

Dane County, Wisconsin
Telecommunications Site Review
New Support Structure

CityScape

C O N S U L T A N T S , I N C .

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August 25, 2017

Mr. Majid Allen
Senior Planner
Dane County Planning & Development
210 Martin Luther King Jr., Blvd
Madison, WI 53703

RE: Dane County
Verizon Wireless / Jenna Drive

Dear Mr. Allen,

At your request, on behalf of Dane County, Wisconsin ("County"), CityScape Consultants, Inc. ("CityScape") in its capacity as telecommunications consultant for the County, has considered the merits of the above referenced application submitted by Buell Consulting on behalf of Verizon Wireless ("Applicant"), to construct a new wireless telecommunications support structure and associated ground compound west of Spring Rose Road, Verona, Wisconsin, *see Figure 1*. The proposed structure is less than 200 feet and does not require FAA approval or tower lighting.

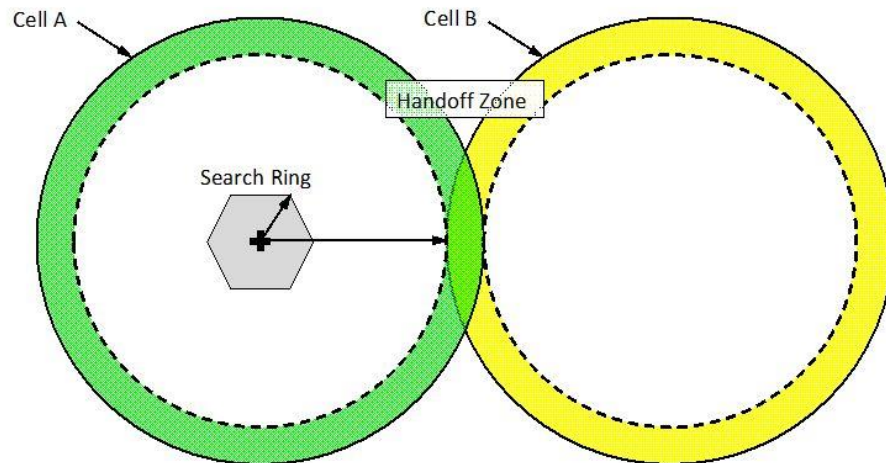
Wireless Informational Tutorial

Cellular, PCS and EMSR wireless communications systems depend on the concept of resource re-use to achieve their network goals and objectives. With some technologies, the individual channel frequencies are reused every few cells, but not too closely, since interference would result. Wireless service is achieved through ground equipment and antennas mounted on towers, buildings or other elevated structures. The height and location of the elevated antenna platform is critical to provide sufficient wireless network coverage. Generally, the higher the antenna is mounted on the support structure, the farther the wireless signal penetrates a geographic area.

In the wireless system evolution, a provider would initially provide service with facilities spaced further apart with relatively tall antenna elevations to maximize the "footprint" at minimal cost. As the subscriber density increases, network capacity for these facilities increases, resulting in frequent busy signals or "no service" messages for end users. To remedy this situation, the antennas are mounted at lower heights to reduce the coverage area, thus reducing subscriber count per facility. When coverage areas are reduced, a new facility is needed to fill in the previously served area.

The Search Ring is a vital part of the submittal for any new personal wireless facility. The Ring identifies the optimum location for the facility and will control the operating parameters needed to meet the facility objectives. Of primary interest to a community are the location and the height of a

structure all which is dictated by the Ring. Cellular search areas are usually circles of approximately one-quarter the radius of the proposed cell. In practice, it is simple to determine whether the search area radius is reasonable. The distance from the closest existing site is determined, halved, and a handoff "overlap" of about 20 percent is added. One fourth of this distance is the search area radius. *Sample 1* illustrates this graphically.



Sample 1 - The hexagonal search ring radius is $\frac{1}{4}$ of the radius of the cell's coverage less a 20% handoff overlap

A reasonable search ring location is a key element in assuring that a site is justified. Generally, new wireless communication facilities are equally spaced with respect to existing sites. However, terrain, network capacity and other issues may necessitate a facility that it is *not* equally spaced with respect to existing sites. Typically, the wireless provider is asked to provide coverage prediction maps to indicate that a site is properly located.

An important part of any wireless communication facility application is the verification of the provider's proposed height requirements with generally accepted engineering. The Applicant utilizes Long Term Evolution (LTE 700 MHz) for voice communications and Advanced Wireless Service (AWS 1700/2100 MHz) for data within Dane County.

In addition to the minimum height and power needed for effective signal coverage, as more wireless devices are deployed, user capacity issues become the limiting factor. Technology is improving which allows towers to handle more devices, but it is not keeping up with the speed that such devices are connecting. As the industry heads for 5G in the next 2-3 years, more *localized* cellular sites will be needed. This will involve shorter towers that are closer together to limit their "reach". This practice has already begun in urbanized areas for the past few years and will continue in rural and urban residential areas. The future will also involve what are known as "small cells" which are antennas placed on street lamps, shorter buildings, etc. For these reasons, as well as the fact that the proposed site is surrounded by neighborhoods, the County can limit the height of the proposed structure and require it to be concealed *or stealth*.

This application is proposed to provide improved service along Highway 18 and the rural areas west of Verona. The proposal has been evaluated from the following perspectives:

- The proposed facility, as specified, is justified due to technological reasons and is essential for the Applicant to provide its telecommunications service; and,
- The proposed facility will follow the guidelines of the Telecommunications Act of 1996, the Dane County Ordinance and all other pertinent rules and regulations.

Dane County Ordinance Requirements

§10.194(1): CUP required

§10.194(2) CUP requirements:

- a. No existing towers exist within search area: none exist
- b. Any existing towers are of sufficient height: none exist
- c. Any existing towers are of sufficient structural strength: none exist
- d. No electromagnetic interference will occur: provided by Applicant
- e. Collocation fees are unreasonable: Not Applicable
- f. Other factors deem existing tower(s) unsuitable: Not Applicable

§10.194(3): Term *reasonable* defined as 25% cost of new tower – Not Applicable

§10.194(4): Third party review – CityScape

§10.194(5): If less than 150 feet is proposed, tower must be capable of future increase to 150 feet and 2 collocations – proposed tower extendable to 165 feet

§10.194(6): CUP required for substantial modification: Not Applicable

§10.194(7): CUP condition requirements can be checked at later date – *defer to County*

§10.194(8): CUP not required for collocations that are non-substantial

§10.194(9): Equipment building limits: complies

§10.194(10): Unused equipment shall be removed – Not Applicable

§10.194(11): Future buildout plans may be required – Not Applicable

Additional CUP requirements for communication towers

- A. Legal Statement: provided in CDs
 - B. Tax Parcel number(s): provided in CDs and on CTIF
 - C. Completed Zoning Application Form: provided
 - D. Completed Communication Tower Information Form (CTIF): provided
 - E. Written Statement: Limited – Short statement from RF engineer
 - F. Site Plan, Design Elevations, **Site Photos and Photo Simulations: partially provided**
 - G. CUP filing fee: *defer to County*
 - H. RF Engineering Analysis: statement from RF engineer and coverage maps provided
-

Site Justification and Coverage

For a new wireless communications facility to be justified, its need, location and height must be addressed. The application proposes to construct a new one hundred thirty-five (135) foot *monopole* tower with future extension capability to one hundred sixty-five 165 feet, *see Appendix, Exhibit A*. The proposed site is within the Applicant's provided search ring.

The only written statement (see E above) is that which was provided by the Verizon RF engineer. It only addresses the site need and that no collocations exist. While it does not go into the detail listed under *project description*, in the County's "Cell Tower Application Packet", it does provide most of the information requested and provides what CityScape needs for a technical review. Most importantly, a statement by the applicant is provided indicating that the site is needed and that no existing towers exist within the search area (CityScape has confirmed this). Thus, Verizon has demonstrated the need for a new facility in the area and has justified an antenna height of 130 feet with the provided coverage maps depicting the improvement to be provided by the proposed site. The proposed site is intended for capacity improvement. Capacity sites are meant to provide stronger service where existing service is weak and subscriber density is high. The existing Verizon service in the area does have some areas of weak coverage. More importantly, the stronger signal levels needed for indoor service and high-data usage is lacking. This new site will remedy these network issues and improve the overall service in the area.

Landscaping/Screening:

The Ordinance does not require any landscaping or screening, just that the Applicant indicate if they volunteer to provide landscaping. In general, CityScape believes some level of landscaping or screening should be required by the County, unless the Applicant can demonstrate that existing, dense, foliage surrounding the site exists and will remain after construction. For purposes of this Application, CityScape recommends the County consider some landscaping as a condition of approval if known development of the property to the southwest is going to be happening in the near future.

Tower Height Considerations:

The Ordinance requires new towers, if less than 150 feet in height, to have structural capacity to increase height in the future to at least 150 feet. Such new proposed towers must also

be able to accommodate at least two (2) collocations (three (3) total arrays). The Applicant is proposing three (3) future collocations, at 115 feet, 145 feet and 160 feet. However, the tower elevation drawing, *in Appendix Exhibit A*, does not depict the 4th array at 115 feet. Typically, arrays are spaced 10 feet apart. A structural letter from the tower manufacturer was provided for an overall height of 165 feet, but the number and location of the collocations is not included. The structural report should include the proposed equipment on the tower (i.e., number of antenna arrays).

CityScape agrees that designing the tower for 3 future collocations is better than the County's requirement of two. CityScape also believes that the future collocations could be spaced 10 feet apart, at 120, 140 and 150 feet, requiring the tower design to only be 155 feet in overall height (160 feet with lightning rod). This would be a future 20-foot increase which could be part of the streamlining process. This is only being noted now so that the structure is properly designed for arrays at these heights (with access ports at these heights).

Missing/Incomplete Information:

The Applicant did provide photographs from the site in four different directions (although not cardinal bearings). Although they are not taken from the proposed base of the tower, they are adjacent to the site with the compound boundaries shown. These are shown in the CDs (Sheets C-2 and P-1). The required photos of the site from adjacent properties are not included. The photo simulations are only from two (similar) directions and only provide a gray rectangle to represent the proposed tower. Typically, a scaled drawing of the proposed tower is overlaid on the photo. In this case, a rectangle may be to scale from a height perspective, but not width, since the tower is not shaped like a rectangular box. However, it is believed the County has agreed to accept these photo simulations and no recommendation to revise will be made.

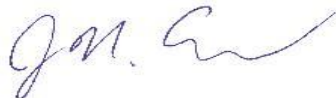
Conclusion:

For purposes of this Application herein, the Applicant has only demonstrated the need for a 135-foot tower, as indicated by the Verizon engineer's statement and coverage maps. CityScape Consultants, as the wireless expert for the County, recommends this Application for a new 135-foot tower be approved with the following conditions:

1. All feed lines shall be installed within the support structure and antenna ports shall be sealed in a manner to prevent access by birds and any other wildlife; and,
2. Proposed tower shall be galvanized and not painted any other color without approval of the City; and,
3. Applicant shall not begin construction until Federal SHPO/NEPA requirements are met; and,
4. County may wish to require some level of landscaping for the southern and western edges of the compound if adjacent development is proposed; and,
5. Prior to construction, the tower manufacturer letter should be revised to indicate the tower will be designed to accommodate three (3) total antenna arrays (of like design to the Applicant's).

I certify that to the best of my knowledge all the information included herein is accurate at the time of this report. CityScape only consults for public entities and has unbiased opinions. All recommendations are based on technical merits without prejudice per prevailing laws and codes.

Respectfully submitted,



Jonathan N. Edwards, P.E.
CityScape Consultants, Inc.

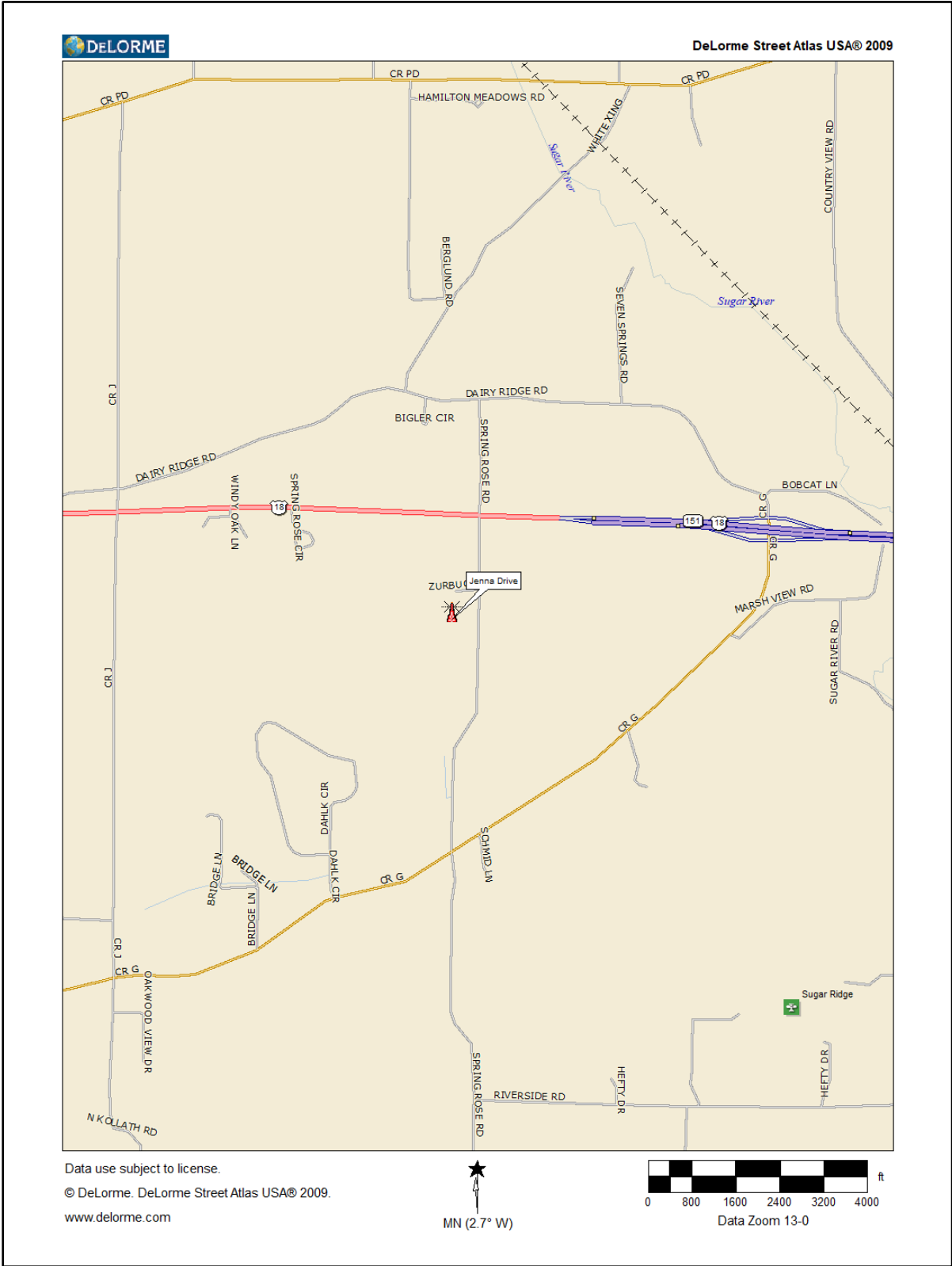


Figure 1 – Site Location

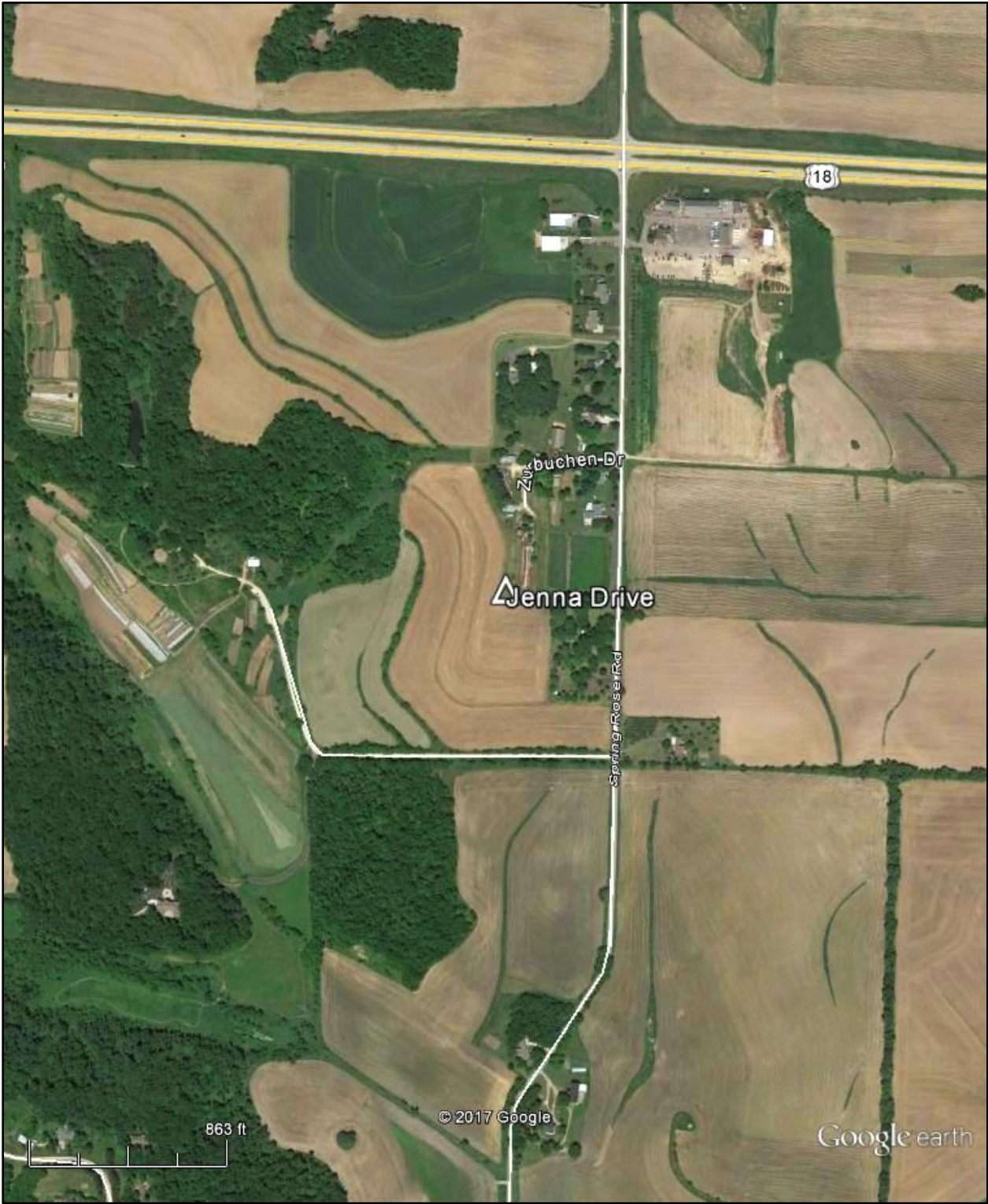


Figure 2 – Aerial Site View

Appendix

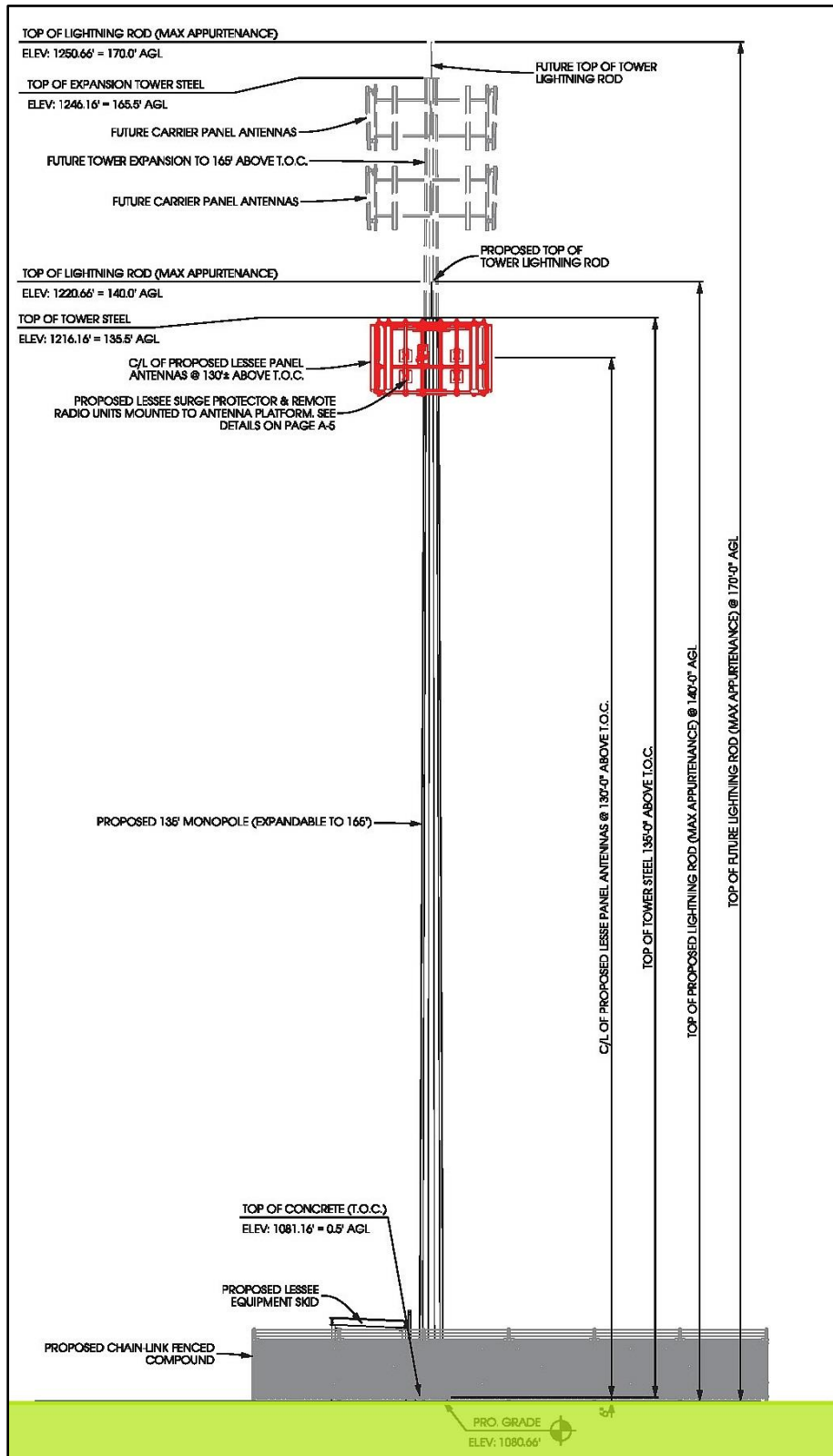


Exhibit A - Proposed Support Structure

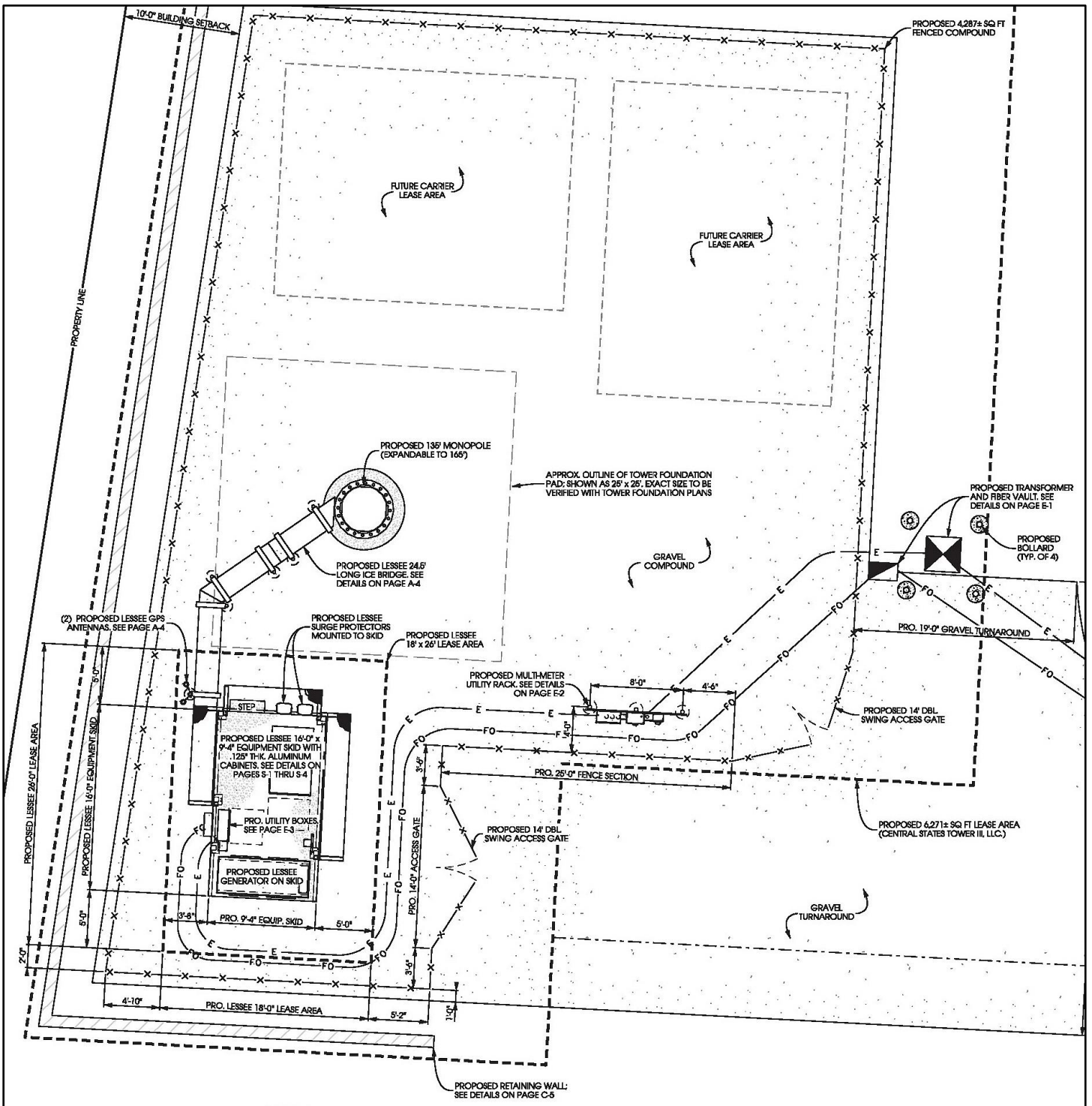


Exhibit B – Proposed Ground Compound