Dowagiac River Watershed

Balancing growth and development with the protection of water quality and natural features

Watershed Resource Paper #3
Water Quality Protection

Water Quality

There is an integral relationship between water resources, water quality, and land use.

Residential uses . . . . . people live by water bodies for aesthetics and recreation
Agricultural uses . . . . . water bodies are often part of a farm
Industrial use . . . . . water is often used for processing and wastewater discharge

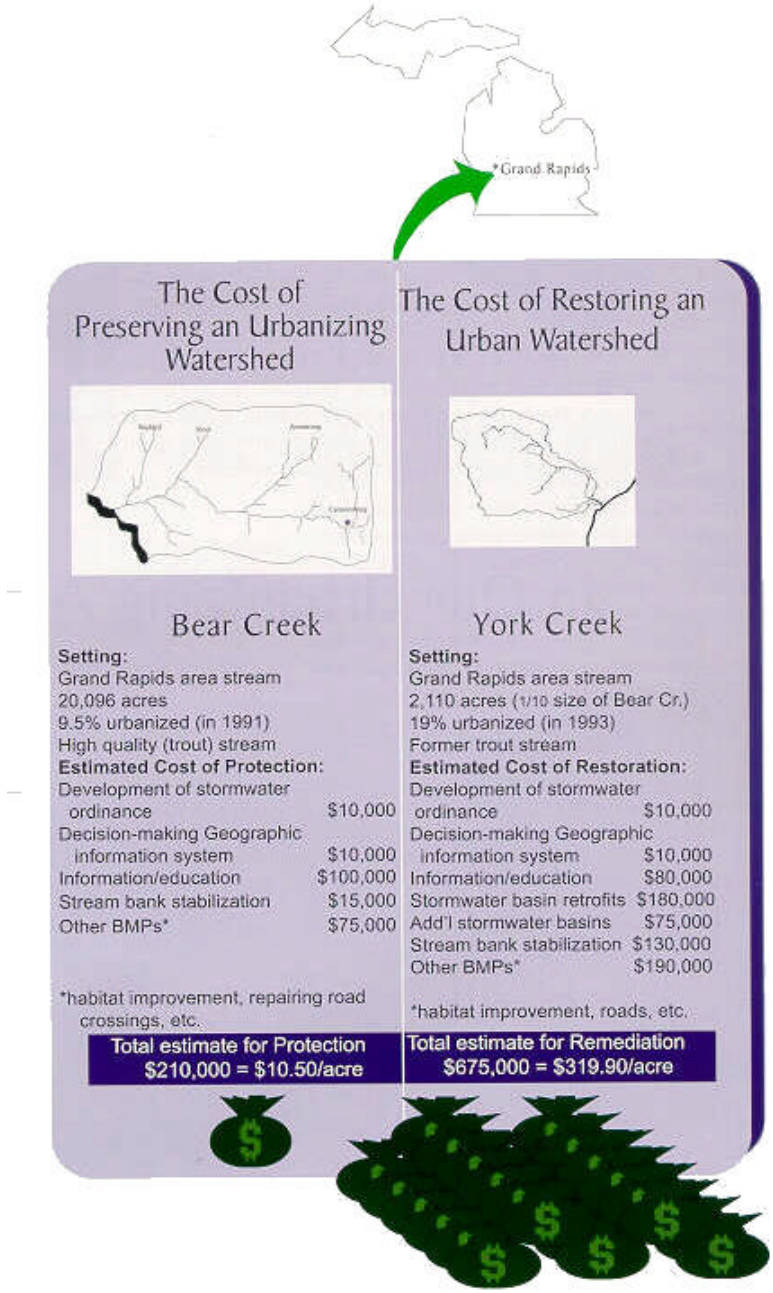
Planning is vital to water quality protection, just as water resources are vital to planning and guiding land use decisions at many levels. Certain land uses require access to water; others isolation from it. Individual landowners, whether residential, agricultural, or industrial, are rarely aware of the complexity of water resources or of the effect their actions may have. This lack of awareness, coupled with the economic and cultural value of water resources, creates a need for action by the community.

Water resources are part of a fragile system which is potentially at risk. Generally, protection and/or improvement of water quality takes place in two arenas; surface water quality - lakes, streams, rivers and ponds - and groundwater quality. The preservation of water quality is important for plant and animal life, tourism, and drinking water supplies.

A combination of poor soils unsuitable for septic systems, a high water table, and an increasing amount of rural development may begin to threaten the quality of an area's water supplies. Specific regulations, such as those pertaining to soil erosion and sedimentation control practices, protection of wetland areas, increased water body setbacks, the use of greenbelts or buffers, and density reductions are among the techniques that can assist in protecting water quality.

Even though the discussion within this Resource Paper deals with surface water and groundwater protection measures, it is critical that the links between these measures be clearly understood. In the Dowagiac River Watershed these two elements are closely linked. The Dowagiac River, a surface water feature, is one of the most heavily groundwater fed rivers of its size in the State of Michigan. The Dowagiac River exhibits cold year-round temperatures and stable year-round flows. Consequently, any activity which compromises either surface water or groundwater quality can have a direct effect on the river.

In the long run, it is more affordable to protect our water resources than it is to try to restore them. Effective planning can be a step in the right direction!



Into Every Life a Little Rain Must Fall…, Michigan Department of Environmental Quality

SURFACE WATER PROTECTION

Surface water features - lakes, streams, rivers, and ponds - are directly affected by land development. Soil erosion, impermeable surfaces (such as parking lots and roofs), soil contamination, and recreational activities can each affect surface water quality.

An important element to surface water protection is the need to moderate the effects that recreational activities have on surface waters. Overuse of lakes and other inland and lakeshore areas can, over time, degrade water quality through small gasoline and oil spills, stirring of lake bottom sediments, and other effects. These activities also have an effect on shoreline erosion, which further contributes to a decline in water quality.

Threats To Surface Water Quality

Non-Point Source Pollution

Non-point source pollution poses one of the greatest threats to surface water. Rather than occurring from one major source, like a sewage treatment plant or industrial use, non-point source pollution results from rainfall or snowmelt moving over and through the ground. As this runoff moves, it picks up and carries away natural and human-made pollutants. These are deposited into lakes, rivers, wetlands, ponds, and groundwater.

In the rural areas of Michigan, including the Dowagiac River Watershed, sources of non-point contamination include a combination of agricultural practices, lawn chemicals, soil erosion, and stormwater runoff. Of these, control of impervious surfaces (such as roofs and roads), from which stormwater runoff flows is an area where local governments may have a significant influence.

<u>Impervious Surfaces</u>

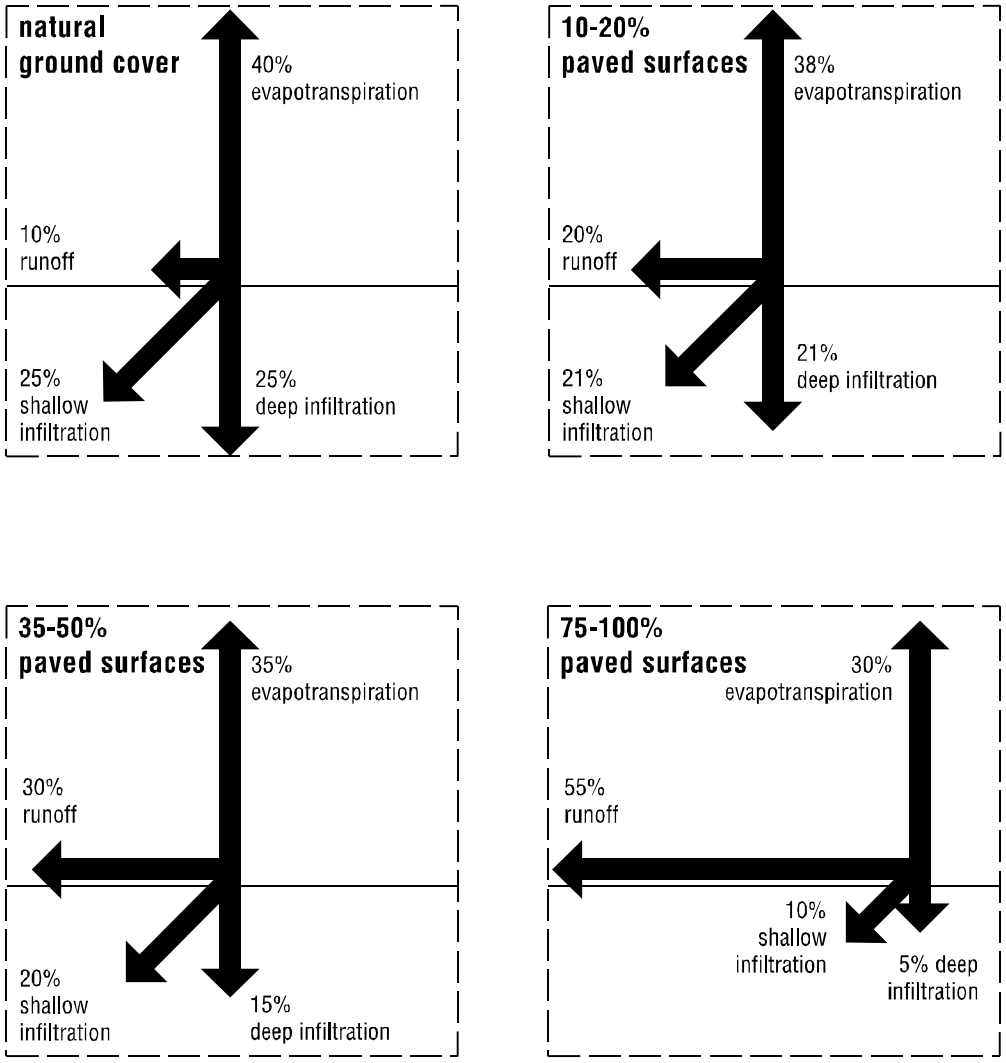
Impervious surfaces may cover anywhere from five to ten percent or more of a site. Smaller sites may have significantly higher coverages, particularly those with commercial and industrial uses with large parking areas. Not only quantity, but quality of runoff from normal precipitation may change considerably, as lawns, roads, and parking lots rinse clean. Other unnatural water sources are added, such as construction cleanup, car washing, or lawn watering.

Source: Soil Conservation District

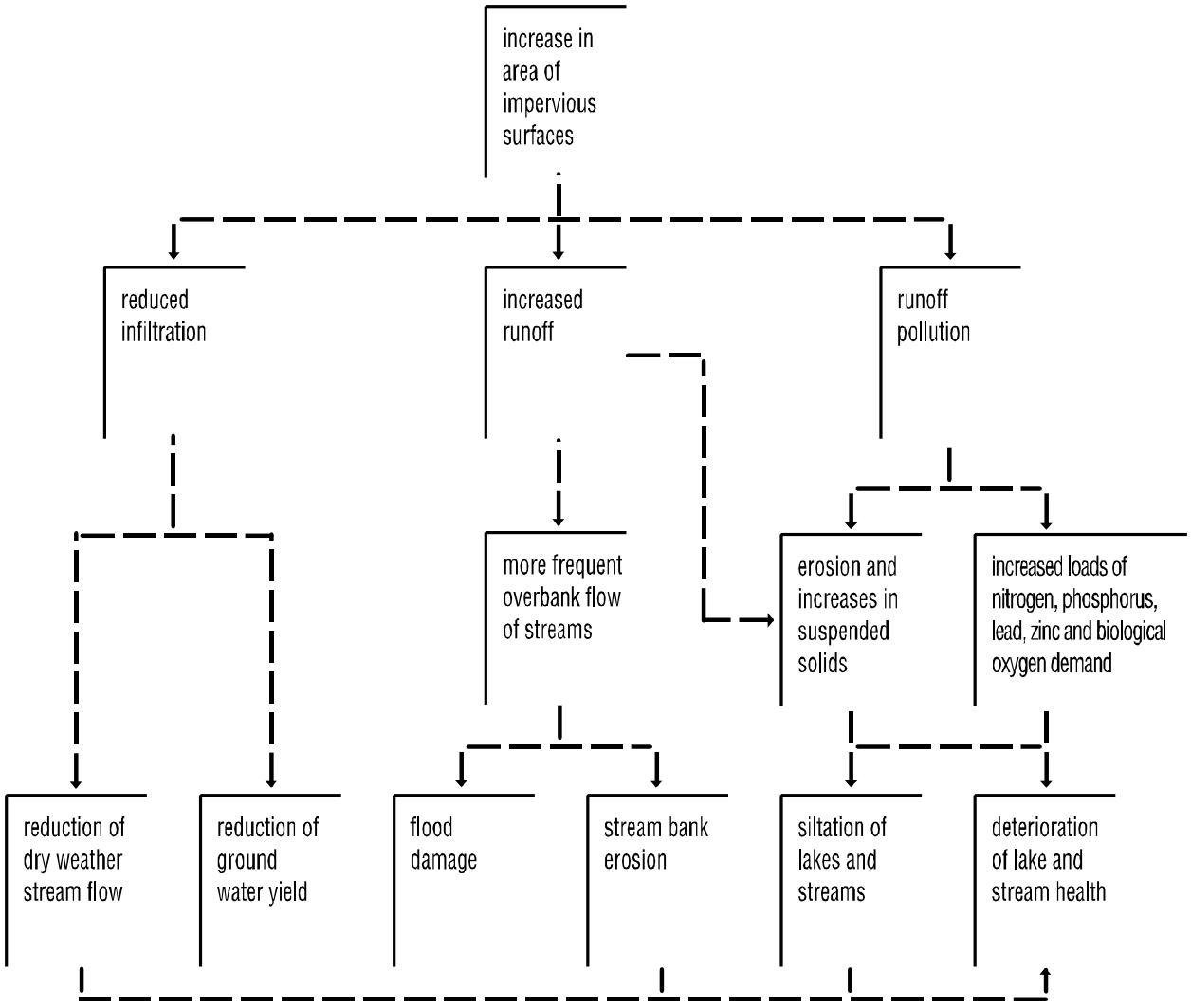
Traditionally, channelization, dams, and storm sewers have been used to control the effects of runoff from development and increased impervious surfaces. While these measures may reduce flooding potential by diverting water, they do not address water quality.

Stormwater, Soil Erosion, and Sedimentation

Ideally, stormwater can be managed in a fashion which will not substantially alter the natural hydrologic regime, especially as it relates to the quantity of runoff (from rainfall) versus infiltration within a watershed. As more development takes place, either on large projects or on small home sites, the disturbed land loses its ability to hold soil in place. Natural vegetative cover is replaced by roof tops, roadways, parking lots, and other impervious surfaces. The increase in impervious area will greatly increase the rate and volume of runoff and decrease water infiltration into the ground.



As a result of these newly developed impervious areas, rainfall can easily overcome the ability of soil to remain in place. As rainfall hits the disturbed soil it has two choices; if on flat ground some may percolate into the groundwater; the remainder will either pond on the site, or find the most direct route available to run off the site, taking soil and pollutants along with it in the form of stormwater.



Data compiled by the Michigan Department of Natural Resources indicates that in extremely developed watersheds (with impervious areas greater than 50%), the peak discharge after development may increase as much as five-fold over the pre-development rate. To address this potential problem, many communities have adopted standards that require post-development rates of runoff not exceed pre-development runoff rates. This is generally accomplished by detaining or retaining stormwater to control the rate at which runoff is allowed to leave the development site. If stormwater facilities are properly designed, significant water quality benefits can also be realized. Various stormwater management alternatives can be employed to accomplish these objectives.

Detention involves temporarily detaining stormwater and releasing it at a controlled rate. With *retention*, stormwater is held indefinitely with no discharge. Stormwater is allowed to infiltrate into the ground rather than flow from the site. Retention facilities are extremely effective at pollution removal, but are not suitable for all conditions. Retention may not be desirable on sites with silt or clay soils (which restrict infiltration) or for uses such as an industrial site where the infiltration of stormwater could contaminate groundwater. In general, retention (i.e., infiltration) basins should only be used as part of a *treatment train*, where soluble organic substances, oils, and course grained sediment are removed by other management practices (such as a detention basin) prior to stormwater entering the retention basin.

In evaluating development proposals, it may prove useful to address short-term erosion control problems (which occur during construction) together with long-term stormwater management issues (after construction). With this approach, a community can ensure that grading, erosion control, and stormwater management practices are integrated in an effective and logical manner. With an understanding of the interrelationship between stormwater quantity and quality, policies can be identified and implemented to address stormwater management issues proactively to minimize potential problems and costly remedial projects.

With sediment being the largest pollutant by volume entering the watershed's streams and lakes, erosion and sediment control is of the utmost importance. Erosion and sedimentation results in loss of fertile topsoil, filling of lakes and streams, increased flooding, damage to aquatic habitat and animals and structural damage to buildings and roads. Drainage controls are intended to ensure that the amount of runoff from a site does not exceed that which existed in its pre-development state. Soil erosion and sedimentation controls are needed to ensure that development activities do not permit soil to be transported from the site to existing or planned drainage systems. A variety of methods exist to assist in achieving this objective, the most visible of which are silt fences which may be seen surrounding many development sites.

For a local unit of government to establish a limit for runoff, it is helpful to look to existing regulatory organizations who have established standards. In the case of sedimentation and erosion, the Natural Resources Conservation Service (NRCS - formerly the United States Soil Conservation Service) has developed the Universal Soil Loss Equation which estimates run-off considering:

< the amount of rainfall
< length of slope
< soil erodibility factor

Vegetation reduces sediments/pollutants running into the stream

< erosion control practices used
< vegetative cover

Where the potential for erosion is high, it is critical not only that controls be in place prior to the start of development, but that such controls be maintained throughout the development process.

The purpose of Part 91, Soil Erosion and Sedimentation Control, of the Natural Resources and Environmental Protection Act (P.A. 451 of 1994, as amended) is to control soil erosion and to protect the waters of the state from sedimentation. This law requires that a permit be obtained for all earth changing activities that disturb one or more acres of land or is within 500 feet of a lake or stream. To obtain the permit, a soil erosion and sedimentation control plan must be submitted that effectively reduces soil erosion and sedimentation and identifies factors that may contribute to soil erosion and sedimentation. In Cass County, permits are obtained from the Cass County Court House.

Five Principles to Effectively Control Sedimentation During Construction Activities:

1. *Plan the development to fit the particular topography, soils, waterways and natural vegetation of the site. The goal is to minimize the amount of soil exposed to erosive forces.*
2. *Expose the smallest practical area of land for the shortest possible time, by scheduling and staging project activities. Stabilize areas with vegetation before beginning construction on the next phase.*
3. *Apply soil erosion prevention practices as a first line of defense. Practices include special grading methods, diversions, runoff control structures, temporary and permanent vegetation, and mulching.*
4. *Apply sediment control practices as a perimeter protection to prevent sediment from leaving the site. Practices include silt fences, interceptor dikes and ditches, sediment traps, vegetative filters, and sediment basins.*
5. *Implement a thorough inspection, maintenance, and follow-up operation. A routine end of the day check by the site engineer to be sure that all control practices are functioning properly.*

Surface Water Protection Measures

One method of effectively protecting water quality is to adopt effective land development regulations for the zoning ordinance. These regulations may affect not only development projects with larger land areas and high intensity uses, but development occurring on individual lots as well.

Density Reductions

Protecting water quality can mean that communities consider how much land they have planned and zoned for various uses.

, Can the expected community or regional population support the planned commercial areas?

, Did the planned areas for growth consider environmental limitations, such as the capacity of the soils to accommodate individual septic systems? Was the presence and efficient use

of existing or planned infrastructure considered, particularly public water and sewer services?

, Can existing infrastructure support planned residential, commercial, and industrial areas?

, What effects will this development have on a community's natural resources?

One direct effect of land use planning is its effect on runoff and water quality. Typically development equates to impervious surface which equates to changes in the functioning of a watershed.

Should Low Density or High Density Development be Encouraged?

At first glance, it would seem appropriate to limit watershed development to no more than 10% total impervious cover. While this approach may be wise for an individual "sensitive"watershed, it is probably not practical as a uniform standard. Only low density development would be feasible under a ten percent zoning scenario, perhaps one acre lot residential zoning, with a few widely scattered commercial clusters. At the regional scale, development would be spread over a much wider geographic area than it would otherwise have been. At the same time, additional impervious area (in the form of roads) would be needed to link the community together.

The Importance of Imperviousness, Watershed Protection Techniques Vol. 1, No. 3 - Fall 1994,

Site Plan Review Standards

To protect water quality and hydrology in the Watershed, it is essential to properly manage stormwater on newly developed sites. Site-level stormwater management plans can be required as part of a community's site plan review standards. Site-level stormwater management plans are generally composed of maps and a narrative. The maps and associated construction drawings show existing site features and proposed alterations highlighting the location and type of proposed stormwater management system. The narrative consists of a written statement explaining the natural and proposed drainage system, a detailed description of projected runoff quantity and quality and an explanation of why certain management practices were chosen for pollution control. Highlighted should be a detailed description of the relationship of the proposed development to drainage and runoff within the entire watershed (within reference to a watershed management plan should one exist). Provisions for site safety and maintenance of approved management measures should also be included.

On the following page is a list of guidelines that applicants should address when designing a stormwater management plan. By having a set of guidelines that clearly state the key management principles that a planning commission wants each applicant to address in a site plan, the overall consistency of site-by-site evaluation can be greatly improved.

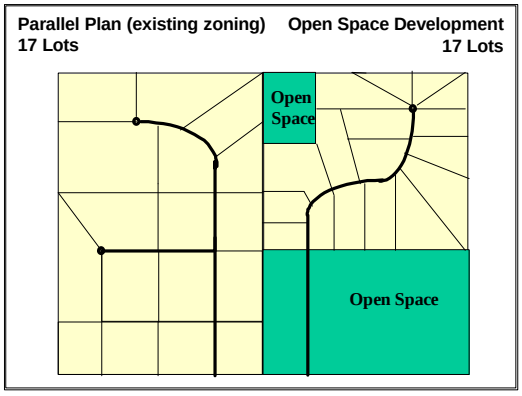
The Storm Management System shall:

1. Consider the total environmental impact of the proposed system.
2. Consider water quality as well as water quantity.
3. Be consistent with the local Plan of Development, and any existing watershed management plan.
4. Coordinate with erosion control measures and aquifer protection.
5. Minimize disturbance of natural grades and vegetation, and utilize existing topography for natural drainage systems.
6. Preserve natural vegetated buffers along water resources and wetlands.
7. Minimize impervious surfaces and **maximize infiltration*** of cleansed runoff to appropriate soils.
8. Direct runoff to minimize off-site volume.
9. Reduce peak flow to minimize the likelihood of soil erosion, stream channel instability, flooding and habitat destruction.
10. Use wetlands and water bodies to receive or treat runoff only when it is assured that these natural systems will not be overloaded or degraded.
11. Provide a maintenance schedule for management practices, including designation of maintenance responsibilities

***** This is very important in the Dowagiac River Watershed to maintain the existing hydrology. The Dowagiac River is eighty to ninety percent fed by groundwater, with only 10% coming from overland surface runoff.

Source: University of Connecticut Cooperative Extension System, 1995

Open Space Development



Water quality protection is a further incentive for the clustering of residential units, also known as Open Space Development. Under this development technique the allowable density is based on a "parallel plan" showing reasonable and permissible development under existing zoning. While Open Space Development may increase the net density for a smaller area of a larger parcel, the overall density would still fall into the requirements of the existing zoning.

It would also allow for the preservation of significant natural features, provide open space for recreation, allow the continuation of farming of interior land areas and decrease the overall amount of impervious surfaces. To preserve the roadside character, some or all of the required open space could be placed abutting the roadway.

Currently, open space development in western Michigan is not particularly prevalent, or indeed, attractive to home buyers. One of the reasons that many buyers are looking in the rural areas is to avoid being too near other homes. Unlike eastern Michigan, where land values are generally higher, open lands are abundant in western Michigan and land prices are still reasonable.

However, there is a segment of the marketplace that can appreciate the value of preserving larger open spaces within a development. Therefore, offering of incentives to developers for using this development technique is appropriate. The basic incentive to which developers will most readily respond is an increase in the number of units which could be permitted over the base density calculated under the parallel plan. This is generally considered a development "bonus."

The amount of the bonus may vary depending on the nature of the development, and they may be used in combinations of one or more different incentives. As an example, incentives may include an increase in the number of units if:

- additional open space is provided, beyond that normally gained in the lowering of individual lot sizes;
- a community wastewater and/or domestic water system is used (avoiding the need for septic systems and individual wells);
- recreational amenities are provided, such as tennis courts, club house, or other similar facility;
- walkways, trails, or bike paths are included within the development; and/or
- significant areas of active agricultural lands are preserved.

Another incentive, where appropriate, would permit commercial uses, usually subject to certain restrictions to limit size and effect on the area.

Lot Coverage

A variety of means exist to control the amount of impervious surfaces, but perhaps the most effective is to control lot coverages. Typically, lot coverage requirements relate only to zoning controls related to "bulk" or amount of land covered by structures, including main and accessory buildings. Additional impervious surface controls can be included to expand the definition of lot coverage to include all impervious surfaces. This definition would be:

> "The part or percent of the lot occupied by impervious surfaces, including, but not limited to, buildings or structures, paving, drives, patios, and decks."

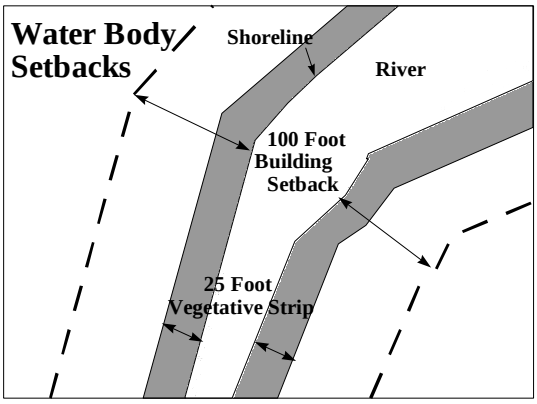
This would require an evaluation of existing lot coverage limitations, which would likely have to be increased for most districts to account for the inclusion of other surfaces in the calculation

of total limits. However, this would prevent the overbuilding of some sites and help reduce the overall amount of stormwater runoff.

Parking Requirements

Another possible change to the zoning requirements is gaining acceptance in areas where runoff is a particular concern. Most parking requirements address "minimum" numbers of spaces, but permit any size parking area to be constructed. Some communities are now utilizing a concept of "maximum" parking requirements to ensure that parking lots are not overbuilt. Generally, the maximum requirements can not be exceeded without specific justification by the developer.

There are several implications to this method of enforcing parking requirements, including the possibility of requiring some parking areas to be removed when changes of use occur that would require a lower maximum parking requirement than the previous use.



Model Development Principles Related to Parking Requirements

- The required parking ratio governing a particular land use or activity should be enforced as both a maximum and a minimum in order to curb excess parking space construction. Existing parking ratios should be reviewed for conformance taking into account local and national experience to see if lower ratios are warranted and feasible.
- Reduce the overall imperviousness associated with parking lots by providing compact car spaces, minimizing stall dimensions, incorporating efficient parking lanes, and using pervious materials in spillover parking areas.
- Provide meaningful incentives to encourage structured and shared parking to make it more economically viable.
- Wherever possible, provide stormwater treatment for parking lot runoff using bioretention areas, filter strips, and/or other practices that can be integrated into required landscaping areas and traffic islands.

Better Site Design: A Handbook for Changing Development Rules in Your Community, Center for Watershed Protection

Water Body Setbacks

In proximity to water features, construction and other activities can decrease water quality through soil erosion and removal of filtering vegetation. Buffer zones around surface water features where vegetation removal or soil disturbance is minimized can help maintain water quality.

Setbacks from inland lakes and streams can be established through the zoning ordinance. Regulations may specify a minimum 100-foot setback for structures and septic systems from the shoreline. Setbacks will generally mirror the minimum requirements of the Natural Rivers Act, which provides a basis for setbacks.

Vegetative Buffers

Setback requirements may include the preservation of at least a 25-foot wide native, uncleared vegetation buffer strip immediately adjacent to the shoreline. Boat storage and dock facilities may also be regulated. Some communities also enforce similar setbacks for agricultural operations and livestock management.

Vegetative shade cools the temperature of the stream

Greenbelts or vegetated buffers are an effective way to address soil erosion and the effects of runoff on surface water quality. The attraction of surface water for residential or other land uses often leads to the desire for additional views to the water by clearing vegetation along streambanks and lake shorelines. This contributes to reduced water quality and may lead to the eventual loss of aesthetic value.

Vegetative buffers improve water quality by:

- reducing sediment, heavy metals, other toxic substances
- stabilizing streambanks and wetland edges from erosion
- providing fish and wildlife habitat
- improved riparian scenery
- reducing water temperature
- increasing aquatic species diversity

The social benefits of vegetative buffers include:

- increased recreational fishing opportunities
- increased safety for bodily contact
- improved drinking water quality
- improved wildlife viewing
- improved riparian scenery

Buffer Widths

Some of the relevant factors to consider when determining the size of a buffer include:

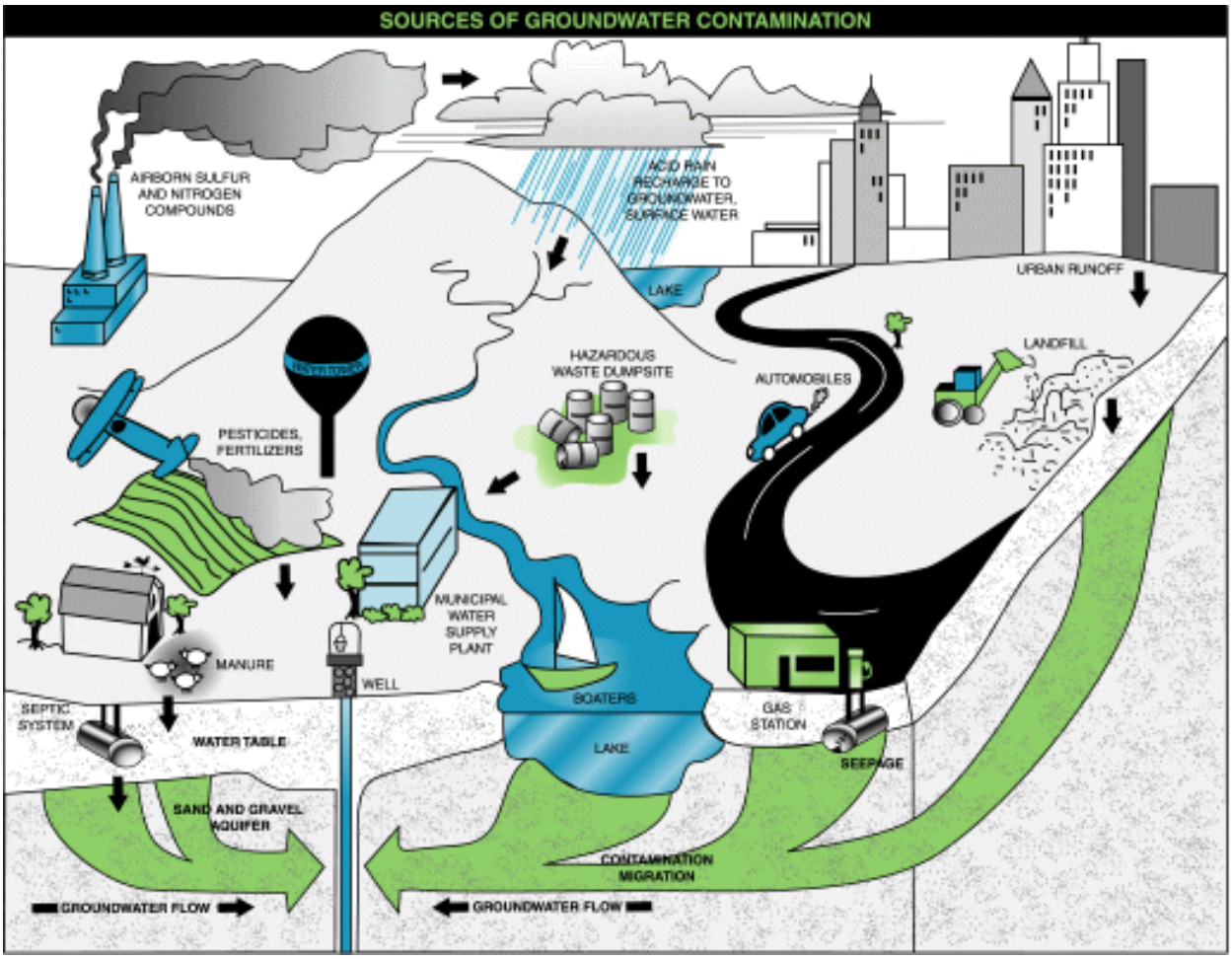
- the *quality* of stream or wetland to be protected;
- *intensity* of the adjacent land use;
- quality or *density* of the buffer;
- the *function* of the buffer;
- *soil* type and how surface water filters into the ground;
- types and amount of *vegetative cover* and how it stabilizes the soil; and

C *slope* of the land within the zone and how significant it is for retaining sediment from reaching the stream, lake, or wetland.

In general, smaller buffers may be adequate when the buffer is in good condition (e.g. dense native vegetation, undisturbed soils), when the water body or resource is of low functional value (highly disturbed, invaded by non-native species such as purple loosestrife), and the adjacent land use has low impact potential (park land or very low density residential development). Larger buffers will provide water quality protection for high impact land uses such as highly developed commercial areas dominated by large parking lots (highly impervious surfaces).

GROUNDWATER PROTECTION

Threats To Groundwater Quality



Any substance that is placed or injected in the ground has the potential to affect groundwater quality. Businesses such as dry cleaners, photographers and hair salons serve as examples of potentially hazardous land uses due to the types of chemicals they routinely use. If these businesses operate on individual well and septic service, the chance of groundwater contamination, through an accidental spill or mishandling, is especially high.
Other businesses normally considered environmentally sound, such as golf courses, can actually threaten groundwater. These businesses often use relatively large amounts of lawn chemicals and can cause temporary "drawdowns"[1] of the water table, affecting nearby uses. Directly applying these chemicals to the ground presents an uninterrupted opportunity for groundwater contamination. Such groundwater contamination could cost a community millions of dollars to remedy or destroy a primary water source. A recent report by the Geophysics Study Committee of the Commission on Physical Sciences, Mathematics, and Resources (National Research Council) stated:

> "Groundwater contamination may be localized or spread over a large area, depending on the nature and source of the pollutant and on the nature of the groundwater system. A problem of growing concern is the cumulative impact of contamination of a regional aquifer from nonpoint sources (i.e., those that lack a well defined single point of origin), such as those created by intensive use of fertilizers, herbicides, and pesticides. In addition, small point sources, such as numerous domestic septic tanks or small accidental spills from both agricultural and industrial sources, threaten the quality of regional aquifers."

The *State of Michigan Comprehensive Groundwater Protection Program,* published by the Michigan Department of Environmental Quality reports that:

> "(A)bout half of all Michigan residents depend on groundwater as their primary source of fresh drinking water - either through public water supply systems or private drinking water wells. For many communities, groundwater is the only possible source of fresh water for drinking. Cleanup of groundwater contamination sites is expensive and slow, and often creates hardships for the persons affected."

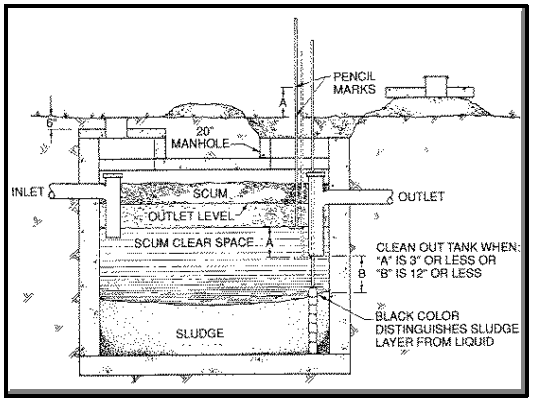
Previous examinations of areas of groundwater vulnerability within the Dowagiac River Watershed have revealed that nearly the entire watershed may be classified as vulnerable. This is reflected in great part by the fact that the Dowagiac River itself is heavily dependent on groundwater flows.

The following describes some of the more prevalent threats to groundwater.

[1] The groundwater table can temporarily be lowered, or a drawdown can occur, if too much water is pumped too rapidly out of the ground.

Septic Systems

Because septic systems are underground, they are often ignored, even by people who use them. But with septic systems, "out of sight" should not mean "out of mind." Groundwater protection will become increasingly important as population densities in areas not served by public utilities continue to increase. In the watershed contaminated groundwater has a potentially devastating effect. As a result, maintaining appropriate densities of development and proper disposal of sanitary sewer wastes are critical factors in ensuring the adequacy and quality of domestic water sources.



Not all sites are suitable for septic systems. Of primary concern is the soil at the site. Soils that are too coarse or too fine can limit the effectiveness of the treatment system. A shallow, seasonally high water table or bedrock can also cause problems. Some of these problems can be overcome by altering the design of the septic system.

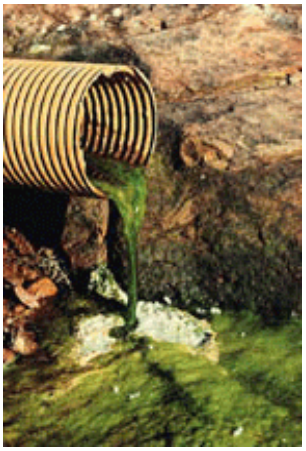
Where they are properly sited, such as in sparsely populated areas and in soils with good drainage above the water table, septic tanks generally pose little or no hazard. *However, even where septic systems are well drained, they may eventually pollute the groundwater.* An improperly sited, designed, installed or operated septic system can pollute drinking and surface water. In such situations, sewage may contaminate wells in the area or move to the land surface, or both.

Sewage-disposal activities are introducing viruses into a variety of groundwater sources; but the persistence and movement of these viruses has only recently become the subject of scientific inquiry, and the extent to which such viruses in groundwater pose a hazard to public health is still largely unknown. In other parts of the country, these problems have already been in evidence. On Long Island, New York, where approximately 3 million residents rely on wells as their sole source of water supply, domestic wastewater seeping from thousands of septic systems and leachates from landfills and industrial waste-disposal sites have contaminated the shallow groundwater in many parts of Long Island.

A problem of growing concern is the cumulative impact of contamination of a regional aquifer from nonpoint sources, including septic systems, among others. For example, the Environmental Protection Agency in 1980 found that about a third of all septic tank installations were not operating properly and that the consequent pollution both above and below ground is substantial. Their conclusion was that the solution to groundwater contamination from septic systems, beyond better engineered on-site facilities or improved maintenance, may lie in better

land-use control and in effective regulations for septic tank installation. *(U.S. Environmental Protection Agency, 1980, Groundwater Protection)*

Point Sources



Some sources of potential groundwater contamination are somewhat easier to identify. They include industrial operations which may use hazardous chemicals, landfills, gasoline filling stations, and other direct sources of contaminates. For the most part, these sources are heavily regulated by the state or federal government. These include regulations affecting landfill, hazardous wastes, underground storage tanks (removal and construction), and brownfield regulations. (Brownfields are previously contaminated sites that, under certain conditions, may be utilized for particular land uses.)

Other, larger sites, may also be considered point sources. Where there are larger, contiguous areas having a combination of poor soils unsuitable for septic systems, a high water table, an increasing amount of rural development, and a large number of intensive livestock operations, these areas can threaten the quality of the groundwater supplies.

Examples of places which may increase concerns relative to groundwater reservoirs include:

- Existing sites identified by Act 307 or the Michigan Public Acts of 1982, as amended (The Michigan Environmental Response Act) and Michigan Department of Environmental Quality identified LUST (Leaking Underground Storage Tanks) sites;
- Existing licensed landfills (active or inactive);
- Industrially used or zoned sites;
- Existing residential development that equals or exceeds a gross density (total acres divided by number of dwelling units) of one unit for every one and one-half (1.5) acres; or
- Existing agricultural development totaling more than five hundred (500) acres.

Groundwater Protection Measures

Efforts to protect groundwater resources need to occur at all levels of government. Special consideration to the types and densities of permitted land uses should apply in areas that offer little natural protection to groundwater. This should also apply where the protection level is unknown. Groundwater quality is also a concern since domestic water for nearly all of the residents of the Watershed outside of the community service areas are supplied through individual wells.

Land use regulations, land acquisition, and education programs can play a key role in protecting groundwater. Examples of land use control activities include the following:

< Land use plans which take into account groundwater vulnerability;
< Zoning ordinance and site plan review standards related to aboveground secondary containment, interior floor drains, and other topics;
< Purchase of land and/or conservation easements to provide a wellhead protection buffer around municipal wellfields; and
< Public education through public meetings, school-based classroom programs, library displays, cable television videos, public information flyers, and municipal newsletters.

Protection of groundwater resources requires efforts on several fronts, including the need for regional planning, land planning for individual sites, and technological advances that may offer alternative solutions. Regional planning must be based on the entire Dowagiac River Watershed; it will do little good for one community to implement solutions to its problems only to find that neighboring communities do not. Groundwater has no respect for community boundaries.

From a land planning perspective, simply requiring larger lots does little or nothing to enhance groundwater quality. One of the few readily available solutions to polluted wells or failed septic systems is to obtain public water and sewer. With the larger lots sizes and frontages prevalent in many of the communities within the watershed, the costs to provide water and sewer services to homes are likely to be exorbitant. On the other hand, where lot frontages are lower, so too will be the cost to provide public utilities.

Several regulations are in place by the counties within the watershed which target the protection of water resources. Septic system regulation, for example, is the responsibility of the various Health Departments in relation to permitting, placement, and enforcement. The county health departments are also responsible for the inspection of septic systems prior to the sale of a parcel of land. If the system fails the counties 'tests, the system must be upgraded or maintenance must be completed before a permit will be issued to the new property owner.

Finally, there are technological advances on the horizon that may offer opportunities to improve groundwater. These include:

C man-made wetlands;
C terraced, overland flow systems;
C package plants;
C sand-filter systems; and
C greenhouse, peat, and bio-filter systems.

The following are some specific measures that may be taken by communities within the watershed to help in the protection of groundwater resources.

Septic System Maintenance Requirements

It is generally recommended that septic tanks be pumped out or the sludge and scum layers be measured at least every three years so that solids don t wash out into the soil treatment system. Solids can clog the soil and limit its ability to properly treat the septic-tank effluent. A local government may choose to impose septic system maintenance requirements on individual developments.

However, implementing this recommendation is sometimes difficult without adequate cooperation between the community and county health departments. One solution may be to adopt a local ordinance that establishes "septic system maintenance districts," where higher concentrations of septic systems are present. Within these districts, property owners could be required to submit evidence of inspection or maintenance of septic systems at periodic intervals. This may be particularly effective for any approved Open Space Developments which have homeowner associations. (See *Technical Paper #2, Open Space Protection* for additional discussion on Open Space Development.)

Secondary Containment
(for industrial and agricultural uses)

A common groundwater protection method for identified potential sources of groundwater contamination (such as above ground fuel storage tanks and facilities) is a requirement for secondary containment. A variety of containment methods are possible, but the most common is the construction of "traps" for runoff and spillage areas where possible contaminants are contained within walls or other structures and any runoff captured and contained within the structure. Other, more elaborate systems are required, such as that pictured, for larger, intensive activities with extensive use of chemicals, fuels, or other potential contaminants.

Site Plan Review

Local units of government through the site plan review process should be made aware of the locations for possible contamination and the measures planned by the operator to reduce the risks associated with those materials. This can be done as part of the site plan review process for potential point sources of contamination, such as industrial uses involving chemicals or hazardous materials. Each site plan should contain a stormwater management plan that details the impact of proposed land use on water quantity and quality, both on-site and within the Watershed. This may be implemented by adding a requirement for site plans for submission of information regarding potential hazardous materials, and measures to be taken to protect

drainage ways, water bodies, or other areas from accidental spills.

Another provision which can be made part of the site plan review process, as well as for discretionary zoning approvals, such as planned unit developments and special land uses, is a requirement for monitoring wells for specific land uses with potential to affect groundwater resources. Monitoring wells have long been required for certain uses, such as landfills. Increasingly, communities are requiring them for other uses, such as golf courses, sand and gravel mining operations, higher density residential developments in identified groundwater vulnerability areas, and others.

Monitoring Well

Provided on the following pages are specific site plan review standards for groundwater protection published by The Michigan Department of Environmental Quality. These standards could be incorporated into a communities zoning ordinance, with additional standards as determined necessary depending on the type of development a community is experiencing, problems experienced in the past, etc.

Site plan review standards allow land use commissioners to review plans for compliance with general planning guidelines to protect groundwater, while the detailed engineering is best left to trained professionals.

Michigan Department of Environmental Quality Site Plan Review Standards for Groundwater Protection (to be included in the Local Zoning Ordinance):

1. The project and related improvements shall be designed to protect land and water resources from pollution, including pollution of soils, groundwater, rivers, streams, lakes, ponds, and wetlands.

2. Stormwater retention, transport, and drainage facilities shall be designed to use or enhance the natural stormwater system on-site, including the storage and filtering capacity of wetlands, watercourses, and water bodies, and/or the infiltration capability of the natural landscape. Stormwater facilities shall not cause flooding or the potential for pollution of surface or groundwater, on-site or off-site.

3. General purpose floor drains shall be connected to a public sewer system or an on-site holding tank (not a septic system) in accordance with state, county and municipal requirements, unless a groundwater discharge permit has been obtained from the Michigan Department of Environmental Quality. General purpose floor drains which discharge to groundwater are generally prohibited.

4. Sites at which hazardous wastes, or potentially polluting materials are stored, used, or generated shall be designed to prevent spills and discharge of such materials to the air, surface of the ground, groundwater, lakes, streams, rivers or wetlands.

5. Secondary containment facilities shall be provided for above ground storage of hazardous substances, hazardous wastes, or potentially polluting materials in accordance with state and federal requirements. Above ground secondary containment facilities shall be designed and constructed so that the potentially polluting material cannot escape from the unit by gravity through sewers, drains, or other means, directly or indirectly into a sewer system, or to the waters of the State (including groundwater).

6. Underground storage tanks shall be registered, installed, operated, maintained, closed or removed in accordance with regulations of the Michigan Department of Environmental Quality.

7. Aboveground storage tanks shall be certified, installed, operated, maintained, closed or removed in accordance with regulations of the Michigan Department of Environmental Quality.

8. Bulk storage facilities for pesticides and fertilizers shall be in compliance with requirements of the Michigan Department of Agriculture.

9. Abandoned water wells (wells that are no longer in use or are in disrepair), abandoned monitoring wells, and cisterns shall be plugged in accordance with regulations and procedures of the Michigan Department of Environmental Quality.

10. State and federal requirements for storage, spill prevention, record keeping, emergency response, transport and disposal of hazardous substances, hazardous wastes, liquid industrial waste or potentially polluting materials shall be met. No discharge to surface water or groundwater, including direct and indirect discharges of waste, waste effluent, wastewater, pollutants, or cooling water, shall be allowed without approval from state, county and local agencies.

Michigan Department Environmental Quality Recommended Site Plan Review Standards for Groundwater Protection

Site Plan Information: (add to usual list of submittal requirements)...

_____ Existing topographic elevations at two (2) foot contour intervals. Indicate direction of drainage flow.

_____ The location and elevations of existing water courses and water bodies, including county drains and man-made surface drainage ways, flood plains, and wetlands.

_____ Proposed stormwater management plan including design of sewers, outlet, and retention or detention ponds. Sufficient data regarding site runoff estimates and off-site drainage patterns shall be provided to permit review of feasibility and permanence of drainage detention and/or retention as well as the impact on local surface and groundwater.

_____ The location and status of any floor drains in structures on the site. The point of discharge for all drains and pipes shall be specified on the site plan.

_____ Location for any existing or proposed outdoor storage facilities (above ground and below ground storage).

_____ Location for on-site wastewater treatment and disposal systems.

_____ Location of existing and proposed private drinking water wells, monitoring wells, irrigation wells, or wells used for industrial processes.

_____ Size, location, and description of any proposed interior or exterior areas of structures for storing, using, loading or unloading of hazardous substances, hazardous wastes, and/or polluting materials.

_____ Delineation of areas on the site which are known or suspected to be contaminated, together with a report on the status of cleanup or closure.

_____ Inventory of hazardous substances to be stored, used or generated on-site, presented in a format acceptable to the local fire marshal.

_____ Completion of the "State-County Environmental Permits Checklist" on the form provided by the municipality.

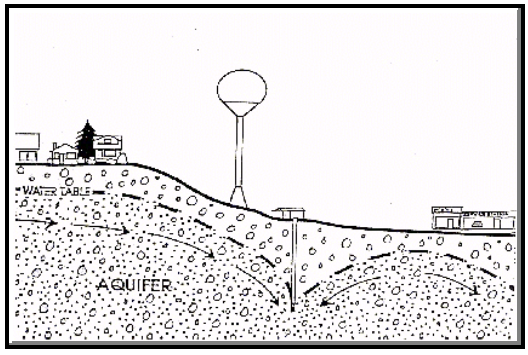
On-Site Community Treatment Systems

The expense involved in resolving groundwater issues for a single site makes some solutions financially difficult. One area-wide solution intended for limited use is a package treatment system which serves smaller areas. Although a single, small development project may not be able to afford the installation and operation of a compact treatment system, several combined projects may join forces to implement an effective waste treatment system.

A number of management and financial issues would obviously need to be resolved before such a system was implemented. Administering the system will likely be the responsibility of individual property owners formed into an association or authority. Questions of who will pay for the initial acquisition and installation of the system as well as maintenance responsibilities will need to be addressed. Issues of liabilities and other legal problems must also be examined. Generally, engineering expertise will be needed to conduct routine repairs and inspections, and replace system components when needed.

To encourage these systems, zoning ordinances may offer density increases for developments utilizing community systems, where public systems are not, and will not be available. The bonus should be reasonable, but may be significantly higher than those bonuses often offered for open space or recreational amenities. These developments will, for the most part, take place within an open space (cluster) development.

Wellhead Protection



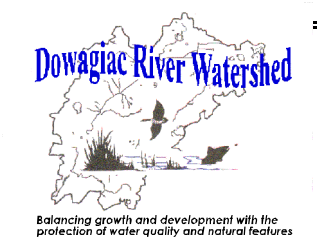
The purpose of wellhead protection programs is to protect public water supplies taken from groundwater from potential sources of contamination. Protection is provided by identifying the area supplying groundwater to the community's wells, identifying potential sources of contamination within that area, and developing methods to cooperatively manage the area and minimize the potential threat to groundwater.

Wellhead protection programs must address seven elements:

- Establishment of roles and duties for communities and property owners within the wellhead protection area.
- A description of the wellhead protection area.
- Identification of potential sources of contamination within the wellhead protection area.
- Procedures to manage the protection area and minimize threats to the water supplies.
- Plans for water supply emergencies.
- Procedures for the development of new well sites.
- Public participation methods.

A wellhead protection area is defined as the surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field. In Michigan, the area for any potential threat is based upon a ground water time-of-travel (TOT) of 10 years.

Zoning and land use measures to protect wellhead areas are generally similar to those that protect open spaces, including purchase of lands, conservation easements, and other similar measures. Grants are available from the Michigan Department of Environmental Quality to assist communities in developing wellhead protection programs and legislation.



ACTION AND IMPLEMENTATION

Community_____

Water Quality Protection	Yes	No	Need to Know More
Density Reductions (page 8)			
Site Plan Review Standards (page 9)			
Open Space Development (page 10)			
Lot Coverage (page 11)			
Parking Requirements (page 12)			
Water Body Setbacks (page 12)			
Septic System Maintenance Requirements (page 19)			
Secondary Containment (for industrial and agricultural uses) (page 19)			
Site Plan Review (page 19)			
On-Site Community Treatment Systems (page 23)			
Wellhead Protection (page 23)			