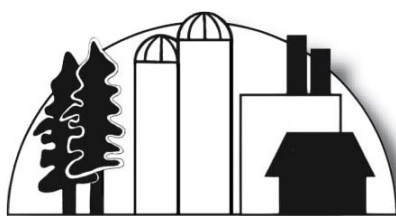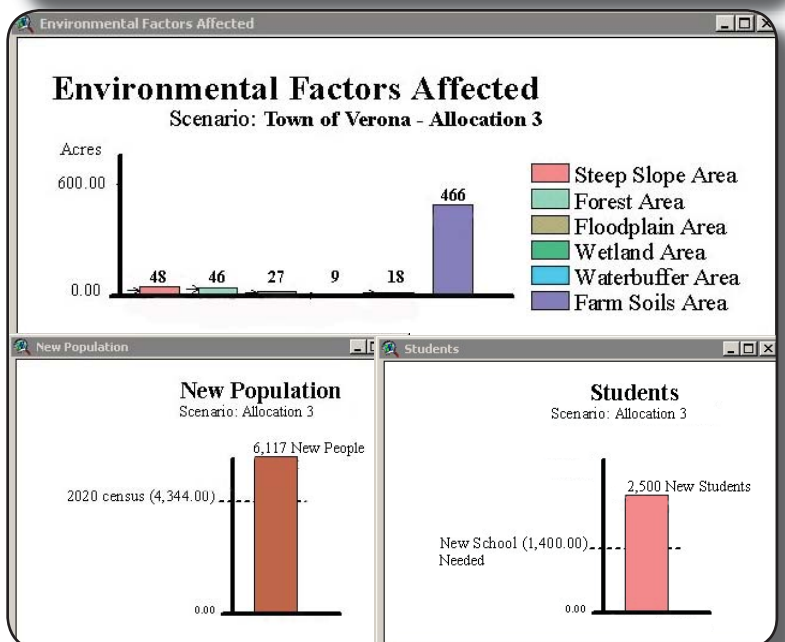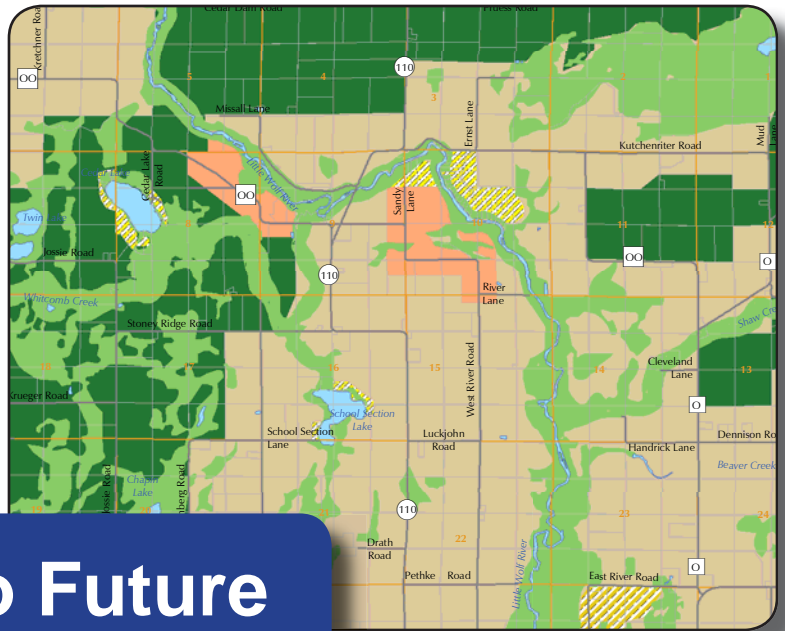# Citizen's Guide to Future Land Use Mapping

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Center *for* Land Use Education

Center for Land Use Education

United States Department of Agriculture

NRCS Natural Resources Conservation Service

Global Environmental Management EDUCATION CENTER

UW Extension

UNIVERSITY OF WISCONSIN STEVENS POINT

Cover photo credits: (top) Future Land Use map developed by the Town of Union Plan Commission; (center) staff photo; (bottom) collage of charts from UW-Madison, LICGF.

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Disclaimer

Maps crafted by Foth and Van Dyke are applied in this document as part of a partnership between Waupaca County and the Center for Land Use Education. The Center for Land Use Education provided technical and educational services in the Waupaca County Comprehensive Planning Process. Map documents are owned by Waupaca County and its municipalities.

Introduction

Have you ever wondered how planners create the future land use map? You know – that map that shows what the community wants to look like 25 years from now. It shows where the community wants houses to develop and where they want to protect farmland and open space. This guide is for citizens, plan commissioners, and local public officials that wonder, "How is a future land use (FLU) map developed?"

After reading this guide you will:
- Know what a future land use map is
- Recognize the information and techniques used to develop a preferred FLU map
- Understand how the public can be involved
- Learn how to use the FLU map for effective decision-making

Though this guide is not intended to make experts out of citizens, it should equip them to more effectively work and communicate with professional planners.

What is a Future Land Use Map?

Map of a Community's Desired Future

The FLU map shows a community's preference for how it wants to use its public and private lands within a given timeframe, commonly 25 or more years. The map shows the community's shared vision regarding where houses and businesses should be built, where farmland and other open spaces should persist, and where recreational opportunities should expand, among others (see Figure 1).

Not an Exact Prediction

The FLU map is not an exact prediction of future land use patterns, although planners do use forecasting and analysis tools to allocate land uses in probable locations. FLU mapping instead estimates what the community may look like if population, housing, and employment forecasts prove true, and if land policies, implemented to reach the desired future, are successful. Human behaviors are difficult to predict because they are not dictated by biophysical factors alone (i.e., food, water, shelter). The ways humans make decisions, hold values, develop culture, and use technology influence how land is allocated and make accurate forecasting difficult. For example, it is unlikely that planners could, with any accuracy, predict the closing of a large corporate plant over a 20-year time span.

Guide for Policy Making

The FLU map is not a policy, but rather a guide for land use policy making. Planning officials should aim to develop land policies that work to achieve the desired future land use pattern delineated on the FLU map.

Since the FLU map is the community's collective vision of their preferred future, it becomes the local governing body's responsibility to implement policies that help to make the community's vision a reality.

Not an Official Map or a Zoning Map

The future land use map should not be confused with an official map or a zoning map. Whereas a FLU map is used as a guide for policy making, official and zoning maps are actual policy documents designed to achieve a preferred future. An official map may show existing and planned streets, highways, historic districts, parkways, parks, playgrounds, railroad right-of-ways, waterways, and public transit facilities. A zoning map displays where zoning district boundaries are located. The zoning map accompanies text that describes what uses are permitted or conditionally permitted within each zone.

Indicator of Policy Performance

The adopted FLU map can be used as a measurable indicator of land policy performance. As land uses change subsequent to planning, changes can be monitored in comparison to the adopted FLU map. Local planners and commissioners use the comparison to identify if land uses are changing in the locations and in the amounts desired, according to the plan. If land uses are not changing as planned, local officials must reconsider land policies or reassess planning goals and objectives.
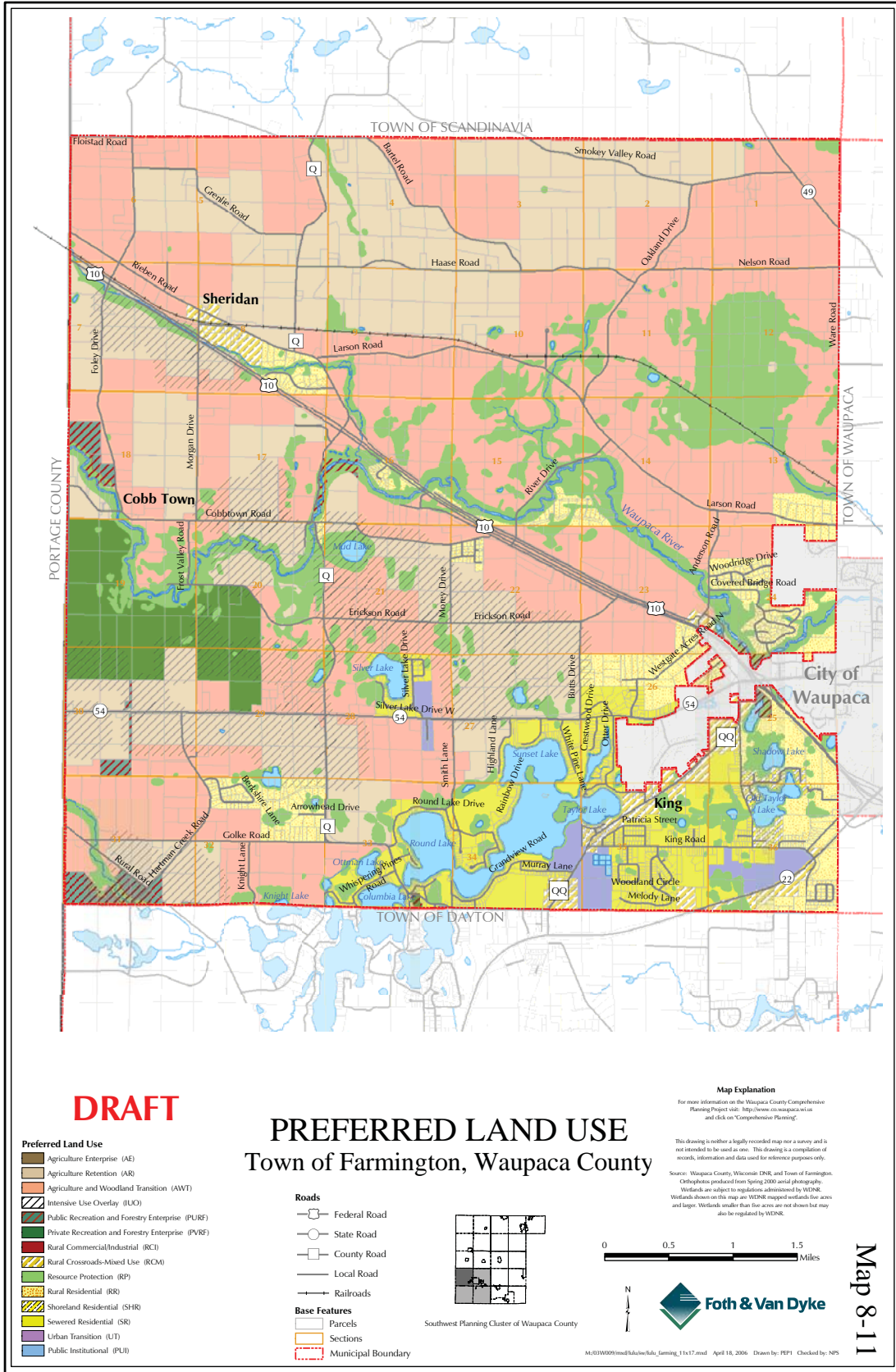
Figure 1. Future Land Use Map, Town of Farmington, Waupaca County. Courtesy Foth & Van Dyke.

FLU Mapping is Part of a Process

FLU mapping is part of a land use or comprehensive planning process. A rational approach is commonly used to tackle land use and comprehensive planning in discernible stages.[1] CLUE describes a rational approach for preparing a plan in five stages:

1. Data Collection and Analysis: Data is collected and analyzed to help decision-makers base judgments on good information.

2. Issue Identification: The public identifies issues, opportunities, and desires to help planners focus the planning effort on relevant community concerns.

3. Goal and Objective Setting: The community sets goals and objectives to address identified planning issues.

4. Strategy Formulation: Land policies, educational strategies, and physical designs are crafted and assessed to attain

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[1] For simplicity, CLUE describes a rational approach to planning in linear fashion. In practice, however, planning happens iteratively to address additional needs and new information.
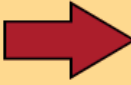
Figure 2. FLU Mapping in the Planning Process

Planning Phases	Pre-Planning			
Planning Stages	Community Diagnosis	Process Design	Stage 1 — Data Collection & Analysis	Stage 2 — Issue Identification
Planning Tasks (related to future land use mapping)	• Determine purpose and readiness for planning. • Explore preliminary issues and concerns. • Profile existing plans and implementation tools for their effectiveness. • Build capacity to conduct planning. • Identify participants and stakeholders.	• Design the planning process . • Identify opportunities for public participation and education. • Establish roles, responsibilities, and membership of groups involved in planning. • Establish budget and identify funding sources.	• Collect "place-based" data (i.e., land use, land cover, soils, etc). • Collect population, housing, and employment forecasts. • Develop current land use, trends, and patterns, maps. • Inventory current land uses and existing land features.	• Identify key community issues, challenges, opportunities and desires. • Verify and support issues using local data and analyses .
Public Participation (selected examples— not an exhaustive list) (communities should select methods relevant locally)			• Public awareness and education. • Public mapping exercise. Community members verify accuracy of maps and current land use data.	• Public awareness and education. • Public forum, focus groups, or workshops to identify community issues, opportunities, and desires.

community goals and objectives.
5. Plan Review and Approval: A public hearing is held to voice concerns and comments about plan strategies. The Plan Commission recommends the preferred plan to the local elected body for adoption.

A tangible FLU map commonly emerges in the "Strategy Formulation" stage, however, the other stages are critical to the development and approval of the FLU map (see Figure 2.)

Planning			Post-Planning	
Stage 3 **Goal & Objective Setting**	**Stage 4** **Strategy Formulation**	**Stage 5** **Plan Review & Approval**	**Implementation**	**Monitoring & Assessment**
• Set goals and measurable objectives related to planning issues. • Develop measurable indicators to monitor progress towards stated goals and objectives.	• Develop alternatives to meet goals and objectives. • Identify places suitable for achieving goals and objectives. • Identify possible implementation strategies. • Assess the environmental and social impacts. • Select preferred alternative and strategies.	• Present plan for public review. • Modify plan to resolve inconsistencies and reflect public concerns. • Plan commission recommends final draft of plan for adoption. • Governing body holds public hearing and formally adopts plan.	• Develop or amend required implementation tools. • Apply implementation strategy.	• Monitor progress towards achieving stated plan goals, objectives and indicators. • Review and revise plan and associated implementation tools as needed.
• Public awareness and education. • Public input to provide opportunity for public to voice concerns over goals and objectives. • Community plan commission to set realistic and measurable goals and objectives.	• Public awareness and education. • Public selects relevant development constraints. • Interactive GIS. Public reviews and modifies FLU alternatives. • Community plan commission modifies and selects preferred alternative.	• Public awareness and education. • Public hearing to garner public input concerning the plan.		

How is a Future Land Use Map Created?

This guide describes the process of creating a FLU map in three phases:
1. Explore the Landscape
2. Measure the Future Demand for Land
3. Develop and Assess FLU Alternatives

Phase I. Explore the Landscape
Where are we now? Where have we been?
Before looking to the future, planners often ask, "Where are we now and where have we been?" Understanding the present and the past are essential before mapping the locations of future land uses. Information about existing conditions and past trends provides valuable insights into where a community might be headed. Maps are a good way to deliver this information. Maps help the public, officials, and planners communicate more effectively with each other. The existing land use map and other thematic maps help planners and citizens alike take inventory of their communities, learn from it, and use it to make better future land use decisions.

Existing Land Use Map
The Existing Land Use (ELU) map is a typical product that emerges out of a comprehensive or land use planning process. It displays the location and extent of various land uses, such as residential, commercial, parks, and agriculture under current conditions, usually a date in the recent past (see Figure 3).

Data
To map ELUs, planners begin with data available to them. Ortho-rectified aerial photography, or orthophotography, and tax parcels are both useful for mapping ELU. With orthophotography, technicians delineate land uses into distinct geographic areas by examining, interpreting, and then digitizing areas of the photo. For example, if the technician who examines the photo sees a roof, lawn, and a driveway, she will digitize (digitally draw) a polygon around that area and record it as "residential" in the database. With parcels, a tax assessor personally examines the property, identifies land uses, their acreages, land and structural improvement values, and then records it for the entire parcel (see Table 1 on page 10).

When digital data are unavailable (now rare in Wisconsin), hardcopy land use maps can be used as a starting point. Hardcopy maps likely show ELUs from an earlier time and must be physically verified for accuracy using a windshield survey. The technician will physically take the map and drive the landscape looking for changes to land use. Other data, such as permitting records can also be used to identify changes that have occurred after the hardcopy map was published.

Land Use Classification
Land use classification codes represent land uses on the map. Once a technician identifies and interprets an area on the ground, she labels that area according to a classification. There are several standard

DRAFT

EXISTING LAND USE
Town of Farmington, Waupaca County

Existing Land Use Classifications

- Residential
- Multi-Family Housing
- Mobile Home Parks
- Farmsteads
- Group Quarters and Elder Care
- Commercial
- Agriculture
- Other Open Land
- Woodlots
- Parks and Recreation
- Utilities
- Institutional
- Industrial
- Mines/Quarries
- Transportation
- Water

Roads
- Federal Road
- State Road
- County Road
- Local Road
- Railroads

Base Features
- Parcels
- Sections
- Municipal Boundary

Map Explanation

This map displays data regarding the use of land as of 2004. Lands are classified based on their use as residential, commercial, industrial, woodlands, agricultural, recreational, institutional, or transportation. This is not a planned land use or future land use map. Rather, this map shows the physical arrangement of land uses at the time the map was produced.

This map can be used as a reference for comprehensive planning purposes. The data shown on this map include the types, amounts, densities, and physical arrangement of existing land uses. These existing land use data provide important reference points used in planning for the types, amounts, densities and physical arrangement of future land uses.

For more information on the Waupaca County Comprehensive Planning Project visit: http://www.co.waupaca.wi.us and click on "Comprehensive Planning".

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data used for reference purposes only.

Source: Waupaca County, East Central Regional Planning Commission, and Town of Farmington.

Southwest Planning Cluster of Waupaca County

0   0.5   1   1.5 Miles

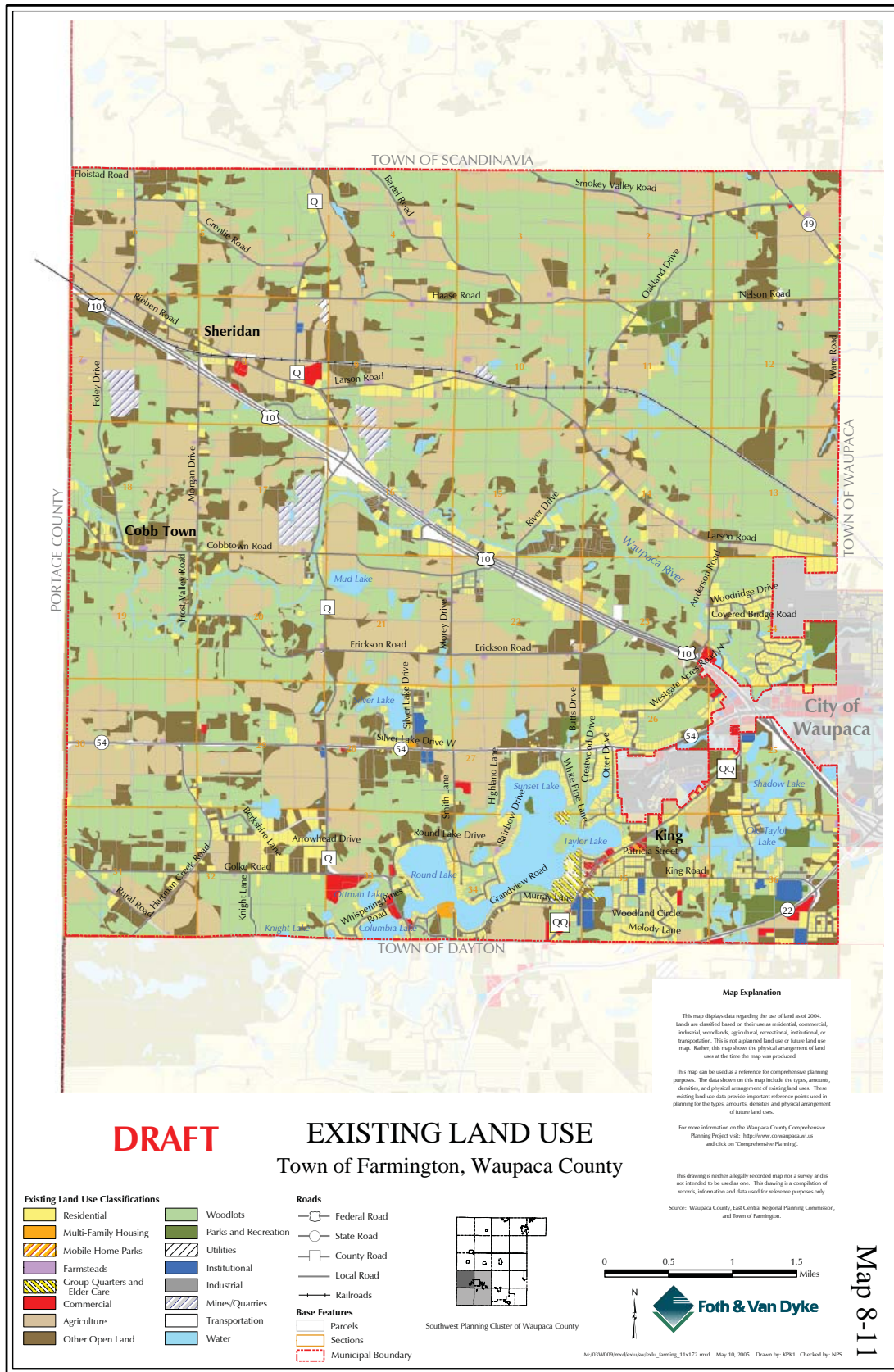**Foth & Van Dyke**

Map 8-11

Figure 3. Existing Land Use Map, Town of Farmington, Waupaca County. Courtesy Foth & Van Dyke.

Table 1. Benefits and Drawbacks of Tax Parcels and Interpreted Orthophotos for Identifying Existing Land Uses. The green cells indicate benefits, the red cells drawbacks and the white cells are neutral.

	Tax Parcels	Orthophoto Interpretation
Data Updates	Updated at land transaction.	Updated when a new aerial flight is budgeted, planned, and flown, new photographs are shot, and interpretation is completed. Time intervals vary.
Costs	Costs are built into the land records keeping and tax assessment process.	The process of planning, flying, stitching photographs, and then interpreting photographs is expensive.
Accuracy	Accuracy lies with the tax assessor.	Accuracy lies with the photo interpreter.
	Incorrect classifications that error on less valuable property are not likely to be contested.	Better suited for mapping natural resource-based land uses.
	Multiple land uses within single parcels are identified and acreage is noted in the database, but their locations cannot be identified within the parcel.	Delineates multiple use landscape based on photo inspection.
	Identified residential parcels 42.9% more accurately than aerial photo interpretation (Carlson).	
Flexibility	Basic classification defined by the Department of Revenue. Can lead to consistency among various communities' maps.	Various pre-defined or locally defined classifications can be used. Land use classifications can range from very basic to very specific.

coding schemes that can be applied to classify land uses. The American Planning Association has created a coding scheme called the Land Based Classification Standard (LBCS) that classifies the Activity, Function, Structure, Site Development, and Ownership of the land. For classifying land use, the activity and function codes are predominantly used. The WI Department of Revenue has codes which tax assessors follow to assess real estate and are attached to parcel data (see Table 2). Other coding schemes are also used. For example, Bay-Lake Regional Planning Commission developed their own classification system in 1975 based on Standard Industrial Codes. Planners sometimes deviate from standard classifications when it benefits their clients or better represents local land uses. Planners, however, strive to apply classifications in a uniform fashion. Using uniform classifications allows communities to more easily compare their land uses and identify actual similarities and differences.

Planners try to limit the number of classifications they use, especially for FLU mapping. Limiting the number of classifications helps make map reading and decision-making more manageable, but conversely limits the amount of information available to make decisions. Therefore, ELU maps often contain a higher number of classifications than FLU maps.

Thematic Maps
In addition to the ELU map, other map products are created that also support

Table 2. Land use classification examples (Department of Revenue and Land Based Classification Standards)

Department of Revenue Tax Assessment Codes

Type	Class	Code
Residential	1	A
Commercial	2	B
Manufacturing	3	C
Agriculture	4	D
Undeveloped	5	E
Agriculture Forest	5m	5m
Forest Lands (Prod)	6	F
Other	7	G

Land Based Classification Standards

Note: Only the Function codes are displayed below. LBCS has classifications for Function, Activity, Ownership, Site, and Structure. These classifications, their definitions, and color coding suggestions are found at http://www.planning.org/lbcs/ .

Function Codes
1000 Residence or accommodation functions
2000 General sales or services
    2100 Shopping
        2110 Goods-oriented shopping
        2120 Service-oriented shopping
    2200 Restaurant-type activity
        2210 Restaurant-type activity with drive-through
    2300 Office activities
        2310 Office activities with high turnover of people
        2320 Office activities with high turnover of automobiles
3000 Manufacturing and wholesale trade
4000 Transportation, communication, information, and utilities
5000 Arts, entertainment, and recreation
6000 Education, public admin., health care, and other inst.
7000 Construction-related businesses
8000 Mining and extraction establishments
9000 Agriculture, forestry, fishing and hunting

Figure 4. Town of Union Plan Committee uses thematic maps to help make decisions.

FLU mapping. Maps that display natural, cultural, and historic resources, ownership patterns, land use trends, and an endless host of other thematic maps can be created to learn more about the community and how it could grow or change. In Waupaca County 2003-2007, thematic maps were used by local plan commissions to make future land use and policy decisions (see Appendix A and Figure 4).

Other maps analyze land use patterns and trends to help planners and the public better understand, "How did we get where we are?" and "Where have we been?" Two maps, created by the UW-Madison, Land Information and Computer Graphics Facility, provide great examples. One map identifies a unique residential land use pattern just outside Madison, Wisconsin. After further inspection, planners noted that development was attracted here in

large part due to the glacial end moraine. The moraine provided soils suitable for septics and access to scenic vistas of rolling farmlands and forests (see Figure 5). In addition, this area is outside of the city of Madison's extraterritorial jurisdiction.

The second map displays changes in developed land uses over a three-decade timeframe (see Figure 6). Historical land use data uncovered that development in Dane County has become more sprawling and less dense over time. With information from analyses like these, local decision-makers have the best possible information to make important land use decisions about the future.

How is the Public Involved?
Planners know by experience that existing land use data and other thematic data are not 100 percent accurate. For example,
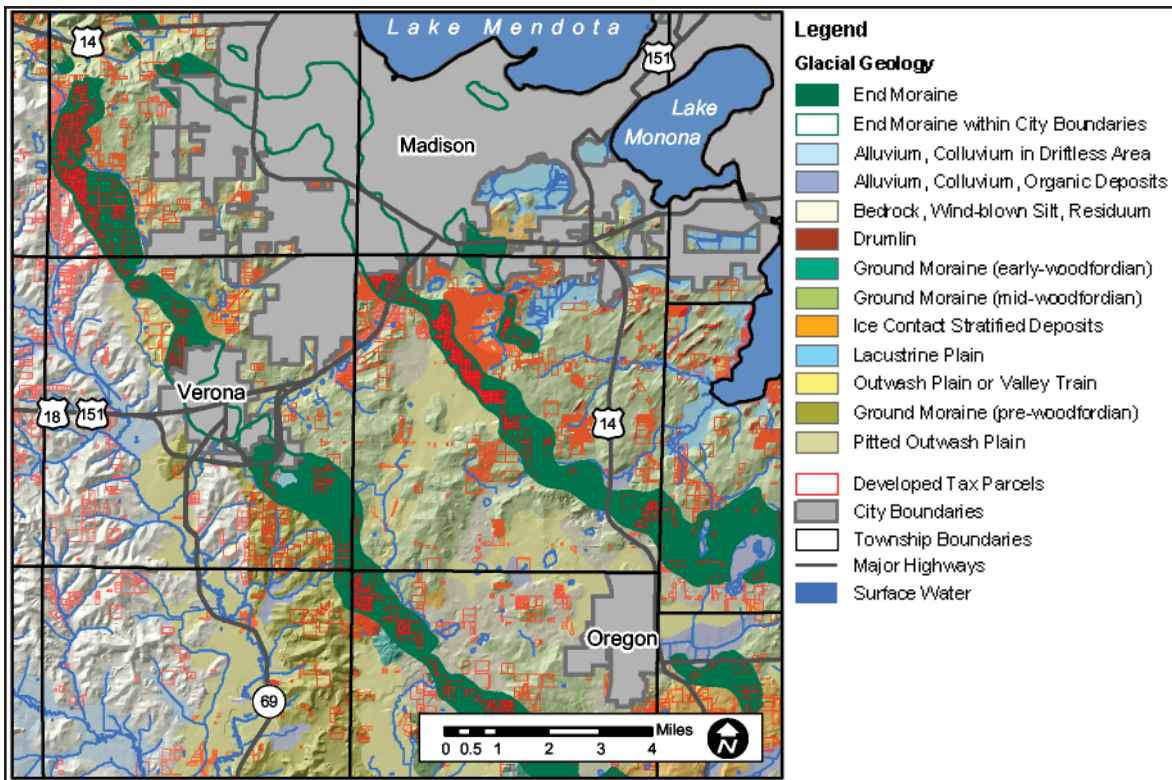

Figure 5. Glacial driven development. Courtesy UW-Madison, LICGF, Created by Douglas Miskowiak, 2000.

HOW IS A FUTURE LAND USE MAP CREATED?

orthophotos can be misinterpreted and changes might have occurred since data were last acquired. Map information and its accuracy are important to the credibility of the process. Maps are planning products that the public can relate to, because they see how the map affects or relates to places they know. Mark Walter, the director of Bay-Lake Regional Planning Commission, put it this way. "Maps should bring about a certain amount of confidence that the public can connect to the remainder of the process. If the credibility of the maps is questionable, the credibility of the entire process can come into question."

To help, the public is often involved to ensure that data are accurate. Because local plan commissioners and members of the public have an intimate knowledge of their community, they are well suited for updating and revising maps. In Waupaca County, each local planning commission was responsible to check each map for accuracy. Commission members identified errors on the map and sent them back to the consultant to make changes. For existing land uses, a windshield survey is often used to check the accuracy of the map. Planners or citizens conducting a windshield survey typically compare a draft hardcopy ELU map by inspecting land uses while driving along local public roadways. When an area of the map differs with that on the landscape, the discrepancy is noted on the map and changes are made in the computer database.

Involving the public to check data provides an opportunity for public understanding and ownership of the data. Involving local

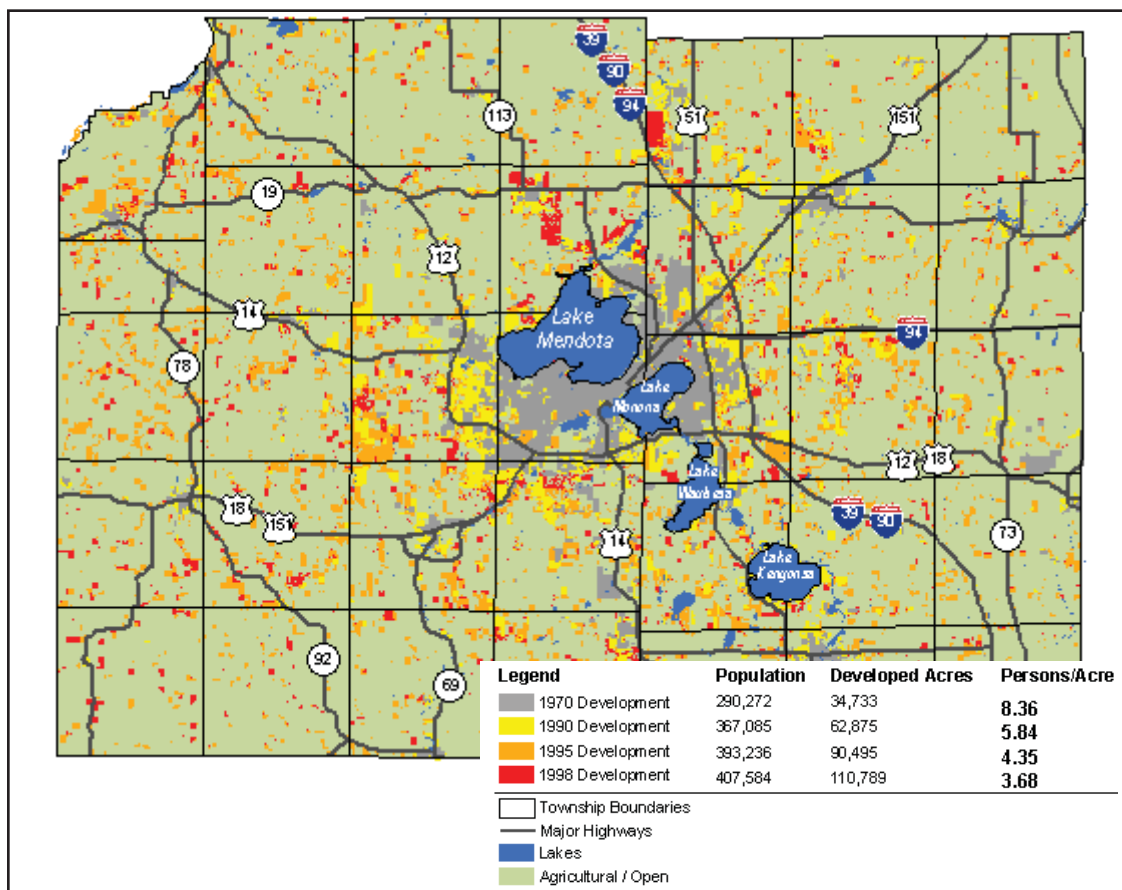| Legend	Population	Developed Acres	Persons/Acre
1970 Development	290,272	34,733	8.36
1990 Development	367,085	62,875	5.84
1995 Development	393,236	90,495	4.35
1998 Development	407,584	110,789	3.68
Township Boundaries			
Major Highways			
Lakes			
Agricultural / Open			

Figure 6. Patterns of Development: 1970-2000. Courtesy UW-Madison, LICGF, created by Douglas Miskowiak and Math Heinzel, 2000.

commissioners and citizens not only helps the planner, but builds the capacity of the public as well. Helping to update data helps the public better understand the data, know how it is created, know what it represents on the land, and understand its limitations. Helping to build the data also gives decision-makers greater confidence in using the data for decision-making.

Phase II. Measure Future Demand for Land

How much land is needed?

New houses and businesses require land. New residents and business owners demand more public services and amenities, such as roads and community parks. These uses also require land. Communities seeking to maintain or grow their agricultural, forestry, and tourism-based economies must allocate land to accommodate them. Land uses consume land. In Phase II, planners estimate how much land is needed to support these future uses.

Decision-makers need to know if land policies are realistic. By estimating how much land is needed to support future land uses, planners provide decision-makers with a reality check. Can the community absorb 250 new houses at "two-acre minimum" densities, grow their agricultural economy, and still protect the natural and cultural resources that residents value? Estimates of land demand compared to available land supplies offers fundamental information to base good decisions.

How is Demand for Land Measured?

Future Residential

Measuring future demand for residential land is common in comprehensive planning. To measure how much future residential land is needed, planners determine two things:

1. How many housing units are expected?
2. At what density will housing units be developed?

To identify how many future units are expected, planners collect information about human populations, households and housing units.

- Population Projections: Estimates of future populations based on past trends of births, deaths, and migration in and out of communities.
- Households: A measure of the actual number of households in a community not including group quarters. A household includes all persons who occupy a room or group of rooms as their separate living quarters. A residence where ten or more unrelated persons live is considered a group quarters.
- Housing Units: An estimate measure of the total number of houses, apartments, group of rooms or a single room intended for occupancy as a separate living quarters authorized by building permits. Group quarters and transient living quarters, such as nursing homes or motels and mobile homes are excluded from U.S. Census estimates (http://quickfacts.census.gov/qfd/meta/long_241962.htm.)

Once planners acquire population and household data, they compare it to acreages of existing residential land use to identify the current trend. This method of measuring residential demand for land is labeled the "ratio method." Many planners use this method for assessing future residential demand in comprehensive plans.

If planners know:
- Existing population, households, or housing units,
- Existing residential acreage, and
- Future population, households, or housing units

Planners can then identify:
- How many residential acres are needed in the future, under this trend or at various other densities

For example, in 2000 the Town of Helvetia in Waupaca County had 649 people and 362 housing units. Existing residential acreage in 2000 was 374 acres. In 2000, just over one acre of land is consumed for every housing unit. If that trend continues over the next 30 years and 200 housing units are added, then 200 acres of residential land will be consumed. If density decreases to ten-acres per housing unit, then Helvetia should expect to allocate 2,000 acres of residential land.

Future Commercial and Industrial

The process used to measure demand for future commercial and industrial land varies depending if the community is urban or rural. Planners interviewed in 2005 all state, with reservations, that they measure future demand for commercial and industrial land using the ratio method. Business growth, especially in rural areas, is sporadic. Predicting growth with accuracy is difficult. The relationship between job growth and land needs is far less linear than that between population growth and land needs. To compensate, planners rely on the local public to help provide a better estimate of what they predict or what they want to come to the community.

In urban areas or highly urbanizing rural areas, the ratio method may not prove any more accurate, but planners can conduct more sophisticated analyses to measure business demand more accurately. The U.S. Census Bureau has data available to better analyze trends in commerce and industry. The Census Bureau conducts an economic census that provides statistics on local employment and business. Using data like these and conducting other analyses in the community can help uncover how many jobs are expected and how many square feet of new business space is needed. These statistics can then be converted into acreage of land needed to accommodate future business.

Future Parks and Open space

Parks and open spaces provide opportunity for recreation, tourism, and even wildlife habitat. The value of park and open space is attributed to enhancing physical and emotional health and economic development. Communities determined to maintain or increase quality of life and economic development will consider assessing demand for parks and open spaces. Decision-makers need to know if the needs of residents and other resource users are met. Do existing resources meet current needs? What resources are needed to accommodate the future needs of our residents, children, tourists, and sports enthusiasts?

Professional planners commonly use three approaches to assessing needs for parks and open space.

Standards Approach
The standards approach compares a community's park and open space resources to a national minimum standard, commonly set by the National Recreation and Park Association (NRPA). This approach measures the number of facilities,

Table 3. Dodge County Parks Assessment

Space (Acreage) Needs: Dodge County 2000-2020

Type of Park	Existing Acreage	Standard	Minimum to meet Standard		Amount Above (or Below) Minimum Standard	
			2000	2020	2000	2020
Neighborhood:						
Playgrounds	93.6	2.5/1000 People	214.7	246.3	(121.1)	(152.7)
Parks	106.7	2.5/1000 People	214.7	216.3	(108.0)	(139.6)
Subtotal:	200.3	4.5/1000 People	386.5	443.3	(186.2)	(243.0)
Community:						
Playgrounds	755.4	3.0/1000 People	257.7	295.5	497.7	459.9
Parks	529.0	5.0/1000 People	429.5	492.6	99.5	36.4
Subtotal:	1284.4	8.0/1000 People	687.2	788.1	597.2	496.3
County:						
Parks	382	4.0/1000 People	343.6	394.1	38.4	(12.1)
Totals:	**1866.7**	**16.5/1000 People**	**1417.3**	**1625.5**	**449.4**	**241.2**

* Average inventory records include Harnischfleger County Park purchased in 2004.

playground equipment, or number of open space acres to a number of people. Dodge County uses this approach to assess their parks (see Table 3). For example, Dodge County falls 121.1 acres short of meeting the minimum playground standard of 2.5 acres per 1000 people.

Demands Approach
The demands approach assesses needs by studying the users of parks and open spaces. Public participation methods are used to identify if current resources are adequate or if additional facilities are desired by users. Bay-Lake Regional Planning Commission asks community members about what they desire before assessing needs for future parks and open spaces. After hearing from the community, planners at Bay-Lake can better assess how much land is needed for parks and open space in the future.

Resource Approach
The resource approach entails identifying specific areas where new parks and open spaces are appropriate based upon their unique or exceptional characteristics. The resource approach is helpful to a community vying to market to residents and tourists based on physical and natural resources. Dane County Parks Department uses the resource approach to identify unique natural resources for protection that fit broader community goals and objectives.

Future Productive Agriculture and Forest Lands
Measuring future demand for productive agricultural and forest land is not common in comprehensive planning. Some communities see agriculture and forestland as a bank of empty land available for new homes and businesses. Communities, however, are starting to recognize the value of agriculture and forestry to local economies. For example, in Marathon County, agriculture accounts for 12 percent of the total workforce and 15 percent of

total economic activity or $1.25 billion annually.

As competition for land increases, communities will need to measure farmland and forestland as developed uses that also consume and compete for available land. The approach used to measure demand for these uses will depend upon the local community's desires, resources, and needs. For example, if a community desires to keep local farms, dairies, and cheese makers competitive they might consider measuring local milk supplies. They might ask, "How many cows are needed to meet the local demand for milk?" Planners can then measure how much land is needed to feed those cows and safely spread wastes. Communities interested in buffering residential uses from the smells and noises of farms will consider how much land is needed to provide an adequate buffer. A 100 foot buffer of farms can consume hundreds of acres per township. An analysis can determine if this policy is realistic.

> Sometimes, however, the public's desires compete for limited land... In this instance, the public must communicate with planners to search for alternative solutions and make tradeoffs...

For forests, communities might consider assessing at what point forestland becomes unprofitable or presents significant barriers for timber harvest. If a community parcels off their forest lands for development, even in 10- or 40-acre segments, will timber companies find managing smaller parcels worthwhile? In this instance, instead of measuring total forested acres, planners instead will measure forest lands in large contiguous masses.

How is the Public Involved?

The public is often involved to provide input about what they desire about their communities. Planners can collect this information through various public participation tools, such as a survey or a public meeting. Public input may reveal a host of information that might include a:

- Strong desire to protect farmland,
- Satisfaction of existing parks and open space, or
- A preference for low density development

Planners interpret this data and use it to help identify how public preferences relate to future demand for land. For example, if existing parks are overcrowded, planners may allocate more acreage per person in future estimates. Sometimes, however, the public's desires compete for limited land. For example, remaining land supplies may not be able to accommodate both low density housing and still protect critical amounts of farmland. In this instance, the public must communicate with planners to search for alternative solutions and make tradeoffs (i.e. higher densities or develop more farmland).

Phase III. Develop and Assess FLU Alternatives

Where to Grow? What are the Consequences?

In the final phase of FLU mapping several alternatives are developed then assessed with the goal of deriving a single preferred FLU map. In this phase, land uses are allocated and boundaries are drawn on a map. Once alternatives are developed, a host of indicators can be measured to determine the scenario's impact on the community and its resources. Indicators might include: acres of land consumed, traffic generated, school children added, water quality, or what the community might look like.

Developing and assessing FLU alternatives provides planners and the public a glimpse into an alternative future. Density proposals, land policies, and public preferences can be tested through computer modeling. In this phase, scenarios are adapted until a preferred FLU alternative is derived.   The preferred alternative is adopted in the community's comprehensive plan. It should display the public's shared vision of the future and reflect community goals and objectives.

How are FLU Alternatives Developed?

Three actions are taken to develop and assess a single FLU alternative. They include:
1. Measure available land supplies
2. Allocate land uses on a map
3. Assess the consequences

1. Measure Available Land Supplies

Measuring land supply serves to inform decision-makers about the adequacy of available lands to accommodate future land uses. Here, two methods are described that are commonly used by professional planners.

Method A: Measuring Existing Land Uses

Many professional planners use existing land uses as a rough gauge of land supply. Each land use category is measured, commonly in acres. Active land uses, such as residences, businesses, infrastructure, and parks are commonly considered unavailable for development. Passive uses, such as farm and forest land are labeled as potentially available and open for new development.

This method does not adequately consider in-fill development and property ownership, and confuses the difference between existing land use and available land supply. For example, the existing land use map will not identify dilapidated residential properties that are candidates for redevelopment. Conversely, because many existing land use maps do not display property boundaries, they do not determine realities linked to property ownership. For example, the ELU map might show a five acre property that has two acres developed as residential and three acres forested. Those three forested acres are often considered available for development with this method. In reality, the intent of the entire five acres is for private residential. It is unlikely that the remaining three acres of forest will be actively managed for timber. It is also unlikely that the owner's intent is to split the parcel further. Many zoning ordinances also restrict further splitting. The remaining three acres is likely unavailable to accommodate new development within the timeframe of the current plan.

Method B: Constraints or Growth Management Factors Analysis

A Constraints, or Growth Management Factors analysis, is a more systematic way to measure available land supplies. The method entails defining and identifying land features that restrict, limit, or modify development from occurring on or near them. For example, surface waters and adjacent wetlands are land features that restrict development. In Wisconsin, development cannot occur on or within 75 feet of these features. Existing development including homes, businesses, and road right of ways are also considered land features that restrict development. Steep slopes, fractured soils, and productive farmlands are good examples of land features where development might instead be limited or modified. Perhaps a limited number of homes can be built in those places or development might be required to adhere to erosion or aesthetic regulations. The result of the analysis is measured to identify how much land is restricted and how much land is available to accommodate new growth.

This method provides a much more realistic estimate of land available for development that is tailored for each community, their resources, and public desires.

The analysis can be highly political and should involve the public to define the categories that restrict, modify, or limit development. Should steep slopes restrict rather than modify growth? Answers to questions like these rarely can be addressed sufficiently by professional planners alone. These issues must be wrestled with within the community. Decision-makers, with help from planners, should look back to community goals and objectives and input from public participation to properly define which category land features fall within. Members of an Ashland County planning committee in 2004 identified these categories and were surprised to see how much land was available for development even when various land features were restricted or limited (see Figure 7).
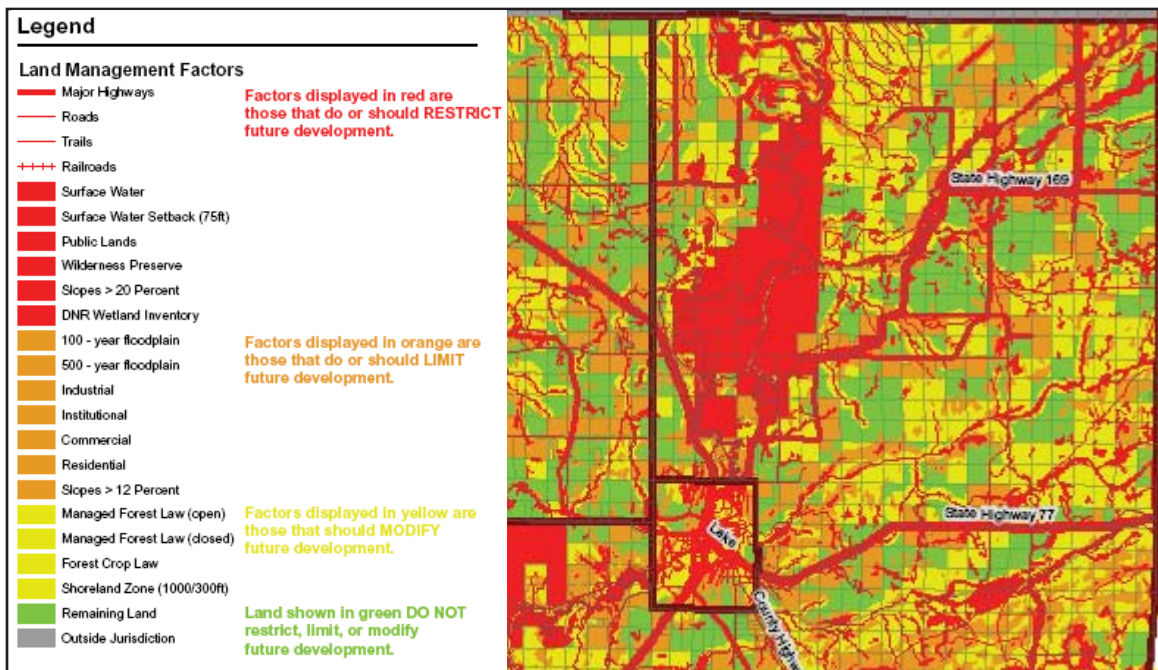

Figure 7. Ashland County Land Management Factors Map.

2. Allocate Land Uses on a Map

Once supply and demand for land is measured, it is time to begin allocating or placing land uses on a map. This phase is also referred to as scenario building. The result of this phase should be to build various alternative scenarios so they can be evaluated for how well they meet community goals and objectives.

Various methods are available to conduct land use allocation and scenario building. The University of Wisconsin-Madison, Land Information and Computer Graphics Facility (LICGF) describes four land allocation methods. These concepts are adapted from LICGF and synthesized below:

Method A: Gestalt Logic:

Users view the landscape as a single whole system and take all they know about the landscape and apply it for decision-making. Information available on maps is a good way to supplement individuals' knowledge about a landscape. Generally, Gestalt logic is applied manually, on paper maps. In Waupaca County, plan commissioners used a hardcopy map to manually draw "bubbles" or polygons that represent preferred FLU locations (see Figure 8). Gestalt logic is most useful for smaller scale applications. As geography becomes larger, it is increasingly difficult to analyze the landscape and make objective decisions. However, among those professional planners interviewed, Gestalt logic is the most commonly used allocation technique.

Methods B: Interactive:

Like Gestalt logic, users process information about an entire landscape and apply it for future land allocation decisions, but they apply the information in a digital format. Instead of manually drawing

Figure 8 displays an alternate method of bubble mapping using Gestalt logic. Instead of drawing bubbles on the map, this rural citizen is placing stickers that represent residential development on the map. Courtesy UW-Madison, LICGF.

polygons, they are digitized or captured in a Geographical Information System (GIS). GIS allows users to view a variety of land information to help them make better informed decisions. The GIS also allows users immediate feedback concerning the consequences of their decisions. In the Town of Verona in Dane County and the Town of Clover in Bayfield County, an interactive tool called "PlaceIt," helped plan commissioners make future land allocation decisions (see Figure 9a and 9b).

Figure 9a: Picture of people using Place-It on an interactive touch screen. Courtesy UW-Madison, LICGF.

Method C: Scenarios:
A user establishes criteria, restrictions, or preferences and then allocates development. This approach sets out to design an alternative future, and then asks, "What policies and conditions are required to achieve that future?" Although this approach is common, it may be difficult to identify all of the policies and conditions required to achieve the preferred option. This approach is often conducted using suitability analyses with GIS. Criteria and preferences are defined, often with public input, and then preferences are spatially located using GIS software and data. Depending on the type of suitability analyses technique used, each spatial area receives a score denoting the degree of suitability (Figures 10a and 10b).

Method D: Agents:
Future development is predicted based upon various policy options. With this method users ask. "What future might result if this policy is chosen?" Policy options and user preferences are identified and then run using the computer model. The outcome is what the future can be expected to be like, if future assumptions hold true and selected policies are implemented. The alternatives are then assessed for their consequences and measured in comparison to community goals and objectives.

3. Assess the Consequences

Good decision-making is well informed. Logically, local officials ultimately need to know what consequences are likely to result before decisions are implemented. What are the benefits and drawbacks of each alternative? Does one alternative consume more farmland than another? Does one alternative require more money than another to implement? Will more water and sewer services be required? What will it look like?

Figure 9b: Image of an Impact Report from Place-It. Courtesy UW-Madison, LICGF.
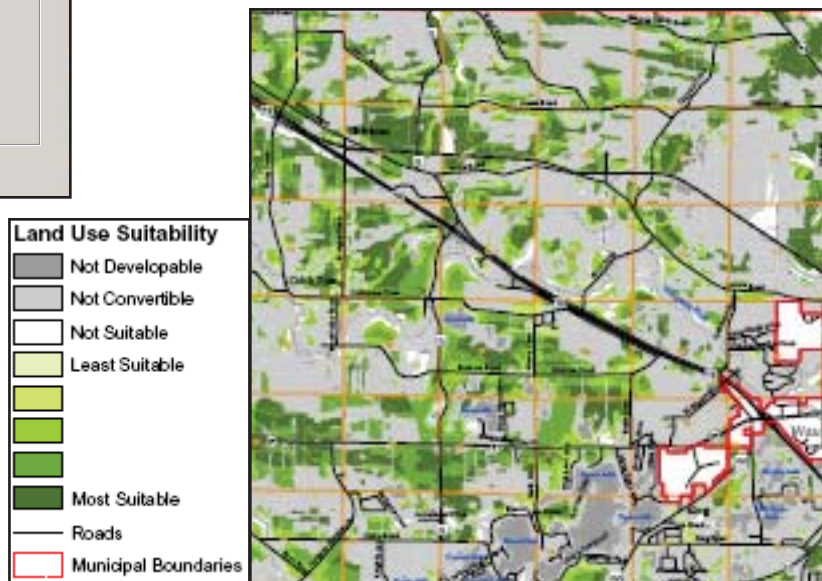

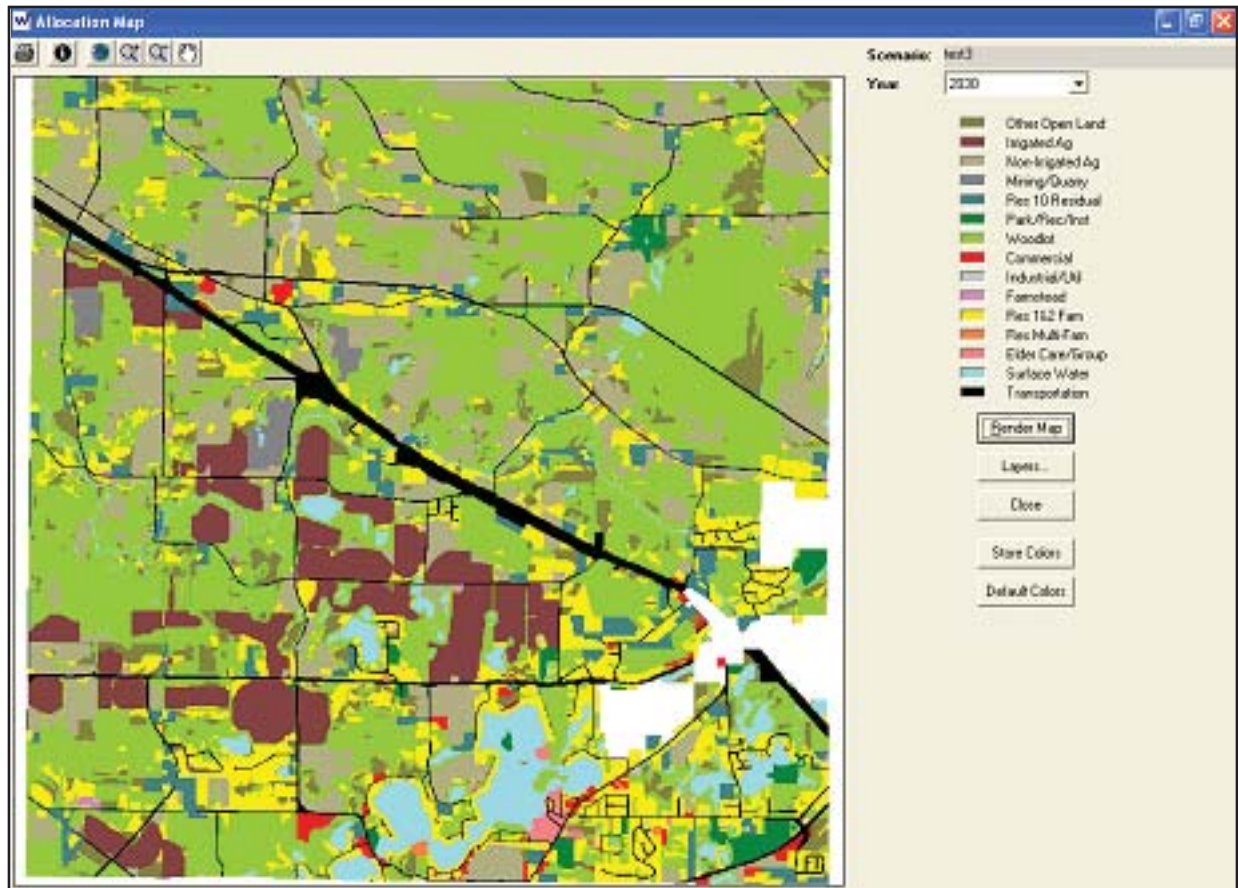Figure 10a. Residential suitability map created with What-If software.

Figure 10b. Future land uses allocated in a rural town using What-If software.

Questions like these can be addressed in the land allocation process using impact assessment tools. Among planners interviewed, however, most say they address the consequences of decision-making in an informal manner. Most consequences are discussed qualitatively rather than measured quantitatively. Issues such as farmland consumption, rural character, and service requirements are often discussed as potential impacts that typically accompany various development options.

For communities more interested in the hard numbers, technology is available to help conduct impact assessments. For example, a GIS can be used to simply add and compare the amounts of farmland consumed among alternatives to see which has the least impact. Other more sophisticated analyses can be developed to measure the impact impervious surfaces have on water quality or what various policy options look like in three dimensions (see Figures 11a, 11b, 11c, 11d, 11e, and 11f on the following pages). Information like this can help local officials make those unpopular or tough decisions. The technology can provide a level of confidence in decision making that is legally defensible and rational.

The type of assessment performed depends upon the issues and all too often the budget of local communities. MSA associates stated that they are technically capable of providing fiscal impacts analyses, housing market assessments, and cost benefits analyses, but communities must budget for them in the process.
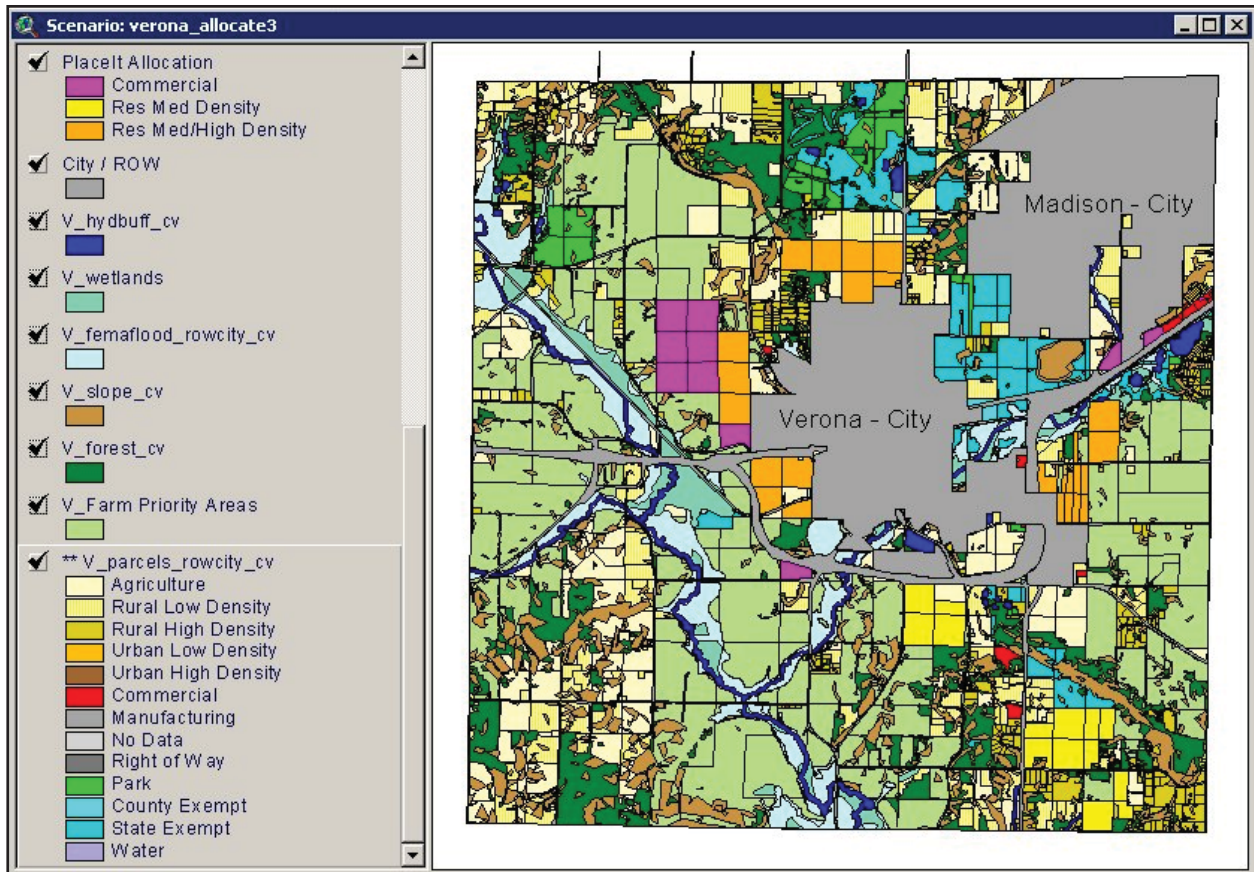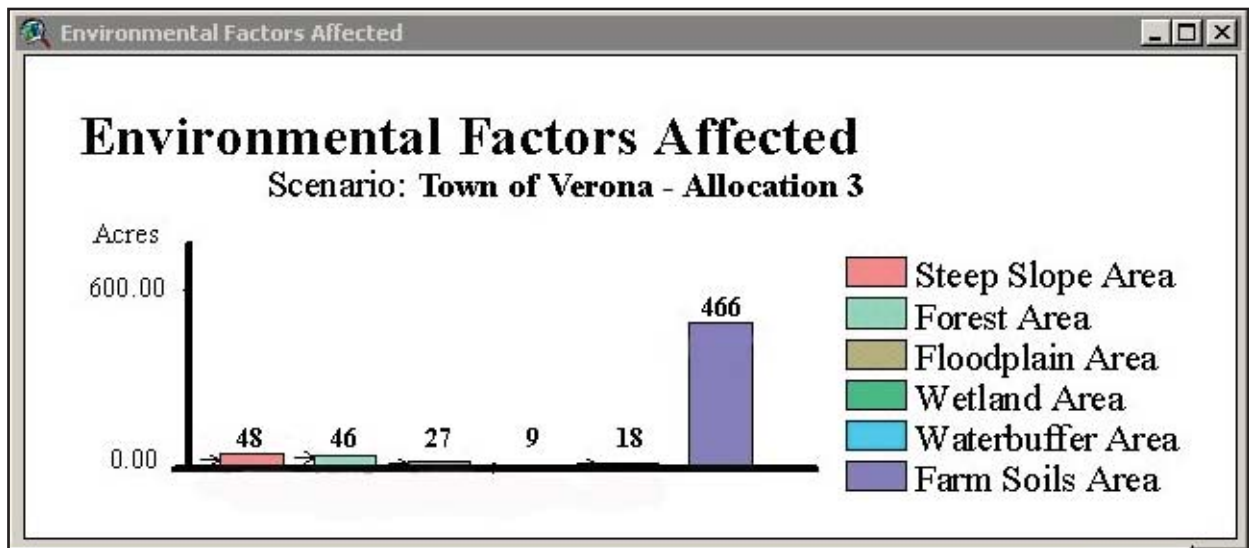
Figure 11a. Land Use Allocation Map

Figure 11b: Land Use Acreage consumed based on allocation shown in Figure 11a.
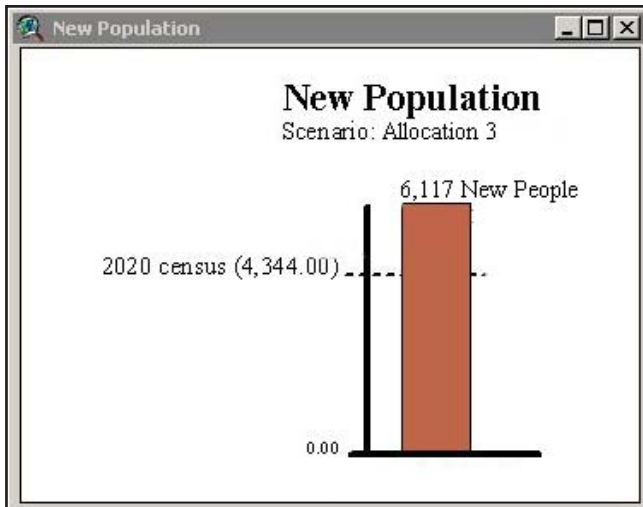
Figure 11c (above): Population added based on allocation shown in Figure 11a.
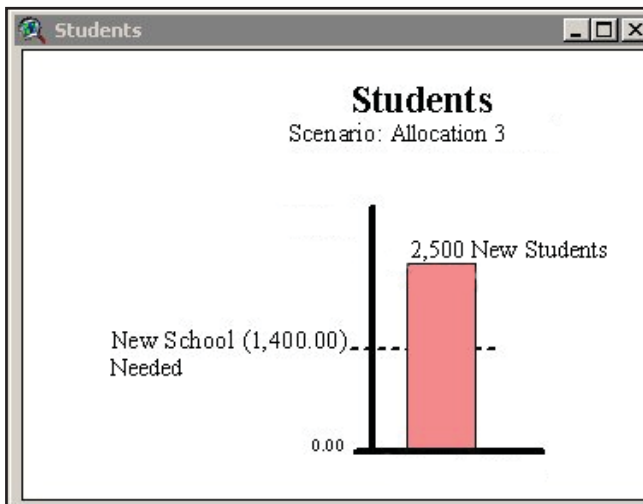

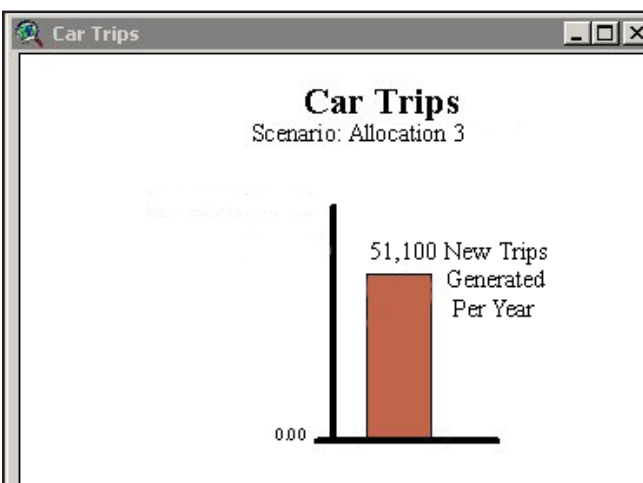Figure 11d (left): Students added based on allocation shown in Figure 11a.

Figure 11e (below): Car trips added based on allocation shown in Figure 11a.

How is the Public Involved?

At this stage in the planning process, there are often increased opportunities for public involvement. At a minimum, a public hearing is required by Wisconsin Statutes to provide the public an opportunity to view the commission's work and provide input.

Oftentimes, local planning processes provide public participation opportunities in addition to the minimum requirements. Very commonly the public is invited to attend the planning sessions when the FLU maps are being crafted. In Waupaca County, many local units have welcomed the public to craft FLU maps alongside appointed commissioners and professional planners. Many communities create the FLU maps themselves, often with support from professional planners.

The public isn't always able to be directly involved. Other venues, such as open houses are commonly used to provide an opportunity for public education and input. Here the public can view alternatives, ask questions, contemplate tradeoffs, and share their input and personal preferences.

Sometimes, communities prefer to hire a planner to draft several FLU alternatives rather than develop the alternatives themselves. Here the commission and the public have opportunities to review the options, ask questions, and alter, reject, or accept crafted alternatives. After the open house or other venue, planners use the input to craft new maps that better fit the community. Though this option means less work for local commissions, communication of preferences is essential for planners to develop a representative FLU map.
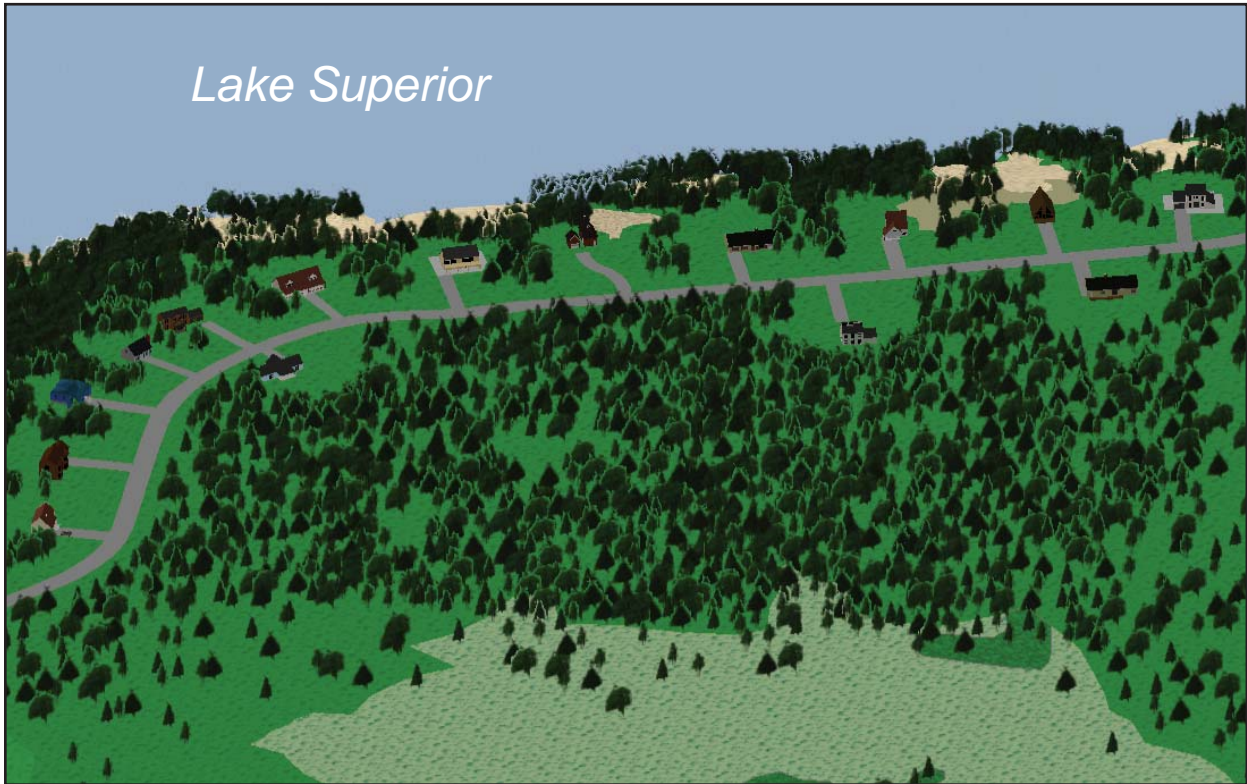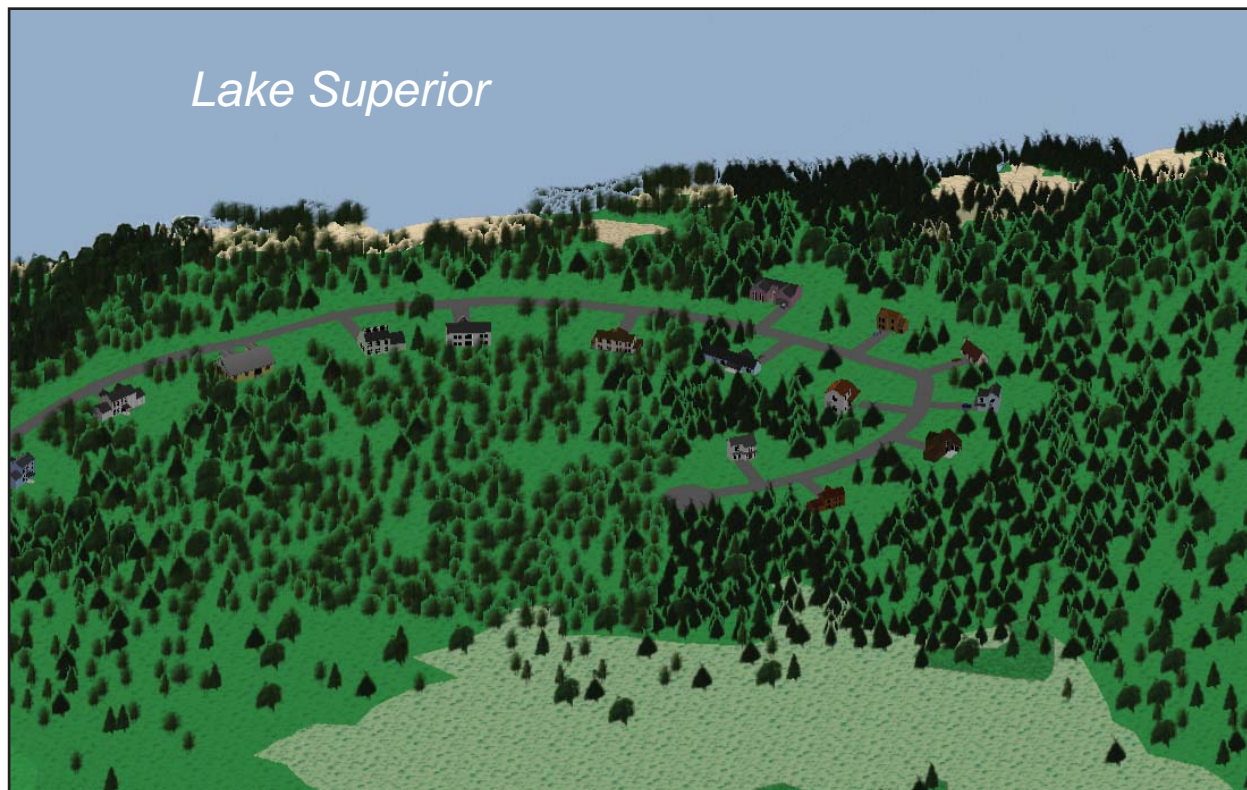
Figure 11f. 3-D Visualization showing two development scenarios. Above is a traditional subdivision. Below is a conservation subdivision. Visualizations created by Douglas Miskowiak and Gina John using ArcScene with data from Northwest Regional Planning Commission.

Conclusion

The FLU map is arguably the most important single document in a community's comprehensive plan. In a single image, it is used to illustrate the community's shared vision of what the future should be like. Ideally, it is created with masses of technical and scientific information and guided with robust public involvement. Although a process in and of itself, FLU mapping is part of the larger process of comprehensive planning. FLU mapping happens along each stage of a typical planning process.

The process often involves professionals, officials, and citizens. Each has a unique role in the creation of a realistic and attainable FLU map. Planners provide information about land supply and demand. Citizens bring to the discussion their preferences, expectations, and local knowledge. Planners apply these data and public input using a variety of allocation and assessment methods to build a realistic and defensible FLU map.

Based on certain physical and political realities, tradeoffs are commonplace. Some community preferences might need to be traded in order to achieve broader community goals. Once a preferred map is adopted into the plan, local officials then move toward implementing policy options to attain the plan's vision. Innovative implementation tools help communities find win-win solutions. Working together, planners, citizens, and officials can develop a FLU map that is legally defensible, rational, and works to help a community attain its goals.

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Interviews with Professional Planners.
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- James Engel, Colleen Steininger, Gary Gibson, and Bill Bailey from the Town of Luddington, Eau Claire County. Interviewed on April 13, 2005.
- Jason Lauman and Sheldon Johnson from North West Regional Planning Commission. Interviewed on April 14, 2005.
- Mark Walter and Richard Heath from Bay-Lake Regional Planning Commission. Interviewed on April 18, 2005.

Appendix A: Table of maps provided in the Waupaca County process

Waupaca County Comprehensive Planning Maps

The maps posted below helped inform local decision-makers about the many cultural, natural, historical, and agricultural features on the landscape. Maps from Waupaca County, developed by Foth and VanDyke, Green Bay, Wisconsin. For a closer examination of these plan maps, please visit www.wcedc.org/CP/.

Agricultural Resources: This map displays data regarding existing agriculture operations and the features of the natural and built environment that support agricultural operations and land uses.

DATA	SOURCE
Soils	USDA/NRCS
Agricultural Infrastructure	UW-Extension Waupaca County
Existing Dairy Farms	UW-Extension Waupaca County
Existing Agricultural Land	East Central RPC, updated by local plan committees

Community Facilities: This map displays data regarding existing public services and community facilities. Public services shown on this map include basic services, like police protection and street maintenance that are available to the general public and are funded by public tax dollars or user fees. Community facilities include both public and private facilities that provide other essential services like schools, churches, and health care. Public recreational facilities and public utility sites are also shown.

DATA	SOURCE
Community Facilities	Waupaca County, local plan committees

Emergency Service Areas: This map displays data regarding the service areas of the ambulance service providers and first responder volunteer groups that serve Waupaca County.

DATA	SOURCE
Emergency Service Areas	Waupaca County, WDNR

Fire Protection Services: This map displays data regarding the service areas of the fire and rescue departments and districts that serve Waupaca County.

DATA	SOURCE
Fire Protection Areas	Waupaca County, WDNR

School Districts: This map displays data regarding the district boundaries of the schools that serve Waupaca County

DATA	SOURCE
School Districts	Waupaca County, WDNR

Environmental Features: This map displays data regarding many of the natural features that can impact the suitability of land for potential land uses.

DATA	SOURCE
Natural Heritage Inventory	WDNR
Surface Waters	WDNR
Wetlands	WDNR
Steep Slopes > 12%	USDA/NRCS
Rock Outcrops	USDA/NRCS
State Natural Areas	WDNR

Natural Resource Protection: This map displays land in Waupaca County that has a protected status or is publicly owned.

DATA	SOURCE
MFL/FCL	Waupaca County
Publicly Owned Lands	Waupaca County

Historical Resources: This map displays data regarding historic, archeological, and other community cultural resources.

DATA	SOURCE
Historical Resources	Waupaca County, WI State Historical Society

Land Cover: This map displays data regarding primary vegetative cover as recorded by satellite imagery in 1991, 1992, and 1993.

DATA	SOURCE
WISCLAND Land cover	WDNR

Existing Land Use: This map displays data regarding the use of land as of 2004. Lands are classified based on their use as residential, commercial, industrial, woodlands, agricultural, recreational, institutional, or transportation. This is not a planned land use or future land use map. Rather, this map shows the physical arrangement of land uses at the time the map was produced.

DATA	SOURCE
Existing Land Uses	East Central RPC, updated by local plan committees

Existing Transportation Features: This map displays data regarding the existing transportation system including road, street, and highway features, airports, railroads, and waterways.

DATA	SOURCE
Transportation Features	Waupaca County, WDNR, WDOT

Existing Land Use Regulations: This map displays data regarding existing zoning regulations, extraterritorial jurisdiction, and wellhead protection areas.

DATA	SOURCE
Land Regulations	Waupaca County, WDNR

TIF Districts and Industrial Parks: This map displays data regarding tax increment finance districts near industrial park locations.

DATA	SOURCE
TIF Districts and Industrial Parks	Waupaca County