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Hedonic Analysis of Riparian/ Wetland Setbacks

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HEDONIC ANALYSIS

OF RIPARIAN / WETLAND SETBACKS

Prepared for:
CHAGRIN RIVER WATERSHED PARTNERS, INC.

By:

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[1] Chang Shik-Song is a Ph.D. candidate and provided excellent research assistance throughout the project. Sashank Garikapati also assisted in the data collection and integration phase of the research.

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EXECUTIVE SUMMARY

With development now reaching ever deeper into and beyond exurban locations, many aspects of the natural environment are being threatened by the development that is attracted to it. At a time when sprawl seems to dominate discussions of regional change, how can a community still attract growth and yet be a responsible steward of the environment at the same time?

Riparian/wetland setbacks are a tool increasingly used to ensure the health of natural environments facing development pressure. While the environmental benefits are clear, their impact on land markets has generated considerable debate. Are setbacks viewed a development restriction placed on parcels, thereby lowering property values? Or, are they viewed, and valued, as a measure ensuring the quality of a property's natural environment, thereby increasing property values? Finally, it could be the case that setbacks simply don't have an impact on the market one way or the other – that the home-buying public is either unaware or indifferent to the presence of setback zoning. Determining the actual role of setbacks in the regional housing market will inform the decision-making process that is crucial if development is going to be sustainable.

This report presents an analysis of the market for single-family houses and condominiums in six communities of the Chagrin River Watershed for the years 1999 through 2005. An hedonic price function approach is employed to account for the structural, neighborhood, and spatial influences in the sale of over 4,000 units, including approximately 400 homes that sold in locations with setback zoning in place.

First, the market was investigated in aggregate to determine whether or not there was a single impact on the market – to see whether or not, after accounting for all other market influences, houses in setback locations were selling for more or less than comparable houses not in setback locations. No impact of setback designation was uncovered.

Second, the impact was investigated as a time-sensitive process, whereby the influence of setback designation could vary from one year to another. No impact of setback designation was uncovered.

Finally, the impact was investigated as a community-specific process, whereby the influence could vary from one community to another throughout the study area. Again, no impact of setback designation was uncovered.

These findings will move the community discussion beyond one fueled by NIMBY (Not In My Back Yard)-type fears and speculation, to one based in the rigorous analysis of actual market data for the region. While it would be undesirable for any one study to single-handedly quash public debate, every single study should inform that debate. To that end, this study offers the following: **Across all formulations of all models considered herein, there is simply no evidence that setback zoning reduces house price.**

INTRODUCTION: WHY ANALYZE LOCAL HOUSING MARKET IMPACTS?

The housing market is one of the most watched markets in the U.S. For one, the rise and fall of the housing market has implications in the local, regional, and national economies. The materials and labor markets that surround new construction activity and the specialized service sectors that are linked to both the new and existing construction markets are inextricably linked to the ebb and flow of housing. Additionally, homeownership not only occupies an important niche in our culture, but houses are typically a family's largest financial asset, so fluctuations in the housing market mean changes in household wealth as well.

It is not only the larger economic forces, such as interest rates or employment, that can impact housing, but also very local, very micro-scale phenomena can influence the housing market. For example, the positive price impact of concentrated redevelopment often spills-over into surrounding areas, increasing proximate property value. Conversely, the increased traffic congestion and air/noise pollution resulting from development could serve to decrease local house prices.

Because of the wealth-altering impacts of such local influences, any government action that could impact the housing market falls under intense scrutiny. Consider the opening of a new highway interchange that almost immediately spikes local property values, while increasing local traffic and development. Housing markets are impacted in the neighborhood of other large government investments, such as schools, public parks, or even sports stadiums.

Finally, government involvement need not be *financial* in nature to impact housing value – action, rather than investment, can also impact house value. Changing tax rates, enforcement of building and housing codes, zoning changes, etc., can all have housing market impacts. This research investigates whether or not the enactment of riparian setbacks are one such government action that can influence house price.

Riparian setbacks are a protective measure, put in place so development is situated at a safe distance from stream resources to protect structures from flooding and erosion, and to protect water quality. As a zoning tool available to local governments, riparian setbacks are a public health and safety measure, reducing flooding and erosion while protecting water quality and the natural environs of an area's rivers and streams[2].

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[2] Chagrin River Watershed Partners, Inc., 2006. Riparian Setbacks: Technical Information for Decision Makers.

Despite these benefits, there is a perception that setbacks have the potential to *decrease* property values. This argument is based on the view that the setback represents a constraint on the use of the property. For example, on a setback property, it may not be possible to build a deck within a certain distance of the water feature without a variance. Essentially, the setback reshapes the property's building envelope such that environmentally sensitive locations are excluded. *If* potential homebuyers view this as a dis-amenity, then lower house prices for setback locations would be the result. On the other hand, if homebuyers viewed this as an environmental amenity, protecting the natural resource that runs through the property, then higher prices for setback locations would be the result. If potential homeowners were indifferent, then there would be no measurable housing market impact.

The research described in this report addresses that very question – Is there a measurable housing market impact of the presence of a riparian setback? If there is a market impact, is it positive or negative, and how large is it? The research described here certainly has the potential to serve as a rallying point for one side of this debate – the question is, which side?

STUDY AREA AND DATA: COMMUNITIES OF THE CHAGRIN RIVER WATERSHED

The initial study area communities were selected by the Chagrin River Watershed Partners, Inc. (CRWP) based on a community having riparian setbacks in their local zoning regulations. The original list of communities and their setback implementation dates are given in Table 1.

In May of 2006, the Chagrin River Watershed Partners convened a small group of local housing experts. This meeting was an important step in the development of the project, as many specific influences to this local market were revealed, discussed and eventually incorporated into the housing model. In addition, at this focus group meeting it was determined that the Village of Hunting Valley and the City of Woodmere were distinct housing markets –that they were not part of the same market as the remaining communities. Thus, they were not included in this study. The study area is shown in Figure 1.

In addition to the actual sales data, the information necessary for the study of a housing market is typically considered along three dimensions: structural data, neighborhood data, and accessibility data. Structural data describe the characteristics of the house and lot that has transacted. Structural characteristics used here include the square footage of the house and the lot, the number of rooms, full bathrooms and half bathrooms, and the presence (or absence) of the following: garage, basement, fireplace, central air conditioning, and a patio or porch. Data are also used to indicate whether or not a house is stream-front (adjacent to a stream or river), and whether or not the property has a setback. In select models, the impact of being stream-front and/or of having a setback is disaggregated by community (Does it have a different impact in one community vs. another) or by year (Has the impact changed over time?).

Neighborhood data are intended to capture the nature of the surrounding area of the sold house and typically include socio-economic indicators as proxies for the elusive concept of "neighborhood quality." Population density is included to measure any preference for more or less heavily settled parts of the study region. The percent of the neighborhood population that was living in the same house in 1995 is included to gauge the impact of resident stability (the opposite of high turnover). Vacancy was included to account for the impact of strong or slack demand, as indicated by the percent of all units that are vacant.

A few variables that are common to the study of house prices are missing from this analysis, and it is a function of the nature of the study area. Since this study focuses on a select number of locations within the broader regional housing market, the amount of variation within the study area is naturally lower than it would be for a region-wide study. School quality is one example. Considered on a region-wide basis, locations in the study area are considered to have above average schools. Thus, if a household was searching region-wide for a new house, school quality would likely be an important factor, and houses located in high quality districts would be expected to sell for higher prices than comparable houses in lower quality school districts.

In this study, however, the variation in the measures of school quality is relatively low. For example, each district in the study area has an Ohio Department of Education report card rating of "Excellent"[3]. That is, since the schools in the study area are all considered above average, a household could choose any house in the area and be in a high quality school district. Thus, school quality was found not to play a significant role in the housing market in the study area. The same held true for other socio-economic variables that are sometimes considered in housing models but had low variability in the study area, such as poverty rates, household income, education levels, and tax rates.

Historically, accessibility-related variables were included in housing models to measure closeness to the central business district. More recently, however, these variables have been used to measure proximity to a variety of local features, both positive and negative. Included in the models here are proximity to institutional land uses, historic districts, open space, and transportation network accessibility points. Distance to the central business district was not included, again because of limited variability in the study area.

Sales data for the study area communities originate with First American Real Estate Solutions (1999-2005). They gather sales data from local sources, compile them, and sell them as the Real Estate Pace data[4]. The Center for Housing Research & Policy at Cleveland State University purchases these files and further processes and archives them, so that analyses spanning several years are possible. The sales data for this study were obtained from the Center for Housing Research & Policy.

Of primary interest in this study is the interaction between housing location and the riparian setback of each community. The study area's riparian setback locations are shown in Figure 2, while the distribution of housing sales is shown in Figure 3.

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[3] Ohio Department of Education local report card data. http://ilrc.ode.state.oh.us/Districts/Default.asp
[4] First American Real Estate Solutions, 1999-2005. The Real Estate PACE. Cincinnati, OH.

Several variables are included to control for the effects of time and space. Quarterly variables are used to indicate the quarter of the year in which each house sold, accounting for the typical trend of housing sales being strongest in quarter three (covering the months of July, August and September). Annual variables are included to indicate the year of sale, accounting for annual fluctuations in house prices (note that these are not always increases).

Finally, variables are included to indicate the community in which the house is located. After accounting for all of the other influences in the model, there remains location premiums in the market associated with select communities. This means that given two houses that are identical in every respect except for the community in which they are located, we would not expect them to sell for the same price. Rather, one would sell for a premium simply because of the community in which it is located, while the other would sell for a relative discount. Such location premiums are typically considered to represent the tangible and intangible package of goods and services provided by a community to its residents. This could include the mix of taxes, the quality of protective services, schools, street maintenance, etc., or less quantifiable aspects of quality of life, such as "small-town ambiance." The use (and significance) of these community-based variables shows that there are housing market differences between some of the communities in the study area, even though, as discussed earlier, they do not seem to be tied to variables such as school quality or socio-economics.

The full list of variables used across the various models detailed in this report is given in Table 2.

METHODOLOGY: GEOGRAPHIC INFORMATION SYSTEMS AND HEDONIC PRICE MODELING

Most broadly, the first set of analysis tasks fall under the umbrella of data integration and was conducted using Geographic Information Systems (GIS). The first of these tasks was geocoding. This is the process by which the sales data, which are provided in spreadsheet format, are geographically, and digitally, located on a map of the study area. In this case, sales were geocoded to a parcel map (although street maps are also common, usually in areas lacking a digital parcel map). Each sale in the data has an associated permanent parcel number (PPN) that uniquely identifies the parcel of land that has transacted. This permanent parcel number is likewise present in the digital parcel map. The geocoding process matches the PPN from the sales data to the PPN from the parcel map, effectively joining the sales data to the map. As a result of the geocoding process it is possible, for example, to map the location and prices of all homes that sold over a given time period.

The additional attribute data that were gathered also were joined to the parcel map using the overlay and data assignment process. For example, many variables were gathered from the US Census at the block group level. The block group map was overlaid, and parcels were assigned the Census data of the block group within which it is located. A similar procedure was followed to assign to each parcel its corresponding school district data, tax rates, and several proximity variables. GIS was also used to determine which sales were “riparian setback sales”. These are sales that took place on a parcel affected by riparian setback zoning after the setback was adopted by the local government.

Once the data were assembled, the impact of the riparian setback was measured using hedonic price analysis. As a regression-based analysis tool, the goal of all hedonic price functions (HPFs) is to explain the value of a good based on the characteristics of that good. The hedonic price function was introduced to urban housing analysis by Rosen[5], and has since been used in a wide variety of applications. Its wide appeal is due to its ability to statistically isolate the relationship between the price of housing and a specific characteristic of housing. The HPF estimates the market for that characteristic, even though an actual market might not exist independently.

[5] Rosen, S. 1974. Hedonic prices and implicit markets. *Journal of Political Economy* 82: 34-55.

For example, there is no independent market for a basement – one cannot go out and purchase a basement independently of a house. Yet the hedonic price function can estimate the value of a basement via the statistical relationship between house price and houses both with and without basements. Similarly, there is no market for riparian setbacks, but the HPF can estimate their relationship to house price.

Perhaps the most important characteristic of the HPF is that it *isolates* the impact of each characteristic on price. This is what sets the HPF apart from an approach that simply compares house price among locations that are in the setback vs. houses that are outside of the setback. Prices may differ substantially but, by simply comparing average house prices, there is no way to know whether or not that difference is actually due to the setback designation or to some other aspect of the housing market. For example, riparian setback locations are typically either adjacent or near a stream or river. It could well be that on average these locations sell for a different price simply because of this proximity effect, and the setback designation has no impact at all. For every characteristic included in the HPF, all other variables are statistically controlled for so that the true relationship between individual characteristics and price can be revealed. Thus, the interpretations of all HPF regression coefficients that follow implicitly include the phrase "Holding constant the effect of all other variables in the model…"

This feature is important because it minimizes the probability that a revealed relationship is influenced by some other market nuance. For example, if it were found that setback designations positively influenced house prices, one could <u>not</u> argue that the impact is due to the fact that setback locations are typically stream-front locations, and that is why they sell for higher prices. Since stream-front is a variable in the model, its impact is controlled for and estimated independently. It can have no influence on the relationship between setback designation and price.

FINDINGS: WHAT ROLE DO SETBACKS PLAY IN THE HOUSING MARKET?

There are two primary markets of interest, the residential market, and the market for vacant land. A single model is estimated for the land market. In the residential market, impacts were investigated along three dimensions. The first is the aggregate model, the second estimates time-specific impacts, and the third estimates community-specific impacts. Each of the three residential models is built of a common set of structural, neighborhood and accessibility variables. Each model is distinguished by the way in which the riparian setback is hypothesized to impact house price.

As is standard procedure when dealing with data from public sources, data cleaning was a necessary pre-analysis step. Primarily, this is done to remove incomplete records, or to clear obvious data errors from analysis sample. For example, it isn't unusual for some housing records to be missing necessary structural information (bedrooms, baths, square feet, etc.) – this would preclude those records from being used in the study. The analysis sample yielded 4,138 residential housing sales over the time period 1999-2005 in the study area. The distribution of sales across communities and years is detailed in Table 3. The total number of sales has been trending around the 600 mark throughout the study time period, peaking in 2003 at 640 sales. By far, the two sales volume leaders have been the City of Aurora and Bainbridge Township. Setback sales in the analysis sample are detailed in Table 4. Setback sales have been steadily increasing over the time period. This has not been the result of a rapid increase in sales in any one location, but rather the increase has been due to new communities adding riparian setbacks over time. The City of Aurora and Bainbridge Township again are the leaders with 142 and 100 setback sales, respectively. A total of 407 setback sales are used in this analysis.

THE AGGREGATE MODEL

This model investigates the degree to which the setback designation has a single, uniform effect on the studied housing market. The key here is that the effect is not expected to vary across time, nor across space. The research hypothesis is that there is a uniform and significant impact of setback designation on house prices.

To begin, the aggregate model, shown in Table 5, is statistically well behaved. The results with respect to the structural, neighborhood and accessibility variables are largely consistent with theory in both the sign of the variable (does it have a positive or negative impact) and significance. The model's adjusted R^2 indicates the proportion of total variation in house price that is explained by the model. Here, the result is 77%, meaning that 77% of the variation in house price can be explained by the factors included in the model.

The first column of Table 5 lists the variables in the aggregate model. The second column lists the estimated regression coefficients, referred to as B. The standard error is a measure of the variation around the regression coefficient, much as a standard deviation is a measure of variation around a mean. By convention, the t-statistic is also reported, although it is only used to arrive at the p-value. While the regression coefficients report the sign and magnitude of the estimated effect, the p-value reports the probability that the regression coefficient is actually equal to zero. Since we are dealing with a sample of data in an inferential mode of analysis, there is always some possibility that the true population regression coefficient is actually zero. This is true of all regression analyses, not just those reported here.

For example, the estimated regression coefficient for the variable Baths is 0.07. This is interpreted as follows: A one-unit increase in the number of full baths is associated with a 7% increase in price. The probability that the true regression coefficient is actually zero, rather than 0.07, is less than one tenth of one percent (<0.001). It is common practice to label any variable where the p-value is less than 0.05 as a significant variable in the regression. While it is not unheard of to expand the 'significant' range up 0.10, in this analysis, p-values between 0.05 and 0.10 will be referred to as marginally significant. Thus, significant variables are interpreted as playing a role in explaining variation in house price. House size, lot size, number of rooms, etc., are all significant variables in explaining the variation in house price. They provide meaningful information as to why some houses sell for more and others sell for less.

If the p-value is greater than 0.10, there is too much uncertainty in the regression coefficient – we are not confident enough that it is truly different from zero. For example, the variable Floodplain has a regression coefficient of 0.03, but a p-value of 0.237. Thus, even though the coefficient is estimated to be 0.03, there is a 23.7% chance that it is actually equal to zero. Since that probability is too large, the variable is considered to be "insignificant", or not important in the regression. Thus, insignificant variables play no role in explaining house price variation in the model. They provide no meaningful information as to why house prices vary.

The interpretation given for Baths above is consistent with how other variables are to be interpreted. A one-unit increase in the variable of interest is associated with a percent change in house price equal to the estimated regression coefficient[6]. If the coefficient is positive, then the change in house price is positive – more of the variable is associated with higher house prices, as is the case for Rooms and Baths, for example. If the coefficient is negative then more of the variable is associated with a negative change in house price. This is the case, for example, for Density. On average, the higher the population density of the surrounding neighborhood, the lower a house's sales price.

Finally, many variables in the model indicate the presence of some condition, such as presence of central air conditioning, or presence of open-space within one-quarter mile. Regression coefficients for these variables are interpreted as the percent change in sales price when that condition is present.

In terms of the structural characteristics of the sold house, lot size, rooms, baths, half-baths, the presence of a garage, fireplace, central air and a patio or porch all contribute positively and significantly to house price. The presence of a garage was not significant. The size of the house is included both as the square footage of the house, and that same variable squared. This allows for a non-linear price impact of house size. For example, this specification would allow for the possibility that a household might find an additional room more valuable in a smaller house, as compared to a larger house. As estimated, an additional 225 square feet of living space (equivalent to an additional 15 foot by 15 foot room) is associated on average with an 8% increase in price. The accessibility measure is also estimated in this fashion. On average, a house located an additional 3 km from one of the access points would sell for an additional 5%.

Population density is negatively associated with house price, meaning that houses sell for less in more densely developed neighborhoods. High vacancy rates depress house values, although the variable is only marginally significant with a p-value of 0.093. Having an institutional land use within one-quarter mile also decreases house price. Neighborhood stability contributes positively to house price – a 10% increase in the percent of five-year residents is associated with a 1.6% price increase. In a rapidly developing area, this is an interesting finding in that more established (older) areas are not being heavily discounted.

The effect of open space reveals a spatial pattern of note. Being within one-quarter mile of an open space area is not significant (although a p-value of 0.13 is close to marginally significant), but having open space between one-quarter and one mile away contributes

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[6] Since the variables representing lot square feet (LSFt) and age of the house (Age) are used in their natural logarithm form, their interpretation is a bit different. Their regression coefficients represent the percent change in house price associated with a one *percent* change in the variable, rather than a one *unit* change.

between 6.6% and 7.5% to home price. This indicates a preference to be close, but not too close to open space.

Proximity to the historic districts in the study area, in Chagrin Falls and Aurora are associated with a significant housing premium. Being in, or within one-quarter mile of a historic district is associated with a 18% increase in price. These are clearly important locational amenities.

Both sets of time-related indicator variables behave as expected. The regression coefficients for the quarterly, annual, and community variables are interpreted as a comparison to the "left-out" category. For example, the left out quarterly variable is the third quarter. Thus, houses selling in the first quarter sold on average for 7% less *than those in the third quarter*. The left-out category for the annual variables is 1999. Houses that sold in 2000, for example, sold for 5.27% more *than those that sold in 1999.* For the community variables, the left-out category is Bainbridge Township. The interpretation of the regression coefficient on Auburn Township, for example, is that on average, houses in Auburn Township sold for 12.58% less *than those in Bainbridge Township*. Auburn Township, City of Aurora and City of Kirtland all sold for less than Bainbridge Township locations on average, while the Village of Chagrin Falls locations sold for more. The sale price of houses in Russell Township did not differ significantly from those of Bainbridge Township houses. While being located in the floodplain was not significant, stream-front homes sold for 3.7% more than homes that were not.

The aggregate model shows that holding other effects constant, setback designation does not increase or decrease house price. The p-value of 0.32 is far beyond any conventional consideration of statistical significance. In other words, **setback designation is not significant in explaining variation in house price in this model**. It is simply not a factor in the local housing market.

TIME-SPECIFIC IMPACTS

The aggregate model assumes that the impact of setback designation does not change over time. The model specification assumes that the impact, whether positive or negative, is identical in each year from 1999-2005. It is possible, however, that the impact of the setback varies with time, and that by considering only one aggregate effect, the aggregate model has masked an impact that may be significant in some, but not all years.

An impact that varies over time could be explained by increased information being available to the public on the topic as more communities implement setbacks. For example, in 1999, when only two of these communities had setbacks in place, a homebuyer might not have heard of a setback before entering the transaction, and thus would not have been able to fully evaluate its implications. By 2005, when every community considered here had riparian setbacks in place, a homebuyer might be more informed on the topic, and could alter his or her behavior, offering more or less for a house accordingly.

The time specific model is formulated to investigate a setback influence that varies over time, and its results are shown in Table 6. The core variables of the time-specific model are the same as the aggregate model and so discussion of their influence will not be repeated here.

The variables 1999sb through 2005sb are of particular interest in this model. First glance shows three of the regression coefficients to be negative, and the remaining four to be positive. Importantly, though, none of the variables are significant, or even marginally significant. Thus, it is not the case that the aggregate model was masking house price impacts that were significant in particular years. **In no single year covered in this sample did setback designation have any impact on house price.**

Community-Specific Impacts

Even though the aggregate model yields no house price impact of setback designation, and even though the time-specific model yields no price impact of setback designation, it could be that setbacks do matter, but on a community-by-community basis. Both previous models were formulated such that any housing market impact, whether positive or negative, whether aggregate or time-specific, is the same across all communities in the study area. Thus, the first two models discussed would be capable of finding only impacts that are invariant study-area-wide. It may be, for example, that setbacks do have a housing market impact, but that it varies among communities in the study area. The aggregate and time-specific models would not have uncovered such an impact.

This model, therefore, isolates the community specific housing market impact of setback designation. Again, the core structural, neighborhood, and accessibility variables remain in the model, so discussion will focus on the variables relevant to the setback designation. There are two sets of variables that are distinct to this model estimation. Both are community-specific – the first group measures the impact of a stream front location, while the second group measures the impact of the setback designation.

The expansion of the stream front variable was necessary because stream front locations and setback designation are so strongly related. Of the 407 setback-designated sales, 323 of them (79.4%) were stream front locations. Neglecting this interaction would confound the measurement of each variable. Thus, ensuring that these effects are estimated separately, community-by-community, is key to the understanding of each.

Table 7 details the results of the community-specific model. Of particular interest are the setback results for Auburn Township, which are statistically significant, and Bainbridge Township, which are marginally significant. In both cases, the regression coefficient is positive, translating to a 12.8% and 5.4% premium for setback locations in Auburn Township and Bainbridge Township, respectively.

This would indicate that given the choice between two otherwise identical homes, homebuyers are willing to pay more for the house that has a setback. While a homebuyer valuing the environmental protection the setback provides could explain this result, our focus group meeting indicated that this explanation is unlikely in this market.

The consensus opinion expressed at that meeting was that potential homebuyers do not know about setback designations. Further, the consensus was that it was unlikely that realtors would even know whether or not a property had a designated setback. Thus, the focus group predicted that setback designation would not be an influence in the area housing market. That makes the results of the community specific model somewhat suspect.

With a disconnect between the statistical results and the market information gathered from local housing professionals in our focus group discussion, these results were further scrutinized. The only results of note from this model are in Auburn Township and Bainbridge Township, which happen to be the last two communities in the sample to add setback designations. Thus, there was a possibility that these two variables (Auburnsb and Bainbridgesb) were also being influenced by time – by the fact that all setback sales in these communities were in either 2004 or 2005, when prices had escalated significantly compared to earlier years in the sample.

To investigate this possibility, a model was estimated for only 2005 sales. If the positive setback impact is purely due to the setback designation, and not due to the fact that these sales occurred in 2005, then the setback designation variables for Auburn Township and Bainbridge Township should also be significant in the 2005 model, just as they were in the (1999-2005) community-specific model in Table 7.

Table 8 shows the hedonic price function results for the 2005 model. Of interest here are the setback coefficients for Auburn Township and Bainbridge Township, which are shown in bold. Neither variable is significant. Thus, when compared to sales only in the same year, the positive impact of the setback designation disappears. It seems, then, that the positive and significant coefficient for setback designation in Auburn Township was being driven by the fact that all of Auburn Township's setback sales were in 2005, when prices were generally higher.

While the same holds true for Bainbridge Township in 2005, there were also setback sales in Bainbridge Township in 2004. Table 9, therefore, shows regression results for only 2004 and the lesson is the same. Once the impact of time is removed by estimating a model that looks exclusively at the process in 2004, the Bainbridge Township setback regression coefficient is no longer significant (shown in bold).

The net results of Tables 7, 8 and 9 reveal **no community-specific negative house price impact of setback designation.** Two communities showed evidence of a positive impact, but that impact seems to be a function of the interaction between community-specific house price appreciation rates, the year of the sale, and the timing of the setback implementation of those communities. When year-specific models were estimated to remove the influence of this interaction, the positive and significant setback impact also disappeared.

THE LAND MARKET

The complexities of market for vacant land complicate the estimation of the impact of setback designation on vacant land prices. There are two main issues of concern.

First, the vacant land market contains far more variety than does the residential housing market. For example, while the sale price of a house is a function of the land and the structure that is built upon it, the price of vacant land often reflects the land itself and the structure that *could be* built upon it. Thus, there is a question as to the degree to which the vacant land market represents only one market. Limiting the investigation only to residentially- zoned vacant land would narrow the analysis, but likely this would be too narrow, as it eliminates the potential of residential development of non-residentially zoned land. The most obvious category this would neglect is agricultural land. Thus, vacant agricultural land is typically added for consideration, as is the case here.

Active agricultural land could also be added, but this complicates matters even further, as price consideration then extends to the current value of the future income stream that otherwise would have been produced agriculturally. Nevertheless, active agricultural lands are often targets for new residential development and so they are included here.

The second complication arises in the quality of the PACE data. The land use codes are notoriously slow to be updated in these data. Thus, there are parcels with a residential/vacant land use code that also indicate residential structures present on the parcel. In this situation, the parcel was likely developed, but the land use code was never changed. The opposite situation exists as well – a land use classification of single-family residential dwelling with no structure apparent from the data, and a recent sales price indicative of a vacant lot. Similarly, there are instances of lots that according to the data are vacant, but with sales price exceeding that of proximate houses. Sorting through these complications is more art than science.

The cumulative effect of these issues is that the vacant land analyses that follow should be considered exploratory, at best. This is a function both of the market itself, and of the data commercially available to study it.

By way of summary statistics, Table 10 shows the distribution of usable vacant land sales across locations and years. There are 1,022 vacant land sales, with Auburn Township and the City of Aurora leading the way with 319 and 273 sales, respectively. Vacant land sales were at their highest in 1999, decreasing to 114 sales in 2002 before rebounding upwards. The analysis includes land determined to be vacant/residential, agricultural land, both active and vacant, and a variety of other parcels judged to be vacant-residential despite not being classified as such. Seventy-seven percent of the vacant land analysis samples are classified as residential-vacant, while 18.4% are classified as agricultural vacant.

Table 11 shows the distribution of vacant land sales with setback designations across years and communities. Clearly, the community to watch is Bainbridge Township, with the second most setback sales after only two years of an established setback regulation.

Table 12 shows the median price per acre of vacant land in each of the communities. The median value is reported for all properties, and then separately for setback and non-setback properties. Medians are used because of the large number of outliers. Since the mean is sensitive to outliers/extreme values, the median is a more appropriate measure of central tendency. The differences vary widely from very small in communities like Auburn Township, to vast in places like the City of Aurora.

These differences on their own, however, can be misleading. They tell nothing of the other characteristics of the land that could influence the price. It could be that setback locations are more often located near high traffic corridors, or topographically are less suitable to development. Simply noting price differences does not point to any particular cause of these differences. It is for this reason that hedonic price functions are typically employed – in an attempt to sort out the various sources of price differences in a land market.

However, the wide range of issues discussed above would call into question the lessons learned from a hedonic price function focusing on vacant land. Keeping this in mind, the following exercise was conducted. Using the full range of data collected for the analysis, a forward-stepwise HPF was estimated.

The “forward-stepwise” procedure is useful in identifying the most important variables in a regression model. The method adds variables to the model based only on their ability to explain the variation in land price per acre. This approach, in the opinion of the author, is best suited to exploratory analyses such as this, as ideally variables should be selected for a regression based on their theoretical relevance to the process at hand, not their ability to explain variation alone.

Nonetheless, it is a worthwhile exercise to identify the variables that are most strongly statistically related to the price per acre of vacant land, and this is revealed by the order in which the stepwise regression chooses them for the model. Table 13 lists these variables in order of importance, and separates them into positive impacts on land value and negative impacts on land value. The strongest influence belongs to the size of the lot, indicating that the larger the lot, the lower the price *per acre* – a kind of volume discount. Besides community (Kirtland and Aurora) and time (2005), the more important themes are sewer service and proximity to Route 422 or Chillicothe Road. The 17 variables identified are the only variables with a p-value of 0.10 or less. That is, they are the only variables that are either significant or marginally significant in explaining the variation in the price of vacant land. **It is noteworthy that the forward-stepwise procedure did not identify setback designation as a significant, or even marginally significant influence on the price per acre of vacant land.**

To further explore the relationship between vacant land price and setback designation, two additional HPFs were estimated (still in an exploratory mode). The first model replicates the forward-stepwise model, except that all variables are entered into the regression, rather than being chosen by the forward-stepwise procedure. The p-value of the setback designation in this model is 0.82, thus revealing **no significant role for setback designation in the explanation of vacant land price variations.**

The final model replicated the aggregate model, with two exceptions. Acres were added as a predictor variable, and the structural variables were removed. The p-value for setback designation in this model was 0.23, again reflecting **no significant role for setback designation in the explanation of vacant land price variations.**

Thus, there are two lessons from the vacant land findings. The first is that the differences in median value between setback and non-setback locations are likely *not* meaningful in terms of policy evaluation. Simply noting a disparity in the characteristics (such as land price) between two distinct groups, without any further analysis, is *never* justification to speak of the *causes* of that disparity.

The second lesson is that upon even the most basic of HPF explorations, the price disparity disappears. Of the three exploratory regression models considered here, none showed setback designation to be a significant influence in the explanation of price per acre of vacant land.

CONCLUSIONS

Since households have so much invested both physically and financially in their homes, even the slightest mention of something that could have a housing impact gets met with strong emotion. The term NIMBY, Not In My Backyard, typically refers to homeowner opposition of something not actually in their backyard, but in their *neighborhood.* Thus, discussions of riparian setbacks should be even more enthusiastic, since they actually do deal with homeowners' backyards. For debates on such topics to move forward, it is critical to provide evidence of what has occurred when similar action has been taken in other, ideally similar, situations. That is where this report can make a contribution.

Seven years of housing market data were analyzed for six local communities with riparian setbacks in place. The analysis covers over 4,000 housing sales and more than 1000 sales of vacant land from 1999 to 2005. Approximately 10% of all sales were properties with a riparian setback in place.

In the market for housing, riparian setbacks had no universal impact on price. Houses with setbacks did not command a price premium because of the value of a protected natural environment, nor did they incite a price-discount due to that same environmental protection. There was no impact, positive or negative.

Investigating the impact on a year-by-year basis also showed no significant impact, positive or negative. As more communities have put riparian setbacks in place, it is reasonable to assume that there is greater local knowledge about them. There has been no market impact, however, of either the increased number of communities with setbacks, or of the increased attention setbacks may garner as they are more widely implemented.

There are also no negative impacts present on a community-by-community basis. It is not the case, for example, that one community feels no impact, while the housing markets of other communities are being devalued because of setback implementation.

Even though the market for vacant land was more difficult to characterize, there was not even preliminary evidence that would indicate cause for concern. The price analyses conducted, while considered exploratory, did not yield a significant price impact of riparian setback designations.

The lesson to be taken from the eight regressions reported here, and the many more that were estimated in preparation of this report, is that riparian setbacks have not impacted local house prices. This confirms, and provides rigorous statistical support for, the opinions of the local housing professionals in our focus group discussions.

While data issues would necessitate further investigation in terms of the land market, the housing market results from this analysis are clear – **there is simply no statistical evidence to support the idea that riparian setbacks negatively impact house price.**

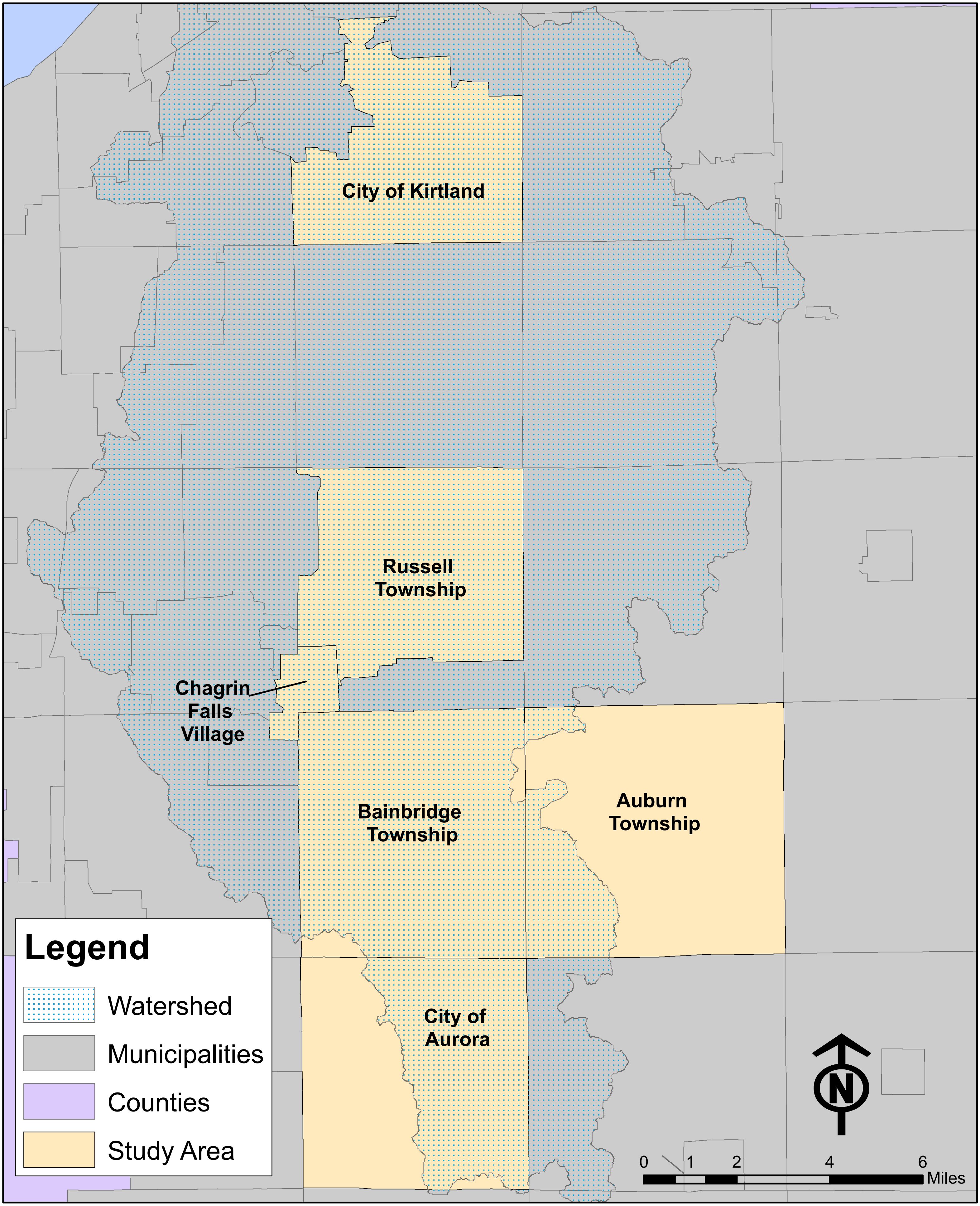

Figure 1. Study area.

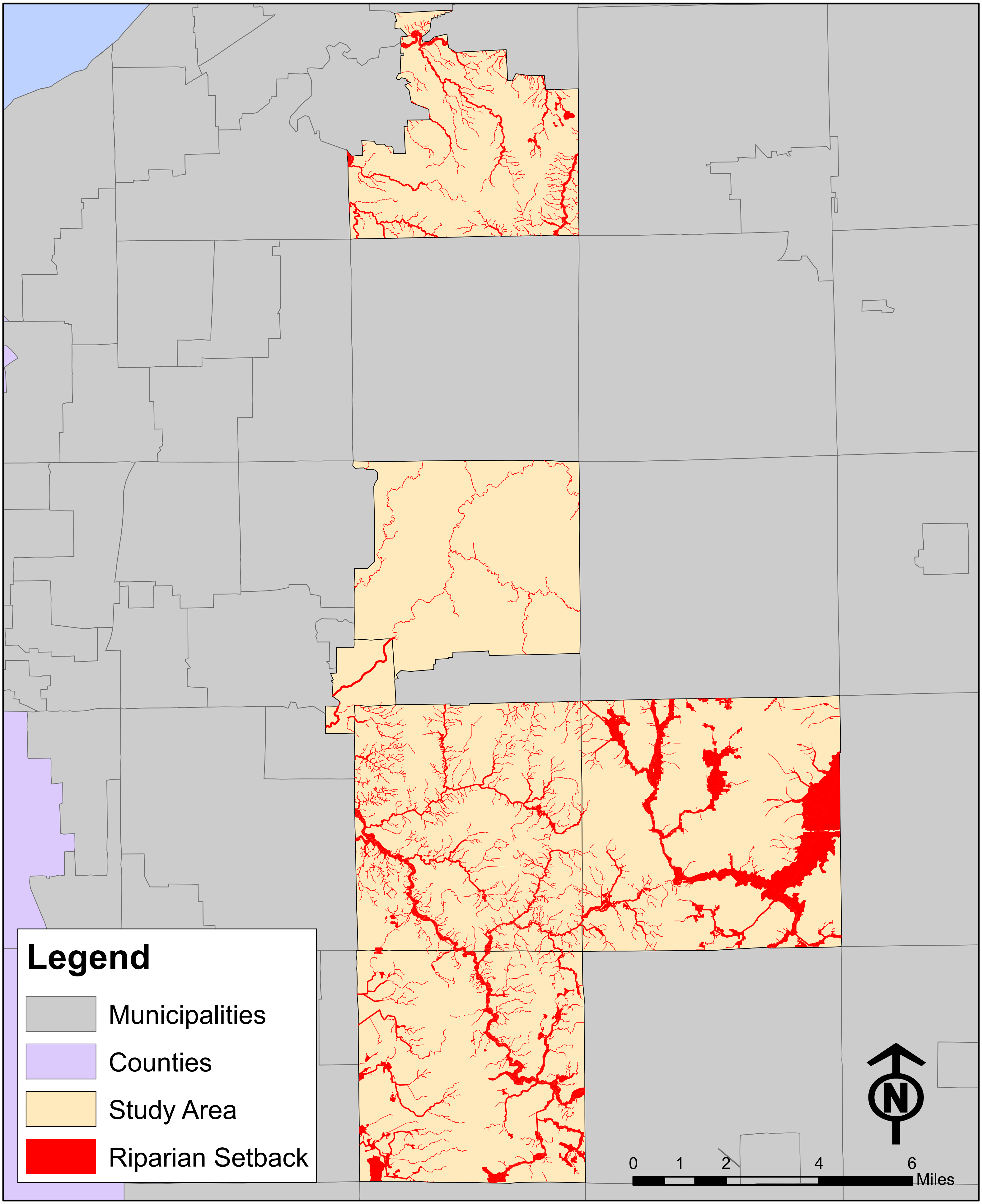

Figure 2. Riparian setback locations.

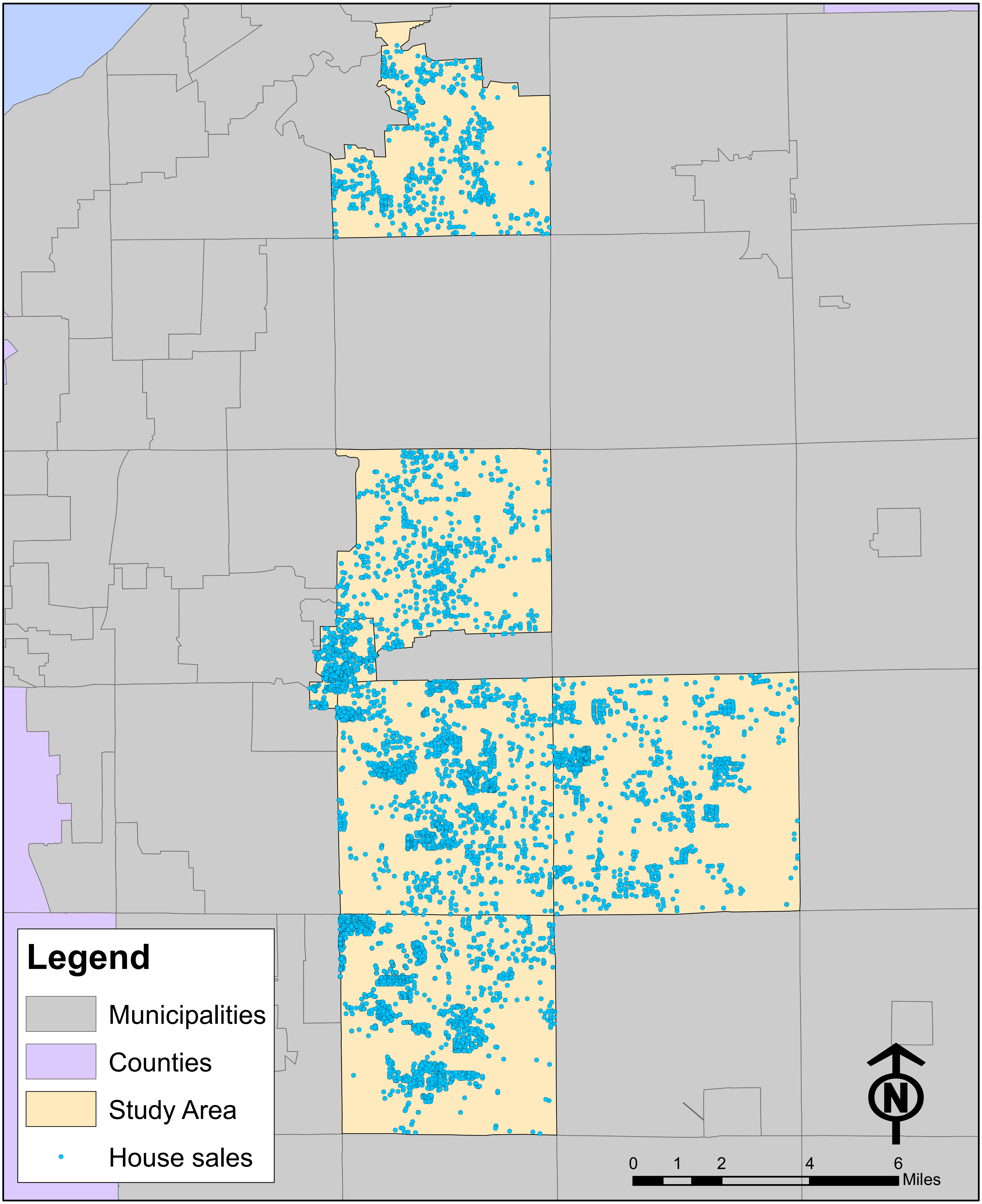

Figure 3. Location of housing sales, 1999-2005.

Community	Setback Implementation
Auburn Township	January 2005
Aurora	June 2000
Bainbridge Township	February 2004
Chagrin Falls	June 1993
Hunting Valley*	October 2000
Kirtland	July 2002
Russell Township	November 1967
Woodmere*	December 2004

Table 1. Communities and their setback implementation dates.

* Based on feedback from the focus group, these communities were not included in the analysis.

Variable name	Meaning	Source
Price	House sale price*	PACE
Age	Age of the house at the time of sale*	PACE
LSFt	Square feet of the lot (in thousands)*	PACE
HSF	Square feet of the house	PACE
HSF2	Square feet of the house^2	PACE
Rooms	Number of rooms	PACE
Baths	Number of full baths	PACE
Hbaths	Number of half baths	PACE
Garage	Indicates presence of a garage	PACE
Basement	Indicates presence of a basement	PACE
Fireplace	Indicates presence of at least one fireplace	PACE
AC	Indicates presence of central air conditioning	PACE
PorPat	Indicates presence of a porch or patio	PACE
Density	Population density	Census 2000
Stability	Percent of the population in the same house five years ago	Census 2000
Vacant	Percent of all housing units that are vacant	Census 2000
Institutional	Indicates institutional land use within 1/4 mile	CRWP/GIS
Openspace1	Indicates openspace within 1/4 mile	CRWP/GIS
Openspace2	Indicates openspace within 1/2 mile	CRWP/GIS
Openspace3	Indicates openspace within 3/4 mile	CRWP/GIS
Openspace4	Indicates openspace within 1 mile	CRWP/GIS
Historic	Indicates historic district within 1/4 mile	CRWP/GIS
Access	Distance to the nearest accessibility point (in meters)	GIS
Access^2	Distance to the nearest accessibility point (in meters)^2	GIS
q1	Indicates sale during quarter 1 (Jan, Feb, Mar)	PACE
q2	Indicates sale during quarter 2 (Apr, May, June)	PACE
q4	Indicates sale during quarter 4 (Oct, Nov, Dec)	PACE
s2000	Indicates sale during 2000	PACE
s2001	Indicates sale during 2001	PACE
s2002	Indicates sale during 2002	PACE
s2003	Indicates sale during 2003	PACE
s2004	Indicates sale during 2004	PACE
s2005	Indicates sale during 2005	PACE

Table 2. Variables in the analysis (continues...)

Variable name	Meaning	Source
Auburn	House is located in Auburn Township	PACE
Aurora	House is located in Aurora City	PACE
Chagrin	House is located in Chagrin Falls	PACE
Kirtland	House is located in Kirtland	PACE
Russell	House is located in Russell Township	PACE
Floodplain	House is located in the floodplain	CRWP
Streamfront	House is streamfront	CRWP/GIS
Setback	House has a setback	CRWP
1999sb	House has a setback and sold in 1999	CRWP
2000sb	House has a setback and sold in 2000	CRWP
2001sb	House has a setback and sold in 2001	CRWP
2002sb	House has a setback and sold in 2002	CRWP
2003sb	House has a setback and sold in 2003	CRWP
2004sb	House has a setback and sold in 2004	CRWP
2005sb	House has a setback and sold in 2005	CRWP
Auburnsf	House is located in Auburn Township and is streamfront	CRWP
Aurorasf	House is located in Aurora City and is streamfront	CRWP
Bainbridgesf	House is located in Bainbridge Township and is streamfront	CRWP
Chagrinsf	House is located in Chagrin Falls and is streamfront	CRWP
Kirtlandsf	House is located in Kirtland and is streamfront	CRWP
Russellsf	House is located in Russel Township and is streamfront	CRWP
Auburnsb	House is located in Auburn Township and has a setback	CRWP
Aurorasb	House is located in Aurora City and has a setback	CRWP
Bainbridgesb	House is located in Bainbridge Township and has a setback	CRWP
Chagrinsb	House is located in Chagrin Falls and has a setback	CRWP
Kirtlandsb	House is located in Kirtland and has a setback	CRWP
Russellsb	House is located in Russell Township and has a setback	CRWP

* natural logarithm used.

Table 2. Variables in the analysis (continued)

Location	Years							
	1999	2000	2001	2002	2003	2004	2005	Total
Auburn Township	58	52	55	68	68	76	66	443
City of Aurora	157	147	134	125	178	147	203	1091
Bainbridge Township	150	169	189	154	187	169	152	1170
Chagrin Falls Village	72	83	64	66	78	70	79	512
City of Kirtland	59	73	56	54	70	62	53	427
Russell Township	85	64	79	61	59	76	71	495
Total	581	588	577	528	640	600	624	4138

Table 3. Distribution of sales across locations and years.

Location	Sales in the setback							
	1999	2000	2001	2002	2003	2004	2005	Total
Auburn Township							21	21
City of Aurora		21	25	21	23	21	31	142
Bainbridge Township						53	47	100
Chagrin Falls Village	5	5	3	2	2	5	3	25
City of Kirtland				11	31	17	12	71
Russell Township	9	7	6	6	3	8	9	48
Total	14	33	34	40	59	104	123	407

Table 4. Distribution of setback sales across locations and years. Shaded years indicate that riparian setback legislation was not yet in place in that community.

Variable	B	Std. Error	t statistic	p-value
(Constant)	11.1011	0.0632	175.68	< 0.001
Age	-0.0889	0.0055	-16.30	< 0.001
LSFt	0.0278	0.0058	4.80	< 0.001
HSF	0.0004	0.0000	15.37	< 0.001
HSF2	-1.91E-08	0.0000	-5.08	< 0.001
Rooms	0.0224	0.0039	5.73	< 0.001
Baths	0.0713	0.0078	9.18	< 0.001
Hbaths	0.0541	0.0080	6.73	< 0.001
Garage	0.0038	0.0158	0.24	0.810
Basement	0.1262	0.0143	8.81	< 0.001
Fireplace	0.0499	0.0111	4.49	< 0.001
AC	0.0486	0.0101	4.81	< 0.001
PorPat	0.0372	0.0124	2.99	< 0.001
Density	-3.16E-05	0.0000	-5.85	< 0.001
Stability	0.0016	0.0005	3.02	< 0.001
Vacant	-0.0033	0.0020	-1.68	0.093
Institutional	-0.0296	0.0142	-2.08	0.038
Openspace1	0.0429	0.0281	1.53	0.126
Openspace2	0.0753	0.0282	2.67	0.008
Openspace3	0.0658	0.0284	2.32	0.020
Openspace4	0.0666	0.0307	2.17	0.030
Historic	0.1834	0.0202	9.06	< 0.001
Access	1.83E-05	0.0000	2.61	0.009
Access2	-1.37E-09	0.0000	-2.58	0.010
q1	-0.0700	0.0113	-6.18	< 0.001
q2	-0.0235	0.0097	-2.44	0.015
q4	-0.0199	0.0105	-1.90	0.058
s2000	0.0527	0.0142	3.72	< 0.001
s2001	0.0748	0.0143	5.23	< 0.001
s2002	0.1104	0.0146	7.53	< 0.001
s2003	0.1639	0.0140	11.69	< 0.001
s2004	0.1853	0.0144	12.84	< 0.001
s2005	0.2245	0.0145	15.44	< 0.001
Auburn	-0.1258	0.0161	-7.84	< 0.001
Aurora	-0.0955	0.0188	-5.09	< 0.001
Chagrin	0.2524	0.0246	10.25	< 0.001
Kirtland	-0.0651	0.0207	-3.14	< 0.001
Russell	0.0007	0.0222	0.03	0.974
Floodplain	0.0293	0.0247	1.18	0.237
Streamfront	0.0371	0.0115	3.22	0.001
Setback	0.0154	0.0155	0.99	0.321

Dependent Variable: Natural logarithm of sales price
F-statistic = 341.36 (p-value < 0.001)
Regression standard error = 0.241
Adjusted R2= 0.77
Number of observations = 4,138

Table 5. Aggregate model results.

Variable	B	Std. Error	t statistic	p-value
(Constant)	11.1011	0.0633	175.44	< 0.001
Age	-0.0888	0.0055	-16.28	< 0.001
LSFt	0.0277	0.0058	4.77	< 0.001
HSF	0.0004	0.0000	15.37	< 0.001
HSF2	-1.92E-08	0.0000	-5.09	< 0.001
Rooms	0.0225	0.0039	5.74	< 0.001
Baths	0.0711	0.0078	9.15	< 0.001
Hbaths	0.0539	0.0081	6.69	< 0.001
Garage	0.0035	0.0158	0.22	0.825
Basement	0.1256	0.0143	8.76	< 0.001
Fireplace	0.0500	0.0111	4.49	< 0.001
AC	0.0489	0.0101	4.84	< 0.001
PorPat	0.0372	0.0125	2.99	0.003
Density	-3.15E-05	0.0000	-5.82	< 0.001
Stability	0.0016	0.0005	3.05	0.002
Vacant	-0.0033	0.0020	-1.70	0.088
Institutional	-0.0296	0.0142	-2.08	0.038
Openspace1	0.0433	0.0281	1.54	0.124
Openspace2	0.0754	0.0282	2.68	0.007
Openspace3	0.0660	0.0284	2.32	0.020
Openspace4	0.0670	0.0307	2.18	0.029
Historic	0.1832	0.0203	9.04	< 0.001
Access	1.82E-05	0.0000	2.59	0.010
Access2	-1.37E-09	0.0000	-2.57	0.010
q1	-0.0704	0.0113	-6.21	< 0.001
q2	-0.0241	0.0097	-2.48	0.013
q4	-0.0200	0.0105	-1.91	0.057
s2000	0.0531	0.0145	3.67	< 0.001
s2001	0.0711	0.0146	4.86	< 0.001
s2002	0.1123	0.0150	7.47	< 0.001
s2003	0.1646	0.0144	11.42	< 0.001
s2004	0.1828	0.0151	12.10	< 0.001
s2005	0.2225	0.0152	14.64	< 0.001
Auburn	-0.1252	0.0161	-7.77	< 0.001
Aurora	-0.0952	0.0189	-5.04	< 0.001
Chagrin	0.2534	0.0247	10.24	< 0.001
Kirtland	-0.0631	0.0209	-3.02	0.003
Russell	0.0024	0.0223	0.11	0.914
Floodplain	0.0292	0.0253	1.15	0.250
Streamfront	0.0373	0.0116	3.23	< 0.001
1999sb	-0.0179	0.0673	-0.27	0.791
2000sb	-0.0049	0.0448	-0.11	0.913
2001sb	0.0655	0.0445	1.47	0.140
2002sb	-0.0196	0.0410	-0.48	0.632
2003sb	0.0002	0.0349	0.00	0.996
2004sb	0.0256	0.0275	0.93	0.352
2005sb	0.0219	0.0257	0.85	0.393

Dependent Variable: Natural logarithm of sales price
F-statistic = 296.7 (p-value < 0.001)
Regression standard error = 0.241
Adjusted R^2= 0.77
Number of observations = 4,138

Table 6. Time-specific model results.

Variable	B	Std. Error	t-statistic	p-value
(Constant)	11.0957	0.0635	174.87	< 0.001
Age	-0.0894	0.0055	-16.38	< 0.001
LSFt	0.0286	0.0058	4.92	< 0.001
HSF	0.0004	0.0000	15.35	< 0.001
HSF2	-1.93E-08	0.0000	-5.11	< 0.001
Rooms	0.0222	0.0039	5.65	< 0.001
Baths	0.0703	0.0078	9.04	< 0.001
Hbaths	0.0532	0.0080	6.63	< 0.001
Garage	0.0079	0.0158	0.50	0.616
Basement	0.1273	0.0143	8.88	< 0.001
Fireplace	0.0515	0.0111	4.62	< 0.001
AC	0.0487	0.0101	4.83	< 0.001
PorPat	0.0399	0.0124	3.21	0.001
Density	-3.15E-05	0.0000	-5.82	< 0.001
Stability	0.0017	0.0005	3.21	0.001
Vacant	-0.0031	0.0020	-1.60	0.109
Institutional	-0.0310	0.0143	-2.17	0.030
Openspace1	0.0408	0.0281	1.45	0.147
Openspace2	0.0747	0.0282	2.65	0.008
Openspace3	0.0640	0.0284	2.26	0.024
Openspace4	0.0637	0.0307	2.08	0.038
Historic	0.1820	0.0203	8.96	< 0.001
Access	1.94E-05	0.0000	2.73	0.006
Access2	-1.49E-09	0.0000	-2.78	0.005
q1	-0.0701	0.0113	-6.19	< 0.001
q2	-0.0246	0.0097	-2.54	0.011
q4	-0.0201	0.0105	-1.92	0.055
s2000	0.0516	0.0142	3.63	< 0.001
s2001	0.0756	0.0144	5.26	< 0.001
s2002	0.1127	0.0147	7.66	< 0.001
s2003	0.1672	0.0141	11.83	< 0.001
s2004	0.1853	0.0145	12.74	< 0.001
s2005	0.2196	0.0147	14.96	< 0.001
Auburn	-0.1326	0.0174	-7.61	< 0.001
Aurora	-0.0941	0.0194	-4.85	< 0.001
Chagrin	0.2534	0.0253	10.03	< 0.001
Kirtland	-0.0573	0.0226	-2.54	0.011
Russell	-0.0218	0.0244	-0.89	0.371
Floodplain	0.0228	0.0269	0.85	0.395
Auburnsf	0.0290	0.0324	0.89	0.372
Aurorasf	0.0137	0.0361	0.38	0.705
Bainbridgesf	0.0173	0.0186	0.93	0.351
Chagrinsf	-0.0191	0.0490	-0.39	0.697
Kirtlandsf	0.0605	0.0314	1.93	0.054
Russellsf	0.0880	0.0233	3.78	< 0.001
Auburnsb	0.1284	0.0574	2.24	**0.025**
Aurorasb	0.0172	0.0349	0.49	0.622
Bainbridgesb	0.0537	0.0288	1.87	**0.062**
Chagrinsb	0.0358	0.0596	0.60	0.548
Kirtlandsb	-0.0602	0.0379	-1.59	0.112
Russellsb	0.0317	0.0425	0.74	0.457

Dependent Variable: Natural logarithm of sales price
F-statistic = 274.05 (p-value < 0.001)
Regression standard error = 0.240
Adjusted R^2= 0.77
Number of observations = 4,138

Table 7. Community-specific model results.

Variable	B	Std. Error	t-statistic	p-value
(Constant)	10.9548	0.1855	59.05	< 0.001
Age	-0.0962	0.0160	-6.03	< 0.001
LSFt	0.0604	0.0171	3.53	< 0.001
HSF	0.0003	0.0001	4.70	< 0.001
HSF2	-1.39E-08	0.0000	-1.29	0.198
Rooms	0.0319	0.0101	3.17	0.002
Baths	0.1152	0.0219	5.25	< 0.001
Hbaths	0.0642	0.0223	2.88	0.004
Garage	0.0021	0.0497	0.04	0.966
Basement	0.1952	0.0519	3.76	< 0.001
Fireplace	-0.0118	0.0303	-0.39	0.698
AC	0.0603	0.0294	2.05	0.041
PorPat	0.0305	0.0376	0.81	0.417
Density	0.0000	0.0000	-2.45	0.015
Stability	0.0017	0.0015	1.18	0.238
Vacant	0.0010	0.0057	0.17	0.866
Institutional	-0.0087	0.0408	-0.21	0.832
Openspace1	0.2271	0.0903	2.51	0.012
Openspace2	0.2493	0.0899	2.77	0.006
Openspace3	0.2247	0.0895	2.51	0.012
Openspace4	0.2394	0.0953	2.51	0.012
Historic	0.1856	0.0601	3.09	0.002
Access	9.77E-06	0.0000	0.49	0.622
Access2	-2.89E-10	0.0000	-0.20	0.841
q1	-0.0676	0.0305	-2.21	0.027
q2	-0.0014	0.0269	-0.05	0.959
q4	0.0054	0.0300	0.18	0.858
Auburn	-0.1707	0.0520	-3.28	0.001
Aurora	-0.1194	0.0550	-2.17	0.030
Chagrin	0.2649	0.0738	3.59	< 0.001
Kirtland	-0.1639	0.0546	-3.00	0.003
Russell	-0.0619	0.0718	-0.86	0.389
Floodplain	0.0723	0.1019	0.71	0.478
Auburnsf	0.0444	0.1208	0.37	0.713
Aurorasf	0.0419	0.1172	0.36	0.721
Bainbridgesf	-0.0981	0.0979	-1.00	0.317
Chagrinsf	-0.0291	0.1146	-0.25	0.800
Kirtlandsf	-0.1991	0.1607	-1.24	0.216
Russellsf	0.0462	0.0662	0.70	0.485
Auburnsb	0.0783	0.1062	0.74	**0.461**
Aurorasb	-0.0070	0.1086	-0.06	0.949
Bainbridgesb	0.1293	0.0901	1.44	**0.152**
Chagrinsb	0.2335	0.1732	1.35	0.178
Kirtlandsb	-0.0617	0.1361	-0.45	0.651
Russellsb	-0.0411	0.1202	-0.34	0.733

Dependent Variable: Natural logarithm of sales price
F-statistic = 46.82 (p-value < 0.001)
Regression standard error = 0.255
Adjusted R^2= 0.76
Number of observations = 624

Table 8. Model results for 2005.

Variable	B	Std. Error	t-statistic	p-value
(Constant)	11.4518	0.1714	66.82	< 0.001
Age	-0.0959	0.0161	-5.95	< 0.001
LSFt	0.0258	0.0158	1.63	0.103
HSF	0.0004	0.0001	6.18	< 0.001
HSF2	-2.73E-08	0.0000	-2.53	0.012
Rooms	0.0193	0.0113	1.70	0.089
Baths	0.0511	0.0188	2.72	0.007
Hbaths	0.0445	0.0221	2.01	0.044
Garage	-0.0822	0.0420	-1.96	0.051
Basement	0.1117	0.0426	2.62	0.009
Fireplace	0.0458	0.0328	1.40	0.163
AC	0.0342	0.0264	1.29	0.197
PorPat	-0.0139	0.0329	-0.42	0.674
Density	0.0000	0.0000	-2.73	0.007
Stability	0.0005	0.0015	0.35	0.725
Vacant	-0.0020	0.0055	-0.37	0.708
Institutional	-0.1260	0.0375	-3.36	0.001
Openspace1	0.0327	0.0759	0.43	0.667
Openspace2	0.0683	0.0760	0.90	0.369
Openspace3	0.0697	0.0762	0.91	0.361
Openspace4	0.0330	0.0816	0.40	0.686
Historic	0.2060	0.0565	3.65	< 0.001
Access	2.85E-05	0.0000	1.58	0.114
Access2	-2.48E-09	0.0000	-1.76	0.079
q1	-0.0649	0.0348	-1.87	0.063
q2	-0.0157	0.0259	-0.61	0.545
q4	-0.0030	0.0285	-0.11	0.915
Auburn	-0.1183	0.0451	-2.62	0.009
Aurora	-0.0730	0.0555	-1.31	0.189
Chagrin	0.3129	0.0706	4.43	< 0.001
Kirtland	-0.0964	0.0645	-1.49	0.135
Russell	-0.0981	0.0640	-1.53	0.126
Floodplain	0.0111	0.0704	0.16	0.875
Auburnsf	-0.0857	0.0863	-0.99	0.321
Aurorasf	0.0505	0.1278	0.39	0.693
Bainbridgesf	-0.0599	0.0733	-0.82	0.414
Chagrinsf	-0.0371	0.1202	-0.31	0.758
Kirtlandsf	0.1283	0.1433	0.90	0.371
Russellsf	0.1587	0.0618	2.57	0.011
Aurorasb	-0.0817	0.1132	-0.72	0.471
Bainbridgesb	0.1080	0.0713	1.51	**0.130**
Chagrinsb	0.0882	0.1491	0.59	0.554
Kirtlandsb	-0.0465	0.1335	-0.35	0.728
Russellsb	0.0849	0.1049	0.81	0.419

Dependent Variable: Natural logarithm of sales price
F-statistic = 44.68 (p-value < 0.001)
Regression standard error = 0.243
Adjusted R^2= 0.76
Number of observations = 624

Table 9. Model results for 2004.

Location	Years							
	1999	2000	2001	2002	2003	2004	2005	Total
Auburn Township	55	43	46	40	47	46	42	319
City of Aurora	85	47	32	24	35	26	24	273
Bainbridge Township	41	24	32	23	27	30	32	209
Chagrin Falls Village	0	0	1	0	2	3	2	8
City of Kirtland	16	32	12	18	14	19	12	123
Russell Township	22	13	12	9	16	8	10	90
Total	219	159	135	114	141	132	122	1022

Table 10. Distribution of vacant lot sales across locations and years.

Location	Vacant land sales in the setback							
	1999	2000	2001	2002	2003	2004	2005	Total
Auburn Township							13	13
City of Aurora		5	5	7	7	7	6	37
Bainbridge Township						19	15	34
Chagrin Falls Village	0	0	1	0	0	0	0	1
City of Kirtland				0	0	3	4	7
Russell Township	2	2	2	0	3	0	2	11
Total	2	7	8	7	10	29	40	103

Table 11. Distribution of vacant land setback sales across locations and years. Shaded years indicate that riparian setback legislation was not yet in place in that community.

	All Locations		Setback Locations		Non-Setback Locations	
Location	n	Median Price Per Acre	n	Median Price Per Acre	n	Median Price Per Acre
Auburn Township	319	$30,000	13	$31,167	306	$30,000
City of Aurora	273	$119,305	37	$66,287	236	$126,603
Bainbridge Township	209	$78,829	34	$71,578	175	$80,000
Chagrin Falls Village	8	$78,525	1	$38,207*	7	$88,082
City of Kirtland	123	$82,022	7	$43,247	116	$84,682
Russell Township	90	$41,061	11	$26,682	79	$42,667

* Since there is only one observation, this represents the actual price, not the median.

Table 12. Median price per acre of vacant land.

Order	Variables	
	Positive Influence	Negative Influence
1		Lotsize
2	In or within 1/4 mile of a planned sewer area	
3	In Kirtland	
4	In Aurora	
5		Vacancy
6		Streamfront
7	Within one mile of 422 or Chillocothe Road	
8	Within 1.5 miles of 422 or Chillocothe Road	
9		Institutional land use within 3/4 mile
10	In or within 1/2 mile of a planned sewer area	
11	2005 sale	
12		Institutional land use within 1/4 mile
13	Within 1/2 mile of 422 or Chillocothe Rd.	
14	$Access^2$	
15		In or within 3/4 mile of a planned sewer area
16	Stability	
17	Floodplain	

Table 13. Significant variables identified through the forward-stepwise regression procedure for vacant land.