

Utilizing Geographic Information Systems to Identify Potential Target Markets for Hydro Restoration Incorporated

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Abstract

Analysis of potential market areas within the seven county Twin Cities metropolitan area was performed for Hydro Restoration Incorporated. The analysis consisted of two phases. The initial phase identified current customer demographic attributes. The second phase of the analysis used current customer demographic information to identify areas with similar demographic attributes within the Twin Cities metropolitan area. The areas identified by the second phase of the analysis will be used to make informed marketing decisions.

Introduction

Hydro Restoration Incorporated was founded in 2001 with the goal of providing the highest quality wood restoration and preservation services in the Twin Cities metropolitan area, focusing primarily on outdoor wood surfaces such as siding, cedar shake roofs, patios, and decks. Since 2001, Hydro Restoration has enjoyed a growing customer base in the northeast Twin Cities metropolitan area. This growth is a result of the current marketing practices of Hydro Restoration and the geographic location of its offices. The goal of this analysis is to identify market areas that will be conducive to the expansion of the Hydro Restoration customer base throughout the Twin Cities metropolitan area (Hydro Restoration, 2001).

Identifying potential market areas is imperative to the success of any small business. In order to succeed, an entrepreneur must attract and retain a growing base of satisfied customers (SBA, 2004). Hydro Restoration Incorporated has been successful at both attracting and retaining customers in the northeast metropolitan area and would like to grow beyond this market area into new markets in and around the Twin Cities.

Businesses today are beginning to rely on GIS to organize, analyze, and represent their business data. Combining business information, such as customers, to specific locations allows the business to create maps that can help identify patterns and understand relationships that are not visible when simply viewing charts and tables

(Boyles, 2002). Businesses that utilize geographic information systems will undoubtedly gain a competitive advantage over businesses that do not.

There are many business solutions that GIS can offer such as: routing, sales territory alignment distribution networking, store locating, billboard placement, and many more (Boyles, 2002). The business solution examined in this analysis is identifying the target market.

There are two key questions that Hydro Restoration needs to answer in order to effectively grow its customer base.

- Where are the current customers?
- Where are the potential customers?

The word “where,” when used in these two questions, implies much more than just geographic locations; its intentions focus directly on the accurate demographic profiling of current and prospective customers to reveal untapped potential markets, and to define markets in which to conduct expansion efforts (Environmental Systems Research Institute Business Division, 2003).

In this analysis, GIS will be used to answer these two questions and will provide Hydro Restoration with an objective view of its current markets and potential target markets by creating a geodemographic representation of current and potential markets in the Twin Cities metropolitan area (Batty, Longley, Webber, 2003).

Background

Hydro Restoration Incorporated operates in the Twin Cities metropolitan area which is comprised of seven counties: Anoka, Carver, Dakota, Hennepin,

Ramsey, Scott, and Washington. The U.S. Census Bureau reported a population of 2,657,256 in the metropolitan area for the year 2000 (U.S. Census Bureau, 2001).

For the purposes of this research, the seven county Twin Cities metropolitan area has been designated as the study area for this project (Figure 1).

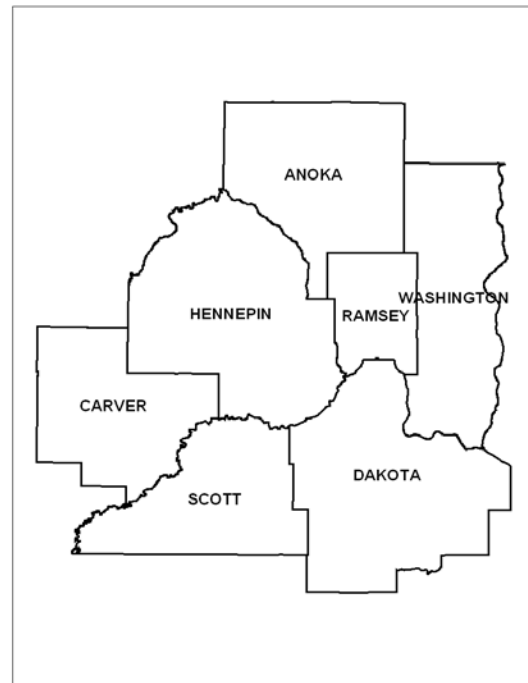


Figure 1. Seven County Twin Cities Metropolitan Area, Hydro Restoration Market Study Area.

Methods

Data Acquisition

Customer information from 2001-2003 was received from Hydro Restoration Incorporated and Twin Cities Census information from the U.S. Census Bureau (<http://factfinder.census.gov>) in Microsoft Excel format. Background data for the seven county Twin Cities metropolitan area such as census tracts,

streets, highways, county boundaries, municipalities, and lakes were obtained from the Metro GIS Datafinder website (www.datafinder.org).

Software Requirements and Data Manipulation

The software used for this project was ArcGIS 8.3, Spatial Analyst, and Microsoft Excel. Each of these components was crucial to the successful completion of this project.

Microsoft Excel was used extensively throughout this project to prepare customer and census data that was exported to ArcGIS 8.3 in tabular database format. Customer and Census data was reformatted and converted to DBASE IV format. However, the spatial representation of the customer and census data were created in moderately different fashions.

The customer data was geocoded using the ESRI StreetMap 2003 geocoding service. This geocoding service uses ESRI’s StreetMap 2003 data as the reference layer. The end result of this process was a point shapefile representing the geographic location of each Hydro Restoration customer (Figure 2). Each record in this shapefile contained information regarding customer name, address, type of work performed, and dollar value of sale (Table 1).

Table 1. Example of records in geocoded customer shapefile.

Customer Name	Address	Sale	Type of Job
Cox	121 Park Ave	\$1600	Pressure Wash
Whitaker	24 Peninsula Rd	\$4500	Pressure Wash
Broen	242 Park	\$1700	Seal

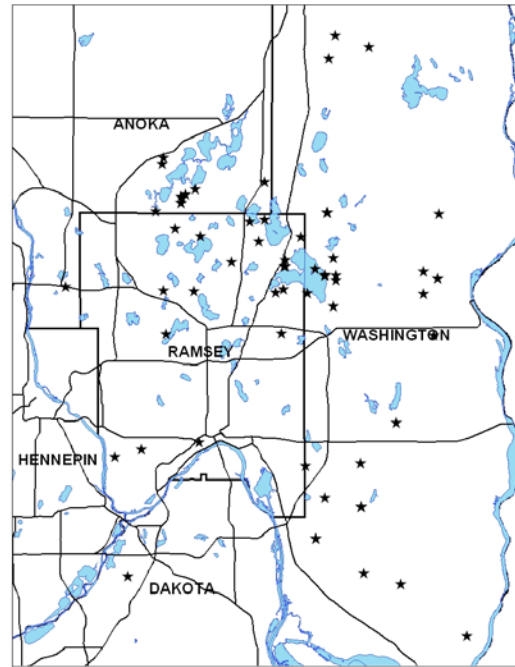


Figure 2. Twin Cities Metropolitan Area Geocoded Customers.

The tabular census data was converted to geodemographic data through the use of the join function. The census tract shapefile obtained from the Metro GIS Website was used in this step. This shapefile was joined to the tabular census data by census tract and then exported as a shapefile. The end result of this process was a geodemographic polygon shapefile containing demographic information corresponding to each census tract within the seven county Twin Cities Metropolitan area. Each record in this geodemographic shapefile contained information about the demographic attributes of each census tract such as, tract number, median family size, total occupied households, median home value, median income, median year built, owner occupied households, and population (Figures 3 and 4).

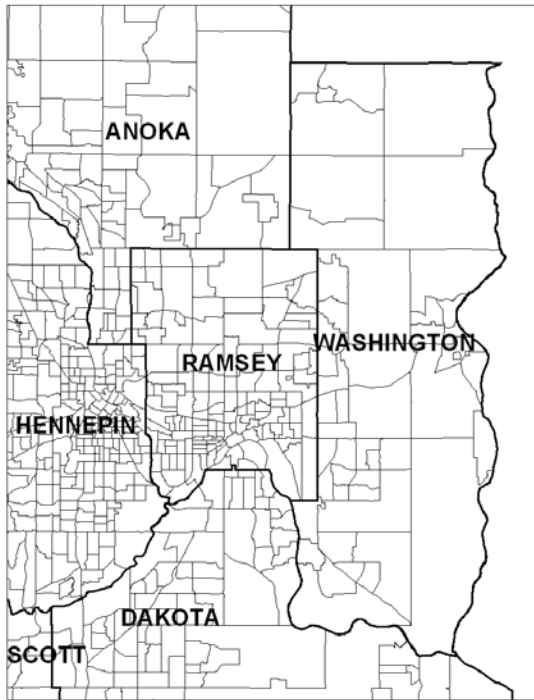


Figure 3. Geodemographic Census Data by Census Tract for the Seven County Twin Cities Metropolitan Area.

Attributes of CensusData						
TRACTS	HOUSEHOLD	POPULATION	MEDIANFAM	OCCHOUSING	OWNEROC	
50107	737	2270	3	737	689	
50109	1536	4834	3	1536	1508	
50108	1050	3083	3	1050	851	
50112	1153	3480	3	1153	1114	
50116	1123	3557	3	1123	1087	
50114	812	2617	3	812	795	
50115	1388	4286	3	1388	1365	
50113	425	1188	3	425	419	
50111	1177	3398	3	1177	1144	
50110	894	2709	3	894	880	
50210	1328	3957	3	1328	1290	
50223	776	2505	3	776	770	
50224	855	2716	3	855	841	
50225	1206	3812	3	1206	1187	
50218	998	3165	3	998	983	
50217	791	2572	3	791	780	
50235	944	2761	3	944	908	

Figure 4. Tabular Information for Geodemographic Census data.

In order to link the customer information to the geodemographic census information a spatial join was performed. The purpose of this spatial join was to combine the customer locations to their corresponding census tract to identify the demographic

attributes of the areas in which Hydro Restoration Incorporated had been servicing customers. The end result of this spatial join was an enhanced geodemographic shapefile that contained census information pertaining to, and number of customers located within, each census tract in the seven county Twin Cities metropolitan area. The census tracts that did indeed contain customers were then extracted from the geodemographic shapefile to create a new shapefile containing only information relevant to the current Hydro Restoration market (Figure 5).

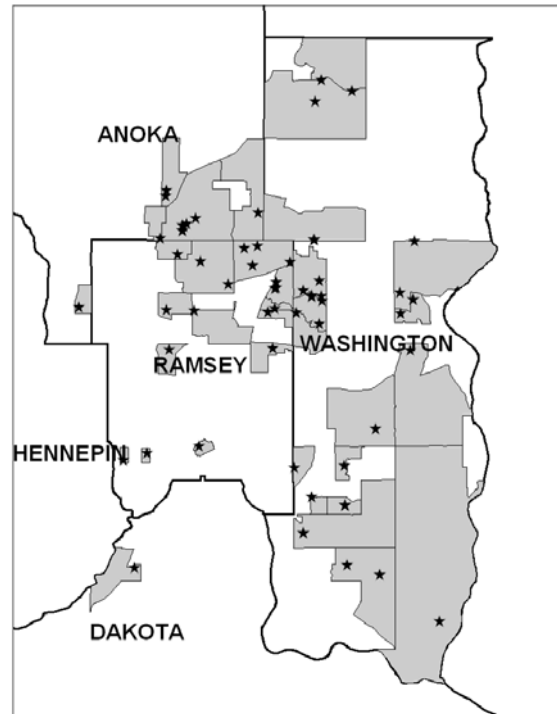


Figure 5. North East Twin Cities Metropolitan Area Hydro Restoration Customer Geodemographic Data.

This extracted customer geodemographic data was exported to Microsoft Excel where analyses were performed to identify the characteristics of Hydro Restoration's current market.

These characteristics are discussed in detail in the results section of this paper.

Next, the Spatial Analyst Extension was used to create a series of grid data sets. 100 meter grids, spanning the entire Twin Cities metropolitan area, were created for each attribute in the geodemographic shapefile. In total seven grids were created representing, median home value, median year built, median income, owner occupied households, total occupied households, median family size, and population. These grids were created for later use as input data sets in a raster calculation designed to identify market areas. The input datasets can be viewed in Appendix A.

Analysis

The first phase of analysis for this project began with identification of current customer demographic attributes. This data was created during the spatial join, discussed earlier in this paper, when the customer points were joined to the census tract polygons. Census tract polygons containing customers were extracted from the overall census tract shapefile. These records were exported to Microsoft Excel where minimum, maximum, and average values were calculated for each demographic variable related to customer inhabited census tracts.

This primary phase of the analysis found that Hydro Restoration Incorporated’s current customer market areas possess demographic characteristics that vary from the overall medians of the entire Twin Cities metropolitan area. For example, the average median income value for a census tract within Hydro Restoration Incorporated’s current market area is

\$72,741 per year, whereas, the overall average median income for the entire seven county Twin Cities metropolitan area is \$55,453 per year. Based on this information one could conclude that Hydro Restoration Incorporated has been successful in census tracts with median income values around \$77,741 per year and, therefore, should not market in census tracts reporting a number smaller than \$70,000.

Each demographic variable was evaluated in this manner to identify the characteristics of census tracts in which Hydro Restoration Incorporated operates. Table 2 describes the average median and total values for demographic attributes corresponding with census tracts located within Hydro Restoration Incorporated’s current market area.

Table 2. Hydro Restoration Incorporated Current Market Area Averages by Census Tract.

Demographic Variable	Average Value
Median Home Value	\$184,492
Median Year Structure Built	1977
Median Income	\$72,741
Owner Occupied Households	1318 Households
Occupied Households	1634 Households
Median Family Size	3 persons
Population	1634 persons

Table 3 describes the average median and total values for demographic attributes that correspond to all of the census tracts within the boundaries of the seven county Twin Cities metropolitan area.

Table 3. Twin Cities Metropolitan Area Demographic Averages by Census Tract.

Demographic Variable	Average Value
Median Home Value	\$143,274
Median Year Structure Built	1955
Median Income	\$55,453
Owner Occupied Households	1059 Households
Total Occupied Households	1485 Households
Median Family Size	3
Population	3840

By examining the differences between the two tables depicted in tables 2 and 3, one can conclude that Hydro Restoration Incorporated’s clientele possess demographic characteristics that vary from the average median and total values of the entire metropolitan area. Therefore, it can be concluded that Hydro Restoration Incorporated should tailor its marketing efforts to target

geographic areas that possess demographic characteristics that are similar to those of its current customer base. This is the goal of phase two of this project.

Phase two of this project uses all of the average median and total values of demographic variables for census tracts within Hydro Restoration Incorporated’s current market area as a blueprint for potential market areas. The parameters for potential market areas are described in Table 4.

Table 4. Parameters for Potential Markets in the Seven County Twin Cities Metropolitan Area

To be a potential market area a census tract must have:
<ul style="list-style-type: none"> • Median Home Values Greater than \$180,000
<ul style="list-style-type: none"> • Median Year Structure Built Greater than 1970
<ul style="list-style-type: none"> • Median Income Greater than \$70,000 per year
<ul style="list-style-type: none"> • Total Owner Occupied Households Greater than 1300
<ul style="list-style-type: none"> • Total Occupied Households Greater than 1600
<ul style="list-style-type: none"> • Median Family Size of 3 or more Persons
<ul style="list-style-type: none"> • Total Population Greater than 1600 Persons

To identify census tracts that are in agreement with these parameters, the Spatial Analyst extension was used. Seven grid datasets were created during the data manipulation process and were used to perform the raster calculations designed to identify census tracts with similar attributes (See Appendix A to view the grid datasets). Each of the

seven input grid datasets geographically represents the following demographic variables for each census tract in the seven county Twin Cities metropolitan area:

- Median Home Value
- Median Year Structure Built
- Median Income
- Total Owner Occupied Housing Units
- Total Occupied Housing Units
- Median Family Size
- Total Population

The goal is to combine all of these datasets to identify areas where all of the agreed upon parameters for potential market areas are met. This process is performed using the Spatial Analyst “Raster Calculator.” The statement used to identify market areas can be seen in table 5.

Table 5. Conditional Statement used in raster calculation to identify potential markets.

```
PotentialMarkets = Con(([avehomevalue] > 180000) & ([aveyearbuilt] > 1970) & ([medincome] > 70000) & ([owneroccup] > 1300) & ([totocchouse] > 1600) & ([familysize] >= 3) & ([population] > 1600), 1, 0)
```

This raster calculation identified various census tracts around the Twin Cities metropolitan area that met the parameters. Figure 6 displays the census tracts identified by the raster calculation described in Table 5. These census tracts have been designated as potential market areas for Hydro Restoration Incorporated. An example of the map layouts created to present these potential

market areas to Hydro Restoration Incorporated can be seen in Appendix B.

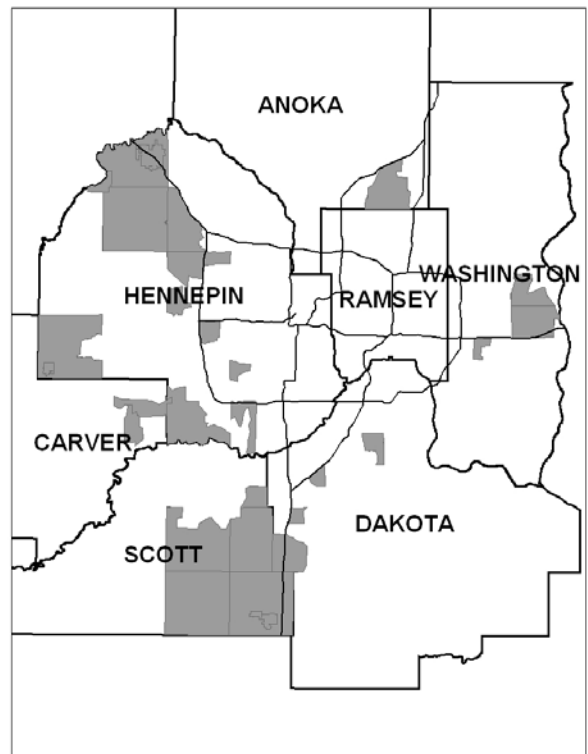


Figure 6. Hydro Restoration Incorporated Potential Market Areas by Census Tract in the seven county Twin Cities metropolitan area.

Results

The analysis identified a number of potential market zones. However, it was decided that this analysis may have been too specific and that some potential areas could have been excluded simply because the census tract did not meet a parameter such as total population greater than 1600 people. In addition, prior to the commencement of this project Hydro Restoration had intended to focus its marketing efforts on the larger homes in and around Lake Minnetonka.

This preliminary analysis fails to recognize those areas because census tracts in and around Lake Minnetonka

have lower populations and fewer households due to larger lot sizes. This area is also very attractive to Hydro Restoration Incorporated because of the size and style of most homes on Lake Minnetonka.

In order to identify wealthier and more sparsely populated areas like Lake Minnetonka in the analysis, the parameters for potential markets had to be changed. After much deliberation with Hydro Restoration Incorporated owner Kip Ramsay, it was decided that the only two important demographic variables were median home value and median income. The excluded variables can be seen in Table 6.

Table 6. Excluded Demographic Variables.

Demographic Variable	Reason Excluded
Median Year Structure Built	All homes need wood preservation and restoration services regardless of age
Owner Occupied Households	The number was too high in preliminary analysis and did not allow for the inclusion of smaller, wealthier census tracts as potential market zones
Total Owner Occupied Households	Same Reason as Owner Occupied Households
Median Family Size	Not Relevant
Total Population	Same Reason as Owner Occupied Households

After further discussion, it was decided that the final analysis would be more aggressive in targeting wealthier potential markets. The final parameters agreed upon by Andrew A. Kruse and Hydro Restoration Incorporated for potential market areas can be seen in Table 7. It was concluded that these parameters would identify market areas with greater potential because the output will not be limited by the demographic variables that were deemed irrelevant.

Table 7. Final Parameters for Potential Markets.

To be a potential market area a census tract must have:
<ul style="list-style-type: none"> • Median Home Values Greater than \$185,000
<ul style="list-style-type: none"> • Median Income Values Greater than \$75,000

Once again, in order to identify census tracts that are in agreement with these parameters, the Spatial Analyst extension was used. However, in this step only two of the seven grid datasets created during the data manipulation process are used to perform a raster calculation designed to identify census tracts with the above attributes (See Appendix A to view the grid datasets). The two input grid datasets geographically represent the following demographic variables for each census tract in the seven county Twin Cities metropolitan area:

- Median Home Value
- Median Income Value

This analysis resulted in a much larger potential market area. This larger

potential market area is due to the less stringent parameters required of a census tract. The original analysis returned a market area size of 211 square miles and this new analysis returned a market area size of 788 square miles. The new proposed market areas can be seen in Figure 7. Additional full page color map layouts for the new potential market areas were created for delivery to Hydro Restoration Incorporated. An example layout is attached in Appendix B.

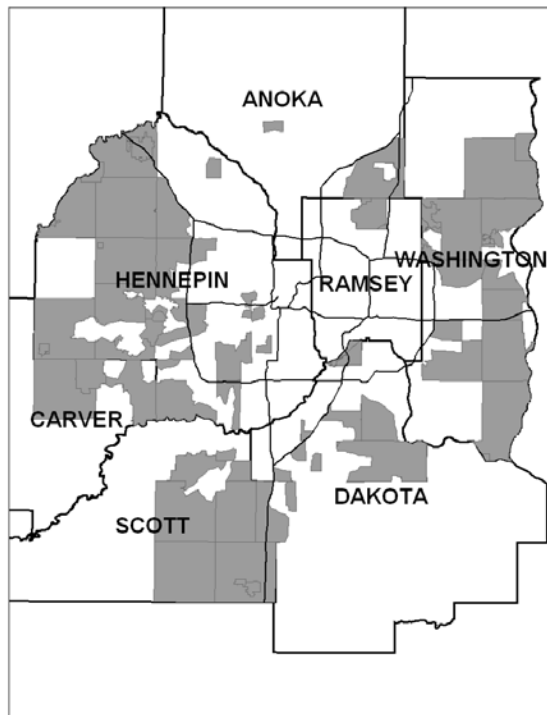


Figure 7. Hydro Restoration Incorporated Potential Market Areas by Census Tract in the seven county Twin Cities metropolitan area.

Deliverables

Both of the created market areas were submitted to Hydro Restoration Incorporated for consideration. In addition, two sets of street addresses pertaining to each market area were created by clipping the ESRI StreetMap 2003 data based on the boundaries of

each market area. These street addresses can be used by Hydro Restoration Incorporated to send out a promotional mailing to customers within the defined market area.

A municipalities layer obtained from the Metro GIS Datafinder Café was clipped to identify municipalities that are located within each of the defined market areas. This information is to be used by Hydro Restoration Incorporated in the process of identifying publications catering to municipalities within the market areas. Hydro Restoration Incorporated can then make decisions as to which publications it would like to advertise in. The municipalities identified for both proposed market areas can be found in Appendix C. Market area 1 lists the municipalities identified for potential marketing efforts defined by the first analyses and market area 2 by the second analyses performed. As stated previously, the variables utilized to define the first market area were median home value, median year structure built, median income, total owner occupied households, total occupied households, median family size, and total population. The variables utilized to create the second market area were median home value and median income. Please examine Appendix C to see the list of municipalities within the market areas.

Additional deliverables to Hydro Restoration Incorporated include 4 large maps representing the North East, North West, South East, and South West Twin City's metropolitan area mounted on bulletin boards. Hydro Restoration will use these maps to monitor and plan daily operations.

Discussion and Conclusion

This study has given Hydro Restoration Incorporated the tools needed to begin marketing in new communities. By profiling current customer demographic attributes and using those attributes as parameters for new markets, Hydro Restoration Incorporated now possesses an objective view of the areas that will potentially be most profitable.

In addition to increasing sales, this information will also save Hydro Restoration the time and money that many businesses often waste marketing in the wrong areas and to the wrong people. This information will help Hydro Restoration grow its business into new geographic areas within and quite possibly beyond the Twin Cities metropolitan area. This project has provided Hydro Restoration with an objective view of its potential market areas and tools available for marketing to those areas. Hydro Restoration Incorporated must now attract, satisfy, and retain a growing customer base by offering the best wood restoration and preservation services possible.

The municipality information in found in Appendix C will be the most helpful data. This data can be used to focus the marketing efforts of Hydro Restoration Incorporated on the municipalities identified as potential markets in this analysis. This information can assist in identifying publications local to those municipalities, defined by this study as market areas, in which to place Hydro Restoration advertisements. This will allow Hydro Restoration Incorporated to maximize the potential impact of its marketing efforts.

This maximization of the impact of marketing efforts would not be as easily attainable without the use of geographic information systems.

Without GIS, Hydro Restoration Incorporated would be blind to its true target market. As a result of this research, Hydro Restoration now has a new found ability to tailor its marketing efforts to target specific geographic locations that are anticipated to have the same characteristics as those markets in which Hydro Restoration currently operates and historically operated in. This information, combined with knowledge of Twin Cities Metropolitan area publications, will assist Hydro Restoration Incorporated tremendously in the development of a new marketing strategy for the 2004 wood restoration season.

Acknowledgements

I would like to thank John Ebert and Martha Roldan for their advice and support throughout the course of this project. I would also like to thank Dr. David McConville for his persistence and unwavering support of the growth of the Resource Analysis program. I would especially like to thank all of my classmates who are always willing to help and offer their ideas and thoughts on different issues. Finally, I would like to thank Kip & Sarah Ramsay of Hydro Restoration for divulging customer information to me and supporting me with other graphics and product information.

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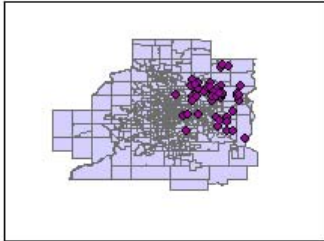
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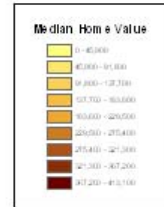
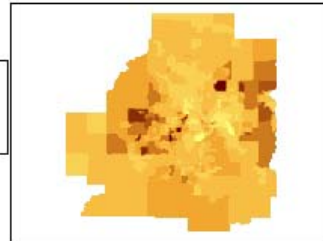
Appendix A

Input Data Sets

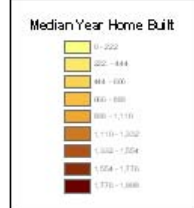
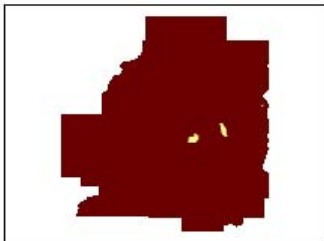
Census Tracts And Customers



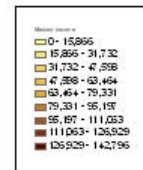
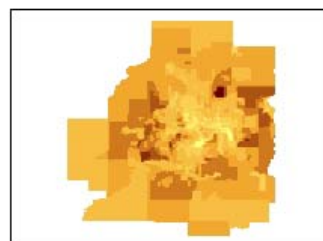
Median Home Value



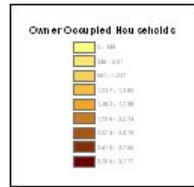
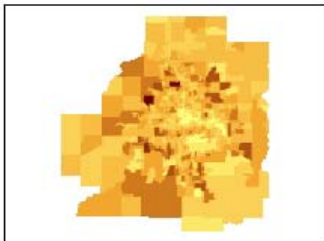
Median Year Built



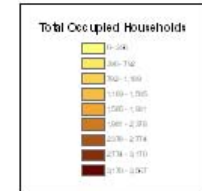
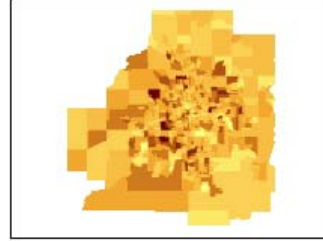
Median Income



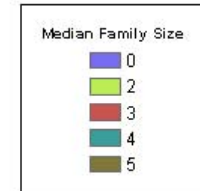
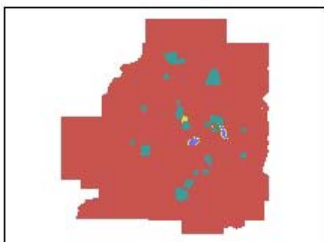
Owner Occupied Households



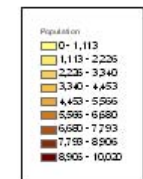
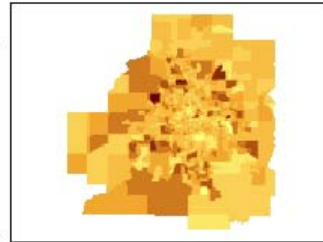
Total Occupied Households

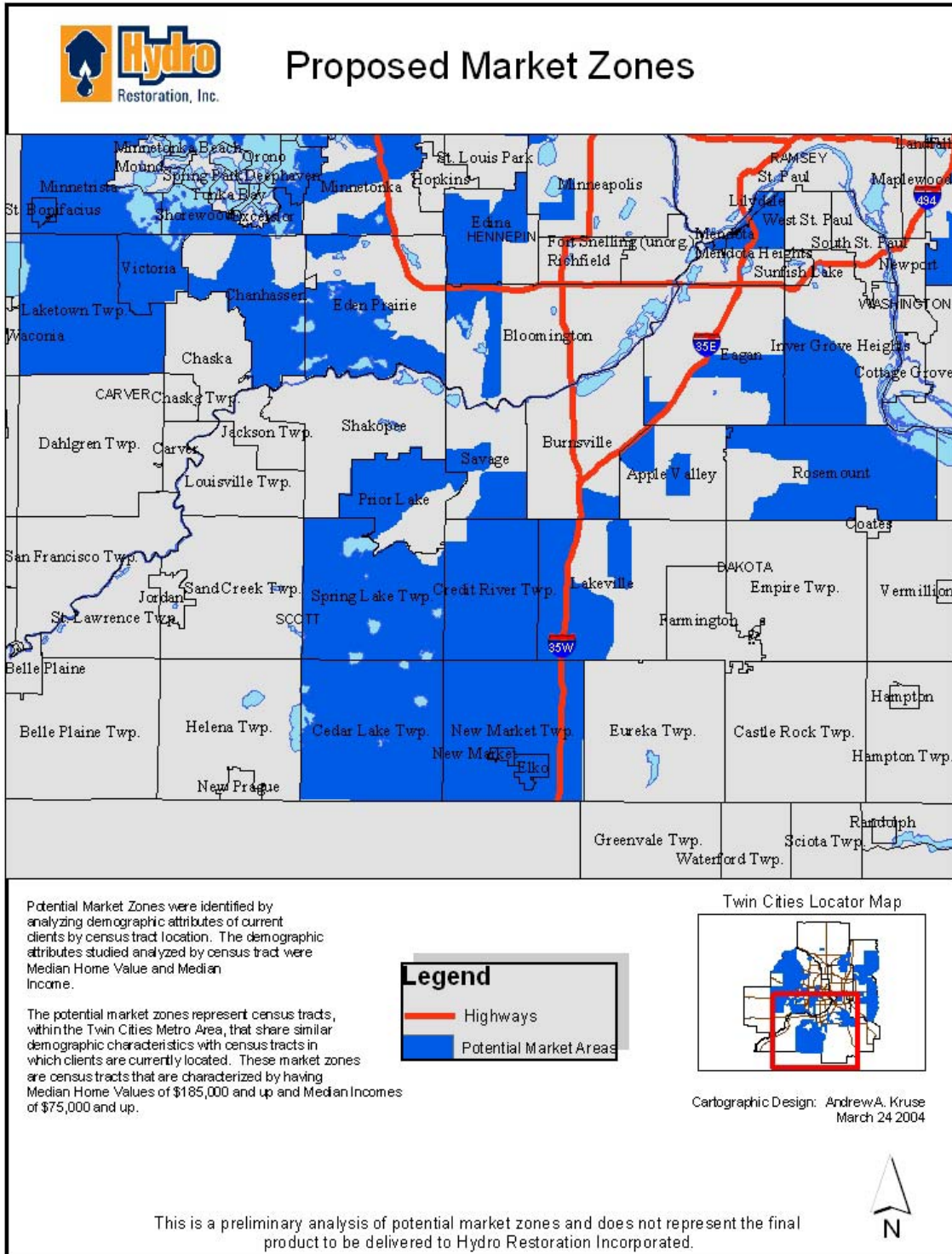


Median Family Size



Population





Appendix C

Market Area 1

Greenvale Twp.	Afton
Elko	Mound
New Market	Lakeland
Helena Twp.	Minnetonka
Eureka Twp.	Watertown Twp.
New Market Twp.	Independence
Cedar Lake Twp.	Minnetrista
Sand Creek Twp.	Wayzata
Spring Lake Twp.	Orono
	West Lakeland Twp.
Prior Lake	Bayport
Lakeville	Baytown Twp.
Burnsville	Lake Elmo
Credit River Twp.	Oak Park Heights
Savage	Stillwater
Rosemount	New Hope
Apple Valley	Plymouth
Inver Grove Heights	Medina
Shakopee	White Bear Twp.
Eagan	North Oaks
Chaska	Circle Pines
Bloomington	Greenfield
Chanhassen	Maple Grove
Eden Prairie	Corcoran
Laketown Twp.	Centerville
Victoria	Hanover
St. Bonifacius	Lino Lakes
Edina	Dayton
Shorewood	Rogers
Hopkins	Hassan Twp.
Woodbury	

Municipalities identified by the initial parameters. Parameters used to identify these municipalities were Median Home Value > \$180,000, Median Year Structure Built > 1970, Median Income > \$70,000, Total Owner Occupied Households > 1300, Total Occupied Households > 1600, Median Family Size >= 3, and Total Population > 1600. This list will be delivered to Hydro Restoration Incorporated in Microsoft Excel.

Appendix C - 2

Market Area 2

Greenvale Twp.	Excelsior	Loretto
Elko	St. Bonifacius	Birchwood Village
New Market	St. Marys Point	White Bear Twp.
Helena Twp.	West St. Paul	New Hope
Eureka Twp.	Mendota Heights	Plymouth
New Market Twp.	Lilydale	Medina
Cedar Lake Twp.	St. Paul	Independence
Sand Creek Twp.	Greenwood	Vadnais Heights
Empire Twp.	Shorewood	Stillwater
Lakeville	Tonka Bay	Mahtomedi
Credit River Twp.	Lake St. Croix Beac	Rockford
Spring Lake Twp.	Edina	Dellwood
Coates	Spring Park	Grant
Ravenna Twp.	Hopkins	North Oaks
Prior Lake	Woodbury	Shoreview
Savage	Afton	Stillwater Twp.
Nininger Twp.	Minnetonka Beach	Circle Pines
Cottage Grove	Deephaven	Greenfield
Hastings	Mound	Maple Grove
Rosemount	Woodland	Corcoran
Apple Valley	St. Louis Park	Centerville
Burnsville	Lakeland	Hanover
Jackson Twp.	Minnetonka	Champlin
Dahlgren Twp.	Watertown Twp.	Dayton
Shakopee	Minnetrissa	Hugo
Waconia Twp.	Wayzata	May Twp.
Eagan	Minneapolis	Lino Lakes
Inver Grove Heights	Golden Valley	Columbus Twp.
Chaska	Long Lake	Marine on St. Croix
Denmark Twp.	West Lakeland Twp.	New Scandia Twp.
Bloomington	Orono	Rogers
Newport	Bayport	Ham Lake
Chanhassen	Baytown Twp.	Hassan Twp.
Eden Prairie	Oakdale	Andover
Victoria	Oak Park Heights	
Mendota	Lake Elmo	
Laketown Twp.	Pine Springs	
	White Bear Lake	

Municipalities identified by the secondary parameters. Parameters used to identify these municipalities were Median Home Value > \$185,000 and Median Income > \$75,000. This list will be delivered to Hydro Restoration Incorporated in Microsoft Excel.