Summer 2002 Volume 6, Issue 3

STREAMLINES

A Newsletter for North Carolina Water Supply Watershed Administrators

IMPERVIOUS IMPLICATIONS

Next to the amount of site disturbed during construction, the amount of land devoted to parking is the most influential component of development affecting water supply watersheds. However, not all parking lots are created equal. This issue of Streamlines focuses on ways of reducing the negative impacts associated with parking lots, and provides information on ways of evaluating parking areas to increase the overall effectiveness of watershed management. This issue also presents an update on the statewide NPDES Phase II rules and regulations that will go into effect next year, and an update on the National Stormwater BMP Database.

IMPERVIOUS SURFACES

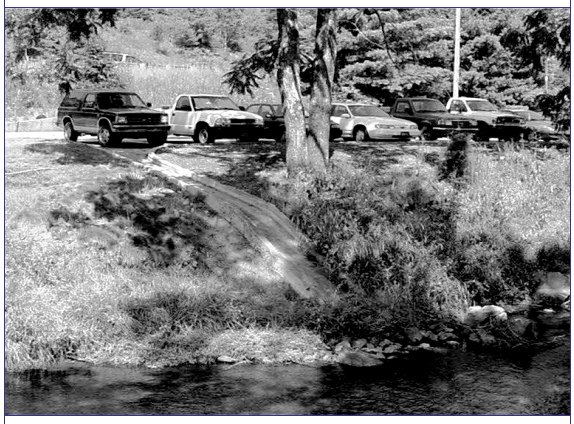
The Water Supply Watershed Protection rules are both preventative and responsive. The rules, which were established in 1992 and updated in 1995, provide significant flexibility in attempting to avoid, minimize and, where necessary, mitigate against impacts to drinking water supplies around the state. While the rules do not explicitly single out parking lots, they do address that area covered by "built upon area" (BUA).

FOUR PARADIGMS IN STORMWATER MANAGEMENT

Activities which increase the amount of impervious cover typically decrease a site's ability to infiltrate rainwater, filter pollutants, utilize nutrients, and complete the hydrologic cycle. The infiltration of rainwater is critical to hydrologic systems, particularly in times of drought. Sites with large parking lots such as office complexes, big box retailers, churches and schools limit infiltration and exhibit "first flushes," the earliest and usually the most polluted runoff leaving a site, more frequently than sites without.

INSIDE THIS ISSUE:

THE INFLUENCE OF PARKING LOTS IN WATERSHEDS



A poorly designed parking area can reduce the effectiveness of watershed planning in your community!

All built upon areas within water supply watersheds must address stormwater runoff. Projects that are built in accordance with the "low density" approach do not require structural controls, such as wet detention basins. For projects that are constructed under an approved "high density" ordinance, structural controls are required. Projects built utilizing the 10/70 provisions must utilize best management practices and direct stormwater runoff away from surface waters. Structural controls are required for communities that use the 10/70 option as part of an approved high density development ordinance.

The following four approaches to managing stormwater can be applied to parking lots individually or comprehensively. These approaches are both historical and categorical in the practice of stormwater management, and each approach is represented in virtually all parking lots. Planning for the optimal use of stormwater infrastructure at parking areas is important at jurisdiction and watershed scales, and in part determines the impact to water supplies.

ELIMINATION

Stormwater collected on concentrated impervious surfaces has been addressed over time through a variety of techniques. Rooftop runoff was often collected in "cisterns," but for streets, plazas and markets, concern focused on moving stormwater runoff offsite as quickly as possible. The ubiquitous "curb and gutter" and "storm drains" are age old inventions and appear in many ancient cities.

But this elimination of stormwater without other management practices in place contributes to downstream impacts of rivers and streams. The impacts include flood intensification, stream bank destabilization, and habitat degradation. In some cases stormwater runoff drained into the water supplies for settlements leading to illness and disease.

FLOOD CONTROL

In response to storm generated flooding, better quantity control techniques were developed. Flooding was partially controlled by diverting concentrated runoff elsewhere. Channeling, armoring or piping of streams was a primary means of conveyance. Ditches were also constructed but these practices harmed existing streams and rivers. Later, more flood control was achieved by storing excess floodwater in large storage ponds.

VOLUME AND VELOCITY CONTROL

Runoff management continued to become more comprehensive and, in response to the Clean Water Act and other environmental requirements, focus shifted to water quality. Regulations require that developments utilizing structural control devices meet water quantity goals as well. Examples of these include

(See Influence on page 2)

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PARKING LOT NATION!

The International Parking Institute estimates that there are more than 105,200,000 parking spaces in the U.S., a number that increases every day. The ratio of off-street spaces to on-street is roughly two-to-one.

(from http://www.parking.org/resource.htm)

Influence (Continued from page 1)

extended detention basins, level spreaders, and constructed wetlands.

WATER QUALITY CONTROL

Intensity of stormwater runoff determines the degree of stormwater management and, as a result, alternative and integrated approaches can offer complementary coverage. Structural and design oriented practices such as bioretention, porous paving, and Low Impact Design can be especially helpful. (See http://h2o.enr.state.nc.us/wswp/SL/wint2000.PDF for more information.)

Many local governments are reducing negative impacts caused by stormwater runoff by carefully planning where and how impervious surfaces are located. Some local governments have begun to evaluate reducing minimum parking requirements for parking lots and other high intensity land uses, set maximum parking allotments for certain land uses, develop shared parking ratios to maximize BUA, and design streets to accommodate more on-street parking. Some local governments have even begun to look at the role of trees in integrated stormwater management plans. Recent research indicates that restocking an urban canopy reduces direct accumulation from rainwater on impervious surfaces, and can also significantly improve pollutant uptake through the leaf and root system.[1]

TECHNICAL RESOURCES

1. Trees: The Oldest New Thing in Stormwater Treatment
Depending on the species and the soil condition, trees can absorb a considerable amount of water. Also, some water polluting elements are readily absorbed by trees which utilize them as food. Learn how much can trees really affect stormwater management?
http://www.forester.net/sw_0203_trees.html

2. "Parking Generation"
The industry standard for setting and managing parking allotments. More information on this report can be found at
http://www.ite.org/

3. For a contrasting perspective, see Shoup, D. "The High Cost of Free Parking", Journal of Planning Education and Research, Vol. 17, No. 1, Fall 1997, pp. 3-20.

4. Non Point Source Education for Municipal Officials – Tech. Paper 5 – Parking Lots.
Provides examples and methods for reducing impacts from surface parking lots.
http://nemo.uconn.edu/publications/about_nrbp/tech_papers/tech_5_pkinglots.pdf

5. Parking Lot Designs – Reduce Runoff and Pollution.
Provides a detailed case study where using low impact designs demonstrates how small alterations can reduce runoff and pollutant loads.
http://www.forester.net/sw_0206_infiltration.html

A RIVER RUNS THROUGH IT

A concrete and asphalt river runs through our cities and has spilled out into the countryside. Eighty to ninety percent of all parking demand is accommodated by surface parking with much being duplicative. Studies in some metropolitan areas indicate that there are seven times more parking spaces than there are vehicles.

This asphalt and concrete river carries with it large amounts of surface water contaminants. Automotive detritus from tires; heavy metals such as lead, zinc, cadmium, and copper; and various chemical fluids all settle on paved surfaces. In addition, parking lots act as heat islands greatly increasing temperature of any stormwater runoff.

Urban researchers anticipate that as more area is used for transportation and as per capita car ownership increases, the amount of acreage devoted to parking will increase. Because each rainfall event carries pollutants from these areas into our waterways, decisions about parking lots can have major implications to the health of water supply watersheds.

FORM FOLLOWS PARKING?

The amount of land utilized for parking is a function of land use. For commercial sites, *value* is directly proportional to the amount of "free" parking. Municipalities have an interest in this relationship because assessed value generates tax revenue, and as such this relationship becomes established and recorded into local zoning codes, ordinances or sector plans as parking minimums. This ratio represents this relationship:

OF PARKING SPACES : SQUARE FOOTAGE OF ACTIVITY

Original incorporation into local codes came in the middle part of the 20th century and was largely influenced by the Institute for Transportation Engineers document titled "Parking Generation."[2] The 1987 update includes parking estimates for 64 different land use categories. For many communities in North Carolina, the ratio for commercial/retail oriented use is 1 parking space per 200 square feet.

However, some question the validity of this information since half of the reported rates are based on four or fewer case studies, 22 are based on a single case study and the standards are measured by using peak demands at "free" parking locations in suburban locations.[3]

RESOURCES FOR WATERSHED PLANNERS

Technical resources for dealing with site specifics and watershed wide applications as they relate to the influence of parking lots are available.

A paper produced by the University of Connecticut's Cooperative Extension Service takes a comprehensive look at policies influencing parking areas in watersheds, and provides practical suggestions for improvements.[4] The report looks at parking lot location, sizing, and design issues, and indicates how each influences water resources. Recommendations are provided as to how to reduce these impacts for each section. For example, the report suggests that no more than 50% of parking be located between the principle building and an abutting street. This distributes the parking around larger buildings, reduces walking distances in parking lots, encourages shared parking facilities. It also benefits water quality by discouraging seas of contiguous parking lots. The report also suggests that reducing stall dimensions to reflect the changing nature of the American automobile can yield more savings by providing more parking services in the same amount of area.

A study conducted at the Florida Aquarium in Tampa, Florida, considered a variety of structural and non-structural controls to identify the most effective solution to dealing with increased impervious surfaces in the watershed.[5] The study shows how alternatives in parking lot design can affect runoff and pollutant loads by evaluating 8 micro drainage areas from a two acre parking lot. Each drainage area had a different combination of pavement, and stormwater BMP. The report examined the different arrangements to indicate which was best for treating and controlling runoff.

At the end of this two year study, when the different elements of the drainage system were compared, the results

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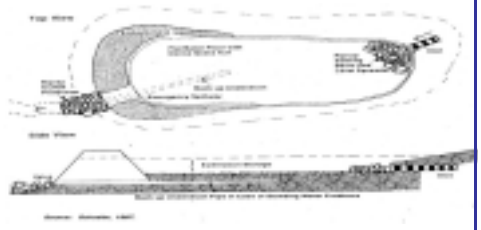
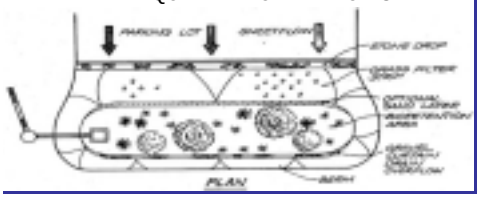
1. ELIMINATION: CURBS & GUTTERS

2. FLOOD CONTROL: STORAGE PONDS



3. VELOCITY CONTROL: EXTENDED DETENTION BASIN

4. WATER QUALITY: BIORETENTION CELL



showed that almost all runoff was retained on-site. Fifty-nine measurable storms were sampled. The site saw reduced pollutant loads of nitrogen, phosphorous, heavy metals, and suspended solids. The "first flush" volume was reduced by upwards of fifty percent, and the entire system reduced pollutant loading by nearly ninety-nine percent through the combination of approaches included in the parking lot design.

NATIONAL STORMWATER BEST MANAGEMENT PRACTICES DATABASE DOUBLES
A NEW TOOL FOR EVALUATING STORMWATER BMP EFFECTIVENESS

This database provides access to BMP performance data in a standardized format for over 190 BMP studies conducted over the past fifteen years. The database may be searched and/or downloaded from the web site, and is also available on CD-ROM. Additional BMP studies are currently being prepared for the database. The database was developed by the Urban Water Resources Research Council (UWRRC) of ASCE under a cooperative agreement with the US Environmental Protection Agency and provides a collection of reports on data, operations, maintenance, effectiveness, evaluation protocols for BMP used in managing stormwater runoff.

More information can be found at: www.bmpdatabase.org

PARKING LOTS IN WATERSHEDS WHAT NEXT?

The four approaches to stormwater management discussed earlier can help evaluate the influence of parking areas in water supply watersheds. The technical resources provided offer examples ways to improve parking areas. Consider that roughly 1/2 of all non-residential BUA in water supply watersheds is or will be devoted to parking lots. Also consider that more than 20,000 gallons of water can be generated from a one acre parking lot during a 1-inch rainfall. Implementation of structural controls is required in some cases, but in other cases simple, non-structural measures may achieve unexpected and beneficial results. The average parking space (10'X20') occupies 200 square feet of impervious area. By reducing the size of one third of the total parking spaces to 7'6"x15' (a size suitable for compact cars) and applying this to a typical 50,000 square foot retail facility more than 7,000 square feet could remain unpaved. This savings if used as a small bio-retention BMP would add additional benefits for water quality.

The Division of Water Quality encourages local governments to "tighten up" the minimum statewide standards. Bonus points are available from certain funding sources for doing so.

Someone said once that we lose our streams lot by lot. We can presume that restoration of them is achievable by going, parking lot by parking lot.

This article was authored by Milt Rhodes, Watershed Planner, Local Government Assistance Unit

NPDES PHASE II UPDATE

In 1972, the National Pollutant Discharge Elimination System program was established under the authority of the Clean Water Act. Phase I of the NPDES stormwater program was established in 1990. It required NPDES permit coverage for municipalities with populations of 100,000 persons or more. In North Carolina, there are six Phase I communities. Phase II of the NPDES Stormwater program was signed into law in December 1999. This regulation builds upon the existing Phase I program by requiring smaller communities, with small municipal separate storm sewer systems (MS4s), to be permitted. Regulated small MS4s must apply for permit coverage by March 2003. Those communities permitted under Phase II are required to develop and implement a comprehensive stormwater management program that includes six minimum measures: (1) public education and outreach on stormwater impacts; (2) public involvement/participation; (3) illicit discharge detection and elimination; (4) construction site stormwater runoff control; (5) post-construction stormwater management for new development and redevelopment; and (6) pollution prevention/good housekeeping for municipal operations. A list of these communities is available at http://h2o.enr.state.nc.us/su/NPDES_Phase_II_designated_cities_counties.htm . 2000 census data is currently being analyzed for additional automatically designated communities.

A small MS4 becomes part of the Phase II program in one of three ways; (1) automatic designation, (2) state designation, or (3) petitioning. Automatic designation into the program applies to areas defined as an Urbanized Area by the U.S. Census Bureau. The definition of an Urbanized Area is complex, but in general terms it is any local government or group of local governments that combined have a population of 50,000 and a density of 1,000 people per square mile. Based on the 1990 census data, there are 17 Urbanized Areas in North Carolina. These areas include 60 cities and 25 counties for automatic designation. A list of these communities is available. State designation requires the Division of Water Quality to develop designation criteria. This criteria is used to screen communities outside of Urbanized Areas to determine if they will be subject to Phase II. Under the federal regulations, the state's designation criteria must be applied, at a minimum, to any unit of government that has a population of 10,000 or more and a density of 1,000 people per square mile. Based on the 1990 census data, the state has at least 23 cities that must be screened through designation criteria. Petitioning is the third mechanism for inclusion of small MS4s into the Phase II program. Under this option, anyone can petition DWQ to cover a local government under a Phase II permit if there are significant water quality concerns associated with that community. Affected communities are notified when a petition is received. DWQ will decide whether the community should be in the program.

The most recent information regarding this program can be accessed from this web site.
http://h2o.enr.state.nc.us/su/NPDES_Phase_II_Stormwater_Program.htm
More EPA information on NPDES Phase II can be found here...http://www.epa.gov/owm/sw/phase2/index.htm

HOW ARE YOU DOING WITH PHASE II PREPARATION?

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Address Correction Requested

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Please continue to look for it at: http://h2o.enr.state.nc.us/wswp/

WHAT'S HAPPENING?

"319 NPS Showcase"
Come to a presentation of non point source (NPS) pollution prevention activities of statewide importance. Topics include: TMDL development, new nutrient management requirements, watershed planning, permit requirements and integrating new storm water requirements with NPS reduction strategies. Hear perspectives from key state leaders on NPS issues and coordination of program and resources, financial and technical assistance.

A "PRIORITIES" outline of the NPS Unit in the Water Quality Section of DENR will also be presented.

Date: November 13, 2002
Contact: Lynn Sprague, (919) 715-6104, lynn.sprague@ncmail.net or Sean Groom, (919) 733-5083 x582, sean.groom@ncmail.net
Registration: $15.00. Lunch will be provided.

Water Quality Committee
October 9, 2002
Archdale Building, Raleigh
http://h2o.enr.state.nc.us/admin/emc/committees/wq/index.htm

Environmental Management Committee
October 10, 2002
Archdale Building, Raleigh
http://h2o.enr.state.nc.us/admin/emc/

DID YOU KNOW?

❖WATER SUPPLY SIGNAGE ALLOWED❖

The North Carolina Department of Transportation is making it standard practice for signs to be placed on highway right-of-way near the boundaries of environmentally sensitive watersheds. Requests for these signs should be sent to the appropriate Division Engineer by the local government or public water supply agency. Signs will be allowed only on US and NC numbered highways. The signs may state, "Water Supply Area/Spill Response 911" or Water Supply Area next XX miles/Spill Response 911" All costs associated with signs will be the responsibility of the local government or public water supply agency.

For more information contact the local Division Engineer for your district.
http://www.doh.dot.state.nc.us/operations/DOT_englist/default.pdf

❖RIPARIAN BUFFERS AND 401 WATER QUALITY CERTIFICATIONS❖

Property within water supply watersheds when traversed by perennial streams can be a challenge to development. This challenge is enhanced in the Neuse, Tar-Pamlico, Catawba Basins and Randleman Watershed due to more extensive rules regarding impacts to riparian areas. More restrictive 50 foot buffers apply to low density development within these river basins and watershed to prevent nutrients from entering the perennial and intermittent streams. A 100 foot buffer is required for high density projects in water supply watersheds. Piping a stream (or culverting), is one method of making a site developable, however, this activity can negatively impact adjacent riparian buffers by affecting the channel, banks and vegetation. No new development is allowed in the buffer zones, but the Water Supply Watershed Protection rules and buffer rules do allow for public road crossings, greenways, and water dependent structures to encroach into riparian buffers without seeking a variance. These allowable activities must direct stormwater runoff away from surface waters, minimize built upon area, and utilize stormwater best management practices. Driveway crossings for residential and non-residential uses are also allowed, however, these crossings should be sized only to support crossings for access and must follow the criteria listed above. All projects that propose to impact streams and the buffer areas of water supply watersheds must receive written approval from the Division of Water Quality, Wetlands/401 Unit, unless the activity is classified as "exempt" in the buffer protection rule. A variance from WSWP rules from the Water Quality Committee of the EMC may be necessary where parking areas, service facilities, or recreational amenities encroach into the buffer area. Checking with either the Wetlands/401 or the Local Government Assistance Unit staff early in the project can help determine whether a variance and/or the degree of mitigation that will be needed for the proposed activity.

Contact DWQ Wetlands/401 WQ Certification Unit at (919) 733-1786 (http://h2o.enr.state.nc.us/ncwetlands/regcert.html) or Milt Rhodes, Local Government Assistance Unit at (919) 733-5083 x366 for more information

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