Gmail by Google

Corey Biddle [redacted]

RECEIVED
MAY 4 2018
PUBLIC SERVICE COMMISSION

Case No. 2017-00143

1 message

Corey Biddle [redacted]
To: psc.info@ky.gov
Cc: [redacted]

Fri, May 4, 2018 at 12:05 PM

Mr. Potts and I are requesting a rehearing regarding Case No. 2017-00143. We have recently received the response identifying our positions as opinion and we certainly disagree.

I have attached several studies and published articles that reinforce the fact that these towers can and do affect property values. This proposed site would place the tower IN the subdivision and near the entrance which all of these publications identify as the "worst case scenario". We are hiring a consulting group to assist us with the fact finding. The consultants have a good deal of experience in these matters and have been successful making our argument in other cases across the country. We're also in the process of hiring legal representation to better our position and understanding with this process.

We respectfully request a rehearing on this matter. We thought we would be scheduled for a hearing in person there in Frankfort. We expected to receive further communications and an actual hearing in person where we could prepare to make our case in a more thorough manor. Please allow the rehearing so we can more sufficiently support our position.

Thank you,

Corey M. Biddle
Adjoining Land Owner
[redacted]

6 attachments

- **Business Wire 2014.pdf** 403K
- **Cost of Convenience 2016.pdf** 8630K
- **HUD Reference Guide.pdf** 324K
- **New York Times 2010.pdf** 1226K
- **Realtor Mag 2014.pdf** 263K
- **G Maps of Subdivision and Area.pdf** 1685K

** I HAVE ATTACHED IMAGES TO DEMONSTRATE THE LOCATION COMPARED TO THOSE STUDIED.

** THE HIGHLIGHT IN ARTICLE "THE COST OF CONVENIENCE" DEMONSTRATES THE POTENTIAL AFFECT ON VALUE BUT THEIR TOWER LOCATIONS WERE NOT AS IMMEDIATE AS THE ONE BEING PROPOSED.

** HUD CONSIDERS THESE TOWERS "HAZARDS & NUISANCES". FURTHER PROOF THEY ARE OF SIGNIFICANCE.

** WE HAVE PROVEN THE LOCATION IS NOT INTENDED FOR AGRICULTURAL OR COMMERCIAL USE. THE APPLICATION FALSELY IDENTIFIES IT AS RURAL AND "COMPLETELY FORESTED".

PLEASE SEE NEXT PAGE.

#1

** Publications site potential 2 to 22% affect on property value. That is devaluing 27 building lots!

We intend to build 1500 to 2000 sq ft. homes on each lot. That provides a significant revenue stream in state and local taxes, this proposed tower would prevent or significantly reduce that value. @ median 10%, that would reduce the value of 27 lots with homes by $472,500.00, if the normal value would average $175,000.00.

** Included top 10 subdivisions in Jefferson Co. None of them have over head utilities or allow any other type of "nuisance" structures. That is directly related to property value. Further proof this tower harms our value.

** Current CON should not have been placed there. Land use was misrepresented and still is. It is much less intrusive @ 60 or so feet tall. Big difference with proposed 240ft. tower. Neither belong in a subdivision!

#2

utilities being extended. No tower is best, but I'll take a compromise if necessary to avoid irreparable harm to the land/investment.

I will be sending this as a registered letter as well along with the copy of the survey. I have the original survey if that needs to be presented.

Thank you,

Corey M. Biddle

B&D Training and Safety Consulting, LLC.

"The only true measure of wealth, is your health. Work Safely!"

[Quoted text hidden]

Subdivision Survey PDF 2017-05-12.pdf
459K

The Cost of Convenience: Estimating the Impact of Communication Antennas on Residential Property Values

Stephen L. Locke and Glenn C. Blomquist

ABSTRACT. *This paper applies hedonic and quasi-experimental methods to measure the disamenity value of communication antennas. We take advantage of a rich dataset of residential housing sales from central Kentucky that contains an extensive set of structural housing characteristics and precise location information. This allows us to overcome endogeneity issues caused by unobservable characteristics correlated with antenna location. The best estimate of the impact is that a property with a visible antenna located 1,000 feet away sells for 1.82% ($3,342) less than a similar property located 4,500 feet away. The aggregate impact is $10.0 million for properties located within 1,000 feet.* (JEL Q51, R21)

I. INTRODUCTION

Accompanying the desirable growth of cell phone and wireless Internet usage has been the not-so-desirable appearance of communication antennas. Cell phone usage worldwide, and especially in the United States, has grown fast. According to the Cellular Telephone Industries Association, in December of 1998 there were 69.2 million wireless subscribers. Fifteen years later, in December 2013, that number was 335.7 million.[1] To put this in perspective, the U.S. Census Bureau estimated the population to be 270.2 million in 1998 and 316.5 million in 2013. The United States has gone from 25.6% of the population having a wireless subscription in 1998 to more than one subscription per person in 2013. With the advances in mobile technology it is possible to do nearly every task that was once only possible on a desktop computer on a mobile device that fits in the palm of a hand. Like any other good or service, the added convenience of mobile technology has costs.

Economists have long been interested in estimating impacts of disamenities in urban areas. For examples see Mieszkowski and Saper (1978) on airport noise, Kohlhase (1991) on toxic waste sites, and Kiel and Williams (2007) on Superfund sites. An area that has received little attention is the disamenity associated with cell phone towers and communication antennas. As the demand for cell phones and mobile technology increases, it is followed by an increase in demand for reliable coverage, which in turn leads to an increase in the number of antennas. In the mid-1990s there was a sharp increase in the number of antenna structures to accompany the mobile phone technology that was becoming more prevalent. Choosing the location for an antenna involves conflicting incentives for residents. Land owners may want to have an antenna located on their property because it provides an additional source of income and better cell phone reception for residents in its vicinity.[2] However, these structures are visually unpleasant. Residents tend to object to having them located nearby because of the visual disamenity they create or because of adverse health effects they may associate with

[1] Visit http://www.ctia.org/ for more information about the growth of cellular subscriptions in the United States.

[2] Airwave Management, LLC, provides some insight into the amount of income these cell phone towers can generate for a land owner. According to their website, payments can reach as high as $60,000 per year (www.cell-tower-leases.com/Cell-Tower-Lease-Rates.html).

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The authors are, respectively, assistant professor, Department of Economics, Western Kentucky University, Bowling Green; and professor, Department of Economics, Martin School of Public Policy and Administration, University of Kentucky, Lexington.

the antennas.[3] Towers are often highly visible, and potential siting can induce objections from residents in the receiving neighborhood. Municipalities have used delays in the approval process in an attempt to appease protestors and possibly prevent siting.[4] Unlike some disamenities such as airport noise, information about the visual disamenity is available.[5]

Figure 1 illustrates when an externality is likely to exist, and the situation when a nearby antenna could provide a net benefit to nearby residents. In the upper photo, an antenna is located on a property adjacent to a residential subdivision. Regardless of any compensation, the antenna structure is likely to be considered a disamenity by nearby residents.[6] The lower photo shows an antenna that could provide a net benefit to nearby residents. The structure located at point A is hidden behind a thicket of trees and far enough away from the nearest neighbor (point C) so as not to impose any cost. If the owner of the property at point B owns the land where the antenna is located, the owner is receiving payments from the antenna's owner, while nearby residents receive the benefit of improved coverage. In this situation the potential disamenity is mitigated by trees. Having an antenna located nearby should not decrease property values; it probably increases property values where the antennas are located.

The purpose of this paper is to apply hedonic and quasi-experimental methods to measure any disamenity caused by communication antennas, controlling for endogenous antenna location and changes in unobserved housing and neighborhood characteristics. Spatial fixed effects are used to control for any time-invariant unobservables correlated with proximity to an antenna. The repeat sales method and quasi-experimental techniques are used to address time-invariant and time-varying unobserved characteristics that could affect the equilibrium hedonic price function. Quasi-experimental techniques are becoming increasingly common in the environmental economics literature and are used instead of instrumental variables when there is not random assignment into treatment and control groups (Greenstone and Gayer 2009).

II. RECENT WORK ON VALUING AMENITIES/DISAMENITIES

Omitted variables are a concern when estimating hedonic price functions. Following Rosen (1974), the hedonic price function of property i can be represented by $P_i = P(S_i,N_i,Q_i)$, where P_i is the price of property i. S_i, N_i, and Q_i are the structural, neighborhood, and environmental characteristics, respectively. Consumers have utility $U = U(X,S_i,N_i,Q_i)$, which is maximized subject to the budget constraint $P_i + X = M$, where X is a Hicksian composite commodity with price equal to \$1, and M is income. This gives the following first-order condition:

$$\left(\frac{\partial U}{\partial Q_i}\right) \Big/ \left(\frac{\partial U}{\partial X}\right) = \frac{\partial P_i}{\partial Q}. \qquad [1]$$

The marginal rate of substitution between the environmental characteristic and the composite good X is equal to the slope of the hedonic price function (market clearing locus) in the environmental characteristic Q_i. Once the hedonic price function P_i has been estimated,

[3] Despite concerns about negative health effects from the radio waves emitted from mobile devices, a comprehensive study of the health effects related to cell phone and cell phone antennas by Röösli et al. (2010) finds that there is no conclusive evidence that using cell phones or living near cell phone towers harms human health. Nevertheless, the perception of such risks may be sufficient to alter behavior.

[4] See City of Arlington, Texas *v.* Federal Communications Commission, 133 S. Ct. 1863.

[5] A recent article by Alcantara (2012), with AOL Real Estate, highlights the concerns residents have about having a communication antenna located near their property. As reported, a group of residents in Mesa, Arizona, is protesting the siting of a cell phone tower in the group's neighborhood. One resident is quoted as saying, "Apart from the tower being so tall, we all feel that property values will go down if they build it so close. Most people I know wouldn't want to buy a house near a cell phone tower."

[6] If the structure was constructed *before* the residents moved in or built a house in this subdivision, no uncompensated externality exists. They have preferences such that the structure does not affect them, or they were compensated for the visual aspect of the structure though a lower purchase price. However, if the structure was constructed *after* the residents moved in or built in this subdivision, they are affected by the sight of the structure and a lower sales price if they do decide to sell the property. The land owner where the structure is located is receiving payments from the antenna's owner, while all affected nearby residents are not being compensated.

FIGURE 1
Houses Likely Affected *(upper photo)* and Houses Likely Not Affected *(lower photo)* by Nearby Antenna
Source: Google Earth 2014, 2015.

the partial derivative of P_i with respect to the environmental characteristic Q_i is equal to the implicit price of the environmental characteristic. However, when there are characteristics unavoidably omitted from P_i that are correlated with Q_i, the estimate of willingness to pay for Q_i will be biased. Endogeneity in the location of the antenna structures is the greatest concern in estimation. Holding all else constant, owners of the antenna structures are going to locate them in areas where it costs the least. If not taken into account, this incentive will lead to an overestimate of the negative impact these structures have on property values. Other issues that have to be addressed in estimation concern buyers' sorting (Cameron and McConnaha 2006; Bayer, Keohane, and Timmins 2009; Bieri, Kuminoff, and Pope 2012; Kuminoff, Smith, and Timmins 2013) and the stability of the hedonic price function (Kuminoff and Pope 2014; Haninger, Ma, and Timmins 2014). To address the sort-

ing concern, spatial fixed effects are included to control for unobservables that may influence both buyers' location choices and the location of communication antennas. The most recent panel data techniques that address both time-invariant and time-varying unobservables are used to account for the possibility of a changing hedonic price function after the construction of a nearby antenna.

While Rosen (1974) shows that the partial derivative of P_i with respect to Q_i provides an estimate of the willingness to pay for a small change in the environmental good Q_i, the appropriate functional form for the hedonic price function is uncertain. Cropper, Deck, and McConnell (1988) use simulations to determine how different functional forms perform when there are omitted variables in the hedonic price regression. They find that flexible functional forms perform well when all of the attributes are included, but recommend using a more parsimonious functional form when there are omitted variables. Since Cropper, Deck, and McConnell's (1988) work, sample sizes have increased dramatically, advances in geographical information systems allow researchers to control for previously unobserved spatial characteristics, unobserved structural housing characteristics are much less of a concern, and quasi-experimental techniques have become more prevalent. Kuminoff, Parmeter, and Pope (2010) find that Cropper, Deck, and McConnell's (1988) recommendations should be reconsidered. When using cross-section data, Kuminoff, Parmeter, and Pope (2010) find that the quadratic Box-Cox functional form with spatial fixed effects performs best. However, for practical purposes, including spatial fixed effects significantly reduces bias regardless of the functional form used.[7]

Kuminoff, Parmeter, and Pope (2010) also show that exploiting variation in an environmental amenity for properties that sell multiple times can reduce bias in willingness-to-pay estimates compared to pooled ordinary least squares with fixed effects. If the spatially correlated unobservables are time invariant, their effect will be purged from the model when first differences are taken. However, if the unobservables are not time invariant, the estimates from a repeat sales model will be biased. Repeat sales models have recently been used to estimate the impact of changing cancer risks (Gayer, Hamilton, and Viscusi 2002), the siting of wind farms (Heintzelman and Tuttle 2012), Superfund site remediation (Mastromonaco 2014), and reductions in three of the U.S. Environmental Protection Agency's criteria air pollutants (Bajari et al. 2012).

While there are advantages of using the repeat sales method and quasi-experimental techniques to eliminate the bias caused by time-invariant unobservables, these methods estimate a capitalization rate that is not necessarily equal to the marginal willingness to pay. It is possible that the presence of, or change in, an environmental (dis)amenity can cause the hedonic price function to change over time. Kuminoff and Pope (2014) and Haninger, Ma, and Timmins (2014) show that as long as the hedonic price function is constant over time, there should be no difference between the capitalization rate and the marginal willingness to pay. Given that the communication antennas are expected to have relatively small impacts on property values, it is unlikely that the construction of a new antenna structure will lead to a change in the hedonic price function. But, this issue will be addressed.

Kuminoff, Parmeter, and Pope (2010) find that a generalized difference-in-differences estimator with interactions between the time-dummy variables and housing characteristics to allow the shape of the price function to change over time performs best when panel data are available. Linden and Rockoff (2008) provide a technique for defining treatment and control groups so that difference-in-differences can be used to estimate the impact of environmental (dis)amenities when treatment and control groups are not clearly defined. Their technique has recently been used to estimate the impact of brownfield remediation (Haninger, Ma, and Timmins 2014) and shale gas developments (Muehlenbachs, Spiller,

[7] Since the quadratic Box-Cox is still computationally intensive and the coefficients are difficult to interpret, semilog and linear Box-Cox models are commonly used.

and Timmins 2014).[8] Parmeter and Pope (2013) provide a thorough overview of the difference-in-differences method and other quasi-experimental techniques. By differencing over time, the difference-in-differences method controls for time-invariant unobservables, just like the fixed effects and repeat sales methods, but also overcomes problems with time-varying unobservables with the "common trends" assumption.[9]

Mastromonaco (2014) and Bajari et al. (2012) both propose methods for reducing bias caused by time-varying spatially correlated unobservables. Mastromonaco (2014) includes census tract–year fixed effects that allow the effect of unobservables at the neighborhood level to vary over time in a repeat sales model. Bajari et al. (2012) also use a repeat sales model but exploit information contained in the residual from the first sale to learn about the characteristics of the house that the researcher cannot observe directly. In contrast, the data used in this study have house characteristics at the time of each sale and allow for control of time-varying housing characteristics that are typically unobservable. In this study the results below show that the unobservables at the neighborhood level that are correlated with proximity to a communication antenna are time invariant and are adequately controlled for using spatial fixed effects.

III. DATA ON HOUSING AND ANTENNAS

Housing data covering a period of 12 years from 2000 to 2011 were extracted from two multiple listing services that serve the Louisville and Elizabethtown areas in central Kentucky.[10] The housing data contain an extensive set of structural housing characteristics, closing date, and sales price for every property sold. All property addresses were geocoded, and a standardized address and latitude and longitude were assigned to each property.[11] This standardized address is used to identify houses that are sold multiple times.

These data are much richer than data extracted from a local property valuation administrator or data from DataQuick that are commonly used. While data from each of those sources identify properties that are sold more than once, the structural housing characteristics are recorded only for the most recent transaction. The data used here identify properties that are sold more than once during the sample period and record the structural housing characteristics each time the property is sold. This detail allows for a check of the assumption that structural housing characteristics are constant over time, an assumption that is often made when using the repeat sales method.

Data for the communication antennas come from the Federal Communication Commission's (FCC) Antenna Structure Registration database.[12] This database includes all communication antennas in the United States that are registered with the FCC. All antennas that may interfere with air traffic must be registered with the FCC to make sure the lighting and painting requirements are met. These data contain antenna characteristics such as dates of construction and demolition, latitude and longitude, antenna height, and antenna type. It is possible there are antennas located in the study area that are not registered, but this is

[8] Muehlenbachs, Spiller, and Timmins (2014) use a difference-in-difference-in-differences model. They use the Linden and Rockoff (2008) technique to find the distance at which shale gas developments do not impact property values, but also use the local public water service area to define a second treatment group. Similar to owners of land where shale gas wells are drilled, owners of land where communication antennas are located receive payments from the antenna's owner.

[9] In this study, a majority of communication antennas were built several years before the property was sold, making a visual check of the "common trends" assumption difficult.

[10] Please contact the author regarding any questions about the multiple listing service data.

[11] One issue with geocoding addresses is that the coordinates will correspond to the location on the street where the property is located and not the exact coordinates of the actual house; Filippova and Rehm (2011) were able to overcome this using the coordinates where the home was located within the plot. In the current study, properties that were not assigned a standardized address and a unique latitude and longitude were excluded from the final sample. Properties with less than 500 square feet or more than 10,000 square feet, or zero bedrooms or zero full baths were also dropped.

[12] Antenna Structure Registration database available at http://wireless.fcc.gov/antenna/index.htm?job = uls_transaction&page = weekly.

rare. Since the construction date of each antenna needs to be known to ensure the antennas located near houses were standing when the properties sold, antennas that did not include a construction date were dropped.[13] Google Earth[14] was used to verify whether not an antenna was standing when the property sold if there was a dismantled date recorded. Since the images include the date the image was captured, it was possible to identify whether the antenna was standing when the property sold.[15]

ArcGIS[16] was used to determine several location-specific characteristics. They include (1) the census tract in which each house is located, (2) the census block group in which each house is located, (3) distance to the nearest communication antenna, (4) distance to the nearest parkway/interstate, (5) distance to the nearest railroad, and (6) distance to the Fort Knox military base. Since the visual disamenity of communication antennas is the focus of this study, all proximity measures were calculated using straight-line distances. All antennas within a 10-mile radius of each property that were standing when the property was sold were identified. This information was used to determine the number of antennas located within specified distances from each property. In addition, using the Viewshed tool in ArcGIS, a variable was created that is distance to the nearest visible communication antenna for each house in the sample. This variable facilitates isolation of the impact of visual pollution (see Paterson and Boyle 2002; Jensen, Panduro, and Lundhede 2014). This variable is used along with (unconditional) distance for comparison.

Averages or shares for the housing characteristics are given in Table 1. The typical house sold for $183,609 (in 2011 dollars), has three bedrooms and two full bathrooms, is 1,655 square feet in size, has a lot size of about eight-tenths of an acre, and is 33 years old. Holding all else constant, the owner of a communication antenna will attempt to locate the antenna in an area that minimizes the antenna owner's cost. To check if antennas are located in areas where property values are low to begin with, Table 1 also shows averages for houses within and beyond 4,500 feet of an antenna.[17] Houses within 4,500 feet of an antenna sell for $32,991 (16%) less than houses more than 4,500 feet away, have slightly fewer bedrooms and bathrooms, are smaller, and are on smaller lots. The most notable difference is that houses within 4,500 feet of an antenna are about 18 years older on average than houses more than 4,500 feet away from an antenna. The differences in means between houses within and beyond 4,500 feet are statistically different from zero at usual levels for all characteristics except for Within 1 Mile Ft. Knox. It appears that communication antennas are in fact located in areas where properties are less valuable. While most of the difference in sales prices for houses within and beyond 4,500 feet of an antenna can be explained by differences in the types of houses, the primary focus of this study is controlling for differences that are unobservable. The precise location information for each house provided in the data is used to control for these unobservables.[18]

For the full sample of houses, the median distance to the nearest visible antenna when a house is sold is 4,459 feet, or approximately 0.84 miles. The mean distance is 5,959 feet (1.3 miles) with a standard deviation of 5,334

[13] Since the earliest construction year in the sample of antennas is 1927 and the latest 2011, it cannot be assumed that the absence of a construction date means the antennas with missing dates were built before the year 2000 and can be included in the final sample.

[14] See www.google.com/earth/ for access to images.

[15] This was a concern for only a handful of antennas. Multiple antennas were assigned the same coordinates, and it was determined that this corresponded to multiple antennas being mounted on the same structure. Some demolition dates indicated that an antenna was removed, and some demolition dates indicated that the actual structure was taken down. Being dismantled refers to the latter.

[16] See www.esri.com/software/arcgis.

[17] 4,500 feet is approximately the median value of distance to the nearest standing antenna in this sample. Distance in thousands of feet is used in the analysis that follows.

[18] A regression of the number of communication antennas in a census tract on the median sales price and census tract demographics suggests that the number of antennas in a census tract is negatively correlated with property values. However, even though the coefficient has the expected sign, the coefficient is not statistically different from zero at conventional levels, and the median sales price and demographics explain only 8% of the variation in the number of communication antennas in a census tract.

TABLE 1
Mean or Share for Structural Housing Characteristics

Variables	All	Less than 4,500 ft	Greater than 4,500 ft
Sales price (2011 dollars)	183,609	167,235	200,226
Bedrooms	3.241	3.161	3.323
Full bathrooms	1.811	1.687	1.937
Partial bathrooms	0.368	0.346	0.39
Square feet of living space	1,655	1,573	1,739
Lot size (acres)	0.82	0.383	1.263
Lot size missing	0.046	0.044	0.049
Has < in lot dimensions[a]	0.127	0.149	0.105
Has > in lot dimensions[a]	0.003	0.003	0.004
Age (years)	33.153	42.078	24.096
Age unknown	0.01	0.006	0.014
Fireplace	0.479	0.474	0.484
Basement	0.602	0.613	0.59
Finished basement	0.175	0.153	0.197
Central air	0.909	0.898	0.921
Brick exterior	0.346	0.322	0.37
Vinyl exterior	0.162	0.157	0.168
Metal roof	0.01	0.006	0.013
Composition roof	0.94	0.944	0.935
Ranch style	0.447	0.409	0.485
Modular style	0.014	0.004	0.024
Cape cod style	0.084	0.102	0.066
Carport	0.057	0.066	0.049
Garage	0.663	0.657	0.668
One-car garage	0.169	0.209	0.128
Multiple-car garage	0.563	0.494	0.632
Within 1 mile parkway/Interstate	0.485	0.629	0.338
Within 1 mile railroad	0.511	0.569	0.452
Within 1 mile Ft. Knox	0.014	0.014	0.014
Sample size	142,161	71,604	70,557

[a] The lot dimensions indicated the lot size was less (greater) than the listed size.

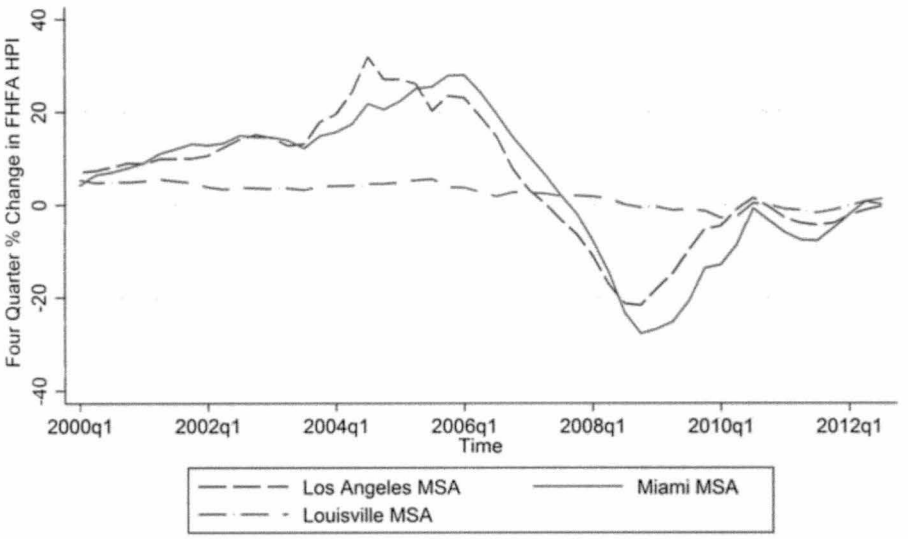
feet. Only 0.4% of houses are within 500 feet of the nearest visible antenna, while 9.5% of the houses in the sample have a visible antenna within 2,000 feet. Some houses are likely affected by the presence of multiple antennas. For example, there are 108 houses that have two visible antennas between 500 and 1,000 feet and 6 that have three antennas within that same radius. This variation in antenna density means that estimating the disamentity value caused by communication antennas using distance to the nearest antenna could be biased due to the presence of multiple antennas. Estimates would tend to be biased upward, because all the value of the disamenity would be attributed to the nearest antenna when it should be attributed to the combination of antennas.

Before moving to estimation of any disamenity value of antennas, it is worth addressing an overall concern about housing market analysis during the Great Recession. The concern is how an equilibrium framework such as that described by Rosen (1974) can produce misleading results during a period of disruption.[19] Without question, housing prices declined between 2006 and 2009, but as Carson and Dastrup (2013) report, there was considerable spatial variation. Across metropolitan areas, housing prices declined none at all to more than 60%. The four-quarter percentage change in the Federal Housing Finance Agency's housing price index[20] is shown in Figure 2 for the study area and the Los Angeles and Miami metropolitan statistical areas (MSAs). Even though the Louisville MSA was affected by the recent housing crisis,

[19] This issue is discussed in detail by Boyle et al. (2012).

[20] Federal Housing Finance Agency Housing Price Index data available at www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index.aspx.

FIGURE 2
Four Quarter Percent Change in the Federal Housing Finance Agency Housing Price Index in the Los Angeles, Louisville, and Miami Metropolitan Statistical Areas



house prices remained relatively stable compared to the larger MSAs that were affected the most. This stability alleviates concerns that the results presented below are being affected by a rapidly changing and unstable housing market.

Changes in census tract demographics[21] from 2000 and 2010 for the study area were also compared to changes for the entire United States. The only notable difference is that unemployment more than doubled nationally, while there was only a 62% increase in the study area. For the entire United States, the percentage change in the number of people who moved in from out of state fell by 71%, while it increased by 12% in the study area; since the study area contains the Fort Knox military base, the above average number of out-of-state movers is to be expected.[22]

Because there is a concern that antennas could be located in areas with not only lower property values but also disadvantaged populations, demographics for census block groups that contain antennas were compared to those within the same census tract that do not have any antenna structures, for the entire state of Kentucky in 2010. While small differences exist, none are significant at conventional levels. Table 1 shows that houses near these antennas sell for less than homes farther away; however, these differences do not appear to be driven by differences in demographic characteristics.[23]

IV. EMPIRICAL MODEL

To determine the impact proximity to an antenna structure has on property values, hedonic property value models and quasi-experimental methods are used. The first regressions rely on cross-sectional variation in distance to the nearest antenna and do not exploit the panel aspect of the data. The second

[21] Census data available at http://factfinder.census.gov.

[22] A regression of the change in the number of communication antennas in a census tract on the percentage changes in demographic characteristics in the same tract suggests that changes in demographics are not leading to significant changes in the number of communication antennas in an area. There were statistically significant coefficients for median income, unemployment, percentage of the population that owns their home, and the percentage of the population with a bachelor's degree or higher. However, the changes in these characteristics required to cause one additional antenna to be constructed or dismantled are extremely large. For example, it would take a 1,067% increase in unemployment to lead to the dismantling of one antenna.

[23] Note that this calculation is possible only for census tracts that have at least one block group without antennas.

set of regressions exploits the panel aspect of the data to reduce the potential bias caused by time-invariant unobservables. The data cover a period of 12 years, with communication antennas being built and dismantled throughout the period as well as in between sales of the same property. These changes allow for estimation of the traditional cross section specifications as well as the repeat sales and difference-in-differences specifications that are becoming more prevalent in the hedonic literature (Gayer, Hamilton, and Viscusi 2002; Linden and Rockoff 2008; Parmeter and Pope 2013; Haninger, Ma, and Timmins 2014; Muehlenbachs, Spiller, and Timmins 2014; Bajari et al. 2012).

Cross-Section Specification and Proximity Measures

Following Kuminoff, Parmeter, and Pope (2010) and Heintzelman and Tuttle (2012), a semilog specification with spatial fixed effects is used to address the potential bias caused by time-invariant, spatially correlated unobservables. The first specification is

$$\ln P_{ijt} = \mathbf{Z}_{ijt}\beta + \mathbf{X}_{ijt}\delta + \lambda_t + \gamma_j + \epsilon_{ijt}, \quad [2]$$

where $\ln P_{ijt}$ is the natural log of the price of house i at location j at time t, $\mathbf{Z}_{ijt}$ is the set of variables describing proximity to the nearest antenna structures, $\mathbf{X}_{ijt}$ includes an extensive set of structural housing characteristics, λ_t are year-month time dummy variables, γ_j are spatial fixed effects, and ϵ_{ijt} is the error term. To demonstrate the importance of including the spatial fixed effects, equation [2] is estimated without spatial fixed effects and again with census tract or census block group fixed effects. If there are unobserved spatial characteristics that are correlated with the proximity variables, β in equation [2] should be more precisely estimated when smaller geographic fixed effects are used.

Distance to communication antennas is measured using a continuous quadratic measure of distance to the nearest visible antenna that was standing when the property sold.[24] The spatial fixed effects ensure that this continuous measure of distance is measuring the impact of a nearby antenna and not proximity to an area that may be a magnet for communication antennas. As a robustness check, the inverse of distance to the nearest antenna that was standing when the property sold is also used.

As an additional robustness check, proximity is measured using 500-foot distance rings that include a dummy variable equal to 1 if a communication antenna is located within some specified distance. The dummy variable method is the primary specification used by Heintzelman and Tuttle (2012) and allows for a high degree of nonlinearity in the disamenity caused by these antennas. A shortcoming of this method is that the size of the distance rings and the distance used as the omitted category is somewhat arbitrary. If properties are affected by the presence of multiple antennas, the dummy variable approach will overestimate the disamenity caused by communication antennas. Since multiple properties in the sample have more than one antenna nearby, proximity is also measured using the number of antennas within each ring. This is the method used by Mastromonaco (2014) to estimate the impact of Superfund sites on property values in Los Angeles.

Panel Analysis

One strategy for removing time-invariant unobservables is to exploit the variation in distance to the nearest antenna for properties that sell multiple times. During the study period, new antennas were constructed and old antennas were dismantled. These changes create variation in distance to the nearest antenna over time for the same property. This approach eliminates any time-invariant unobservables that may be correlated with the proximity variables and is the primary method used by Gayer, Hamilton, and Viscusi (2002), Heintzelman and Tuttle (2012), Mastromonaco (2014), and Bajari et al. (2012). The following regression is estimated:

[24] Banfi, Filippini, and Horehájová (2008) and Bond (2007a, 2007b) estimate the impact of cell phone towers on property values, but their specifications do not fully account for endogeneity of tower location and correlated unobservables.

$$\ln P_{it} - \ln P_{it'} = (z_{it} - z_{it'})\beta + (\mathbf{X}_{it} - \mathbf{X}_{it'})\delta + \lambda_t + \epsilon_{it} - \epsilon_{it'}, \quad [3]$$

where $\ln P_{it}$ is the natural log of the price of house i at time t, z_{it} is the distance to the nearest standing antenna at time t, and $\mathbf{X}_{it}$ are structural housing characteristics that may vary over time. Following Gayer, Hamilton, and Viscusi (2002), λ_t is a set of year variables equal to –1 if the year indicates the first year the property sold, 1 if the year indicates the year of the last sale, and 0 for all other sales.[25] This allows for appreciation in housing values over time. ϵ_{it} is the error term. This specification is different from the repeat sales model that is typically estimated. In the typical repeat sales model, only the proximity variables that measure distance to the nearest antenna would be allowed to vary over time, while the structural housing characteristics are assumed to be constant. Several recent studies use data from sources that do not record the structural housing characteristics each time a house is sold and make the assumption of constant structural characteristics (Heintzelman and Tuttle 2012; Mastromonaco 2014; Bajari et al. 2012). Equation [3] will be estimated with and without the changing structural housing characteristics to control for changes and determine how sensitive the estimate of β is to the assumption of constant structural characteristics.

There are shortcomings when using the repeat sales approach. There is the possibility that the unobservables are not time invariant. Kuminoff, Parmeter, and Pope (2010) show that when the omitted spatial characteristics are time varying, the bias in the first-differenced estimates increases substantially. Since not all properties are sold multiple times, the repeat sales approach leads to much smaller sample sizes. In addition, properties that sell multiple times may be systematically different than properties that sell only once. Properties that turn over multiple times may be repeatedly priced below market value, or more importantly, the local disamenity has an above-average effect on those properties. With an extensive list of housing characteristics at the time of all sales, the number of time-varying unobservables is smaller than in studies that do not have house characteristics at the time of sale each time the property is sold.[26]

[25] Bailey, Muth, and Nourse (1963) introduce this method of estimating a price index using a repeat sales framework. The first period (year 2000) is the base year, and the remaining coefficients can be interpreted as the log price index.

V. RESULTS

Cross-Section Results

Results that use a continuous measure of distance to the nearest visible antenna are reported in Table 2, Panel A. In column (1), census tract fixed effects are included, and the results show that holding constant the characteristics of the house, the year, and month the property was sold, and the area in which the property is located, consumers are willing to pay a premium to be located farther away from a communication antenna. The estimates in column (1) show that the sales price of a house is increasing at a rate of approximately 0.74% at a distance of 1,000 feet and at a rate of about 0.68% at 2,500 feet. No effect is found beyond 21,093 feet (approximately 4.0 miles). Interestingly, specifications (not shown) that do not include any spatial fixed effects indicate that houses with communication antennas nearby sell for more, not less, than houses where the nearest antenna is farther away. Column (2) includes census block group fixed effects, which are more precise than the census tract fixed effects used in column (1). These estimates suggest that the sales price of a house increases at a rate of about 0.57% at a distance of 1,000 feet, and a rate of 0.53% at 2,500 feet. No effect is found beyond 21,583 feet (approximately 4.1 miles). Even though the effect of distance is identified by variation in distance within a smaller geographic area, the specification using census block group fixed effects provides

[26] A difference-in-differences specification was also used to mitigate the effects of time-invariant unobservables. This technique is discussed in detail by Parmeter and Pope (2013) and used by Linden and Rockoff (2008), Muehlenbachs, Spiller, and Timmins (2014), and Haninger, Ma, and Timmins (2012) in difference-in-differences. Treatment and control groups were identified using the method of Linden and Rockoff (2008).

TABLE 2
Cross-Section Results for Antenna Impact Using Continuous Measures of Distance

Variable[a]	(1) ln(Sales price)	(2) ln(Sales price)
Panel A		
Distance to nearest visible antenna	0.00772*** (0.00150)	0.00600*** (0.00132)
Distance^2 to nearest visible antenna	−0.000183*** (3.49e–05)	−0.000139*** (2.99e–05)
Constant	10.51*** (0.0309)	10.24*** (0.0195)
Observations	141,208	141,208
R-squared	0.853	0.862
Panel B		
Distance to nearest antenna	0.0104*** (0.00187)	0.00888*** (0.00173)
Distance^2 to nearest antenna	−0.000323*** (5.81e–05)	−0.000284*** (5.74e–05)
Constant	10.50*** (0.0307)	10.23*** (0.0199)
Observations	142,161	142,161
R-squared	0.853	0.862
Panel C		
Inverse distance to nearest visible antenna	−0.0359*** (0.00886)	−0.0285*** (0.00743)
Constant	10.56*** (0.0299)	10.28*** (0.0187)
Observations	141,208	141,208
R-squared	0.853	0.862
Year-month dummies	Yes	Yes
Tract fixed effects	Yes	No
Block group fixed effects	No	Yes

Note: Distances to antennas are measured in thousands of feet. Standard errors are clustered at the level of included fixed effect.

[a] Also included in each regression are bedrooms, full bathrooms, partial bathrooms, square feet, square feet^2, lot size, lot size missing, age, age^2, age unknown, fireplace, basement, finished basement, central air, exterior type, roof type, style of home, garage, carport, within 1 mile parkway/interstate, within 1 mile railroad, and within 1 mile Ft. Knox.

*** $p<0.01$.

estimates that are more precisely estimated than the census tract specification. This result provides further evidence that there are spatially correlated unobservables that are negatively correlated with distance to a communication antenna.[27]

Panel B uses the same quadratic distance specification but uses the more naive measure of distance to the nearest antenna that does not take into account whether the nearest antenna is visible from the house. While the effect is similar, it is estimated with less precision than the specification that accounts for visibility of the nearest antenna. For approximately 5% of the houses in the sample, the nearest antenna is not visible, and that fact produces measurement error in this specification.[28]

As a robustness check, the same specifications are estimated using the inverse of distance to the nearest visible antenna. These re-

[27] Regressions were estimated that included the percentage of rural residents in a census tract instead of census tract fixed effects. The results show that the sales price of a house is decreasing as the number of people living in rural areas increases, and that proximity to a communication antenna has a positive effect on the sales price of a house in highly urban areas, and a negative effect in more rural areas. This is consistent with the idea that antennas in more urban areas are more likely to be disguised than in rural areas, where the antennas structures tend to be much larger. Urban areas have multiple structures such as tall buildings, smoke stacks, clocks, and church steeples that antennas can be located on or around. The R^2 for the urban/rural specification was 0.72 compared to 0.85 in the census tract specification in Table 2.

[28] As an additional robustness check, a specification was estimated that uses distance to the nearest tower-type antenna. These structures are larger and are visible at greater distances than the smaller antenna structures and are expected to have a larger effect on property values and have an effect at greater distances if they are visible. If the estimated effect is larger than when all antennas are considered, this provided additional evidence that households are aware of this visual disamenity and respond rationally (Pope 2008; Currie et al. 2015). As expected, the results show that the tower-type antennas lead to a larger decrease in property values and have an effect farther away.

TABLE 3
Cross-Section Results of Antenna Impact Using 500-Foot Distance Rings: Any Antenna and Number of Antennas

Variable[a]	(1) ln(Sales Price) 1 if Within	(2) ln(Sales Price) Number Within
0 to 500	−0.0752*** (0.0232)	−0.0494** (0.0206)
500 to 1,000	−0.0613*** (0.0134)	−0.0390*** (0.0112)
1,000 to 1,500	−0.0630*** (0.0109)	−0.0417*** (0.00917)
1,500 to 2,000	−0.0620*** (0.00987)	−0.0417*** (0.00691)
2,000 to 2,500	−0.0512*** (0.00918)	−0.0289*** (0.00650)
2,500 to 3,000	−0.0450*** (0.00796)	−0.0286*** (0.00538)
3,000 to 3,500	−0.0428*** (0.00759)	−0.0288*** (0.00473)
3,500 to 4,000	−0.0343*** (0.00652)	−0.0248*** (0.00456)
4,000 to 4,500	−0.0128** (0.00593)	−0.0167*** (0.00425)
Constant	10.30*** (0.0194)	10.31*** (0.0208)
Observations	141,208	141,208
R-squared	0.862	0.863
Year-month dummies	Yes	Yes
Tract fixed effects	No	No
Block group fixed effects	Yes	Yes

Note: Standard errors are clustered at the census block group.
[a] Also included in each regression are bedrooms, full bathrooms, partial bathrooms, square feet, square feet^2, lot size, lot size missing, age, age^2, age unknown, fireplace, basement, finished basement, central air, exterior type, roof type, style of home, garage, carport, within 1 mile parkway/interstate, within 1 mile railroad, and within 1 mile Ft. Knox.
** $p<0.05$; *** $p<0.01$.

sults are shown in Table 2, Panel C. When census tract fixed effects are included, the estimates show that the sales price of a house is increasing at a rate of approximately 3.6% at a distance of 1,000 feet, and at a rate of about 0.57% at 2,500 feet. When census block group fixed effects are included, the estimates show that the sales price of a house is increasing at a rate of about 2.9% at a distance of 1,000 feet, and a rate of 0.46% at 2,500 feet. Again, the effect is estimated more precisely as more precise fixed effects are included. Overall, the results do not appear to be extremely sensitive to functional form when using a continuous measure of distance.

Results from an alternative specification that uses 500-foot distance rings are shown in Table 3. Column (1) indicates whether an antenna is located within a specified radius, and column (2) estimates the marginal effect of an additional antenna within the same radius by using the density of nearby antennas. The results suggest that houses located near an antenna sell for less than a comparable house farther away and that both distance to the nearest antenna and the density of nearby antennas have a significant effect on property values. In both specifications, the effect of communication antennas on property values diminishes almost monotonically with distance.[29]

[29] Bond and Wang (2005) and Bond (2007a) estimate the impact of cell phone towers on property values in New Zealand, but the studies have limitations. The first lacks precise location information for the houses and uses street name fixed effects as a proxy for distance to a tower. The second geocodes houses, but the model is misspecified. They use a continuous distance measure but set distance equal to zero if the house sold before the tower was constructed. Bond's (2007b) is the only study found that uses U.S. data. It is limited to sales from one area of Orange County, Florida, and includes the latitude and longitude of each property in each regression. Banfi, Filippini and Horehájová (2008) look at the impact of cell phone towers on rents in Zurich Switzerland and find a significant decrease in rents of about 1.5% on average. Filippova and Rehm's (2011) is the most recent study. They use data from the Auckland region of New Zealand and also use distance bands and a continuous distance measure. Their distance band specification yields insignificant results, and the coefficient of the continuous distance measure has a significant, but wrong-signed coefficient. They report a negative but insignificant impact on property values. The authors fail to consider the interaction terms between distance and their location variables. Given they use 50-meter increments for their distance bands, it is likely there is not enough variation within each band to identify any impact.

TABLE 4
Results Using Repeat Sales and a Continuous Measure of Distance: All Repeat Sales and Sold Only Twice

Variable	(1) Δ ln(Sold price)	(2) Δ ln(Sold price)
Panel A		
Δ Distance to nearest visible antenna[a]	0.00537*** (0.000924)	0.00200** (0.000941)
Constant	0.0543*** (0.00308)	0.152*** (0.00527)
Observations	29,759	20,871
R-squared	0.102	0.144
Panel B		
Δ Distance to nearest visible antenna[a]	0.00546*** (0.000869)	0.00254*** (0.000861)
Δ Bedrooms	0.0781*** (0.00562)	0.0613*** (0.00628)
Δ Full bathrooms	0.171*** (0.00802)	0.169*** (0.00912)
Δ Partial bathrooms	0.105*** (0.00959)	0.111*** (0.0114)
Δ Finished basement	0.0211*** (0.00385)	0.00992** (0.00458)
Δ Central air	0.255*** (0.00979)	0.243*** (0.0116)
Δ Carport	0.0585*** (0.0145)	0.0397*** (0.0151)
Δ Garage	0.0152* (0.00783)	0.0220** (0.00914)
Observations	29,759	20,871
R-squared	0.202	0.231
All repeats	Yes	No
Sold twice	No	Yes

[a] Distances to antennas are measured in thousands of feet. Standard errors are clustered at the property level.
* $p<0.1$; ** $p<0.05$; *** $p<0.01$.

The results that account for number of antennas (shown in Table 3, column (2)) are consistent with the argument made by Mastromonaco (2014) that considering only distance to the nearest site will lead to biased estimates if there are multiple sites that could adversely affect a property's sales price. As is expected, adding an additional antenna near a residential property has a smaller effect than an antenna being located near a property that did not previously have one nearby. Since the absolute value of the point estimate of almost every coefficient in column (2) of Table 3 is smaller than the corresponding coefficient in column (1), the estimates that measure proximity with distance to the nearest site are likely biased. To further explore this possible effect, a specification (not shown) was estimated that included both distance to the nearest visible antenna along with the density of nearby antennas, using 500-foot rings. Although the effect of density of nearby antennas remained significant, the effect of distance to the nearest antenna was not significant at conventional levels.

Panel Results

Results from the first repeat sales specification that assumes the structural housing characteristics are constant over time are shown in Table 4, Panel A. In this specification, the change in sales price is assumed to be a function of the change in distance to the nearest visible antenna and a set of year dummy variables that are equal to –1 if the year indicates the time of the first sale, 1 if the year indicates the year of the last sale, and 0 for all other sales. Comparing the change in sales price for houses that are sold more than once eliminates any bias that could be caused by time-invariant spatially correlated unobservables.

Comparing columns (1) and (2) for each cross-section specification in Table 2 shows that as more precise spatial fixed effects are used, the estimated effect of communication antennas on the sales price of a house is smaller and more precisely estimated. This indicates that the spatially correlated unobservables are negatively correlated with proximity

to an antenna. If this is true, and the unobservables are time invariant, the repeat sales estimates of the impact communication antennas have on property values should be similar to the estimates using the more precise census block group fixed effects.

The results in each column of Table 4 are consistent with this hypothesis. Column (1) includes all houses that sold more than once during the sample period. For every 1,000-foot change in distance to the nearest antenna, on average, the sales price of a house increases by 0.54%. Column (2) includes the set of houses that sold only twice during the 12 years the data cover. Since repeat sales are identified by the standardized address that was assigned to each property, limiting the sample to houses that sold only two times reduces the chance of including houses that are being considered repeat sales due to a coding error. Even though the sample size is reduced by 8,888 observations compared to the sample of all repeat sales, the R^2 increases by 0.042, and the effect of distance is still precisely estimated. In this specification, for every 1,000-foot change in distance to the nearest antenna, on average, the sales price of a house increases by 0.20%.

Of the 29,886 houses that sold more than once, a nontrivial number experienced a change in a major structural characteristic between sales. For example, 4,316 (17%) of houses had a change in the number of bedrooms between sales. The repeat sales results in Table 4, Panel B are based on relaxing the assumption that structural housing characteristics are constant over time. As is expected, including the changes in structural housing characteristics leads to a higher R^2, increases in each characteristic lead to a larger positive change in sales price, and the effect of distance is more precisely estimated. This result suggests that the change in distance to the nearest antenna between sales of the same property is not completely orthogonal to the change in housing characteristics, an assumption that must be made when detailed sales data are not used. When changing structural housing characteristics are accounted for, the estimated impact is slightly larger than the estimate in Panel A. While these estimates are not statistically different at conventional levels, a larger effect when the changing structural housing characteristics are included is consistent with the results from Bajari et al. (2012) that show ignoring time-varying correlated unobservables leads to underestimates of the benefits of pollution reduction.[30]

VI. DISCUSSION AND CONCLUSIONS

Overall, the results from the preferred specifications that include spatial fixed effects show that houses located near communication antennas sell for less on average than comparable houses located farther away from an antenna. There are a few important points to note about these results. First, regardless of the specification, time-invariant spatially correlated unobservables bias the cross-sectional estimates of the disamenity associated with nearby communication antennas when no controls for neighborhood characteristics are included. When spatial fixed effects are not included, the results suggest that houses near communication antennas sell for more, not less, than a similar house farther away from an antenna. When spatial fixed effects are included to capture the effect of time-invariant spatially correlated unobservables, each specification used indicates that houses near communication antennas sell for less than a similar house located farther away from an antenna. When the more precise census block group fixed effects are included, the estimated reduction in sales price caused by a communication antenna becomes smaller and is estimated more precisely in each of the cross-section specifications. This effect reinforces the importance of carefully controlling for

[30] Estimates from the difference-in-differences specification show that houses within 2,000 feet of an antenna at the time they were sold sell for about 3.3% less than a comparable house more than 2,000 feet away from an antenna at the time it was sold. When the equilibrium price function with respect to structural housing characteristics is allowed to change over time, an effect of about 2.2% is found but is not statistically significant at conventional levels. Since many houses in the sample are affected by the presence of multiple antennas, defining treatment and control groups using the method of Linden and Rockoff (2008) that uses distances to the nearest standing and not-standing antennas may not be appropriate.

spatially correlated unobservables that are correlated with proximity to a localized disamenity.

Consistent with the conjecture made by Mastromonaco (2014), estimating the effect of communication antennas on property values using distance to the nearest antenna is likely biased due to the presence of multiple nearby antennas. The results in column (2) of Table 3 indicate that a house located within 500 feet of an antenna sells for 7.5% less than a similar house more than 4,500 feet away from its nearest antenna. The results in column (2) of Table 3 show that adding an additional antenna within 500 feet of a house leads to a smaller reduction in sales price of 4.9%.

The results also suggest that the omitted spatial characteristics correlated with proximity to a communication antenna are time invariant and are being captured by the census block group fixed effects. First, the effect communication antennas have on nearby properties is smaller and is estimated more precisely when census block group fixed effects are used compared to the census tract estimates. This confirms that there are unobservables spatially correlated with distance to a communication antenna. Second, the repeat sales method eliminates any bias caused by time-invariant unobservables and provides results that are smaller than the cross-sectional estimates that include census block group fixed effects. Since the antennas are located in areas where property values are lower, the repeat sales specification that eliminates all time-invariant unobservables should yield results with the smallest amount of bias. Since the sample of houses that are sold multiple times may not be a random sample of all houses, some bias could still exist.

The best estimate of reduction in sales price caused by communication antennas shows that the sales price of a house is increasing at a rate of about 0.57% ($1,047) at a distance of 1,000 feet from the nearest antenna (Table 2, Panel A, column (2)). This suggests that a property located within 1,000 feet of the nearest antenna at the time of sale will sell for 1.82% ($3,342) less than a similar house that is 4,500 feet from the nearest antenna. In this specification, time-invariant spatially correlated unobservables are controlled for with census block group fixed effects. The repeat sales results in Table 4 provide additional evidence that the spatially correlated unobservables are being captured by the fixed effects. These estimates of the disamenity associated with communication antennas controls for time-invariant unobservables at the property level and suggests that a property located within 1,000 feet of an antenna will sell for 0.89% ($1,634) less than a similar house that is 4,500 feet from the nearest antenna (Panel B, column (2)). However, since the repeat sales are identified by matching a standardized address, these results could be sensitive to measurement error.

This effect is smaller than the estimated reduction caused by similar disamenities. Kroll and Priestley (1992) provide a review of the literature concerning overhead transmission lines and property values through the early 1990s. They find that in studies where a significant decrease was found, the decrease in property values typically fell in the range of 2% to 10%, and the effect diminished beyond a few hundred feet. Hamilton and Schwann (1995) estimate the impact of high voltage electric transmission lines have on property values, but primarily focus on the importance of using the correct functional form. They find that properties adjacent to a line lose about 6.3% of their value, but more distant properties are hardly affected. Using a repeat sales model, Heintzelman and Tuttle (2012) find that having a wind turbine located 0.5 miles away leads to a reduction in sales price from 8.8% to 15.81%.

The preferred specification for estimating the disamenity associated with communication antennas is the continuous measure of distance using census block group fixed effects (Table 2, Panel A, column (2)). These results imply that a property with an antenna located within 1,000 feet at the time of sale will sell for 1.82% ($3,342) less than a similar house that is 4,500 feet from the nearest antenna. In this sample, there are 3,031 houses within 1,000 feet of an antenna structure. Using the preferred repeat sales specification as a lower bound, if each antenna within 1,000

feet of a property were moved to a distance of 4,500 feet, there would be an aggregate increase in sales price of $4.95 million. The best estimate suggests the aggregate increase would be $10.13 million. These values should be compared to the cost of camouflaging or disguising communication antennas near residential properties to mitigate the effect they have on property values.

In areas where antennas are highly visible (Figure 1, upper photo), there is a potential externality caused by these antennas. If antennas are constructed near residential properties after the homeowner purchases the property, those houses suffer a small but nontrivial decrease in their property value and their owners are unlikely to be compensated by the land owner where the antenna is located or the owner of the antenna. Camouflaging is one solution to this problem that has been implemented in some areas. Camouflaged towers blend in with the landscape or are constructed in already standing structures such as church steeples and clock towers. Such developments will mitigate the disamenity associated with communication antennas and reduce the cost of convenience.

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Archives

HUD HOC Reference Guide

Hazards & Nuisances: Overhead High Voltage Transmission Towers and Lines

Chapter 1
Appraisal & Property Requirements
Page 1-18f

The appraiser must indicate whether the dwelling or related property improvements is located within the easement serving a high-voltage transmission line, radio/TV transmission tower, cell phone tower, microwave relay dish or tower, or satellite dish (radio, TV cable, etc).

1. If the dwelling or related property improvement is located within such an easement, the DE Underwriter must obtain a letter from the owner or operator of the tower indicating that the dwelling and its related property improvements are not located within the tower?s (engineered) fall distance in order to waive this requirement.
2. If the dwelling and related property improvements are located outside the easement, the property is considered eligible and no further action is necessary. The appraiser, however, is instructed to note and comment on the effect on marketability resulting from the proximity to such site hazards and nuisances.

- Airports
- Railroad tracks and other high noise sources
- Flood zones and insurance
- Lead based paint
- Radon
- Overhead high voltage transmission towers and lines
- Operating and abandoned oil and gas wells, tanks and pressure lines
- Insulation materials
- Lava zones
- Avalanche hazards

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REALTOR®Mag

Cell Towers, Antennas Problematic for Buyers

DAILY REAL ESTATE NEWS | FRIDAY, JULY 25, 2014

An overwhelming 94 percent of home buyers and renters surveyed by the National Institute for Science, Law & Public Policy (NISLAPP) say they are less interested and would pay less for a property located near a cell tower or antenna.

What's more, of the 1,000 survey respondents, 79 percent said that under no circumstances would they ever purchase or rent a property within a few blocks of a cell tower or antennas, and almost 90 percent said they were concerned about the increasing number of cell towers and antennas in their residential neighborhood.

Trouble Spots for Buyers:

- Home Owners Object to Cell Tower Installations
- Field Guide to Cell Phone Towers
- 6 Ways a Home May Turn Off Buyers
- 6 Ways to Turn Off Buyers at Open Houses

The survey, "Neighborhood Cell Towers & Antennas—Do They Impact a Property's Desirability?" also found that properties where a cell tower or group of antennas are placed on top of or attached to a building (condominium high-rise, for instance) is problematic for buyers.

"A study of real estate sales prices would be beneficial at this time in the Unites States to determine what discounts home buyers are currently placing on properties near cell towers and antennas," says Jim Turner, chair of NISLAPP.

The NISLAPP survey echoes the findings of a study by Sandy Bond of the New Zealand Property Institute and past president of the Pacific Rim Real Estate Society (PRRES). "The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods," which was published in The Appraisal Journal in 2006, found that buyers would pay as much as 20 percent less for a property near a cell tower or antenna.

Source: "Neighborhood Cell Towers & Antennas—Do They Impact a Property's Desirability?" National Institute for Science, Law & Public Policy (June 2014)

Survey by the National Institute for Science, Law & Public Policy Indicates Cell Towers and Antennas Negatively Impact Interest in Real Estate Properties

94% of respondents said a nearby cell tower or group of antennas would negatively impact interest in a property or the price they would be willing to pay for it

July 03, 2014 01:57 PM Eastern Daylight Time

WASHINGTON--(BUSINESS WIRE)--A survey conducted in June 2014 by the National Institute for Science, Law and Public Policy (NISLAPP) in Washington, D.C., *"Neighborhood Cell Towers & Antennas—Do They Impact a Property's Desirability?"*, shows home buyers and renters are less interested in properties located near cell towers and antennas, as well as in properties where a cell tower or group of antennas are placed on top of or attached to a building.

Of the 1,000 survey respondents, 94% reported that cell towers and antennas in a neighborhood or on a building would impact interest in a property and the price they would be willing to pay for it. And 79% said under no circumstances would they ever purchase or rent a property within a few blocks of a cell tower or antennas. And almost 90% of respondents said they were concerned about the increasing number of cell towers and antennas in their residential neighborhood, generally. See Full Results here: http://electromagnetichealth.org/electromagnetic-health-blog/survey-property-desirability/.

The NISLAPP survey reinforced the findings of a study by Sandy Bond, Ph.D. of the New Zealand Property Institute, and Past President of the Pacific Rim Real Estate Society (PRRES), published in *The Appraisal Journal* in 2006, The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods. That study found buyers would pay as much as 20% less, as determined at that time by an opinion survey in addition to a sales price analysis.

Jim Turner, Esq., Chairman of the National Institute for Science, Law and Public Policy, says, "The results of the 2014 NISLAPP survey suggest there is now high awareness about potential risks from cell towers and antennas, including among people who have never experienced cognitive or physical effects from the radiation." He adds, "A study of real estate sales prices would be beneficial at this time in the Unites States to determine what discounts homebuyers are currently placing on properties near cell towers and antennas."

Read More

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The New York Times

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A Pushback Against Cell Towers

By MARCELLE S. FISCHLER AUG. 27, 2010

Wantagh

TINA CANARIS, an associate broker and a co-owner of RE/MAX Hearthstone in Merrick, has a $999,000 listing for a high ranch on the water in South Merrick, one of a handful of homes on the block on the market. But her listing has what some consider a disadvantage: a cell antenna poking from the top of a telephone pole at the front of the 65-by-100-foot lot.

"Even houses where there are transformers in front" make "people shy away," Ms. Canaris said. "If they have the opportunity to buy another home, they do."

She said cell antennas and towers near homes affected property values, adding, "You can see a buyer's dismay over the sight of a cell tower near a home just by their expression, even if they don't say anything."

By blocking, or seeking to block, cell towers and antennas over the course of the last year, Island homeowners have given voice to concerns that proximity to a monopole or antenna may not be just aesthetically unpleasing but also harmful to property values. Many also perceive health risks in proximity to radio frequency radiation emissions, despite industry assertions and other evidence disputing that such emissions pose a hazard.

Emotions are running so high in areas like Wantagh, where an application for six cell antennas on the Farmingdale Wantagh Jewish Center is pending, that the

Town of Hempstead imposed a moratorium on applications until Sept. 21. That is the date for a public hearing on a new town ordinance stiffening requirements.

At a community meeting on Aug. 16 at Wantagh High School, Dave Denenberg, the Nassau county legislator for Bellmore, Wantagh and Merrick, told more than 200 residents that 160 cell antennas had been placed on telephone poles in the area in the last year by NextG, a wireless network provider.

"Everyone has a cellphone," Mr. Denenberg said, "but that doesn't mean you have to have cell installations right across the street from your house." Under the old town code, installations over 30 feet high required an exemption or a variance. But in New York, wireless providers have public utility status, like LIPA and Cablevision, and they can bypass zoning boards.

Earlier this month in South Huntington, T-Mobile was ordered to take down a new 100-foot monotower erected on property deemed environmentally sensitive (and thus requiring a variance). Andrew J. Campanelli, a civil rights lawyer in Garden City, said a group of residents had hired him to oppose the cellular company's application.

"They were worried about the property values," Mr. Campanelli said. "If your home is near a cell antenna, the value of your property is going down at least 4 percent. Depending on the size of the tower and the proximity, it is going down 10 percent."

In January, in an effort to dismantle 50 cell antennas on a water tower across from a school in the village of Bayville, Mr. Campanelli filed a federal lawsuit that cited health risks and private property rights.

In a statement, Dr. Anna F. Hunderfund, the Locust Valley superintendent, said that in February 2009 the district had engaged a firm to study the cellphone installations near the Bayville schools, finding that the tower "posed no significant health risks," and she noted that the emission levels fell well below amounts deemed unsafe by the Federal Communications Commission.

In June 2009, Sharon Curry, a psychologist in Merrick, woke up to find a cell antenna abutting her backyard, level to her 8-year-old son's bedroom window.

Puzzled by its presence, particularly because she lives next to an elementary school, she did research to see if there was cause for concern. What she learned about possible health impacts, she said, led her to seek help from civic associations and to form a group, Moms of Merrick Speak Out, to keep new cell towers out. She said she was seeking the "responsible" placement of cell antennas, away from homes and schools.

The Federal Communications Act of 1996 says health concerns are not a valid reason for a municipality to deny zoning for a cell tower or antenna. Property values and aesthetics, however, do qualify, according to the act.

Frank Schilero, an associate broker with RE/MAX Innovations in Wantagh, has a listing on a $629,000 home down the street from the Farmingdale Wantagh Jewish Center, where the application is pending to put six cell antennas on the roof.

"People don't like living next to cell towers, for medical reasons or aesthetics," Mr. Schilero said. "Or they don't want that eyesore sticking up in their backyards." There is an offer on his listing, he added, but since the buyer heard about the possible cell antennas she has sought more information from the wireless companies about their size and impact.

Charles Kovit, the Hempstead deputy town attorney, said that under the proposed code change any new towers or antennas would have to be 1,500 feet from residences, schools, houses of worship and libraries.

The town recently hired a consultant, Richard A. Comi of the Center for Municipal Solutions in Glenmont, to review antenna applications.

Under the new ordinance, applications for wireless facilities would require technical evidence that they had a "gap" in coverage necessitating a new tower.

"If not, they will get denied," Mr. Kovit said. The wireless companies would also have to prove that the selected location had "the least negative impact on area

character and property values." If another location farther away from homes can solve the gap problem, "they are going to have to move."

A version of this article appears in print on August 29, 2010, on Page RE9 of the New York edition with the headline: A Pushback Against Cell Towers.

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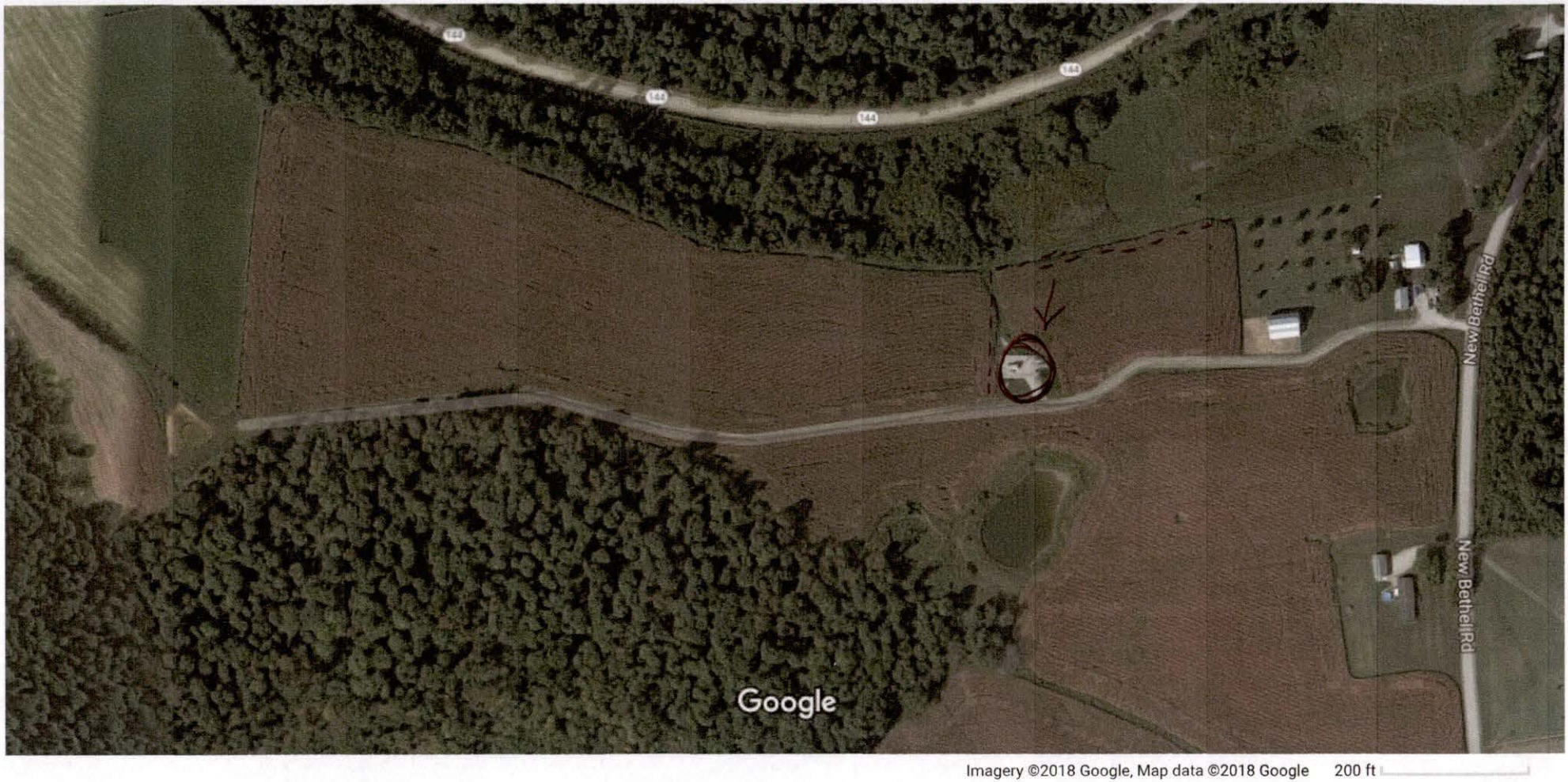

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The Impact Of Cellular Phone Base Station Towers On Property Values

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The Impact Of Cellular Phone Base Station Towers On Property Values

Keywords: Electromagnetic fields - radio frequency & microwave radiation - cellular phone base stations – property values - stigma

Abstract: Studies show that devices that emit electromagnetic fields (EMFs) are no longer seen as a welcome sign of progress. Media attention to the potential health hazards of EMFs has caused changes in public perception. The introduction of cellular phone systems and a rapid increase in the number of users of cellular phones in the last decade has increased the exposure of the population to EMFs quite considerably. Health consequences of long-term use of cellular phones are not known in detail, but available data indicate that development of non-specific health symptoms is possible (Szmigielski & Sobiczewska, 2000). Conversely, it appears health effects from cellular phone equipment (antennas and base stations) pose few (if any) known health hazards (Barnes, 1999).

A concern associated with cellular phone usage is the siting of cellular phone transmitting antennas and their base stations (CPBSs). These are appearing at an alarming rate across the country mainly on the rooftops of buildings but with numerous base stations installed on towers. These towers are occasionally located in close proximity to houses and schools. The extent of opposition from property owners affected by the siting of these is increasing due to fears of health risks from exposure to EMFs (despite the research reports to the contrary), changes in neighbourhood aesthetics and loss in property values. However, the extent to which such attitudes are reflected in lower property values affected by proximity to CPBSs is not known in New Zealand.

This paper outlines the results of a pilot study carried out in 2002 to show the effect of CPBSs on residential property values in Auckland, New Zealand. The research examines residents' perceptions toward living near CPBSs and how they evaluate the impacts of these structures. A case study approach was used. The results were mixed with responses from residents ranging from having no concerns to being very concerned about proximity to a CPBS. Consequently, how these perceptions impact on property values was also mixed with responses from residents ranging from being prepared to pay the same to being prepared to pay more than twenty percent less for a property located near a CPBS. Interestingly, in general, those people living near the CPBSs were much less concerned about issues such as future health risks or the aesthetic problems caused by the sites than people who lived in areas further away from them. A more in-depth study to confirm these results is to follow in 2003 that will include econometric analysis of sales transaction data.

1. Introduction

Understanding the effects of CPBSs on property values is important to telecommunications companies in helping plan the siting of these and for determining likely opposition from property owners. Similarly, property valuers need to understand the valuation implications of CPBSs when valuing CPBSs-affected property. The owners of affected property also want to understand the magnitude of effects, particularly if compensation claims or an award for damages are to be made against such property.

CPBSs are increasingly in demand as the two major cellular phone companies, Telecom and Vodafone, seek to upgrade and extend their network coverage. This demand could provide the owner of a well-located property a yearly income for the siting of a CPBS (Williams, 2001). However, new technology that represents potential hazards to human health and safety may cause property values to diminish due to the existence of "widespread public fear" and "widespread public perceptions of hazards". The increased media attention to the potential health hazards of CPBSs has caused a spread of such fear with a resulting increase in resistance to CPBSs due to the perceived negative effects on health, aesthetics and property values in close proximity to CPBSs.

Studies (for example, Krause et al. 2000 and Fesenko et al. 1999) suggest a positive correlation between long-term exposure to the electromagnetic fields produced by CPBSs and certain types of cancer. Yet other studies (for example, the World Health Organisation 1993, Royal Society of Canada 1999, and the UK Independent Expert Group on Mobile Phones 2000) report inconclusive results on health effects. Notwithstanding these results, recent media reports (for example, Fox 2002) indicate that the extent of opposition from some property owners affected by the siting of CPBSs is still strong. However, the extent to which such attitudes are reflected in lower property values affected by CPBSs is not widely known in New Zealand.

The two studies that have been conducted (commissioned by Telecom in Auckland (1998/99) and Christchurch (2001)) to ascertain the adverse health and visual effects of CPBSs on property values but these have not been made publicly known. Further, although the researchers reported through personal correspondence with Bond in 2002 that the results showed that property prices are not statistically significantly affected by the presence of CPBSs, their research involved only limited sales data analysis. Further, no surveys of residents' perceptions were undertaken, nor of the media attention to the sites and the affect this may have on saleability of properties in close proximity to CPBSs. Hence, this initial study aims to help fill the research void on this contentious topic. The research develops a case study approach to determine residents' perceptions towards living near CPBSs in two Auckland neighbourhoods and to quantify these effects in monetary terms according to an increasing or decreasing percentage of property value.

A more in-depth study will be undertaken in 2003 in Christchurch, NZ using both an opinion survey and econometric analysis of sales transaction data. The final results can then be used to help resolve compensation issues and damage claims in a quantitative way. Further, they will provide a potential source of information for related government agencies in assessing the necessity for increasing health and other information pertaining to CPBSs to help allay public concerns about these.

The paper provides a brief review of the cellular phone technology and relevant literature. The following section describes the research procedure used, including a description of both case study and control areas. The results are then discussed. The final section provides a summary and conclusion.

2. Literature Review

2.1 Background: Cellular Telephone Technology[1]

Increasing demand for a more convenient communication system has led to the emergence of the wireless (mobile) telephone technology through the allocation of a portion of the radio frequency

[1] The information in this section was sourced from http://www.telecom.co.nz, http://www.mfe.govt.nz and http://www.moh.govt.nz.

to this and through interconnection with the existing wire telephone network.

Mobile phones are sophisticated two-way radios that use ultra high frequency (UHF) radio waves to communicate information. The information is passed between a mobile phone and a network of low-powered transceivers, called mobile phone sites or cell sites. As mobile sites are very low powered they serve only a limited geographic area (or "cell"), varying from a few hundred metres to several kilometres, and can handle only a limited number of calls at one time. When a mobile phone user on the move leaves one "cell" and enters another, the next site automatically takes over the call, allowing contact to be maintained.

When a mobile phone connects to the network, it uses radio signals to communicate with the nearest mobile phone site. All of the mobile phone sites in a network are interlinked by cable or microwave beam, enabling phone calls to be passed from one cell to another automatically. Mobile phone sites are also linked to the public telephone network so callers can access other networks, cities or countries. A mobile phone site is typically made up of a mast with antennas connected to equipment stored in a cabinet. Power is fed into the cabinet by underground cable. The antennas are designed to transmit most of the signal away horizontally, or just below the horizontal, rather than at steep angles to the ground.

The actual use of radio frequency transmission requires only a small amount of energy, making mobile phone technology one of the most efficient forms of communication available. Unlike television and radio transmitters which work at full power all the time, a mobile phone site is designed to control its output so that it provides exactly the signal strength required to handle the number of calls being made at that moment, no more and no less. Therefore, if no calls are being made at any one moment, the cell site will virtually shut itself down.

As mobile phone sites can only accommodate a limited number of calls at any one time, when this limit is reached the mobile phone signal is transferred to the next nearest site. If this site is full or is too far away, the call will fail. One way of achieving an increased capacity is with the use of micro-sites or infill sites. These are mini mobile phone sites that can be mounted on street light poles, traffic lights or building verandas. They are common at busy intersections where they can help handle the increased capacity at rush hour and during the day they will rarely be required. Micro-sites only have a range of one to two hundred metres, and therefore cannot be used everywhere. They are designed for operation in dense urban areas in conjunction with conventional sites.

2.1.1 NZ Adoption of Cellular Phone Technology

The cellular telephone service first became available in New Zealand in 1987. By mid 1988 there were approximately 2,300 customers throughout New Zealand. In the late 1990's over 300,000 customers had cellular phones. This figure has continued to balloon in recent years. It is estimated that today over 2.3 million New Zealanders have a mobile phone and it is expected that 80 percent of people will be mobile within five years (Telecom, 2002)[2].

Cell site capacity is a major issue that the telecommunication companies are faced with at present. As the population continues to grow and so does the number of people using mobile phones, more and more cell sites are going to be required to meet customer demand for reliable coverage. In

[2] At the end of March 2002, Telecom had more than 1.3 million mobile phone customers and more than 750 mobile phone sites throughout New Zealand (a 54% share of the mobile market).Vodafone had over 1.1 million mobile phone customers throughout New Zealand (a 46% share of the mobile market), (Vodafone, 2002).

areas such as Auckland where almost complete coverage has been achieved, the main issue is ensuring that there is the capacity to handle the ever-increasing number of mobile phones and calls being made.

2.2 Locating Cellular Phone sites

Unlike higher-powered transmission sites such as television and radio, mobile phone sites are very low powered. Therefore, if cellular service companies are to provide a reliable service to their customers they are required to locate their sites where the service is needed.

For cellular phone service providers the main aims when locating cell sites are finding a site that provides the best possible coverage in the area without causing interference with other "cells" and one that causes the least amount of environmental impact on the surrounding area. Where possible service providers will attempt to locate cell sites on existing structures such as buildings where antennas can be mounted on the roof to minimize the environmental impact. Where this is not possible the site will require a mast to be erected to support the antennas.

For service providers, the preferred location for cell sites is in commercial or industrial areas due to the previous difficulty in obtaining resource consent for towers located in residential areas under the Resource Management Act.[3] Under the Resource Management Act 1991 (RMA), resource consent may be required from the local council to establish a cell site in the area. This may be either notified or non-notified. If the council decides it is to be notified this allows anyone in the community to have their say about it. Once submissions have been received and a hearing is held (if required) the council decides whether or not to grant the consent. One of the positive outcomes of the RMA resource consent procedure is the resulting unobtrusive nature of most cell sites. Some sites have even been incorporated into clock towers, building's chimneys and building signage.

There is no concern of the providers running out of room to locate the towers in the short term, however, it is expected that in the future, service providers will be required to share sites as they do overseas. If the service providers were to use the same mast they would have to be well separated meaning a much higher mast and a more undesirable structure in the community.

Despite the high level of demand for better cell phone coverage, the location of cell sites continues to be a contentious issue. The majority of people want better cell phone coverage in areas where they live and work, but they do not want a site in their neighbourhood. Thus, cell sites in or near residential areas are of particular concern. Concerns expressed usually relate to health, property values and visual impact (Szmigielski and Sobiczewska, 2000 and Barnes, 1999).

In general, uncertainties in the assessment of health risks from base stations is presented and distributed by organised groups of residents who protest against settlement of base stations. These reports appear to be exaggerated with a frequent tendency for including incredible extrapolation of results from microwave exposure systems which do not resemble either the intensities or the frequencies applied in the cell phone systems being tested. When the media publishes these stories it serves only to amplify the negative bias in these results and raises public concern. According to Covello (1998), this leads to incorrect assessment of risks and threats by the public with a tendency to overestimate risks from base stations and neglect risks from the use of cell phones.

[3] This has now been amended and replaced with a much simply consent process.

2.3 Assessment of Environmental Effects

2.3.1 Introduction: The Resource Management Act 1991

Under the Resource Management Act 1991 (RMA) an assessment of environmental effects is required every time an application for resource consent is made. Information that must be provided includes the following:

> "An assessment of any actual or potential effects that the activity may have on the environment, and the ways in which any adverse effects may be mitigated". (Section 88(4)(b), RMA).

An assessment of the environmental effects (AEE) of cell sites would take into consideration such things as:

- Health and Safety effects
- Visual effects
- Effects on the neighbourhood
- Interference with radio and television reception

2.3.2 Radio Frequency and Microwave Emissions from CPBSs

According to the Ministry for the Environment (2000), the factors that affect exposure to radiation are as follows.

- Distance: Increasing the distance from the emitting source, decreases the radiation's strength and decreases the exposure.
- Transmitter power: The stronger the transmitter, the higher the exposure.
- Directionality of the antenna: Increasing the amount of antennas pointing in a particular direction increases the transmitting power and increases the exposure.
- Height of the antenna above the ground: Increasing the height of an antenna increases the distance from the antenna and decreases the exposure.
- Local terrain: Increasing the intervening ridgelines decreases the exposure.

The amount of radiofrequency power absorbed in the body, the dose, is measured in watts per kilogram, known as Specific Absorption Rate (SAR). The SAR depends on the power density in watts per square metre. The radio frequencies (RF) from cellular phone systems travel in a "line of sight". The antennas are designed to radiate energy horizontally so that only small amounts of RF are directed down to the ground. The greatest exposures are in front of the antenna so that near the base of these towers, exposure is at minimum. Further, power density from the transmitter decreases rapidly as one moves away from the antenna. However, it should be noted that by initially walking away from the base, the exposure rises and then decreases again. The initial increase in exposure corresponds to the point where the lobe from the antenna beam intersects the ground. For instance, on the ground within 7-10 meters from the cell site, power densities are about 0.2 W/m^2 while within 100 metres, power densities will be around 0.0003-0.005W/m^2 (Ministry for the Environment, 2000 and Szmigielski and Sobiczewska, 2000).

2.3.3 Adverse Health Effects

According to Barnes (1999) and Szmigielski and Sobiczewska (2000) the analog phone system (using 800-900 Megahertz band) and digital phone system (using 1850-1990 Megahertz band) expose humans to electromagnetic field (EMF) emissions: radio frequency radiation (RF) and microwave radiation (MW), respectively. These two radiations are emitted from both the cellular phones and CPBSs.

For years the cell phone companies have assured the public that cell phones are perfectly safe. They state that the particular set of radiation parameters associated with cell phones are the same

as any other radio signal. However, reported scientific evidence challenges this view and shows that cell phone radiation causes various effects, including:[4]
- Alters brain activity
- Disturbs sleep
- Alters human reaction times: responses and speed of switching attention significantly worse
- Weakness the blood brain barrier
- Increased auditory brainstem response and hearing deficiency in 2 KHZ to 10 KHZ range
-Causes significant changes in local temperature, and in physiologic parameters of the cardiovascular system
- Causes memory loss, connection difficulties, fatigue, and headaches
- Increases blood pressure
- Reduces melatonin, etc..

According to Cherry (2000), there is strong evidence to conclude that cell sites are risk factors for:
- Cancer, specifically brain tumours and leukaemia
- Heart attack and heart disease, particularly arrhythmia
- Neurological effects including sleep disturbance, learning difficulties, depression and suicide
- Reproductive effects, especially miscarriage and congenital malformation
- Viral and infectious diseases because of reduced immune system competency associated with reduced melatonin and altered calcium ion homeostasis.

The main health concerns relating to EMF emissions from CPBSs are caused by the fact that radio frequency fields penetrate exposed tissues. Radio frequency energy is absorbed in the body and produces heat. All established health effects of radio frequency exposure are clearly related to heating. Public concern regarding both cell phones and CPBSs in many countries has led to a number of independent expert groups being requested by governments and cellular service providers to carry out detailed reviews of the research literature.

Research on the health effects of exposures to RF are reviewed by, for instance, The New Zealand Radiation Laboratory (2001), the World Health Organization (1993), International Commission on Non-Ionizing Radiation Protection (ICNIRP) (1997,1998), the Royal Society of Canada (1999) and the UK Independent Expert Group on Mobile Phones (2000). The reviews conclude that there are no clearly established health effects under low levels of exposure. Such exposures typically occur in publicly accessible areas around RF transmitters.

Various epidemiological studies[5] have been undertaken on the health effects of exposure to RF/MW radiation. However, most of these studies are conducted with occupational groups exposed to the radiation at work rather than with the general population in the home environment. The results of such studies provide insufficient evidence of the linkage between exposure and cancers in the general population due to the different intensities and duration of MW exposure in workers compared to those in the general public. The MW exposure in the home environment is typically continuous but not exceeding $0.1 W/m^2$ while in the working environment, the duration is

[4] Mann & Roschkle (1996), Krause et al. (2000), Borbely et al. (1999), Kellenyi et al. (1999), Khdnisskil, Moshkarev & Fomenko (1999), Hocking (1998), Burch et al. (1998) and others as resported in Cherry, N. (2000).

[5] Epidemiological studies study the relationship between exposure to EMFs and health in a population through observation. It is employed to provide evidence of EMF's association with any diseases, statistically. However, these studies cannot control for the degree of exposure. In the real world there are multiple exposures (such as radiation from television and radio).

limited to 1-2 hours period but intensities range between 2-10W/m^2 (Szmigielski and Sobiczewska, 2000).

According to Barnes (1999), the Institute of Electrical and Electronics Engineers (IEEE) and the American Food and Drug Administration (FDA) found no health hazard associated to cell phone use. Laboratory studies revealed no related cancer symptoms in people exposed to levels at or below current standards (refer to the discussion on standards, below, in section 2.3.4). Furthermore, Szmigielski and Sobiczewska (2000) add that MW radiation from cell phone systems contribute only 10 percent of the total MW energy emitted from other sources such as TV and radio signals. They conclude similarly to Barnes (1999) that there is currently no valid scientific data providing evidence of bio-effects from weak MW emission. However, there are questions over the delayed effects of exposure.

The Royal Society of Canada (1999) reports that biological effects, such as cell proliferation, are found at low levels of exposure and depend on other exposure conditions, stated earlier, but are not known to cause any adverse health effects. Nonetheless, at high exposures, heating is produced and can eventually damage tissues. Szmigielski and Sobiczewska (2000) state that at intense exposure the "thermal effect" from MW energy absorption inside tissues is associated with DNA damage. Further, they add that other non-specific health symptoms (NSHS) such as headaches, fatigue and small changes in blood pressure are also found.

While, at present, medical and epidemiological studies reveal weak association between bio-effects and low-level exposures of RF/MW fields, controversy remains between scientists, producers and the general public. Information from scientific or technological experts must be provided to the public to help allay fears about cell phone systems and help them to make rational investment decisions when considering the purchase of a property located in proximity to a CPBS. However, risk communication ("the exchange of information about the nature, magnitude, significance, acceptability and management of risk", Covello 1998) has always posed a challenge to the policy makers (usually politicians) responsible for communicating risk data to the general pubic. Risk communication usually involves the provision of information about the probability of exposure to the risk and about the nature and extent of the consequences. Yet, events of a probabilistic nature relating to an uncertain science are not well understood by the general public. This, together with negative media attention, results in the perception of uncertainty over the health effects from cell phone systems.

2.3.4 Radio Frequency Exposure Standards

2.3.4.1 International Standards

Despite ongoing controversy, the reviews of research on the health effects of exposures to RF helped establish the basis for exposure standards that will limit exposures to a level for safe and healthy living and working conditions. Most standards set by, for example, the International Commission on Non-Ionising Radiation Protection (ICNIRP), the American National Standards Institute (ANSI) and New Zealand are based on the most adverse effects. These standards have been developed to give people an assurance that what cellular service providers are doing complies with safety guidelines.

The 1998 ICNIRP guidelines have been accepted by the world's scientific and health communities as these are not only consistent with other stated standards but are also published by ICNIRP, a highly respected and independent scientific organisation. ICNIRP is responsible for providing guidance and advice on the health hazards of non-ionising radiation for the World Health

Organization (WHO) and the International Labour Office (Ministry for the Environment and Ministry of Health, 2000).

2.3.4.1 The New Zealand Standard

When a mobile phone site is being planned, radio frequency engineers calculate the level of electromagnetic energy (EME) that will be emitted by the site. The level of EME is predicted by taking into account power output, cable loss, antenna gain, path loss, height and distance from the antenna, etc. These calculations result in figures that allow engineers to calculate maximum possible emissions in a worst-case scenario – as if the site was operated at maximum power all the time. The aim is to produce EME levels that are below international and New Zealand standards in areas where the general public have unrestricted access.

It is a requirement that all mobile phone sites in New Zealand comply, in all respects, with the New Zealand Standard for radio frequency exposures, NZS 2772.1:1999 Radiofrequency Fields Part I: Maximum Exposure Levels – 3kHz to 300GHz. This standard, which was adopted in April 1999, was based largely on the 1998 ICNIRP recommendations for maximum human exposure levels to radio frequency. The standard also includes a requirement for:

> "Minimising, as appropriate, Radio Frequency exposure which is unnecessary or incidental to achievement of service objectives or process requirements, provided that this can be achieved at modest expense." (National Radiation Laboratory, 2001, p.7).

Currently this standard sets out a limit of continuous exposure to the public for radio frequency levels from mobile phone sites of 450 microwatts per square centimetre. This standard is the same as used in most European countries, and is more stringent than that used in the United States, Canada and Japan. This exposure level has been lowered even further in some cases. For example, the Christchurch City Council has made their allowable standard 200 microwatts per square centimetre (which is less than 50% of the New Zealand Standard). In reality however, mobile phone sites only operate at a fraction of the level set by the standard. The National Radiation Laboratory has measured exposures around many operating cell sites. Maximum exposures in publicly accessible areas around the great majority of sites are less than 1% of the public exposure limit in the standard. Exposures are rarely more than a few percent of the limit, and none have been above 10%.

2.3.5 Effects on Property Values in New Zealand

In New Zealand, based on two court cases: McIntyre and others vs. Christchurch City Council [1996] NZRMA 289 and Shirley Primary School vs. Telecom Mobile Communications Ltd [1999] NZRMA 66, there are two main alleged adverse effects of cell-phone base station on property values:

- The risk of adverse health effects from radio frequency radiation emitted from cell-phone base stations
- The adverse visual effects

Very few cell site cases have actually proceeded to Environment Court hearings. In McIntyre and others vs. Christchurch City Council, Bell South applied for resource consent to erect a cell phone base station in Fendalton, Christchurch. The activity was a non-complying activity under the Transitional District Plan. Residents' objected to the application. Their objections were related to the harmful health effects from radio frequency radiation. In particular, they argued it would be an error of law to decide on the present state of scientific knowledge that there were no harmful health effects from low-level radio frequency exposure levels. It was also argued that the Resource

Management Act (1991) contains a precautionary policy and that section 104 requires a consent authority to have regard to potential effects of low probability but high impact in considering an application.

The Planning Tribunal considered residents' objections and heard experts' opinions as to the potential health effects, and granted the consent, subject to conditions. It was found that there would be no adverse health effects from low levels of radiation from the proposed transmitter, not even effects of low probability but high potential impact.

In Shirley Primary School vs. Telecom Mobil Communication Limited, Telecom applied to the Christchurch City Council for resource consent to establish, operate and maintain a CPBS on land at Shirley Road, Christchurch, adjacent to the Shirley Primary School. This activity was also non-complying under the Transitional District Plan. Again, the Council granted the consent subject to conditions. However, the school appealed the decision, alleging four main adverse effects, as follows:

- The risk of adverse health effects from the radio frequency radiation emitted from the cell site
- The school's perception of the risks and related psychological adverse effects on pupils and teachers
- Adverse visual effects
- Reduced financial viability of the school if pupils were withdrawn because of the perceived adverse health effects

The Court concluded that the risk of the school children or teachers at the school incurring leukaemia of other cancer from radio frequency radiation emitted by the cell site is extremely low, and the risk to the pupils of exposure to radio frequency radiation causing sleep disorders or learning disabilities is higher but still very small. Accordingly, the Telecom proposal was allowed to proceed.

In summary, the Environmental Court has ruled that there are no established adverse health effects arising from the emission of radio waves from CPBSs as there is no epidemiological evidence to show this. The court was persuaded by the ICNIRP guidelines that risk of health effects from low-level exposure is very low and that the cell phone frequency imposed by the NZ standard is safe, being almost two and a half times lower than that of the ICNIRP's.

However, in the court's decisions they did concede that while there is no proven health affects that there is evidence of property values being affected by both of the above allegations. However, the court suggests that such a reduction in property values should not be counted as a separate adverse effect from, for example, adverse visual or amenities effects. That is, a reduction in property values is not an environmental effect in itself; it is merely evidence, in monetary terms, of the other adverse effects noted.

In Chen vs. Christchurch City Council the court stated that valuation is simply another expert opinion of the adverse effect (loss). Further, in this case the court established a precedent relating to the effects on property values. In Goldfinch vs. Auckland City Council (NZRMA 97) the Planning Tribunal considered evidence on potential losses in value of the properties of objectors to a proposal for the siting of a CPBS. The Court concluded that the valuer's monetary assessments support and reflect that the adverse effects of the CPBS. Further, it concluded that the effects are more than just minor as the CPBS stood upon the immediately neighbouring property.

2.3.6 Research on Property Value Effects

While experimental and epidemiological studies focus on the adverse health effects of radiation from the use of cell phones and CPBSs few studies have been conducted to ascertain the adverse health and visual effects of CPBSs on property values. Further, as there has been very few cell site cases proceeding to the Environment Court little evidence of property value effects has been provided by the courts. Thus, the extent to which opposition from property owners affected by the siting of CPBSs are reflected in lower property values is not well known in New Zealand. Two studies have been commissioned by Telecom in Auckland (1998/99) and Christchurch (2001) but these have not been made publicly known. Further, although the researchers communicated with the authors that results showed that property prices are not statistically significantly affected by the presence of CPBSs, their research involved only limited sales data analysis. Further, no surveys of residents' perceptions were undertaken, nor of the media attention to the sites and the affect this may have on saleability of properties in close proximity to CPBSs. This initial study aims to help fill the research void in this area.

3.0 DATA COLLECTION AND ANALYSIS

3.1 Research Objectives and Methodology

An opinion survey was conducted to investigate the current perceptions of residents towards living near cell-phone base stations and how this proximity might affect property values. Residents were asked questions, about: how they rate the suburb they live relative to other similar suburbs; when the CPBS was constructed and the proximity of it in relation to their home; the importance they place on the CPBS as a factor in relocation decisions and on the price/rent they were prepared to pay for their house; the degree of concern of the effects of health/stigma/aesthetic/property values, etc.

Two case study areas in the city of Auckland, New Zealand were selected for this pilot study: the residential suburbs of Clover Park, Manakau in south-Auckland and St Johns in east-Auckland. Each case study included residents in two areas: the case study area (within 300 metres of a cell phone tower) and a control area (over 1km from the cell phone tower). Both areas within each case study had the same living environment (in socio-economic terms) except that the former is an area with a CPBS while the latter is without a CPBS.

Sixty questionnaires[6] were randomly distributed to each of the areas (case study and control) in each neighbourhood (i.e. 240 surveys were delivered in total). As time and cost in conducting the survey were both limited delivery of the surveys was by hand to the property owner's letterbox. Respondents were instructed to complete the survey and return it to the letterbox. These were collected by hand two days after delivery.

The surveys were coded and the property address of each, once delivered, was recorded. This enabled each respondent's property to be located on a map and to show this in relation to the cell site. With a sample size of just 60 for each area within each neighbourhood the results are not fully representative of how the entire population perceive cell sites. However, the results do provide a gauge of the perceptions that people have about living near a cell site, or moving to an area near one, and how this might impact on values of properties in proximity to a CPBS.

The analysis of responses included the calculation of means and percentage of responses to each question to allow for an overview of the response patterns in each area. Comparison of the results between the case study area and the control area reveal any significant differences.

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[6] Approved by the University of Auckland Human Subjects Ethics Committee (reference 2002/185).

3.2 Case Study Areas

3.2.1 St Johns

The east-Auckland suburb of St Johns was selected (see Appendix A for a location map) as there are two CPBSs within close proximity of each other on St Johns Road near its intersection with St Heliers Bay Road. It is a medium to upper priced residential housing suburb[7] in a generally sought after neighbourhood due to its close proximity to beaches, schools, shopping, recreational facilities and the Auckland CBD.

3.2.2. Manakau

The south-Auckland neighbourhood of Clover Park, Manukau City was selected (see Appendix A for a location map) as it is also proximate to a CPBS but it provides a different (lower) socio-economic sample to the first study area. The address of the CPBS site is 726 Great South Road, Manukau City and is located on a BP petroleum station property. It is situated among trees between Valentine Restaurant and Rainbows End Theme Park, at the corner of Great South Road and Redoubt Road, Manukau City.

The questionnaires were distributed to properties in Sikkim Crescent, the residential area that runs off Great South Road. The area is an older, lower-priced residential suburb area characterised by houses in a poor state of repair.[8] It has good access to the Auckland-Hamilton Motorway and is within close proximity to a primary school and recreational facilities such as the Cycling Velodrome, Manukau Sports Bowl and the Greyhound Race Track. However, there are no shops nearby apart from the basic supplies available from the BP petroleum station. Some properties are also near a high voltage power pylon.

3.3 Control Areas

3.3.1 St Johns

The control area for St Johns is located further away (over 1 kilometre) from the CPBS in the case study area and is in the same suburb. The area contains a living environment and housing stock very similar to the case study area, as stated above, the only exception is that there is no cell site.

3.3.2 Manakau

The control area for Manakau is in the neighbourhood of Manukau Heights, Manukau City. It is located further away (over 1.5 kilometre) from Clover Park. The area contains a living environment and housing stock very similar to Clover Park, as stated above, the only exception is that there is no cell site. The questionnaires were distributed to properties in the streets of Sidey Avenue, Dillion and Darrell Crescents. Manakau Heights has good access to the Auckland-Hamilton Motorway and is within close proximity to a primary school and recreational facilities (Totara Park and Murphys Bush Scenic Reserve).

4. Research Results

Appendix B provides a summary of the main findings from the survey. These are outlined and discussed in more detail below.

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[7] The median house price for Auckland city in October 2002 was $335,000 and for St Johns it was $375,000. St Johns borders the high-priced Eastern Suburbs where the median house price was $515,000.

[8] The median house price for Auckland city in October 2002 was $335,000 and for Manakau it was $278,000.

4.1 Survey 1: Cell Site: St Johns

Of the 60 questionnaires mailed to homeowners and tenants in the study area, 53% were completed and returned. Over half (56%) of the respondents were homeowners.

4.1.1 Desirability of the suburb as a place to live

One-third (34%) of respondents have lived in St Johns for between 1- 4 years, and 40% for more than five years. Two-thirds (66%) rated St Johns as either desirable or very desirable as a place to live when compared with other similar suburbs. The reasons given for this include that the suburb is within walking distance to shops and is clean and relatively graffiti-free. The reasons 17% responded that St Johns is less desirable compared with other suburbs is that it is not as close to the waterfront/beaches as the adjoining suburbs of Kohimarama and St Heliers.

4.1.2 Feelings towards the CPBS as an element of the neighbourhood

The CPBS was already constructed when 81% of the respondents bought their house or began renting. Of these respondents, 21 (80%) said the proximity of the tower was of no concern to them. For the 20% of respondents' that said the proximity of the tower was of concern to them the most common reasons given for this were: health reasons, as proclaimed by the media, and that it obstructed their views somewhat. Of the 19% that said the CPBS was not constructed when they bought the house or began renting all said they would have gone ahead with the purchase anyway if they had known that the CPBS was to be constructed.

4.1.3 Affect on Decision to Purchase or Rent

The tower was visible from the house of 60% (19) of the respondents, yet the majority (13) said it was barely noticeable. Over two-thirds (71%) of the respondents said the location of the cell site nearby did not affect the price they were prepared to pay for the property. Ten percent said they were prepared to pay a little less (between 0-9% less) and the remaining 19% bought their property before the cell site was constructed.

4.1.4 Concerns About the Proximity to the CPBS

Generally, residents were not particularly worried about the effects that proximity to a CPBS has on health, stigma, property value or aesthetics. Of the concerns about towers that respondents were asked to comment on, the negative effects on aesthetics and future health were what respondents were most worried about, but only to a limited degree. Over two-thirds were not worried about the possibility of harmful health effects in the future (28% were somewhat worried) and 72% were not worried about "stigma" associated with houses near CPBSs (18% were somewhat worried and 10% were very worried). The majority of respondents (90%) were not worried about the affect that proximity to a CPBS will have on property values in the future (10% were somewhat worried) and just over half (53%) were not worried about the aesthetic problems caused by CPBSs (47% were somewhat worried).

4.2 Survey 2: Control Group: St Johns

Of the 60 questionnaires mailed to homeowners and tenants in the study area, 57% were completed and returned. Nearly two-thirds (65%) of the respondents were homeowners.

4.2.1 Desirability of the suburb as a place to live

Nearly a third (29%) of respondents have lived in St Johns for between 1- 4 years, and over half (53%) for more than five years. Over three-quarters (76%) of the respondents rated St Johns as either desirable or very desirable as a place to live when compared with other similar suburbs. The reasons given for this include that the suburb has cheaper house prices but is still central to

services and the beaches, it has good views, the houses are of a good quality and the area is well serviced by public transport. The reasons 6% responded that St Johns is less desirable compared with other suburbs include its proximity to lower socio-economic areas and the high number of sub-standard rental properties in the area.

4.2.2 Feelings towards a CPBS as an element of the neighbourhood

Two-thirds (65%) of the respondents would be opposed to the construction of a cell phone tower nearby. The location of a CPBS would be taken into account by 82% of respondents if they were to consider moving.

4.2.3 Affect on Decision to Purchase or Rent

If a CPBS were located nearby over half (53%) of the respondents would be prepared to pay substantially less for their property, and nearly one-third (29%) would be prepared to pay just a little less for their property.

4.2.4 Concerns About the Proximity to a CPBS

Of the concerns about towers that respondents were asked to comment on, the negative effects on aesthetics and future health were what respondents were most worried about. More than half (59%) of the respondents were worried somewhat and over one-third (35%) were very worried about the possibility of harmful health effects in the future and the aesthetic problems caused by CPBSs. Similar responses were recorded for the "stigma" associated with houses near CPBSs (59% were somewhat worried and 23% were very worried) and the affect that proximity to a CPBS will have on property values in the future (53% were somewhat worried and 35% were very worried).

Other comments provided by respondents at the end of the survey, include:

- "In no way would I choose to live near such a cell phone site at all".
- "A decisive statement on the health, aesthetic and property value issues by the authorities concerned is long overdue – there seems to have been a great deal of procrastination to date".
- "This survey appears to be biased as you haven't asked, for example, how important coverage is, and if this meant putting in a cell phone site what would this mean for you. Also, a lot of people are complaining about roads being dug up to lay phone cables – at least cell sites are not disruptive to the same extent when being installed".

4.3 Discussion of the Results: St Johns

From the above responses it appears that people who live near cell sites seem to be far less concerned about the possible associated health risks and aesthetic issues of the sites than those people who live further away from the sites. An explanation for the difference between the case study and control groups' responses is that the case study group are those people that have already purchased or rent in an area where a CPBS is constructed and may not represent the entire population of potential land purchasers/renters. Such residents are, by the very fact that they have purchased/rented in an area where a CPBS is located, less sensitive to this than might be the case for the market as a whole. Such people who live near something that is perceived but not proven to be a risk tend may pass the threat off and take the view that there is no evidence of it being a problem so why worry about it.

Alternatively, the case study residents' apparent lower sensitivity to the CPBS than the control group residents may be due to the possible affect of cognitive dissonance reduction. In this case,

they are not necessarily less sensitive to the CPBS but are unwilling to admit, due to the large amounts of money already paid, that they may have made a poor purchasing/renting decision to buy a property located in close proximity to a CPBS.

4.4 Survey 1: Cell Site: Manakau Results

After the distribution of the questionnaires, the collection of survey responses resulted in only 3 responses (5%) from each area. With such a lower than expected response rate, the results are unlikely to be representative of the total population and the impact that CPBSs have on property values could not be conclusively determined. However, some interesting perceptions were revealed and are described generally below.

4.4.1 Desirability of the suburb as a place to live

Two-thirds (67%) of the respondents were homeowners and have been residing in the area for over 5 years. Half of the respondents rated Clover Park as desirable and the other 50% rated it as less desirable as a place to live compared to other similar suburbs (for example, East Tamaki and Manakau Heights).

4.4.2 Feelings towards the CPBS as an element of the neighbourhood

Two-thirds of the respondents did not know about the existence of the CPBS when they brought or began renting their house. The remaining third said it was not constructed. Consequently, the proximity of the CPBS was not of concern to them. If they had known at the time of purchase or rental that the CPBS was to be constructed half said they would not have gone ahead with the purchase/rental whereas the other half said they would have.

4.4.3 Affect on Decision to Purchase or Rent

None of the respondents could se the CPBS from their house. Consequently, it did not affect the price or rent they were prepared to pay for the property.

4.4.4 Concerns About the Proximity to a CPBS

Of the concerns about CPBSs that respondents were asked to comment on two-thirds (66%) were somewhat worried about the possibility of harmful health effects in the future, the stigma associated with houses near CPBSs and the affect on property values. The remaining one-third was not worried about these things. All respondents were somewhat concerned about the aesthetic problems caused by the towers.

4.5 Survey 2: Control Group: Manakau

Two-thirds of the control group respondents were tenants living in the area between 6 months and 4 years. They rated their suburb as either desirable or very desirable as a place to live compared to other similar suburbs due to the easy access to amenities.

4.5.1 Feelings towards a CPBS as an element of the neighbourhood

Two-thirds of respondents would be opposed to the construction of a CPBS nearby. Yet, at odds to this response, only a third said it would be a factor to consider when relocating.

4.5.2 Affect on Decision to Purchase or Rent

One-third of the respondents said they would be prepared to pay 0-9% less for a property nearby a CPBS, one-third were prepared to pay 10-19% less and the remaining one-third would pay 20%or more, less for such a property.

4.5.3 Concerns About the Proximity to a CPBS

All of the respondents were greatly concerned about the harmful health effects from proximity to a CPBS while two-thirds were worried a lot about stigma, loss in property values in the future and aesthetic problems associated with houses near CPBSs. The remaining one-third or respondents were only somewhat worried about these factors.

4.6 Discussion of the Results: Manakau

From the responses above, it appears that the effects of CPBSs tend to be ignored in Manakau if the residents are unaware of them in their neighbourhood, as would be expected. Yet, there are strong concerns about the effects of CPBSs from residents in the control area. Nonetheless, these survey results are inconclusive due to the limited response rate.

5. Limitations of the Research

There are a number of limitations affecting this survey in addition to the limited response rate for Manakau. There was a time constraint in locating an appropriate CPBS that was visible to the residents in the Manakau case study area. The selected site is situated amongst trees and not highly visible. Many of the residents were not aware of its existence that likely affected both he responses and response rate. Further, giving respondents only two days to complete the survey may have been insufficient. Fortunately, this time constraint did not adversely affect the St Johns area response rate.

Finally, it must be kept in mind that these results are the product of only two case studies carried out in a specific area (Auckland) at a specific time (2002). The value-effects from CPBSs may vary over time as market participant's perceptions change due to increased public awareness regarding the potential adverse health and other effects of living near a CPBS. Perceptions toward CPBSs can change either positively or negatively over time. For example, as the World Health Organisation's ten-year study of the health effects from CPBSs is completed and becomes available consumers' attitudes may either increase or decrease depending on the outcome of those studies. To confirm this, many similar studies, of similar design to allow comparison between them, need to be conducted over time and the results made public.

As a result of these limitations caution must be used in making generalisations from the study or applying the results directly to other similar studies or valuation assignments.

6. Areas for Further Study

This research has focused on residents' perceptions of negative affects from proximity to CPBSs rather than the scientific or technological estimates of these risks. The technologists' objective view of risk is that risk is measurable solely in terms of probabilities and severity of consequences, whereas the public, while taking experts' assessments into account, view risk more subjectively, based on other factors. Further, the results of scientific studies about the health effects of radio frequency and microwave radiation from CPBSs are not always consistent. Residents' perceptions and assessments of risk vary according to a wide range of processes including psychological, social, institutional, and cultural and a reason why their assessments may be at odds with those of the experts.

Given the public concerns about the potential risk arising from being located nearby a CPBS it is important for future studies to focus more attention on this issue. More information is needed on the kinds of health and other risks the public associates with CPBSs, and the level of risk

perceived. How far away from the CPBS do people feel they have to be to be safe? What are the social, economic, educational and other demographic variables that influence how people perceive the risks from CPBSs? Are these perceived risks reflected in property values and to what extent? Do these perceived risks vary over time, and to what degree?

Answers to these questions, if shared amongst researchers and made public, could lead to the development of a global database. Such a database could assist valuers in determining the perceived level of risk associated with CPBSs from geographically and socio-economically diverse areas to aid in the valuation of property affected by these, anywhere in the world. Similarly, knowledge of the extent these risks are incorporated into property prices and how they vary over time will lead to more accurate value assessments of properties in close proximity to a CPBS.

7. Summary and Conclusions

This research report presents the results of an opinion survey undertaken in 2002 to residents' perceptions towards living near CPBSs and how this impacts on property values. From the results it appears that people whom live close to a CPBS perceive the sites less negatively than those whom live further away.

As research to date (ICNIRP, 1998) reports that there are no clearly established health effects from RF emissions of CPBSs operated at, or below, the current safety standards the only reason a rational investor might continue to avoid property near a cell site would be because it was intrusive on the views received from the property or because of the adverse aesthetic effects of the CPBS on the property. Yet, recent media reports (for example, Fox, 2002) indicate that people still perceive that CPBSs have harmful health effects.

Thus, whether or not CPBSs are ever proven conclusively to be free from health risks is only relevant to the extent that buyers of property near a CPBS perceive this to be true. Consequently, values of residential property located in close proximity to CPBSs may be adversely affected by the negative perceptions of buyers, regardless of research evidence to the contrary.

Further research is needed to provide more statistically valid conclusions than this pilot study provide about the public perceptions towards the health and visual effects of CPBSs and how this influences property values. To this end a larger study is to be conducted in 2003 that will include, in addition to a survey of affected residents living in close proximity to a CPBS, econometric analysis of the sales transaction data.

The results from such studies can provide useful information to related government agencies in assessing the need for increasing the public's understanding of CPBSs of how radio frequency transmitting facilities operate and of the strict exposure standard limits imposed on the telecommunication industry. A lack of understanding of these issues creates public concern about the location of CPBSs. As more information is discovered that refutes any adverse health effects from CPBSs and as this, together with information about the NZ Standards for high safety margins regarding the emission of RF and MW radiation, are made more publicly available, the perceptions of risk may gradually change. The visual effects can still pose a concern to residents, however, but this may vary according to the size, height and design of the CPBSs as well as the landscape surrounding them.

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Appendix A- Survey Location Map

Appendix B - Survey Results

Case Study Area:

Questions	St Johns Response (*%, n = 32)	Manakau Response (*%, n = 3)
1.Which one of the following categories best describes you?	- Homeowner (56%) - Tenant (44%)	- Homeowner (67%) - Tenant (33%)
2.How long have you lived at this address?	- Less than 6 months (12%) - 6 months ~ 1 year (12%) - 1 ~ 4 years (34%) - More than 5 years (40%)	- Less than 6 months (0%) - 6 months ~ 1 year (0%) - 1 ~ 4 years (33%) - More than 5 years (67%)
3. Comparing your suburb to other similar suburbs, how do you consider your suburb:	- Very desirable (22%) - Desirable (44%) - Less desirable (19%) - About average (15%)	- Very desirable (0%) - Desirable (50%) - Less desirable (50%) - About average (0%)
4. When you purchased this house / began renting, was the cell phone tower already constructed?	- Yes (81%) - No (19%)	- Yes (0%) - No (33%) - I don't know (67%)
5. Was the proximity of the cell phone site of concern to you?	- Yes (80%) - No (20%)	- Yes (0%) - No (100%)
6. If you had known at the time of purchase or rental that a CPBS was to be constructed, would you still have purchased or rented?	- Yes (100%) - No (0%)	- Yes (50%) - No (50%)
7. Is the cell phone tower visible from your house?	- Yes (60%) - No (40%)	- Yes (0%) - No (100%)
8. How did the cell phone site affect the price or rent you were prepared to pay for this property?	-Substantially more (0%) -A little more (0%) -No Influence (71%) -A little less (10%) -Substantially less (0%) Tower not constructed (19%)	-Substantially more (0%) -A little more (0%) -No Influence (100%) -A little less (0%) -Substantially less (0%)
9. Concerns associated with properties near a CPBS: (a) The possibility of harmful health effects in the future. (b) The stigma associated with houses near cell phone sites. (c) The affect on your properties value in the future (d) The aesthetic problems caused by the tower	 - Not worried (69%) - Somewhat worried (28%) - This worries you a lot (3%) - Not worried (72%) - Somewhat worried (18%) - This worries you a lot (10%) - Not worried (90%) - Somewhat worried (10%) - This worries you a lot (0%) - Not worried (53%) - Somewhat worried (47%) - This worries you a lot (0%)	 - Not worried (33%) - Somewhat worried (67%) - This worries you a lot (0%) - Not worried (33%) - Somewhat worried (67%) - This worries you a lot (0%) - Not worried (33%) - Somewhat worried (67%) - This worries you a lot (0%) - Not worried (0%) - Somewhat worried (100%) - This worries you a lot (0%)

* Valid Percentage: This indicates the percent of those respondents that answered that specific question (it does not include non-responses).

Appendix B continued - Survey Results

Control Area

Questions	St Johns Response (*%, n = 34)	Manakau Response (*%, n = 3)
1.Which one of the following categories best describes you?	- Homeowner (65%) - Tenant (35%)	- Homeowner (33%) - Tenant (67%)
2.How long have you lived at this address?	- Less than 6 months (12%) - 6 months ~ 1 year (6%) - 1 ~ 4 years (29%) - More than 5 years (53%)	Less than 6 months (0%) - 6 months ~ 1 year (33%) - 1 ~ 4 years (33%) - More than 5 years (33%)
3. Comparing your suburb to other similar suburbs, how do you consider your suburb:	- Very desirable (35%) - Desirable (41%) - Less desirable (6%) - About average (18%)	- Very desirable (33%) - Desirable (33%) - Less desirable (0%) - About average (33%)
4. Would you be opposed to the construction of a cell phone site nearby?	- Yes (65%) - No (35%)	- Yes (67%) - No (33%)
5. If you were to consider moving houses, would the location of a CPBS be a factor?	- Yes (82%) - No (18%)	- Yes (33%) - No (67%)
6. How would a cell phone site nearby affect the price or rent you would be prepared to pay for this property? Please specify as a % of total property price	-Pay substantially more (0%) -Pay a little more (0%) -No Different (18%) -Pay a little less (29%) -Pay substantially less (53%) - +20% or more (0%) - +10% to +20% (0%) - 1% to +9% (0%) - -9% to 0% (47%) - -19% to -10% (0%) - -20% or less (53%)	-Pay substantially more (0%) -Pay a little more (0%) -No Different (33%) -Pay a little less (0%) -Pay substantially less (67%) - +20% or more (0%) - +10% to +20% (0%) - 1% to +9% (0%) - -9% to 0% (33%) - -19% to -10% (33%) - -20% or less (33%)
7. Concerns associated with properties near CPBSs: (a) The possibility of harmful health effects in the future. (b) The stigma associated with houses near cell phone sites. (c) The affect on your properties value in the future (d) The aesthetic problems caused by the tower	- Not worried (6%) - Somewhat worried (59%) - This worries you a lot (35%) - Not worried (18%) - Somewhat worried (59%) - This worries you a lot (23%) - Not worried (12%) - Somewhat worried (53%) - This worries you a lot (35%) - Not worried (6%) - Somewhat worried (59%) - This worries you a lot (35%)	- Not worried (0%) - Somewhat worried (0%) - This worries you a lot (100%) - Not worried (0%) - Somewhat worried (33%) - This worries you a lot (67%) - Not worried (0%) - Somewhat worried (33%) - This worries you a lot (67%) - Not worried (0%) - Somewhat worried (33%) - This worries you a lot (67%)

JEFFERSON COUNTY PVA

LOUISVILLE'S TOP 10 MOST EXPENSIVE NEIGHBORHOODS OF 2015

January 6, 2016

By TRE PRYOR | January 5, 2016 6:00 am

I find it fun each year to stop and take a look back and see how our Louisville real estate market fared. There's so many different vantage points from which to choose.

In my **Insider Louisville's 2015 Real Estate Year in Review** , I primarily focused on aggregate stats for home sales and values. If you haven't read it yet, I highly recommend it as a good synopsis of all that happened last year.

Next week we'll look ahead at what 2016 has in store. Could the rising interest rates put a damper on our stellar sales track? Could the paltry offering of available properties for purchase keep Louisville renters on the sideline? We'll tackle these questions and more in my next piece.

But for now, let's do some window shopping.

I think it's fair to say all of us have our eyes on what *might* be our next home. It could be your dream home! It may be a property that's so out of reach, the only way to get it would be if an unknown, rich relative suddenly appears out of nowhere and bestows a giant inheritance upon you. Either that or a lottery jackpot, right?

Even though it's unlikely, it doesn't mean we can't have fun checking out the **most amazing neighborhoods in Louisville**.

BEHIND THE NUMBERS

I began **this practice in 2013** , then carried it on again **the following year** . At the end of this piece, I'll share which neighborhoods held a spot in each of these Top 10 rankings and which new ones joined the high-rollers club.

First, some ground rules. I only included Jefferson County neighborhoods that had at least three homes sell during the year for at least $500,000. I then took all those sale prices and averaged them to build the rankings.

In 2015, there were 415 homes sold above this mark in Louisville. That's a big jump from the 346 homes the year before.

The neighborhood with the most homes in this survey was **Norton Commons** with 40. In these rankings, Norton Commons came in as Louisville's 17th most expensive neighborhood.

And now the countdown…

10) MOCKINGBIRD GARDENS

Mockingbird Gardens is a small neighborhood off Highway 42 by the Crescent Hill golf course. One home (not pictured) sold for $1,550,000 this year and really brought the average up. | Photo by Tre Pryor)

Average Sale Price: $761,013
Number of Homes Sold Above $500k in 2015: 8

9) LAKE FOREST

Lake Forest is Louisville's largest neighborhood. It is also one of Louisville's most expensive, though a small percentage of homes can still be purchased below $500,000 as well. | Photo by Tre Pryor

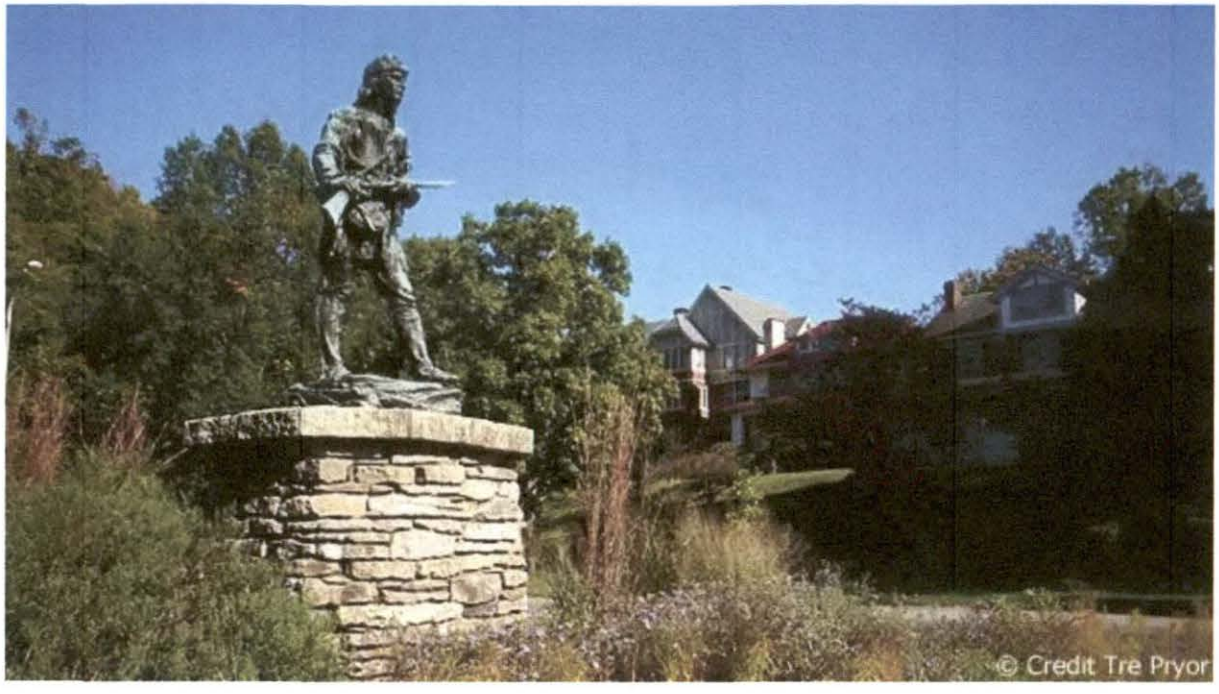
Average Sale Price: $772,873
Number of Homes Sold Above $500k in 2015: 31

8) INDIAN HILLS

Indian Hills is another Louisville neighborhood with a wide range of home prices, especially after annexing the less expensive neighborhood to the northeast a few years back. | Photo by Tre Pryor

Average Sale Price: $811,642
Number of Homes Sold Above $500k in 2015: 14

7) CHEROKEE TRIANGLE



Condos, bungalows, brick traditional homes and, oh yes, stately mansions can all be found in the Cherokee Triangle — a Louisville gem of a neighborhood. | Photo by Tre Pryor

Average Sale Price: $851,563
Number of Homes Sold Above $500k in 2015: 8

6) ANCHORAGE

In the 1940s, Anchorage was a quaint little town out in the country. Today it's practically in the heart of the city with all the outward expansion. It's still a sought-after location for many in search of luxury living. | Photo by Tre Pryor

Average Sale Price: $934,139
Number of Homes Sold Above $500k in 2015: 18

5) GLENVIEW

No. 2 in 2013, then first in 2014, Glenview fell to No. 5 in this year's survey. But that doesn't change that it's home to some of Louisville's most amazing homes. | Photo by Tre Pryor

Average Sale Price: $954,250
Number of Homes Sold Above $500k in 2015: 4

4) SPRING FARM LAKE

Home to this past year's **Homearama**, Spring Farm Lake is a continuation of high-end homes that began on Spring Farm Road about 10 years ago. Just remember that new construction costs have risen lately, so each square foot of luxury will now cost you more than it used to. | Photo by Tre Pryor

Average Sale Price: $963,158
Number of Homes Sold Above $500k in 2015: 8

3) SPRING FARM PLACE

Spring Farm Place is the first neighborhood that began a confusing theme of similarly named subdivisions located off Wolf Pen. This subdivision has been home to new construction luxury in Louisville's East End for the past decade. | Photo by Tre Pryor

Average Sale Price: $1,062,500
Number of Homes Sold Above $500k in 2015: 4

2) CHEROKEE HILLS

Only a handful of homes trade hands each year in this neighborhood nestled between Bonnycastle and Seneca Gardens. As it turns out, when the 7,000-square-foot mansion on 4 acres sells for $2.3m, it tends to bring up the area's average. | Photo by ©Listing Broker

Average Sale Price: $1,093,800
Number of Homes Sold Above $500k in 2015: 5

1) HARROD'S GLEN

High-end neighborhoods tend to take longer to complete. Harrod's Glen was no exception, especially with its unfortunate timing alongside the housing recession. But if you drive through it today, you'll see some of the most beautiful homes in Louisville. | Photo by ©Listing Broker

Average Sale Price: $1,911,667
Number of Homes Sold Above $500k in 2015: 3

INTERESTING FINDINGS

In the end, it wasn't even close. Harrod's Glen is by far the most expensive neighborhood in Louisville. Even as the East End bridge nears completion, the additional traffic isn't stopping high-end buyers from snatching up these incredible homes just minutes from the Gene Snyder Expressway.

Now let's see how this year's most expensive Louisville neighborhoods compare to past years.

2015	2014	2013	
1	Harrod's Glen	Glenview	Spring Farm
2	Cherokee Hills	Mockingbird Valley	Glenview

3	Spring Farm Place	Glenview Acres	Mockingbird Valley
4	Spring Farm Lake	Bonniewood	Bonnycastle
5	Glenview	Mockingbird Gardens	Anchorage Woods
6	Anchorage	Anchorage	Mockingbird Gardens
7	Cherokee Triangle	Indian Hills	Indian Hills
8	Indian Hills	Woodstone	Cherokee Gardens
9	Lake Forest	Sutherland	Anchorage
10	Mockingbird Gardens	Rolling Fields	Hurstborurne

In closing, here are the remaining Louisville neighborhoods from our report and how they finished the year.

1. WATERFRONT PARK PLACE $680,500
2. ROLLING FIELDS $671,700
3. HIGHLANDS $648,393
4. OWL COVE ESTATES $648,333
5. CHEROKEE GARDENS $642,857
6. BEECH SPRING FARM $632,289
7. NORTON COMMONS $631,851
8. SUTHERLAND $620,893
9. WOLF PEN SPRINGS $610,667
10. INNISBROOK $599,518
11. OXMOOR WOODS $599,083
12. LOCUST CREEK $598,109
13. LANDIS LAKES $580,250
14. MOCKINGBIRD VALLEY $551,874

15. SHAKES RUN $544,851
16. POLO FIELDS $544,500
17. ROCK SPRINGS $544,400
18. THE FALLS AT OLD HENRY $540,517
19. SENECA GARDENS $527,333
20. MOCKINGBIRD TERRACE $516,978

This entry was posted in **Kentucky-Wide News**, **Louisville-Jefferson County News**, **Mayor's Community Conversations**, **Website News**.

Categories

Help Videos
Important Dates
Jefferson County PVA News
Kentucky-Wide News
Louisville-Jefferson County News
Mayor's Community Conversations
Subscription Service News
Website News

Fact Sheet:
Cell Towers Create Significant Decline in Property Value

Arrowbee residents are justifiably concerned that the proposed Verizon cell tower will reduce the value of our homes and properties. Peer reviewed studies and experienced real estate and appraisal professionals agree that cell towers impact property value significantly. The ripple effect of negative property values in Arrowbee will also impact the value of property in the surrounding area.

POTENTIAL BUYERS ARE TURNED OFF BY CELL TOWERS FOR THREE PRIMARY REASONS:

- **Aesthetics** – Cell towers, even those that look like fake pine trees, are aesthetically unpleasing. They are not compatible with the nature of the neighborhood. They change the character of a neighborhood, especially those in rural areas. They create a visual blight. Potential buyers aren't interested in spending their money on visual blight.

- **Health Concerns** – Despite industry assertions about the safety of cell towers, there has been widespread media attention about persistent health concerns for cell towers and for wireless technology in general. Regardless of the validity of these concerns, the ***perception*** is what influences a potential buyer. With widespread concern comes widespread negative perception.

- **Property Value** – Potential buyers are not interested in a property that has the baggage of a cell tower that may affect the future value of the property. Buyers see the risk of the investment as too great.

STUDIES HAVE DOCUMENTED THE DETRIMENTAL EFFECTS OF CELL TOWERS ON PROPERTY VALUES:

1. A study by the National Institute for Science, Law & Public Policy published in June 2014 titled "Neighborhood Cell Towers & Antennas-Do They Impact a Property's Desirability?" found that:
    - **94% of home buyers** and renters are less interested and **would pay less** for a property located near a cell tower or antenna
    - **79%** said that **under no circumstances would they ever purchase** or rent a property within a few blocks of a cell tower or antennas
    - **90% said they were concerned** about the increasing number of cell towers and antennas in residential neighborhoods.

Data compiled by J. Barbieri
November 2015

- Betsy Lehrfeld, an attorney and Executive Director of NISLAPP says: "The proliferation of this irradiating infrastructure throughout our country would never have occurred in the first place had Section 704 of the Telecommunications Act of 1996 not prohibited state and local governments from regulating the placement of wireless facilities on health or environmental grounds. The federal preemption leaves us in a situation today where Americans are clearly concerned about risks from antennas and towers, some face cognitive and physical health consequences, **yet they and their families increasingly have no choice but to endure these exposures, while watching their real property valuations decline**." Link here.

2. A study published in The Appraisal Journal in the Fall of 2007 titled "The Effect of Distance to Cell Phone Towers on House Prices in Florida" found that:
    - In terms of the effect that proximity to a tower has on price, the overall results indicate that this is statistically significant and negative. Generally, the closer a property is to the tower, the greater the decrease in price. The effect of proximity to a tower **reduces price by 15%** on average. Link here.

3. A study published in The Appraisal Journal in the Summer of 2005 titled "The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods," found that:
    - People generally expect to pay 10% to over 20% less for a home located near a cell tower, and
    - **Actual prices were reduced by 21%** after a cell tower was built in a neighborhood.
    - "Even buyers who believe that there are no adverse health affects from cell phone base stations, knowing that other potential buyers might think the reverse, **will probably seek a price discount** for a property located near a cell phone base station." Link here.

THERE IS WIDESPREAD AGREEMENT AMONG REAL ESTATE PROFESSIONALS ACROSS THE COUNTRY ABOUT THE NEGATIVE IMPACT OF CELL TOWERS ON PROPERTY VALUE

By California Statue, real estate agents representing a seller of residential property..."have the duty to conduct a reasonably competent and diligent visual inspection of the property and to disclose to a prospective buyer all material facts affecting value, desirability, and implicitly intended use." Link here.

- Tina Canaris, an associate broker and a co-owner of RE/MAX Hearthstone in Merrick, said: "Even houses where there are transformers in front" make "people shy away," "If they have the opportunity to buy another home, they do." She said cell antennas and towers near homes affected property values, adding, "You can see a buyer's dismay over the sight of a cell tower near a home just by their expression,

even if they don't say anything." From: "A Pushback Against Cell Towers," New York Times, 8-27-10. Link here.

- Addora Beal, Broker Associate with Hall Chambers Real Estate testified to the Glendale City Council in January 2009 that: "Perception is everything. If the public perceives it to be a problem, then it is a problem. It really does affect property values." Link here at the 2:35:24 mark.

- Donna Bohanna, President/Realtor of Solstice International Reality said to the Los Angeles Board of Supervisors in 2009 that: "As a realtor, I must disclose to potential buyers where there are any cell towers nearby. I have found in my own experience that there is a very real stigma and cellular facilities near homes are perceived as undesirable." Link here.

- Twenty-seven real estate professionals signed a letter to the Burbank City Council ini 2009 stating that cell towers negatively impact the property value of surrounding homes and properties. The letter said in part: "It is our professional opinion that cell towers decrease the value of homes in the area tremendously." Link here.

- Real estate appraiser Robert Heffernan presented a report to the Bridgewater New Jersey zoning board in 2012, stating that: "I believe the tower will have an adverse impact to surrounding properties." He continued, saying that price differentials "are based on a negative externality, which causes the house closest to the structure to be lower in the value that ones farther away." He noted that structures that are unlike what is typically seen in a neighborhood create an anomaly and that in his experience, people do not choose to live near these types of structures. Link here.

TWO IMPORTANT NOTES

1. The U.S. Ninth Circuit Court of Appeals in October 2009 affirmed residents' right to oppose a wireless tower based on aesthetics, saying in part that: "The experience of traveling along a picturesque street is different from the experience of traveling through the shadows of a WCF [wireless communications facility], and we see nothing exceptional in the city's determination that the former is less discomforting, less troubling, less annoying and less distressing than the latter." Link here.

2. Also note that El Dorado County's rules about Special Use Permits (which Verizon is seeking) require that the special use "would not be...injurious to the neighborhood." A decline in property value is an extraordinary burden to place on residents, particularly when Verizon already has coverage in the area, and that a rural county surely has non-residential areas better suited for industrial blight.

The New York Times

REAL ESTATE | IN THE REGION | LONG ISLAND

A Pushback Against Cell Towers

By MARCELLE S. FISCHLER AUG. 27, 2010

Wantagh

TINA CANARIS, an associate broker and a co-owner of RE/MAX Hearthstone in Merrick, has a $999,000 listing for a high ranch on the water in South Merrick, one of a handful of homes on the block on the market. But her listing has what some consider a disadvantage: a cell antenna poking from the top of a telephone pole at the front of the 65-by-100-foot lot.

"Even houses where there are transformers in front" make "people shy away," Ms. Canaris said. "If they have the opportunity to buy another home, they do."

She said cell antennas and towers near homes affected property values, adding, "You can see a buyer's dismay over the sight of a cell tower near a home just by their expression, even if they don't say anything."

By blocking, or seeking to block, cell towers and antennas over the course of the last year, Island homeowners have given voice to concerns that proximity to a monopole or antenna may not be just aesthetically unpleasing but also harmful to property values. Many also perceive health risks in proximity to radio frequency radiation emissions, despite industry assertions and other evidence disputing that such emissions pose a hazard.

Emotions are running so high in areas like Wantagh, where an application for

Town of Hempstead imposed a moratorium on applications until Sept. 21. That is the date for a public hearing on a new town ordinance stiffening requirements.

At a community meeting on Aug. 16 at Wantagh High School, Dave Denenberg, the Nassau county legislator for Bellmore, Wantagh and Merrick, told more than 200 residents that 160 cell antennas had been placed on telephone poles in the area in the last year by NextG, a wireless network provider.

"Everyone has a cellphone," Mr. Denenberg said, "but that doesn't mean you have to have cell installations right across the street from your house." Under the old town code, installations over 30 feet high required an exemption or a variance. But in New York, wireless providers have public utility status, like LIPA and Cablevision, and they can bypass zoning boards.

Earlier this month in South Huntington, T-Mobile was ordered to take down a new 100-foot monotower erected on property deemed environmentally sensitive (and thus requiring a variance). Andrew J. Campanelli, a civil rights lawyer in Garden City, said a group of residents had hired him to oppose the cellular company's application.

"They were worried about the property values," Mr. Campanelli said. "If your home is near a cell antenna, the value of your property is going down at least 4 percent. Depending on the size of the tower and the proximity, it is going down 10 percent."

In January, in an effort to dismantle 50 cell antennas on a water tower across from a school in the village of Bayville, Mr. Campanelli filed a federal lawsuit that cited health risks and private property rights.

In a statement, Dr. Anna F. Hunderfund, the Locust Valley superintendent, said that in February 2009 the district had engaged a firm to study the cellphone installations near the Bayville schools, finding that the tower "posed no significant health risks," and she noted that the emission levels fell well below amounts deemed unsafe by the Federal Communications Commission.

In June 2009, Sharon Curry, a psychologist in Merrick, woke up to find a cell antenna abutting her backyard, level to her 8-year-old son's bedroom window.

Puzzled by its presence, particularly because she lives next to an elementary school, she did research to see if there was cause for concern. What she learned about possible health impacts, she said, led her to seek help from civic associations and to form a group, Moms of Merrick Speak Out, to keep new cell towers out. She said she was seeking the "responsible" placement of cell antennas, away from homes and schools.

The Federal Communications Act of 1996 says health concerns are not a valid reason for a municipality to deny zoning for a cell tower or antenna. Property values and aesthetics, however, do qualify, according to the act.

Frank Schilero, an associate broker with RE/MAX Innovations in Wantagh, has a listing on a $629,000 home down the street from the Farmingdale Wantagh Jewish Center, where the application is pending to put six cell antennas on the roof.

"People don't like living next to cell towers, for medical reasons or aesthetics," Mr. Schilero said. "Or they don't want that eyesore sticking up in their backyards." There is an offer on his listing, he added, but since the buyer heard about the possible cell antennas she has sought more information from the wireless companies about their size and impact.

Charles Kovit, the Hempstead deputy town attorney, said that under the proposed code change any new towers or antennas would have to be 1,500 feet from residences, schools, houses of worship and libraries.

The town recently hired a consultant, Richard A. Comi of the Center for Municipal Solutions in Glenmont, to review antenna applications.

Under the new ordinance, applications for wireless facilities would require technical evidence that they had a "gap" in coverage necessitating a new tower.

"If not, they will get denied," Mr. Kovit said. The wireless companies would also have to prove that the selected location had "the least negative impact on area

character and property values." If another location farther away from homes can solve the gap problem, "they are going to have to move."

A version of this article appears in print on August 29, 2010, on Page RE9 of the New York edition with the headline: A Pushback Against Cell Towers.
