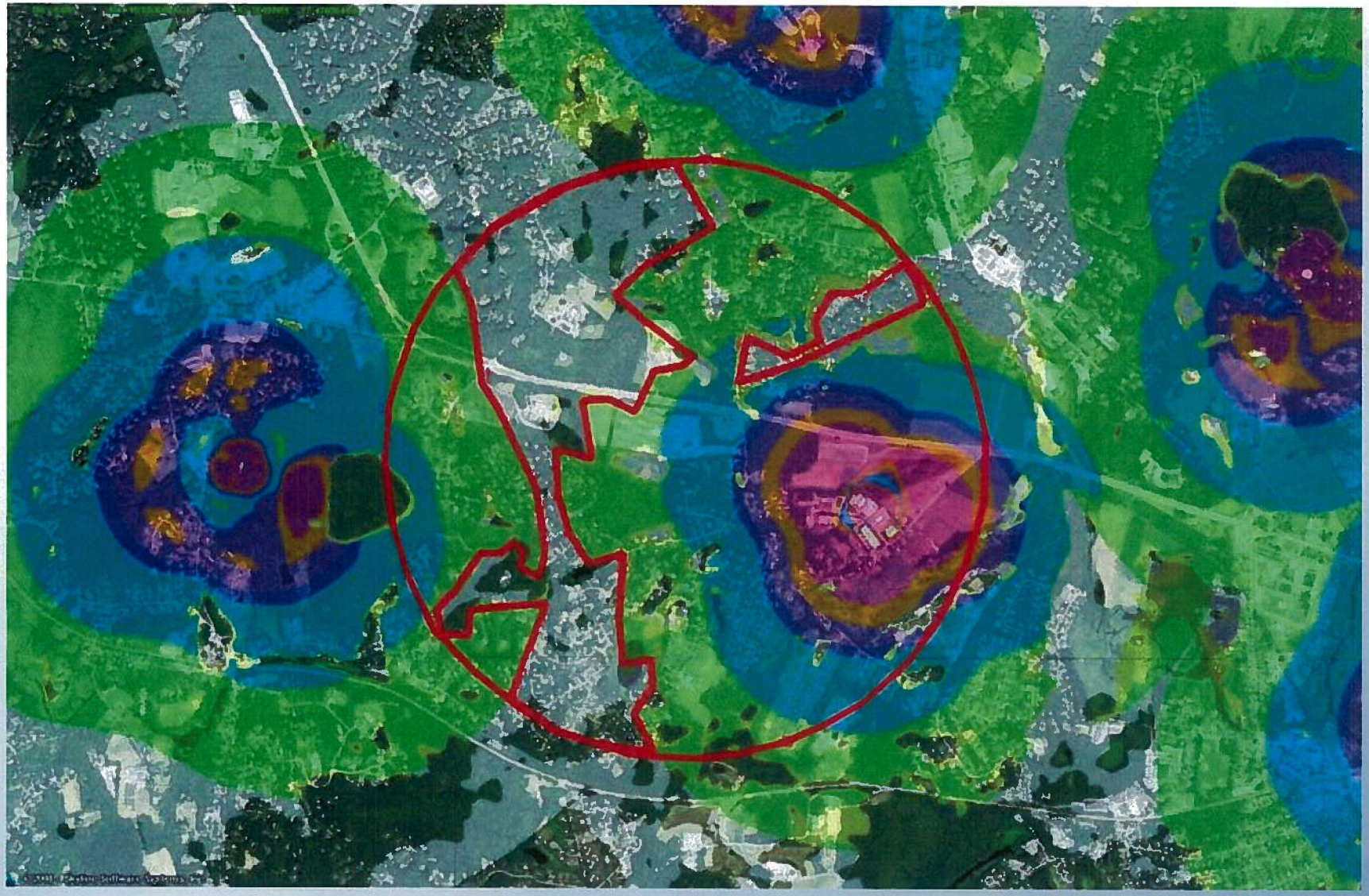
Proposed Craig Rd Tower 7244

Covers wasted area over Water District and farm fields



Total Proposed

Significant gaps in residential and commercial zones



Analysis 2
Criterra Optimization;
Best Location to Fill Target Area:

Adesa Concord (Zone OP-2)

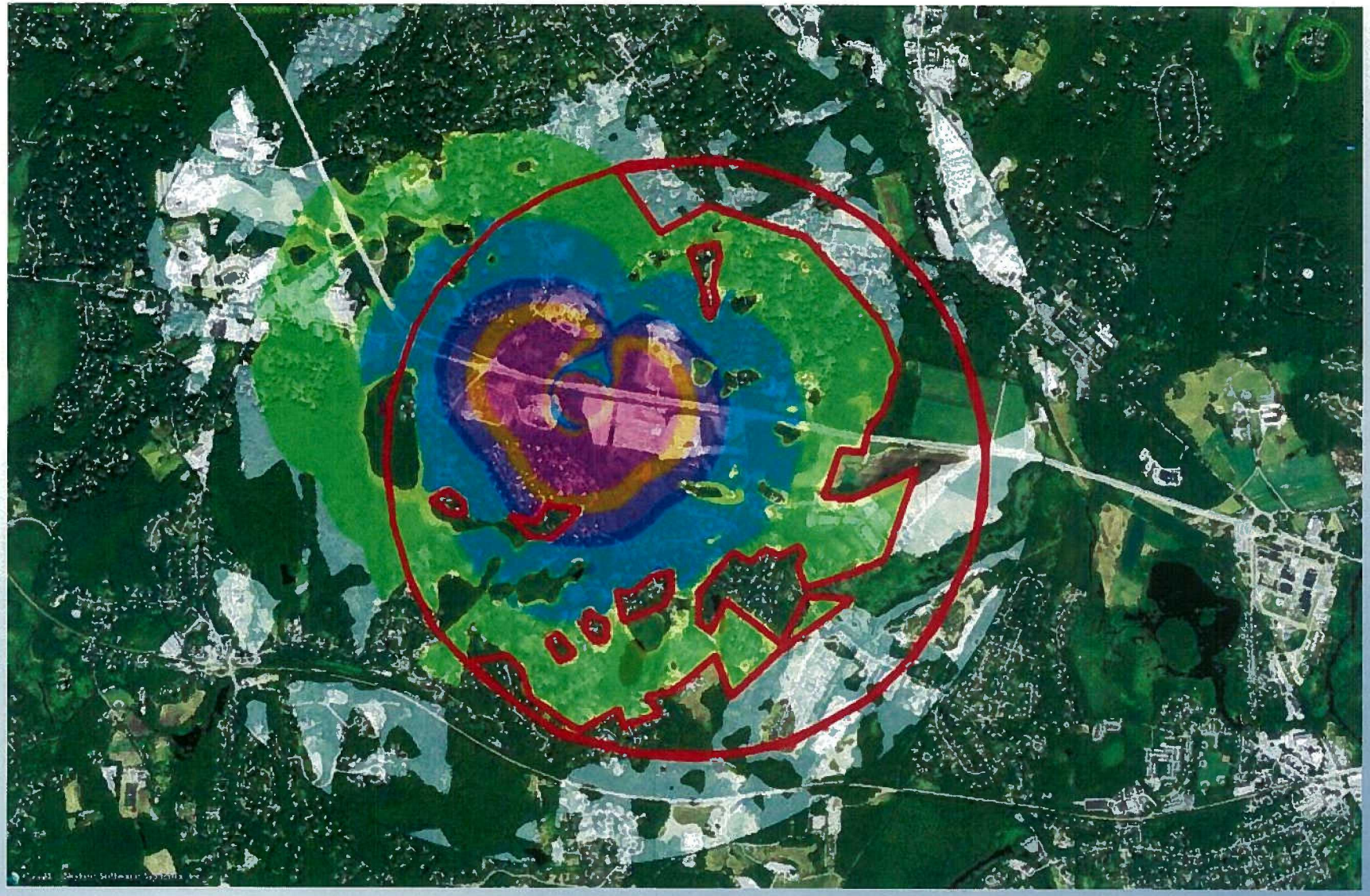
Car Lot Behind Concordian Motel

LAT/LON 42.4717042, 42.4717042

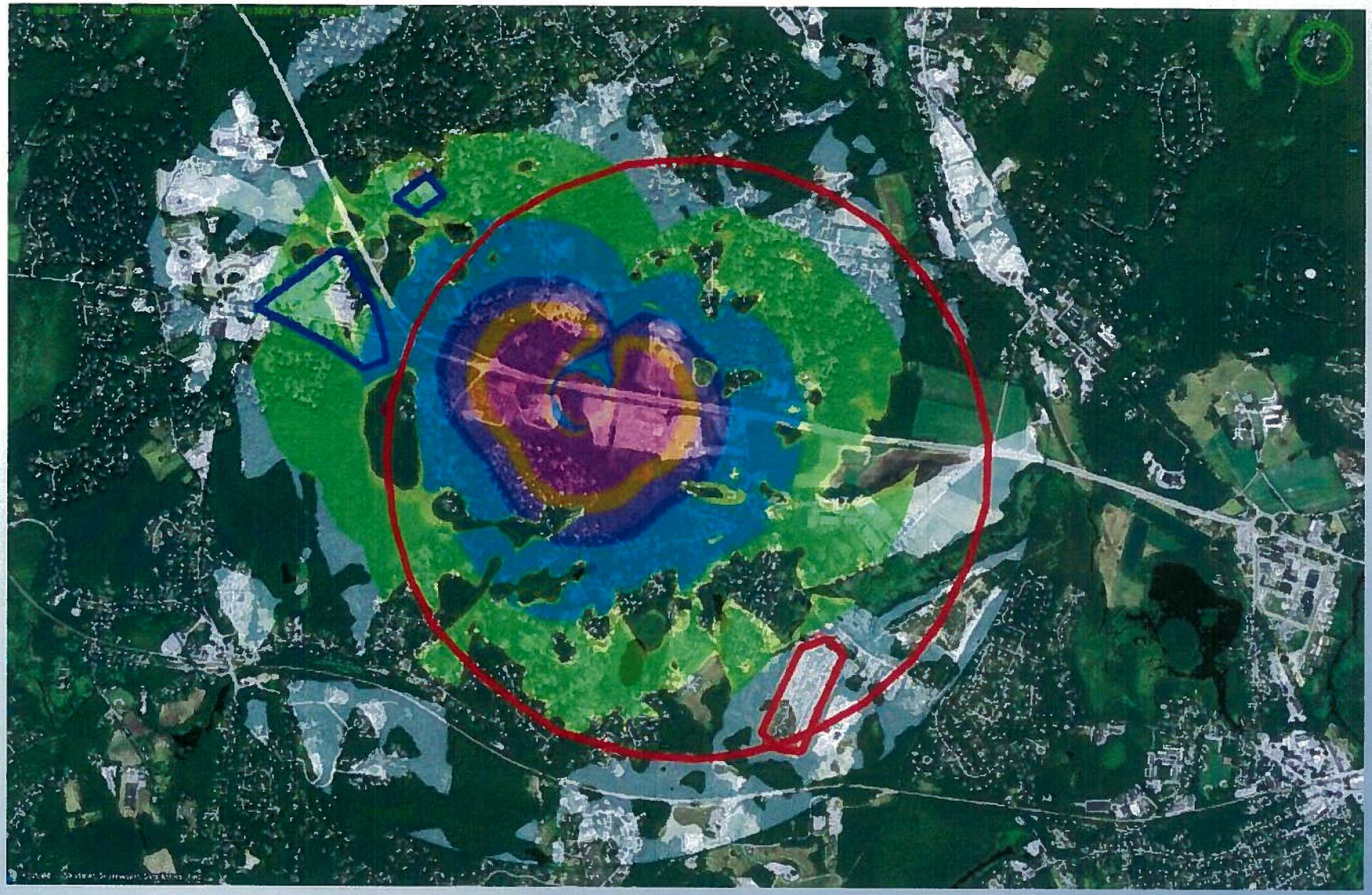
Three LLPX310R set at AZ = 60º, 180º, and 300º

Adesa Tower

Covers ~72% of SBA target area

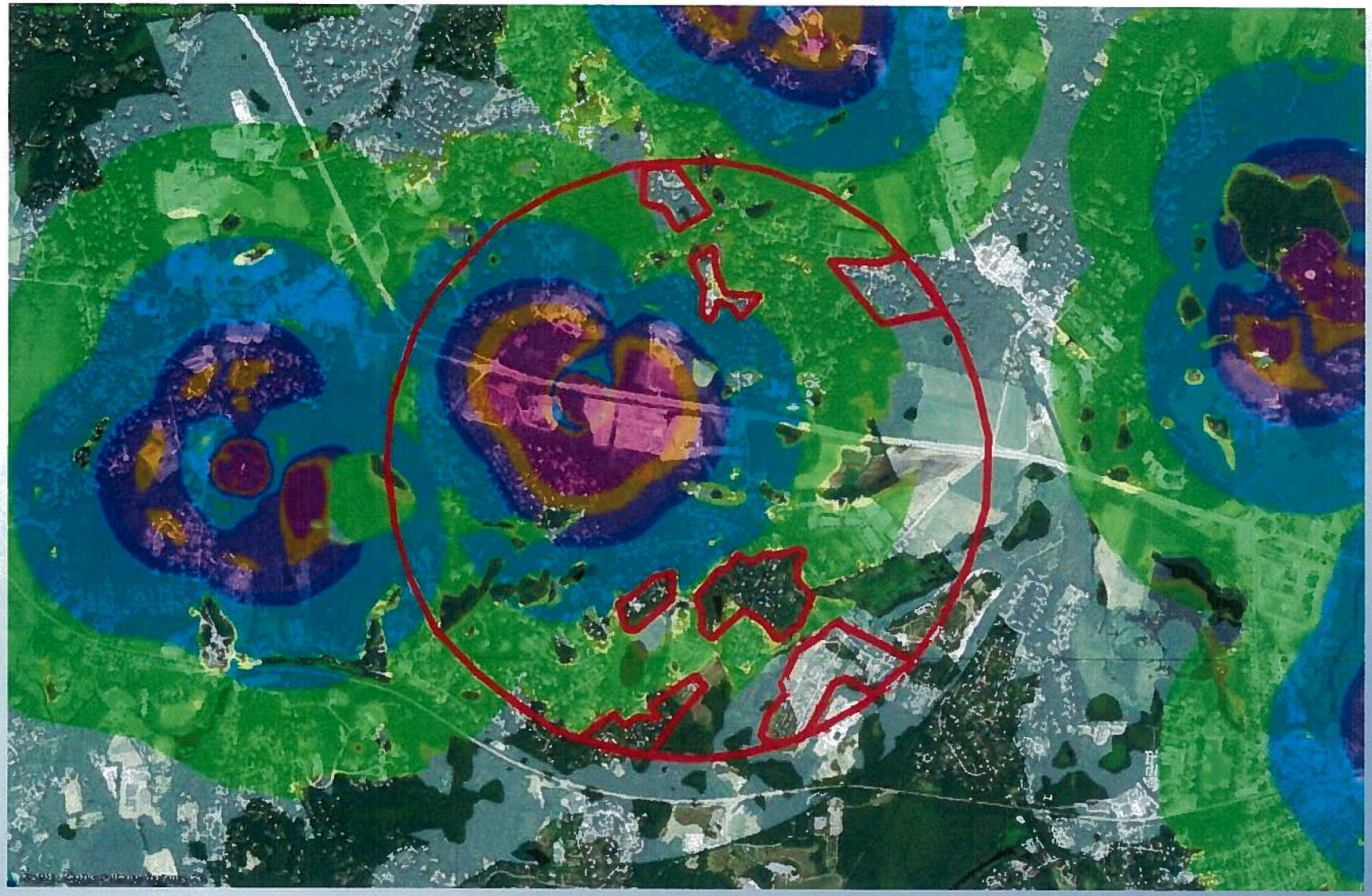


Compliments Safety Facility, Schools, and Kelly Corner

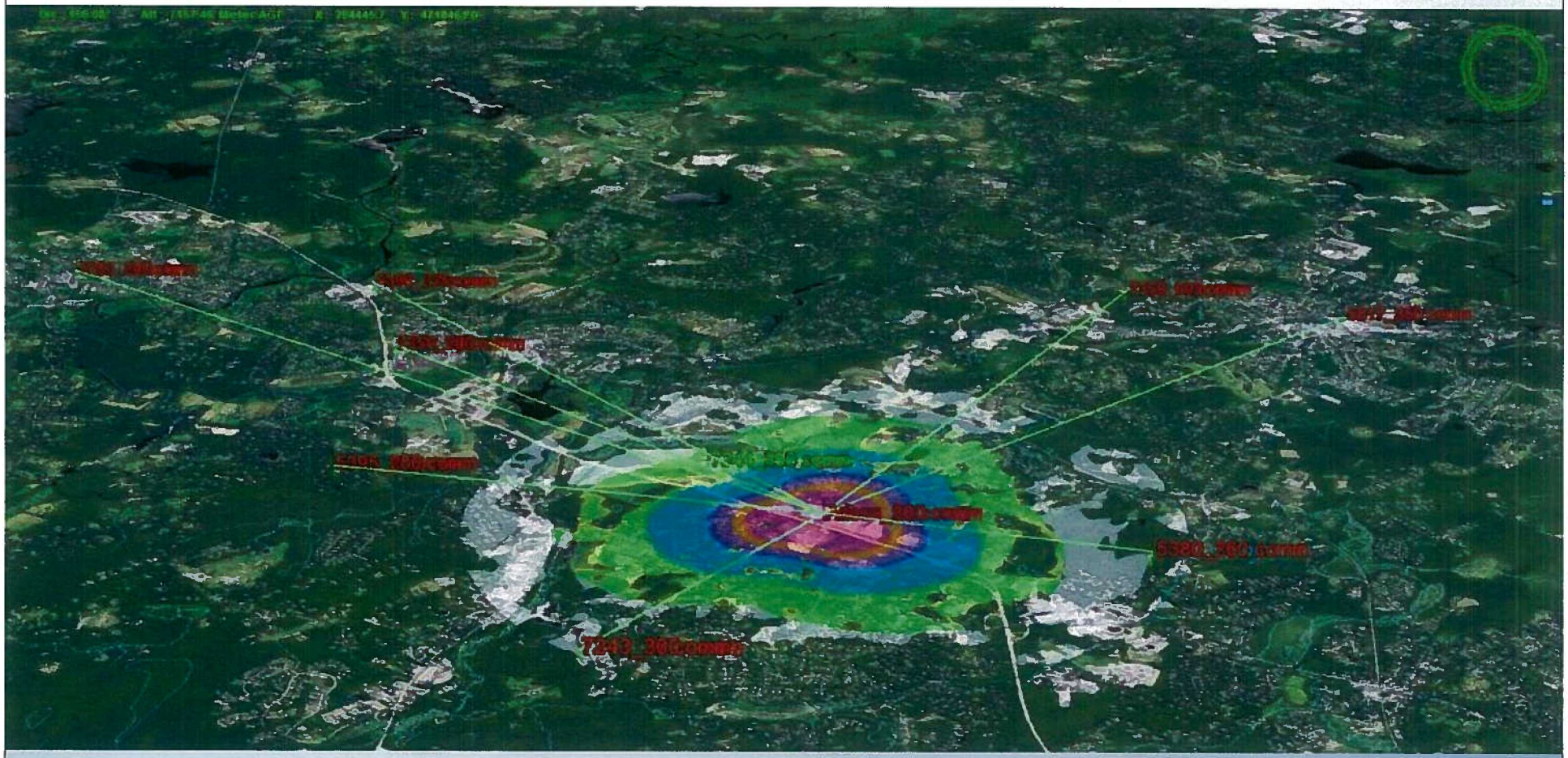


Adesa with Other Proposed

Minor gaps in residential zones



Adesa 100% MW Backhaul

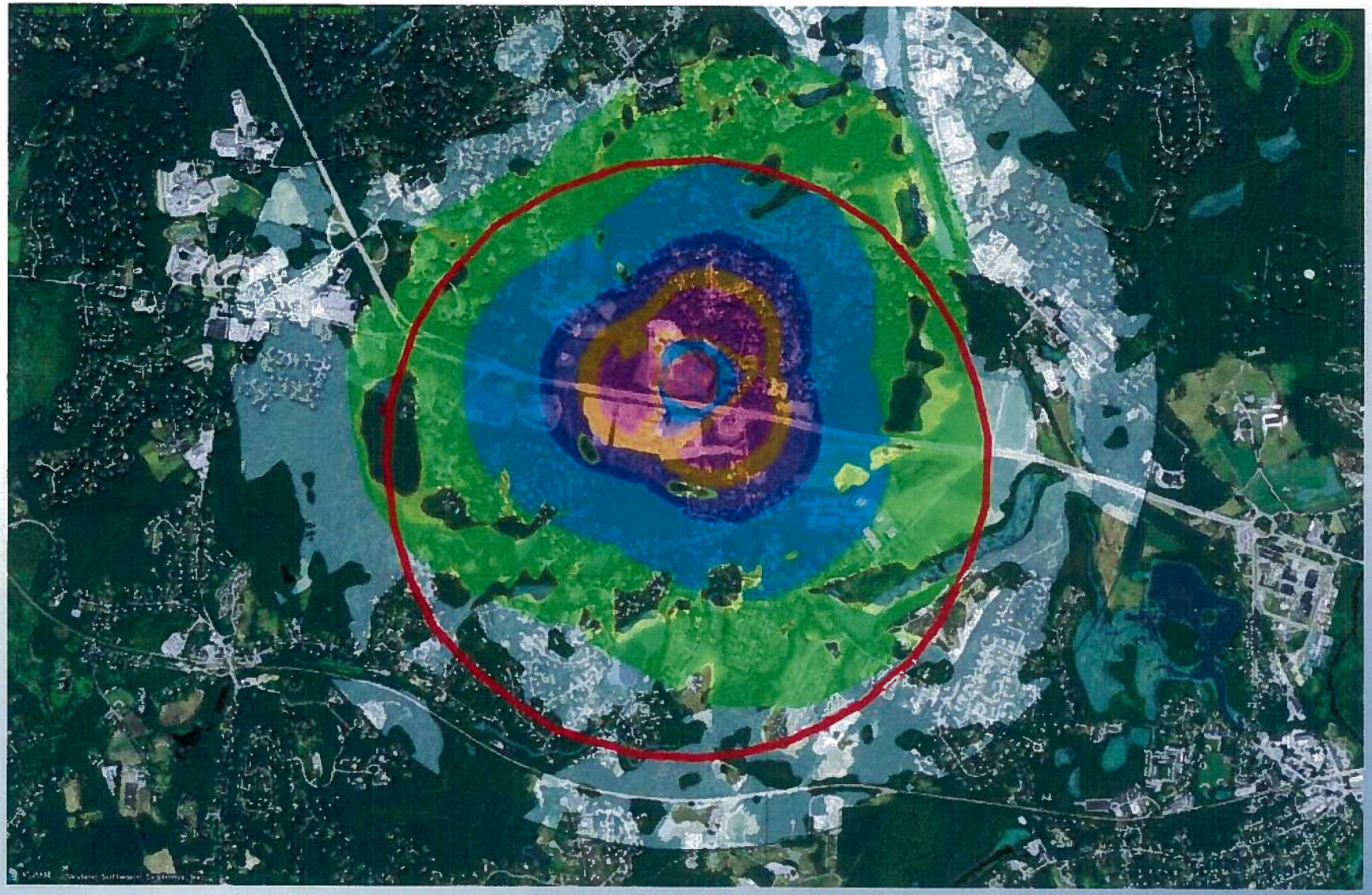


Conclusions

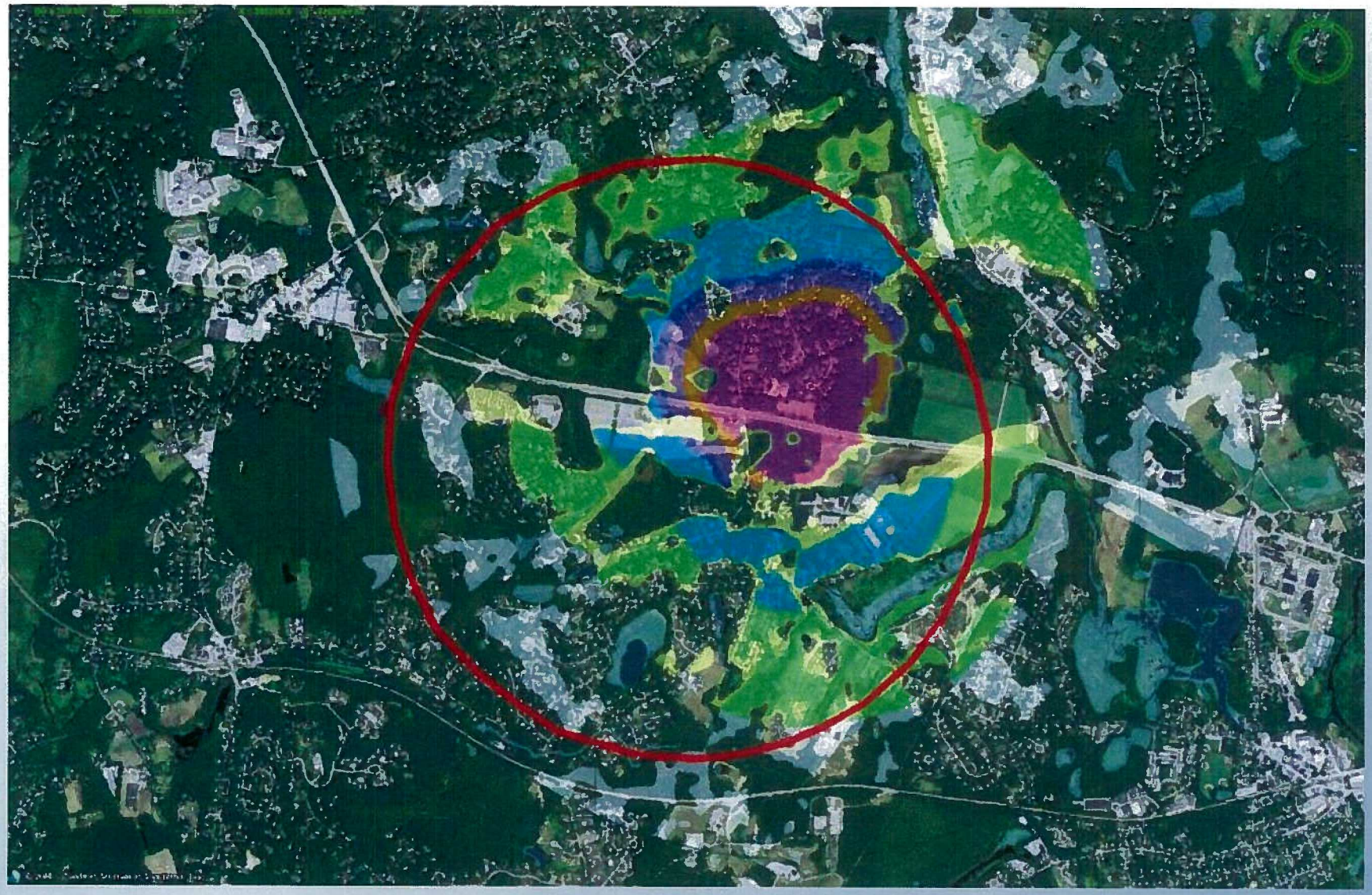
- SBA Towers II, Inc. "5-7 Craig Road Alternative Analysis"
  - Craig Rd Tower 7244 covers only ~56% of target
  - Tower 7244 covers large areas of unpopulated lands
  - When combined with other proposed towers, has significant gaps along Route 2 and residential and commercial zones
- Adesa Concord
  - Optimal site based on ~72% coverage of target
  - Suitable OP-2 location with good indoor coverage for schools, Kelly Corner, and Public Safety Facility
  - Coverage gap over Heritage residential area
  - When combined with other proposed towers, covers most of target circle and all commercial zones
  - 100% backhaul capability to all proposed towers

Backup Slides: Alternative Options

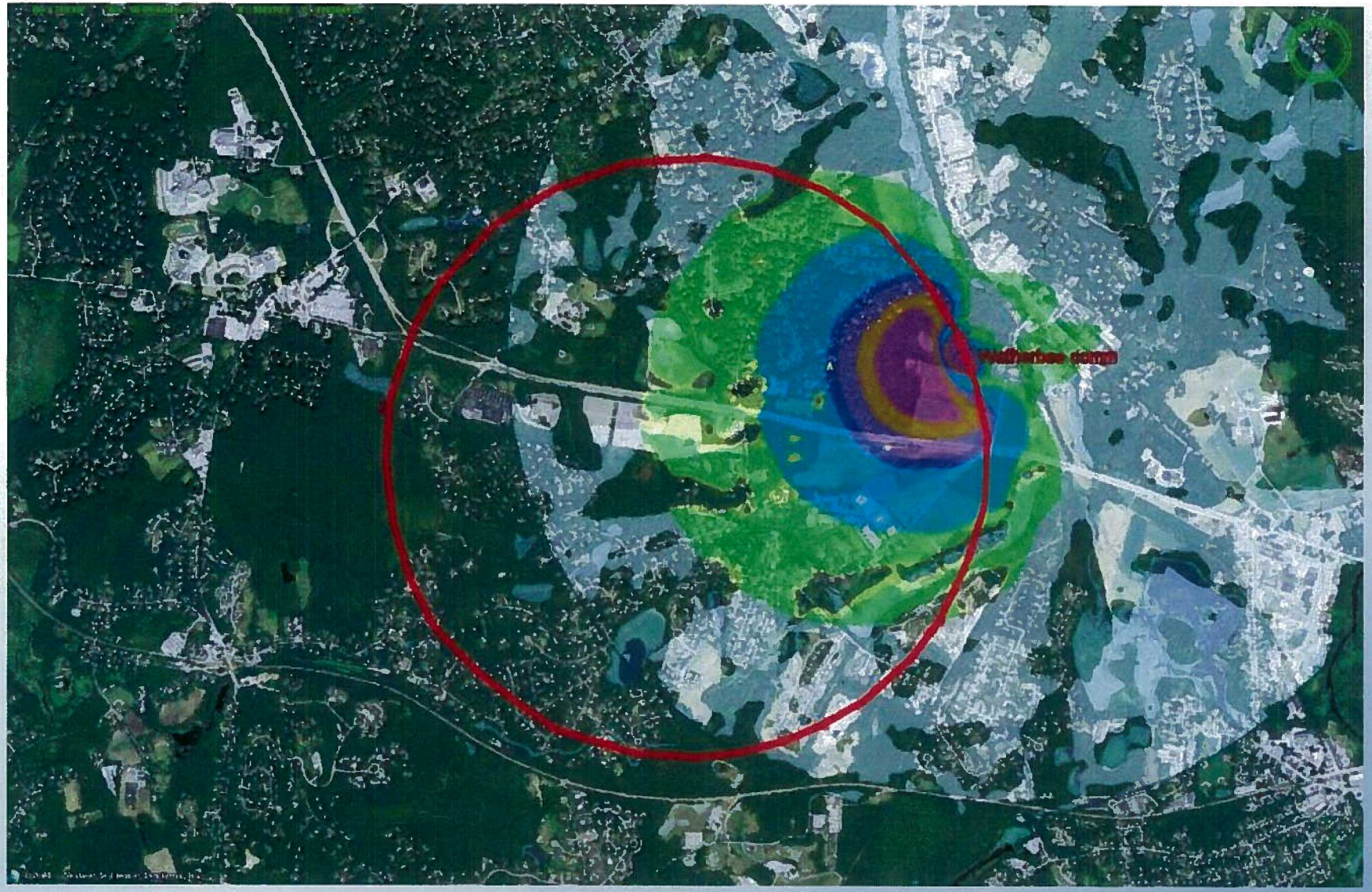
Transfer Station (3 Antennae)



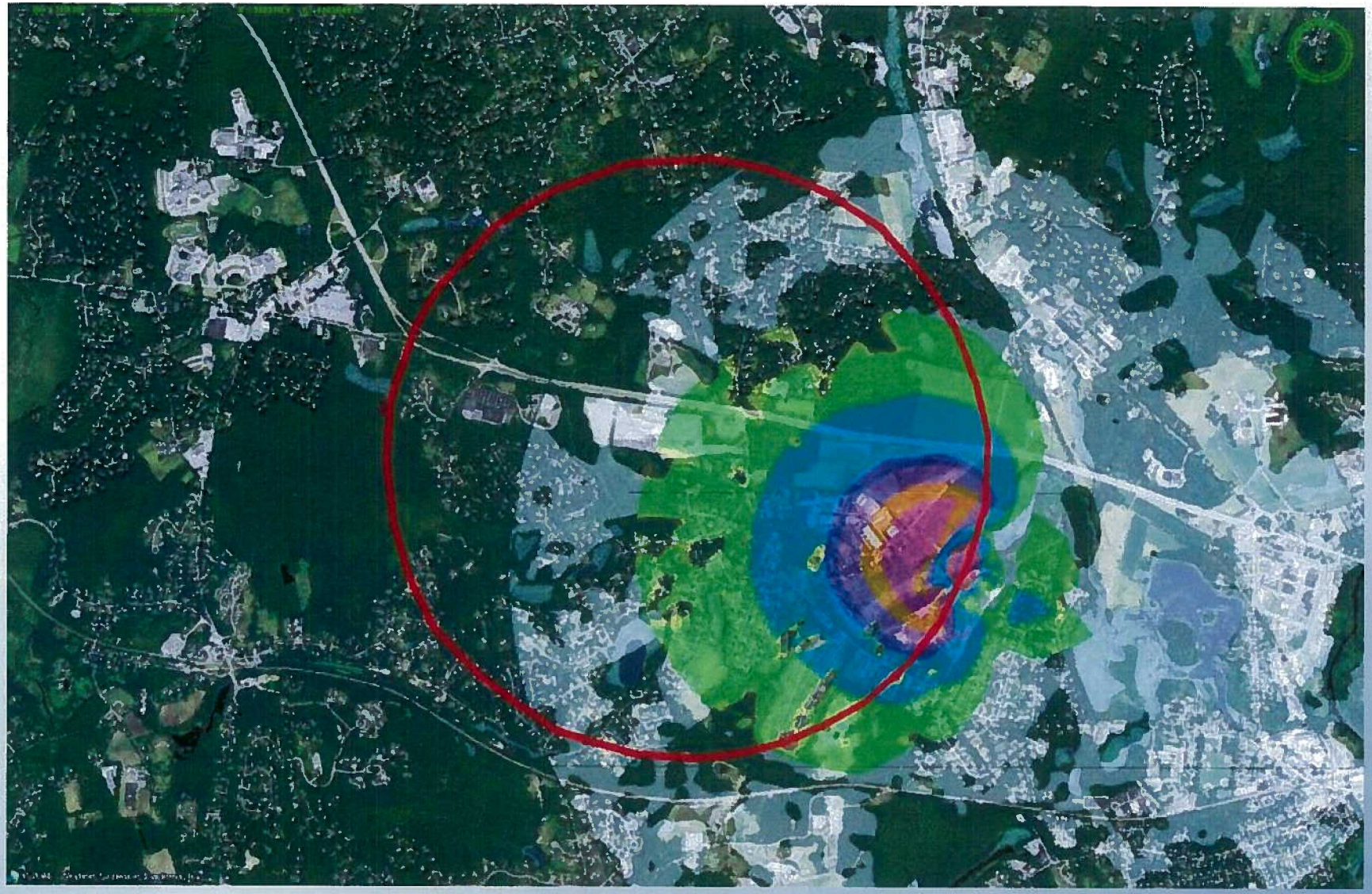
54 Hosmer (3 Antennae)



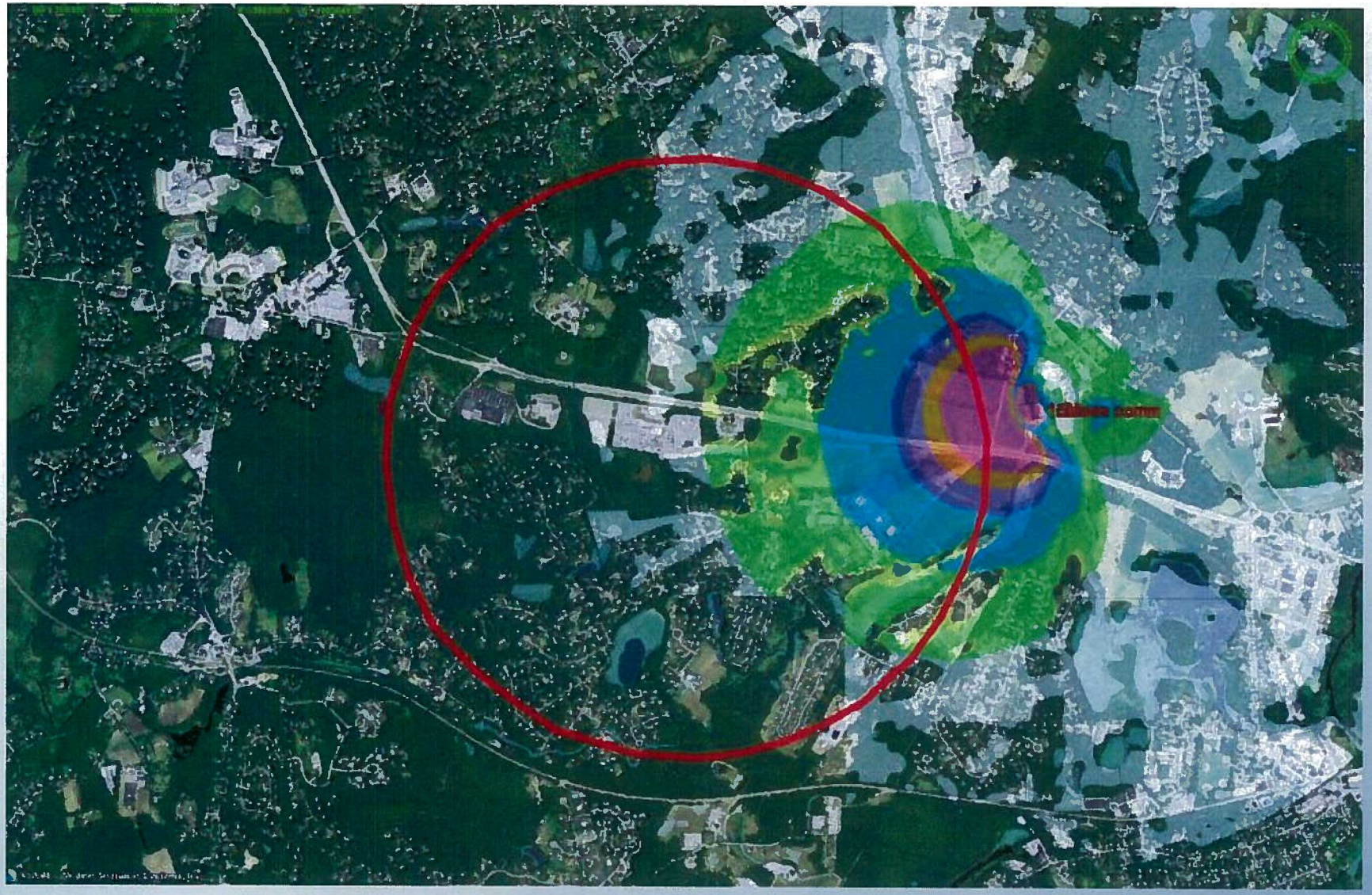
Wetherbee (1 Antenna @ AZ 250)



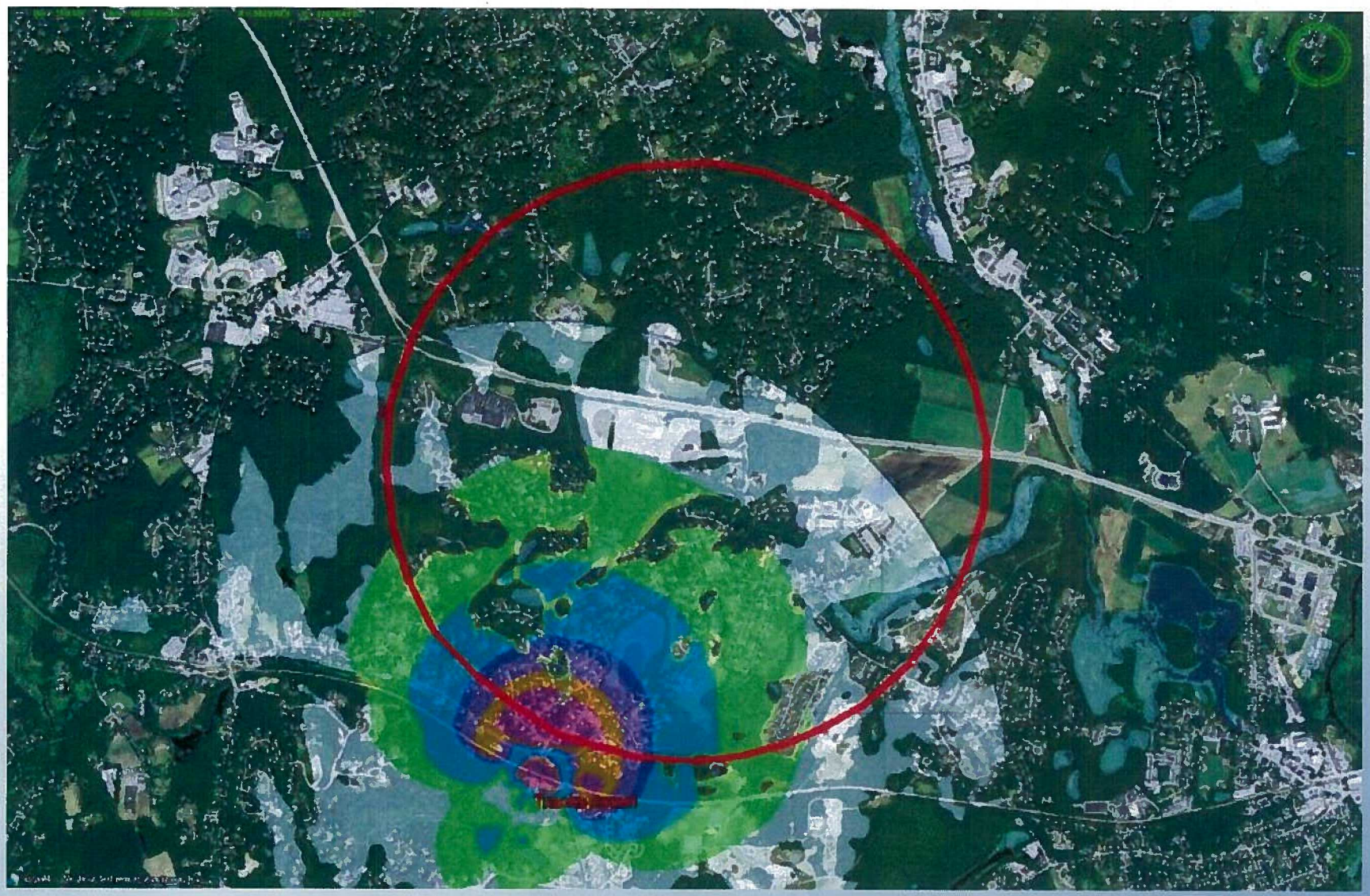
Acton Water Ridge (1 @ 290)



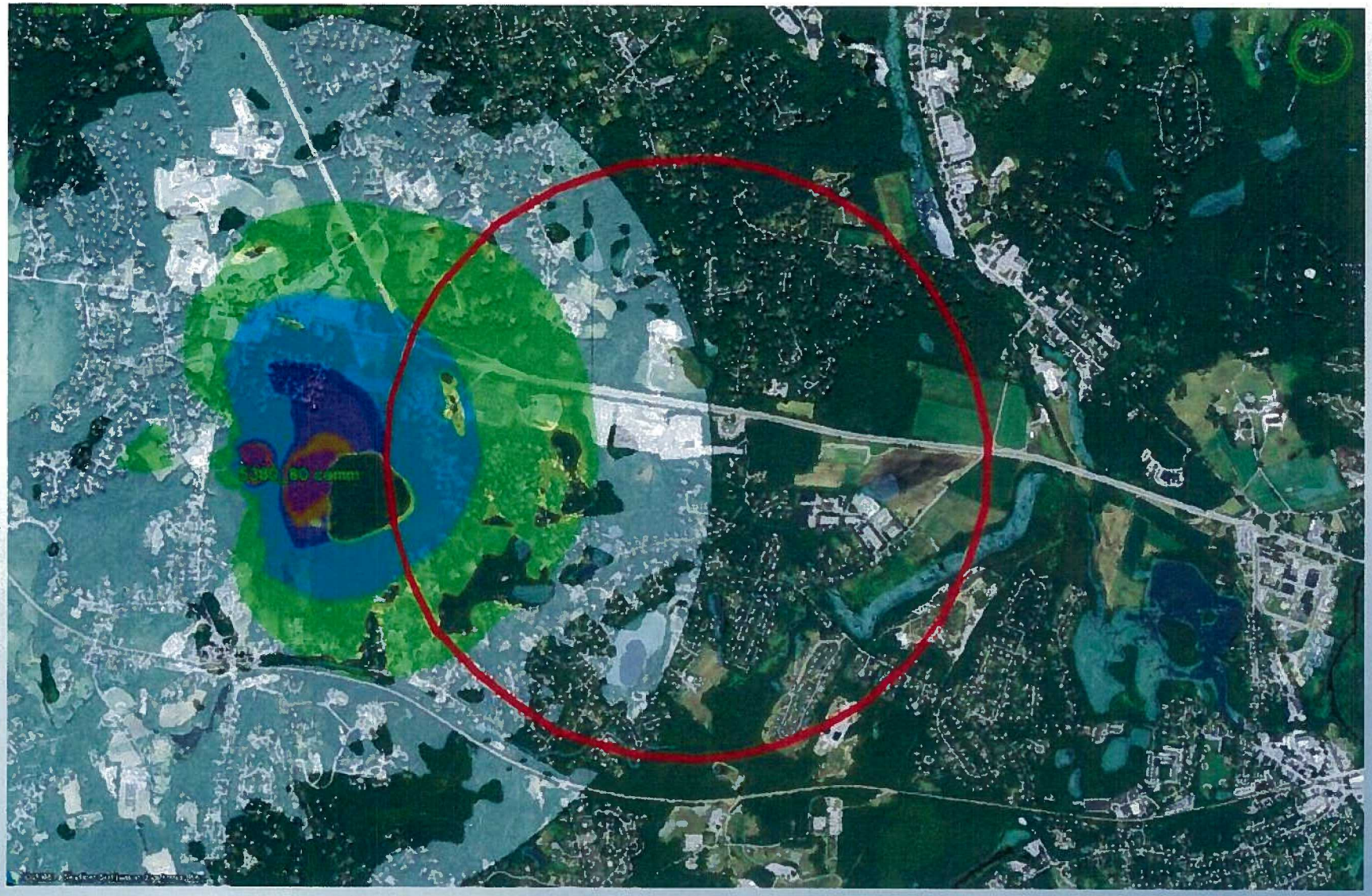
15 Massachusetts



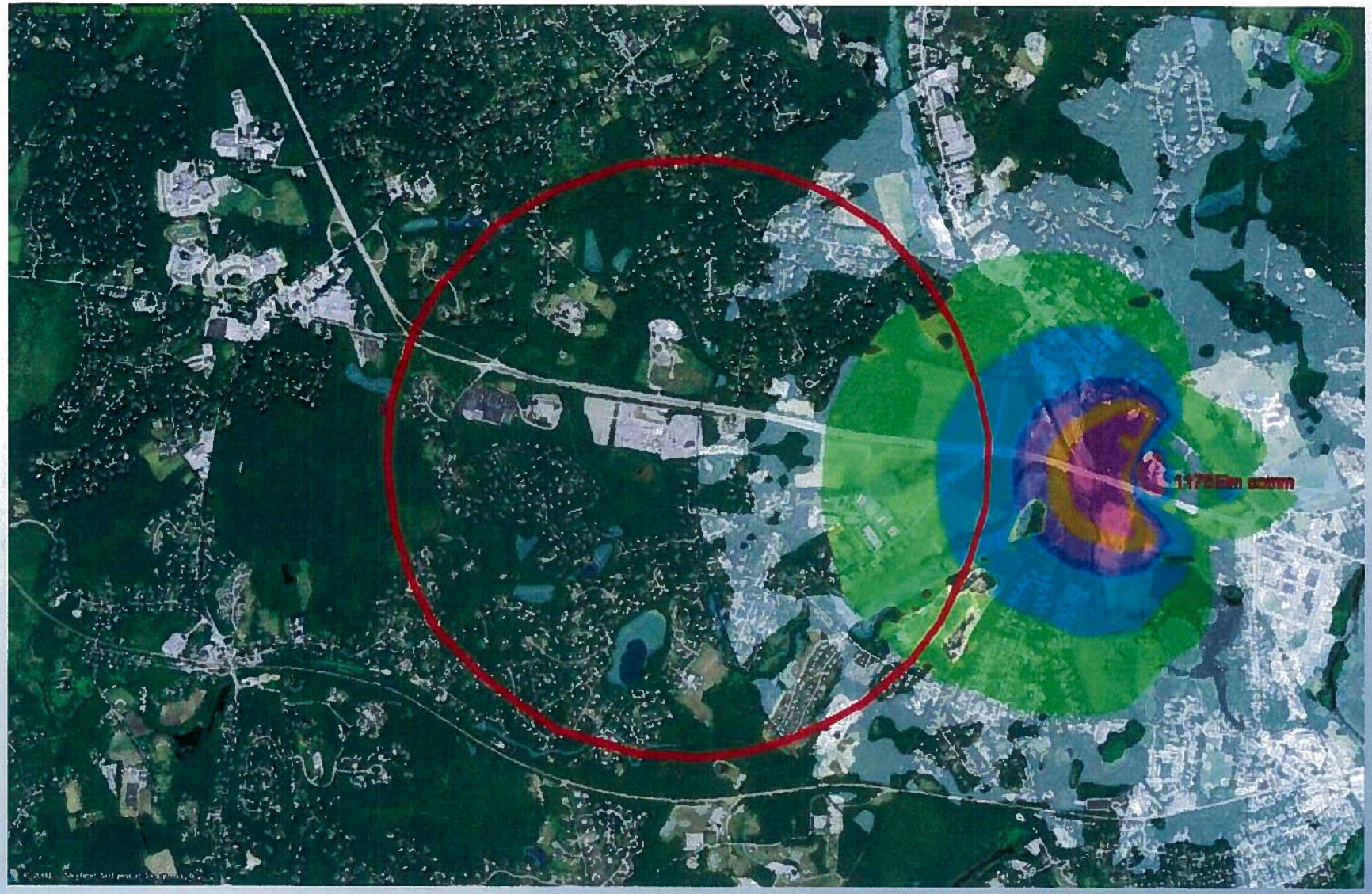
Maxson's (1 @ 27)



Great Hill Tower 5380 (1 @ 80)

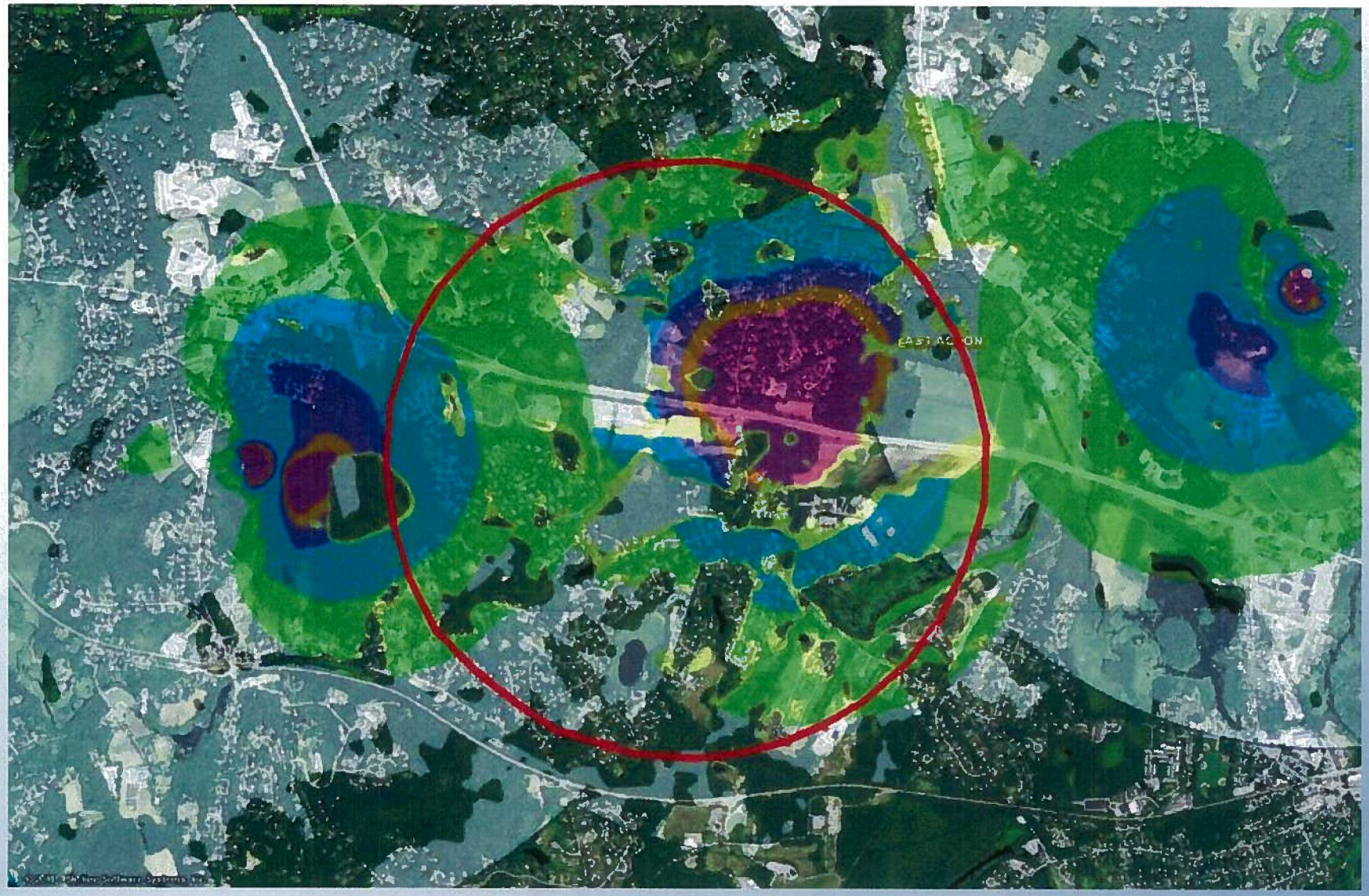
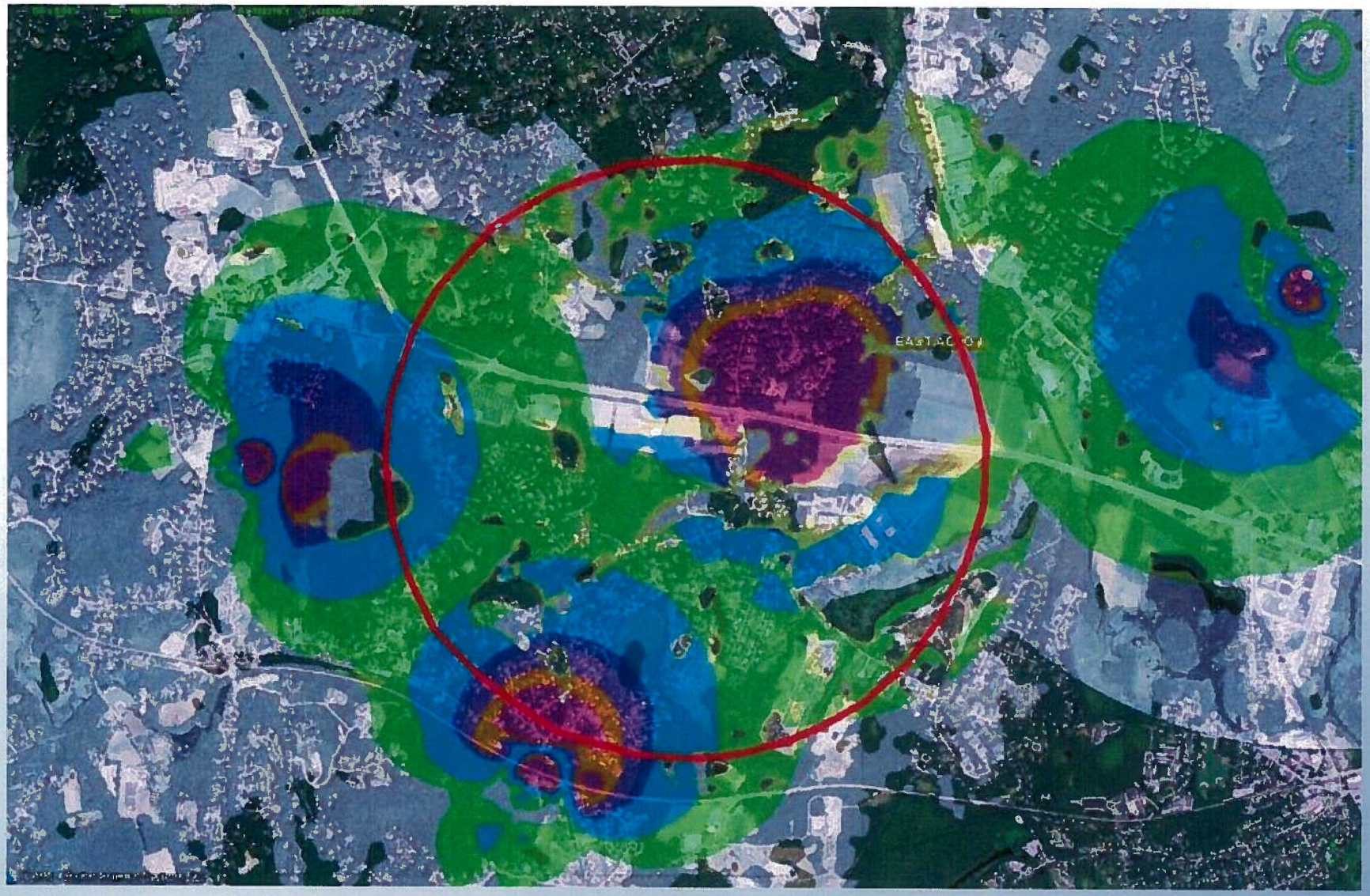


1175 Elm (1 @ 270)



MCI Concord

Combo Hosmer, 5395, and 5380



Hosm./5395/5380 with Maxson