

Responses to Questions

Town of Groton, Zoning Board of Appeals

regarding the

Proposed Heritage Landing Housing Development

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Director, MIT Haystack Observatory

Michael J. Person

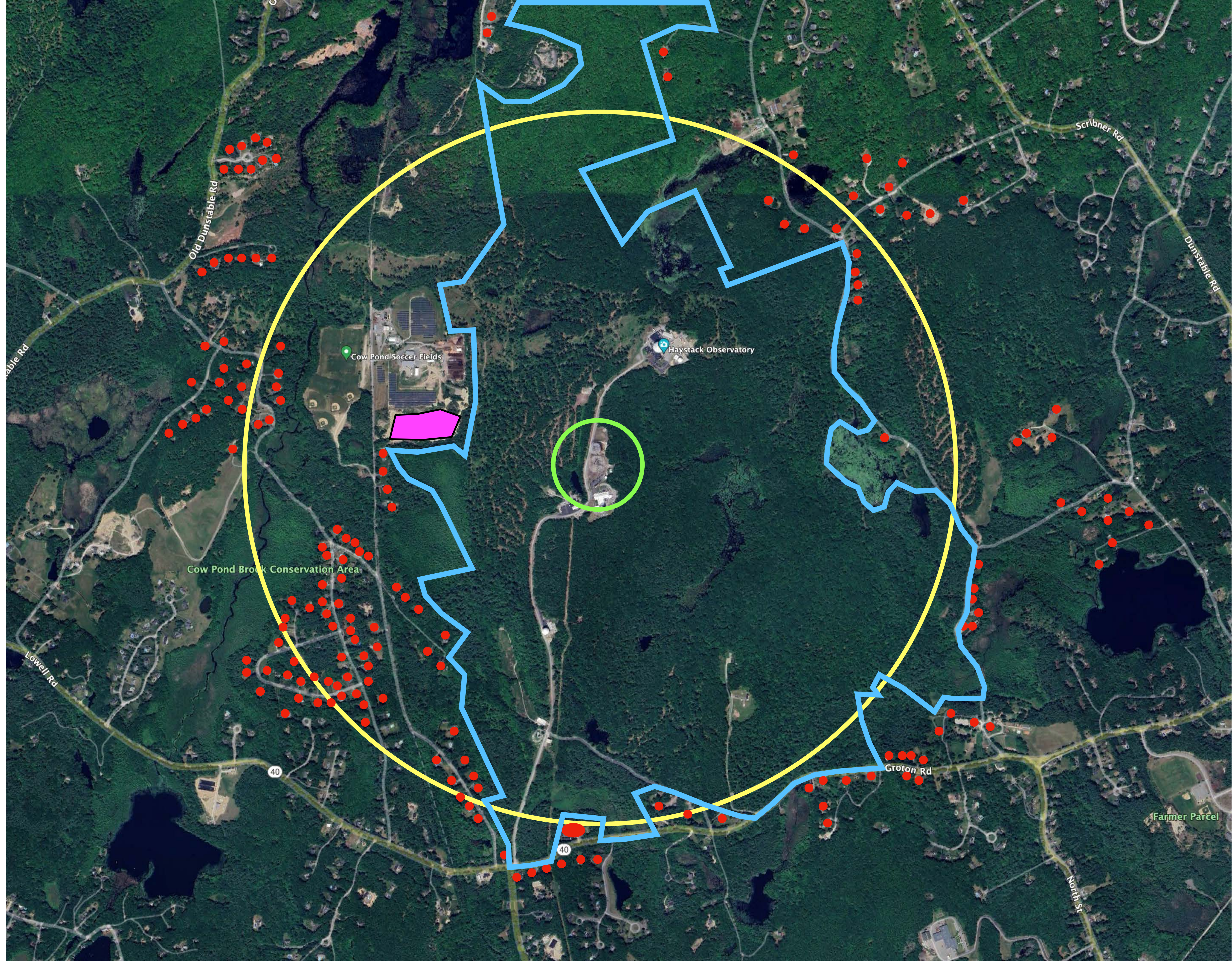
Director, MIT Wallace Observatory

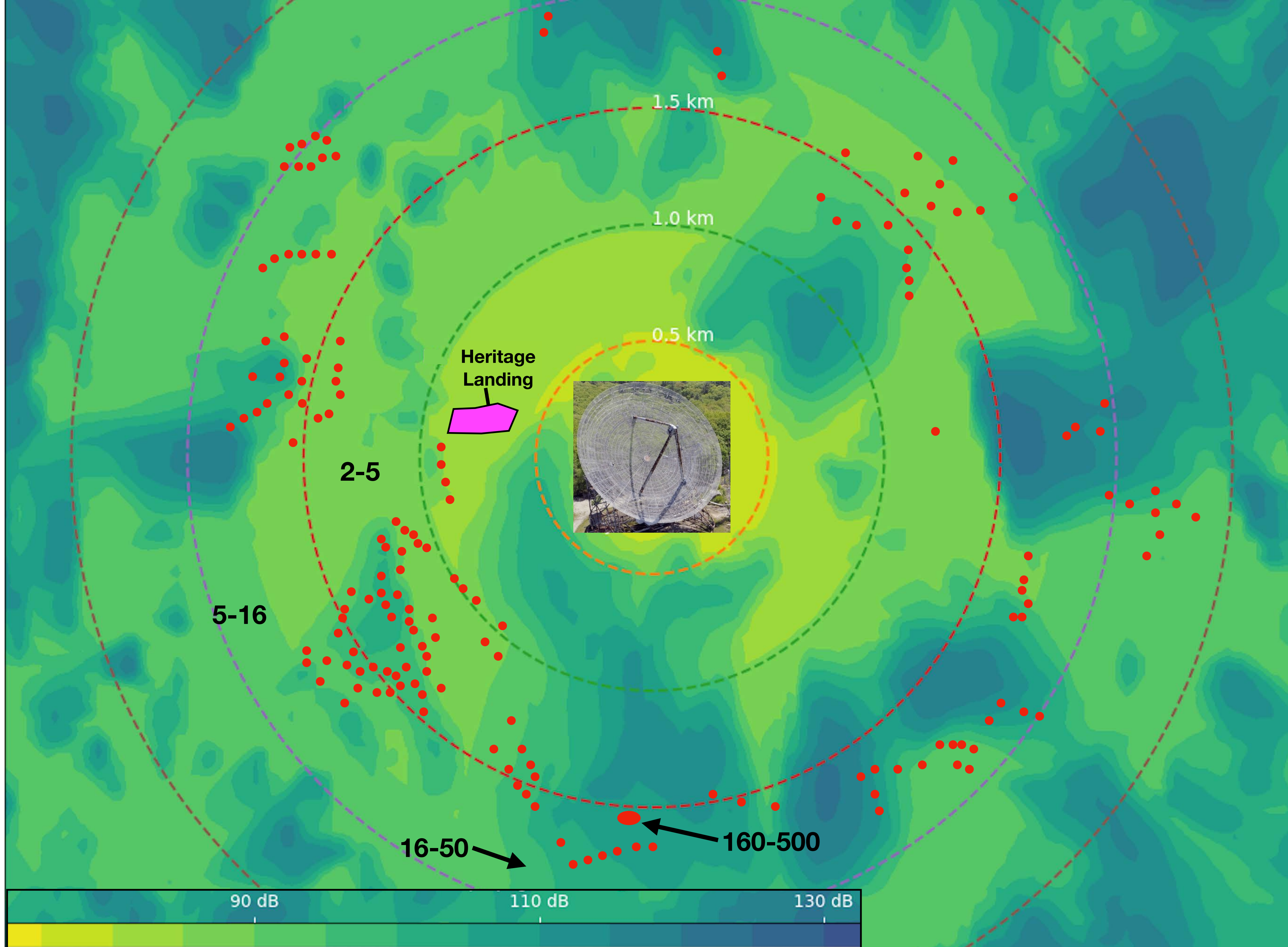
August 9th, 2023

Three Key Questions

1. Housing development will be ongoing, **why is this one in particular a problem** for us?
2. Devices are regulated by the FCC, **so how big a problem are they** for us?
3. Is the **solar farm** not at least as big a problem?

Housing Development





Heritage
Landing



2-5

5-16

16-50

160-500

90 dB

110 dB

130 dB

Devices, FCC Regulations

FCC Limits on Interference

- Electromagnetic Interference (EMI)
 - Signals generated by electrical and electronic devices - **incidental**, not intentional
 - EMC - Electromagnetic Compatibility - devices should not interfere **with each other**
- Applies to all kinds of devices
 - Computers, printers, electronic games, TVs and monitors, audio equipment, LED bulbs, ...
- Devices can interfere (internally) **with themselves!**
 - Manufacturers of complex, sophisticated devices are strongly motivated to limit EMI
 - Many devices are actually **pretty radio-quiet** as a result
- Some, especially simpler, inexpensive ones **are not** (e.g. LED light bulbs)

FCC **mandates** maximum permissible EMI levels

FCC Limits and Radio Science

- Limits are set to prevent interference problems:
 - With other **nearby devices**
 - With **communication broadcasts** of various kinds
- FCC limits are **not relevant** to modern radio science work!

One **single device** emitting at the FCC limit
From a distance of **600 meters**
is roughly **1,000,000,000,000** times stronger
than objects in the sky radio astronomers routinely study



Is **NOT** the same as



Expected Interference Impact

From Heritage Landing

- Interference from consumer devices will **jump 5x**
 - Based on accurate calculations, assuming typical device mix
 - Major component of the radio noise we deal with
- This will happen **immediately upon occupancy**
 - Unlike gradual increase occurring over last 10-20 years
 - No time or funding for Haystack to adapt
 - Will further restrict future research at the site

The Solar Farm



The 3 MW Solar Farm

- Installed in 2016 by Ameresco
- Haystack/LL invited by Ameresco to do detailed RFI testing
 - Concern about good grounding on top of landfill cap
 - Concern about RFI properties of the inverters
- Verified that grounding was excellent, inverters very quiet
- Emissions have proved to be very low ✓✓

Light Pollution

Light Pollution (background info)

The Bad

- Rising at **10.4%** a year! (US national average from *Science*)
- Numerous effects (Human health, wildlife, night sky)

The Good

- Doesn't accumulate; instant fix
- We're better than most: **3.2%** a year. (Measured at Wallace Observatory)
- Sensible precautions effective

LIGHT TO PROTECT THE NIGHT

Five Principles for Responsible Outdoor Lighting



Illuminating
ENGINEERING SOCIETY



USEFUL



ALL LIGHT SHOULD HAVE A CLEAR PURPOSE

Before installing or replacing a light, determine if light is needed. Consider how the use of light will impact the area, including wildlife and the environment. Consider using reflective paints or self-luminous markers for signs, curbs, and steps to reduce the need for permanently installed outdoor lighting.

TARGETED



LIGHT SHOULD BE DIRECTED ONLY TO WHERE NEEDED

Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.

LOW LIGHT LEVELS



LIGHT SHOULD BE NO BRIGHTER THAN NECESSARY

Use the lowest light level required. Be mindful of surface conditions as some surfaces may reflect more light into the night sky than intended.

CONTROLLED



LIGHT SHOULD BE USED ONLY WHEN IT IS USEFUL

Use controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed.

COLOR



USE WARMER COLOR LIGHTS WHERE POSSIBLE

Limit the amount of shorter wavelength (blue-violet) light to the least amount needed.

Local Effects from Heritage Landing

Proximity is key!!

- 40 units at 1000 yards is equivalent to 500 units at 2 miles.

Direction Matters

- Groton is **better** than most
- Heritage Landing **location**.

