

Chapter Four: Facing Old and New Challenges

On March 22, 1987, the Mobro garbage barge left New York City for North Carolina where it sought to unload its cargo—some 3,000 tons of solid waste. After docking in Morehead City, the barge was prohibited from unloading. For the next three months, the Mobro wandered the Gulf Coast and Caribbean looking for a place to unload. Eventually, the barge returned to New York where the waste was incinerated at a Long Island facility. This episode became a symbol of the growing disposal crisis in the United States and brought solid waste to the forefront of the nation's issues.¹

In the late 1980s, North Carolina and many other states experienced a short-term disposal capacity crisis. The federal government changed landfill regulations and state law set a new course for North Carolina's waste management future.

The review of accomplishments allowed common ingredients for success to be identified. Reviewing North Carolina's less successful efforts over the past 15 years allows the identification of common factors that inhibit progress. Both methods yield data essential for successful strategic planning, especially for the partially or unaccomplished goals from the last 10-year Plan. In addition to carry-over goals, this chapter examines new situations that arose in the last decade and challenges they present.

THE TRANSFORMATION OF THE ROLE OF LOCAL GOVERNMENTS

Forty years ago, most of the waste generated by North Carolina households, businesses and industries went to "town dumps." These uncontrolled and unregulated facilities were phased out in the 1970s and replaced by "sanitary landfills." The new landfills were required to cover wastes, control vectors and divert rainwater to reduce leachate. Throughout the 1960s and 1970s, local governments took on the increasing needs of solid waste management. Waste generation exploded as increasingly affluent American cities and counties became stewards of the new generation of sanitary landfills. The term the U.S. EPA began using for waste in the 1970s, "municipal solid waste," reflected the philosophy that cities and counties were responsible for ensuring safe and adequate disposal.² Almost every North Carolina county and many larger cities owned and operated one or more sanitary landfills, making local governments the state's primary waste managers.

In the early 1990s, rising disposal costs spurred many governments to charge "tipping fees" based on the weight or volume of materials to be disposed of in landfills. The fees coincided with the increasing use of "enterprise funds" for solid waste management. Over time, many solid waste programs no longer relied on property taxes, becoming self-reliant through the collected fees.

Regulations such as North Carolina's 1989 Solid Waste Management Act and the Federal RCRA "Subtitle D" rules placed broad responsibility on localities. Local governments faced increasing responsibility to make landfill disposal safer and reduce waste disposal to the extent possible. Because many counties found the new requirements too costly, they abandoned landfill management. Today, most North Carolina counties do not operate landfills. Many opt to transfer waste to larger, often privately owned, regional landfills outside their jurisdictions. This transformation changed local government's role from a primary solid waste manager to one of many players.

¹ Essential Action, Philadelphia Ash Dumping Chronology, (2003). <http://www.essentialaction.org/return/chron.html> [6 August 2003].

² The term is still used today and reflects the inaccurate view that the only materials going into landfills come from household garbage cans.

By the late 1990s, for-profit companies developed a number of large, regional landfills across the state. Some partnered with a county “host” that received a portion of the tipping fees. By FY 99-00, North Carolina shipped almost half of its waste to large, private landfills. Many shipments from county-owned transfer stations travel miles to reach a landfill. Between 1990 and 2000, the number of North Carolina landfills fell dramatically, the size of existing landfills rose, and ownership shifted from public to private. Exports also rose as large, private landfills in South Carolina and Virginia attracted North Carolina waste through county transfer station contracts and direct private hauling.

The old paradigm of locally owned and operated landfills funded through the general tax revenue is obsolete. Today, larger landfills – both privately and publicly owned – rely on tipping fees to operate. The shift presents a host of challenges that affect modern solid waste management.

Lack of Flow Control

The movement to tipping fees as a primary funding source for solid waste facilities and the emergence of privatized disposal create a disincentive for communities that planned to build and operate larger, more expensive landfills. Their inability to control the flow of local waste to their facilities played a major factor.

The U. S. Supreme Court expressly forbids some types of flow control because it violates the federal Interstate Commerce Clause. The lack of flow control reduced the amount of waste coming to landfills, so competition began and tipping fees dropped. The need for fees to pay down the debt created by expensive landfill development discourages many local governments that own landfills to divert waste through reduction and recycling. Local governments that began using transfer stations were more motivated to reduce waste, but without strong commitment from local officials many North Carolina’s solid waste management initiatives failed.

Changing Types of Solid Waste Management Facilities

As counties left the landfill business, they began using publicly or privately owned transfer facilities. Waste is transferred from garbage trucks to tractor-trailers at these facilities, which are often owned by private haulers. The haulers transport the waste to landfills either in North Carolina or out-of-state.

Private transfer stations are often established in urban areas. Private operations successfully compete for waste. The development of transfer stations and large, regional landfills creates many local and private alternatives for waste disposal. Where waste once went to the local landfill by default, it now travels to any number of disposal facilities that may be located miles away.

In FY 1999-2000, 76 transfer stations operated in North Carolina and waste became a portable “commodity.” Tipping fee competition that increased amounts at facilities with lower rates instigated the loss of flow control. The practice caused local governments to “lose” waste and the revenues it generates to privately owned landfill companies. Many local governments cannot compete effectively because they need the revenue from tipping fees to pay down their landfill debt and support additional solid waste programs such as recycling. Moreover, facilities offering lower rates need large volumes of waste to remain profitable. This need for waste reduces any incentive to reduce the waste stream through recycling. The need for waste conflicts with the desire to reduce it. This conflict creates a predicament for local government solid waste management.

In addition to transfer stations, C&D landfills have also grown in number and size. In general, C&D wastes are difficult to transfer because they are bulky, hard to compact, and cost more per ton to manage. Because C&D is the fastest growing waste sector, demand for disposal capacity grew rapidly. This spurred the development of a number of local and private C&D landfills through the 1990s. By FY 99-00,

61 C&D landfills operated in North Carolina. The large number of facilities, coupled with less stringent operating requirements, have kept disposal prices for C&D waste relatively low. At present, there is no research proving that this waste does *not* pose a long-term environmental threat. Consequently, the adequacy of C&D landfill regulations face increasing scrutiny.

Low Cost of Disposal and Long-term Effects on Capacity

In the 1980s, landfill fees were projected to reach \$50 or higher by the year 2000—high enough to help solid waste incineration and aggressive recycling programs compete as serious management alternatives. However, the “economies of scale” of large landfills, competition for tonnage among private and public landfills, and the increasing mobility of solid waste has kept statewide tipping fees in the \$30-\$35 range. This low disposal cost sometimes “out-competes” recycling options.

Growth in the state’s waste stream, disincentives to reduce waste, and increased difficulties to site landfills create a scenario where less space will be available for solid waste disposal. The consequences could be wide-ranging. Sudden increases in regional disposal costs affect state and local government economies and the environment. Because it is unlikely that state residents will experience uniform hardships, some areas may remain unaffected. However, other areas – typically urban with larger waste volumes – may well experience increased disposal or transportation costs, surges in illegal dumping, and other economic or environmental hardships.

Long-range and Interstate Movement of Waste

As waste has become more portable, state and county boundaries become increasingly irrelevant to its disposal. North Carolina now exports more than 10 percent of its waste stream. In 2001, most North Carolina counties sent municipal solid waste to another county or state, often 50-90 miles away.

Addressing the Challenges of the Paradigm Shift

The shift in solid waste management from locally owned and operated landfills funded through the general fund revenue to larger, often privately-owned landfills that rely on tipping fees affected local governments’ ability to undertake solid waste initiatives. However, local governments must renew and increase their solid waste management roles to meet this plan’s goals and objectives. Waste reduction, recycling and other disposal initiatives cannot succeed without the leadership and commitment of North Carolina’s local governments.

“Top-down” state measures are often viewed locally as “unfunded mandates.” To establish local, integrated solid waste management programs and initiatives, adequate support, guidance, technical assistance and sufficient funding must be available. Programs on source reduction, reuse, recycling and composting practices, as well as technical assistance on full cost accounting, enterprise funds and alternative financing programs are a few examples of this necessary support. County and municipal solid waste plans must establish strategies to implement integrated solid waste management programs that guide solid waste management within their jurisdiction.³

Clear outlines between local and state government authority to manage solid waste management would increase local government participation. Local governments now have the authority to pass ordinances, contract waste management services, delegate waste management responsibilities and establish local

³ It should be noted that some of the 1992 Solid Waste Management Plan goals addressed these considerations. Some objectives were partially accomplished; others remain unaccomplished. Other objectives require ongoing effort, beyond the scope of the 1992 Plan. These objectives are incorporated into the goals of this Plan.

programs.³ However, increased leadership on the local level – supported by the programs described above – would improve solid waste management initiatives.

Finally, a need exists to monitor local governments' capacity to implement solid waste mandates and requirements and assess their progress.³ At present, local governments and private facilities measure progress and describe activities on an annual basis. Their reports are used to create an annual report on solid waste management efforts that is presented to the Governor and General Assembly. Goals are tracked by a database management system, but the resources, needs and ability to meet mandates are not currently monitored. To properly address local governments' needs, data on local solid waste management efforts must be identified, cataloged and evaluated.

RISING DISPOSAL RATES

In the late 1980s, the General Assembly set a 25 percent reduction goal for per capita waste by 1993. Goal Two of the 1992 State Solid Waste Management Plan aimed to reduce 1991 base levels of per capita waste disposal by 40 percent before 2001. These goals were not accomplished. After limited progress in the early 1990s, the disposal rate in North Carolina grew on both a per capita basis and in absolute amounts. Disposal has increased from 1.08 tons per capita in FY 1991-92 to 1.22 tons in FY 2001-02. This 45 percent increase in tonnage over eight fiscal years leads to projection of more than 18 million tons *per year* by 2020. Various factors, often interrelated, have kept North Carolina from achieving its waste reduction goal. These factors are discussed below.

Loss of flow control by local governments and incentives to dispose

The paradigm shift described in the previous section resulted in the privatization of waste. Local governments that own solid waste facilities rely on tipping fees to fund disposal facilities and operations, while private landfills seek profit. Both entities have little current incentive to decrease the flow of waste. Local governments that must pay to transport waste through transfer stations have a higher economic incentive to reduce waste generation.

Lack of development of large-scale alternative disposal solutions

Alternative disposal solutions have not been developed as expected. Incineration has not expanded, primarily due to the greater expense required to develop an incinerator and the uncertainty of waste flow.

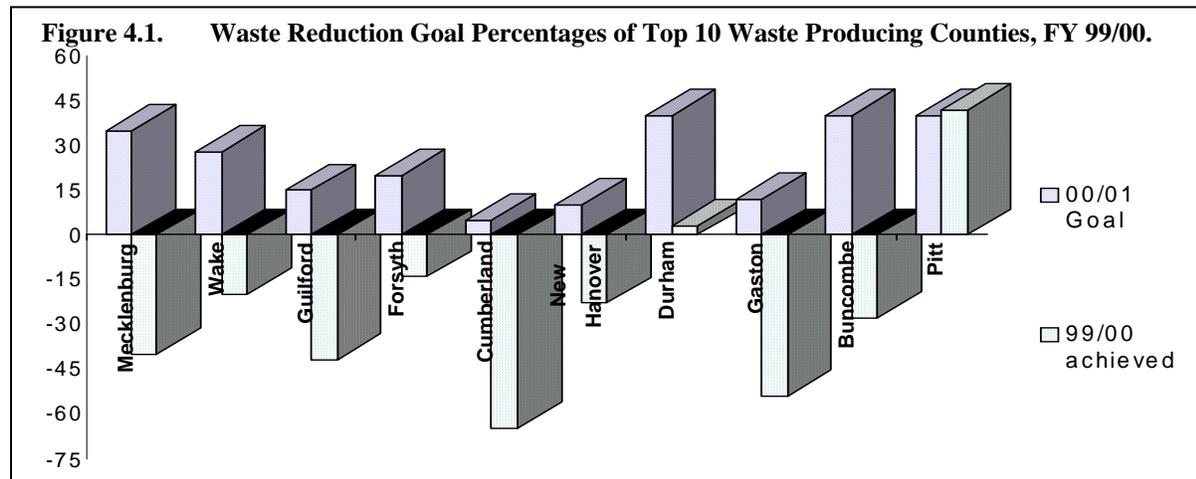
Mixed waste composting and other technologies that treat or modify waste to render it beneficial or less potentially harmful have proven unsuccessful. A number of "magic box" options have been proposed over the years, but none have proven viable over time.

Lack of commitment by local and state agencies

The general increase in environmental awareness and ethics that gained momentum in the late 1980s and early 1990s did not significantly reduce waste generation in North Carolina. Recycling rates rose, but were outpaced by disposal increases. Without sufficient mandates, resources or support, the ability to develop the infrastructure needed to combat increasing waste was limited. Additionally, other environmental issues garnered the attention that solid waste once received. The movement to lined landfills also created the false sentiment that the solid waste "problem" was solved.

Legislation established in 1996 allowed local governments to use "good faith" efforts to create individual waste reduction goals instead of embracing the state's 40 percent reduction goal to be achieved by 2001. Compared to the state's goal of 40 percent (using an average weighted relative to population), local plans only achieve a 27 percent reduction. Local solid waste management plans show a decrease in commitment

and funding to solid waste reduction and programs that maintain or enhance programs and initiatives. A sample of 28 counties (the top 20 waste-producing counties, plus every ninth county ranked by the amount of waste produced) shows that only five achieved their waste reduction goal in FY 99-00. Of the state's 100 counties, fifteen met their FY 99-00 waste reduction goal, but 52 *decreased* their future goals. Only two of the top 10 waste-producing counties made progress towards waste reduction.



Some counties, such as Mecklenburg, Orange and Chatham, increased their future waste reduction goals and continued expanding programs to address them. However, few counties plan innovative programs and several have merely extended the implementation dates for initiatives they have yet to operate. For example, plans developed in 1997 that stated, “beginning in 1997 this county will...” were simply modified to read “beginning in 2000 this county will...”.

The lack of commitment is not without reason. As local economies and populations grow, county funding priorities turned to building or sustaining infrastructure such as roads, sewer and water capacity, and capital improvements. Because solid waste reduction goals are established on a local level without a state mandate, other local needs have taken precedence.

Economic growth

North Carolina's economy has boomed since the last 10-year State Plan was released. Increasing affluence allowed households and businesses to replace and buy more products, which increased discards. Since 1990, North Carolina's employed population rose over 25 percent and the gross product nearly doubled. Annual retail sales and construction of dwellings soared. In 1991, total dwellings constructed in the state equaled 39,034; in 1998, the total rose to 80,514. Single-family dwellings alone saw an increase of 30,671 during this period. With each house built yielding four tons of disposed waste, the building increase created an extra 122,684 tons of construction waste annually. The share of waste streams associated with economic growth (electronics and disposable products) also increased.

Minimal source reduction efforts

The 1992 State Plan goal to implement source reduction programs and increase recycling in state government was only partially accomplished. The fourth annual *Report of State Agency Purchases of Recycled Products and Reduction of Solid Waste Disposal* (FY 96-97) shows that 89 percent of state agencies practice some level of source reduction. Developing and maintaining current programs will require training courses, workshops, sample planning documents and manuals, fact sheets, on-site and on-call assistance, along with financial support. Expanding these efforts could reduce the waste stream.

Waste generation from tourism

Tourism has grown into one of the state's largest industries. More than 44 million people visit North Carolina and spend nearly \$12 billion dollars each year.⁴ The 10 largest waste-producing counties are in the top 25 percent of counties generating tourist dollars. With more than half of North Carolina's domestic travel expenditures in the food service and lodging industries, both sectors generate large amounts of waste that have yet to be targeted by aggressive recycling programs.

Waste Stream Composition

In addition to disposal increases, the types of waste disposed have changed. New disposables have been added to the household waste stream. Some new materials have limited recycling markets and programs (e.g., construction wastes); others pose more complex challenges. A few of the materials posing challenges include:

- **Household Hazardous Wastes.** In FY 1999-2000, 24 programs provided HHW collection for roughly 30 percent of the population. These programs collected just under 1,000 tons of HHW, providing a glimpse into the amount of HHW currently disposed in landfills. Assuming the programs capture 10 percent of locally disposed HHW and factoring in non-program counties creates a projected total of more than 33,300 tons of HHW entering North Carolina landfills and transfer stations each year.
- **Used Motor Oil.** Approximately 500,000 gallons of oil enter landfills in North Carolina annually as residue in disposed filters and bottles.⁵ While HHW and oil contribute little to the overall volume, they significantly affect its overall toxicity.
- **Electronics Disposal.** Obsolete electronic products such as computers, televisions and radios are one of the nation's fastest growing and most complicated waste streams. The products contain a variety of materials, including some hazardous elements. Increased consumption and high turnover contribute to the continued growth of this stream. The 1998 North Carolina Recycling Market Assessment estimated 53,398 tons of electronic discards would be generated in 2002.

The state's recovery infrastructure for these materials is immature, so the vast majority of electronics are disposed in landfills or stockpiled in homes and businesses. For North Carolina to successfully divert these products and their hazardous elements, it needs to fund a collection infrastructure and education program for residents and businesses. If local funding is used for electronics as it has been with HHW, the infrastructures created are likely to be similar. Recovery efforts will develop slowly and concentrate in more affluent urban areas. A statewide funding source, such as an advance disposal fee, would assure a more equitable infrastructure and education programs.

DISPOSAL CAPACITY AND THE DIFFICULTY OF SITING NEW LANDFILLS

The disposal capacity crisis of the 1980s was created when small landfills filled up and newly imposed regulations closed other facilities. The ensuing development of larger, lined landfills gave the false impression the capacity crisis was solved. However, the late 1990s saw public and private entities experience increased public opposition and greater difficulty to site new facilities and maintain operating

⁴ North Carolina Department of Commerce, Tourism (2003). <http://www.nccommerce.com/tourism/> [4 August 2003].

⁵ N.C. Division of Pollution Prevention and Environmental Assistance, "Oil-Related: Used Oil Commodity Profile" in Markets Assessment (1998). <http://www.p2pays.org/ref/02/0162212.pdf> and <http://www.p2pays.org/ref/02/0162213.pdf> [4 August 2003].

facilities. The combination of higher disposal rates and insufficient disposal alternatives support a concern for North Carolina's ability to create future landfill capacity.

Public response to landfill proposals has been intensely negative, especially from the communities neighboring potential sites. Recently issued permits are often met with legal challenges and local elected officials cite negative public response as their primary reason for not giving local government approval for proposed landfills. A partial list of recent landfill permitting battles includes:

- **Durham County.** After a lengthy siting process, Durham decided in 1998 to transfer waste to a Virginia facility rather than build a new local landfill.
- **Wake County.** Despite purchasing the property well in advance and securing local government support, Wake fought an extensive battle with residents from the town of Holly Springs over a planned landfill near the town.
- **Orange County.** Attempts to site both municipal solid waste and C&D facilities have met with strong resistance.
- **Mecklenburg County.** The new solid waste facility located near the South Carolina border took more than a decade to develop. The facility only accepts C&D waste and has yet to accept municipal solid waste.
- **Guilford County.** A C&D landfill near High Point shut down after public controversy about the materials accepted at the facility. Subsequent attempts to build another landfill in Guilford County have failed. When a C&D landfill closed and the materials came to the city of High Point's landfill, that city banned C&D materials from its municipal solid waste landfill.
- **Forsyth, Franklin and Halifax counties.** A private landfill in Forsyth County has unsuccessfully sought expansion. Proposals for a landfill in Franklin and Halifax counties were withdrawn after citizens objected.
- **City of Greensboro.** With a projected 2007 closure date, the potential expansion of its municipal solid waste landfill met with strong opposition. Various alternatives are currently being considered.
- **Chatham, Duplin and Lee counties.** Planned MSW or C&D landfills were withdrawn in the face of local public opposition.

Because many of the new landfill battles occurred in urban areas where growth helps limit local options, new disposal capacity appears most likely to develop in rural areas. The fact that one million tons of North Carolina's exported waste goes to landfills in rural areas of Virginia and South Carolina lends weight to this prediction.

FACTORS INFLUENCING LANDFILL CAPACITY

Although landfill capacity is a poorly understood concept, the resource is a public health necessity. Municipal solid waste landfills provide a controlled, monitored environment for solid waste that requires disposal. North Carolina now has 41 MSW landfills in operation, but all will "fill up" or reach their full capacity. The ability to understand and measure current and future landfill capacity is necessary for the welfare of North Carolina's residents.

The rate of solid waste disposal in North Carolina has increased over the last decade in both absolute and per capita amounts. Despite the 40 percent per capita reduction goal, rates continue to rise since record-keeping began in FY 1990-91. The increases continued during times of economic growth and recession, refuting theories that waste disposal decreases during economic downturns. Reasons for the increase

include loss of local government flow control, a reduced commitment to waste reduction by state and local government agencies, economic and population growth, and changes to the waste stream. As disposal rates rise, landfill lifetimes become shorter.

Rising disposal rates could be curbed with increased recycling and composting efforts. Markets and opportunities to engage in recycling programs exist, but the alternatives are initially more expensive than landfill disposal for some waste streams. Additionally, communities that rely on tip fees have little incentive to divert materials. While recycling markets developed significantly since the late 1980s, recovery levels have not kept pace. Increasing the availability of disposal alternatives and reducing waste creation could extend landfill capacity statewide. Reducing waste by only five percent a year through source reduction, recycling and other mechanisms would extend North Carolina's landfill capacity by nearly 60 percent.

Landfill capacity largely depends on the state's ability to open and maintain solid waste facilities. Obviously, closing landfills reduces capacity while opening landfills enlarges capacity. At present, public sentiment towards landfills is negative. New facilities are sometimes prevented from establishment and operating facilities are occasionally closed before they reach maximum capacity. In many cases, public fears could be labeled as "misconceptions." The facilities do not pose the risk to public health and the environment that some citizens may perceive. Public education may minimize such fears and may reduce some of the opposition to solid waste facilities. Education efforts could preserve operational facilities and aid the development of new sites. Both results are needed for North Carolina to maintain and expand its landfill capacity.

In addition to public opposition, the intensive permitting process poses another hindrance to siting new facilities. Improving the permit review process may also help new landfills be sited and increase prospects for landfill capacity.

MEASURING LANDFILL CAPACITY

The concept of 'landfill capacity' can be defined in different ways. A landfill is a three dimensional volume of space filled by tons of waste over a period of time. Thus, landfill capacity can be measured in three particular aspects:

- (i) The remaining *volume* of cubic space in a landfill,
- (ii) The remaining *capacity* for tonnage of waste in a landfill, or
- (iii) The remaining amount of *time* before a landfill is "full."

Measuring Landfill Capacity by Volume

In North Carolina, landfills are permitted with a specific total design capacity and operating capacity. Both describe the volume of air space available for use and both are measured in cubic yards (yds^3). Total design capacity equals the absolute maximum of useable air space at a particular site. The measurement is planned by landfill engineers at the outset of the permit process. Some landfills seek additional capacity through permitted site expansion, but it happens rarely because the permitting process is lengthy and complex. Total design capacity is generally determined before operations begin.

Operating capacity is the amount of air space that a given landfill operator is permitted to use. Operating capacity is generally permitted in "phases" that are periodically increased until total design capacity is met or the landfill closes for other reasons. A landfill's total design capacity may never be realized due to additional permit requirements, owner and operator choice, or other reasons.

Landfill space volume is measured by aerial or ground survey. Once the “used airspace” is determined, the remaining total capacity is calculated by subtracting that figure from the landfill’s total design capacity. For example, a hypothetical landfill may be designed with a total capacity of 5 million yds³ with operations scheduled to begin in July 1998. A survey conducted in June 2003 shows that 1 million yds³ have been used. The remaining volume of capacity for that landfill is the original permitted 5 million yds³ minus the 1 million yds³ used. In this case, the landfill has 4 million yds³ of remaining space for disposal.

Measuring Landfill Capacity in Mass

All waste is weighed before it is placed into any municipal solid waste landfill. The weight and county of origin, along with other facts, are recorded by landfill operators for annual reports. The data are used to calculate the ratio of tonnage to used airspace, also known as the *utilization factor*. The figure gives insight into how efficiently airspace is utilized. The greater the amount of waste that can be fit into a cubic yard, the more efficient a landfill will be. Different waste types, compaction rates, daily covers and landfill age all influence utilization factors.

Utilization factors can be used to project future waste tonnage capacity. To return to the example above, the landfill had received 600,000 tons of waste since July 1998 that the survey indicated used 1 million yds³ of airspace. The landfill’s utilization factor can be calculated using the equation below:

$$\text{Utilization Factor} = \frac{\text{Tons Disposed}}{\text{Airspace Used by Tonnage}} = \frac{600,000 \text{ tons}}{1,000,000 \text{ yds}^3} = 0.60 \text{ tons / yds}^3$$

The results show the landfill operated at a rate of 0.60 tons (or 1,200 pounds [.60 x 2,000]) of waste per cubic yard used. Compared to most North Carolina landfills, this utilization factor is high.

The equation below shows how the data can be used to calculate any landfill’s remaining tonnage capacity. Assuming the landfill utilization rate remains stable, multiplying a landfill’s remaining airspace (determined in the first hypothetical equation) by its utilization factor yields the landfill’s remaining capacity for tonnage.

$$\begin{array}{l} \text{Remaining} \\ \text{Capacity for} \\ \text{Tonnage} \end{array} = \begin{array}{l} \text{Remaining} \\ \text{Airspace} \end{array} \times \begin{array}{l} \text{Utilization} \\ \text{Factor} \end{array} = 4,000,000 \text{ yds}^3 \times 0.60 \text{ tons/yds}^3 = 2,400,000 \text{ tons}$$

In this case, the hypothetical landfill’s projected remaining capacity is 2.4 million tons of waste before it reaches maximum design capacity.

Measuring Landfill Capacity in Time

The figures above can also be used to calculate a landfill’s remaining lifetime. Assuming landfill operations remain the same, its remaining capacity can be calculated by dividing the remaining capacity for tonnage by the average monthly tons of disposal. To calculate the remaining lifetime of the hypothetical landfill, use the equation below.

$$\begin{array}{l} \text{Remaining} \\ \text{Capacity} \\ \text{in Months} \end{array} = \frac{\text{Remaining Capacity for Tonnage}}{\text{Average Tons Disposed Per Month}} = \frac{2,400,000 \text{ tons}}{10,000 \text{ tons/month}} = 240 \text{ months} \\ \text{or 20 years}$$

This formula is based on the assumption that past practices predict future actions. However, if the annual disposal rate rises to 15,000 tons per month, the landfill’s life drops to 13 years. The time remaining is

directly related to the rate of tons received per month. Lifetimes can be extended or shortened depending on landfill operators' actions, the surrounding community, or other related circumstances.

For example, we now know increased disposal rates lessen a landfill's remaining lifetime. We also know that unpredictable catastrophic events, such as hurricanes, stress landfill capacity. Political circumstances such as public opposition can also shorten landfill lifetimes when facilities close before they reach total capacity. Conversely, other actions like increased recycling, waste reduction efforts, and more efficient landfill operations can lengthen a landfill's remaining lifetime.

NORTH CAROLINA'S LANDFILL CAPACITY

North Carolina currently has approximately 206 million cubic yards of landfill capacity. The state utilization factor of .57 shows these cubic yards can reasonably be expected to house nearly 118 million tons of MSW waste. Assuming the state's landfill use rate remains the same as last year's (2002-2003) rate of 605 thousand tons per month, the state has a capacity of 16 years (see Figures 4.2 and 4.3 below). This projection does not include waste exported to other states.

The capacity figure is misleading. A great deal of the capacity is not available due to permit conditions, franchise arrangements, political decisions and distance. To illustrate the limiting factors, consider that the Camp Lejeune landfill only accepts waste from the Marine Corps base, the Alamance County landfill is only permitted to accept waste from Alamance County, and the Upper Piedmont landfill has a permitted limit of 600 tons per day. Many landfills have franchise agreements that only allow waste from a particular distance from the landfill. Other landfills have permits and franchise that allow them to accept waste from other jurisdictions, but they chose not to do so. Landfill owner/operators are also free to choose not to use all permitted space.

Accessibility is the primary factor limiting full utilization of the state's capacity. In North Carolina the maximum distance large quantities of waste are currently transferred is a little less than 100 miles. There are some exceptions, but this holds true when factoring in the concept of waste sheds or service areas. Map 2.1 gives a graphic depiction of this average using data from 2001-2002.

Because accessibility varies across the state, some regions have less capacity than the state average. This is especially true if out-of-state capacity is not considered. Statewide capacity does not appear to be a problem at this time. However some regions within the state will experience disruptions and additional costs as arrangements change, including the possibility that waste may travel further than it currently does.

The last new permitted landfills that were operational in 2002 are located in Anson, Sampson and Mecklenburg counties. Since 2000, no landfill permits have been issued that resulted in a landfill being constructed and operating. One landfill permitted in 2003 is under construction in Lenoir County, but the facility is not yet in operation.

Figure 4.2: Calculation of Statewide Monthly Disposed Tonnage

Volume Airspace Used (yd ³)	83,439,238.00
Tons Disposed	47,936,314.57
2002-2003 Tons Disposed	7,258,143.68
Months of Operation	
Utilization Factor (tons/yd ³)	0.57
Lifetime Avg. Tons Disposed Per Month	537,311.92
2002-2003 Avg. Tons Disposed Per Month	604,845.31

Figure 4.3: Calculation of Available Statewide Disposal Airspace and Capacity

	Permitted	Total
Original Available Airspace (yd ³)	125,748,044.00	289,211,652.00
Remaining Airspace (yd ³)	42,308,806.00	205,772,414.00
Remaining Capacity for Tonnage (tons)	24,306,648.55	118,217,416.69
Remaining Capacity in Months	40.19	195.45
Remaining Capacity in Years	3.35	16.29

Notes on Calculations in Figures 4.2 and 4.3:

- Avg. Tons Disposed Per Month = Tons Disposed/Months of Operation
- 2002-2003 Avg. Tons Disposed Per Month = 2002-2003 Tons Disposed/12 months
- Utilization Factor = Tons Disposed/Volume of Airspace Used
- Remaining Airspace = Original Available Airspace – Volume of Airspace Used
- Remaining Capacity for Tonnage = Remaining Airspace x Utilization Factor
- Remaining Capacity in Months = Remaining Capacity for Tonnage/02-03 Avg. Tons Disposed Per Month
- Remaining Capacity in Years = Remaining Capacity in Months/12 months

LONG-TERM CARE OF LANDFILLS

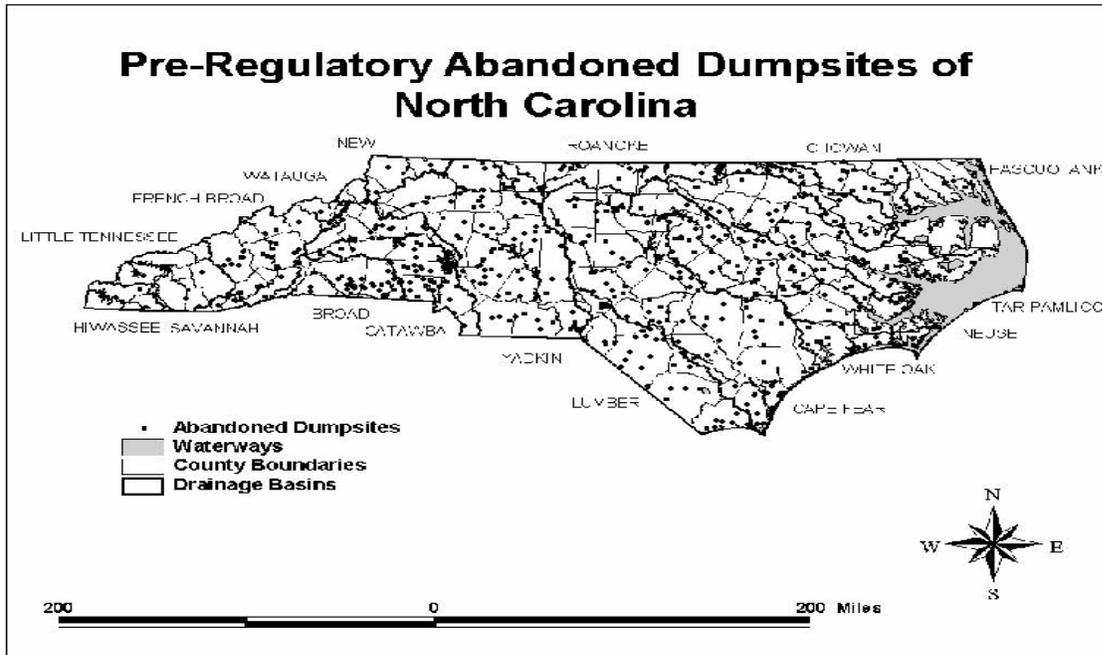
The Legacy of Closed Landfills

North Carolina communities have growing concerns about groundwater contamination from leachate leaving closed unlined landfills. Leachate is any liquid, or suspended components in liquid, which has percolated through or drained from solid waste. Leachate often contains potentially toxic chemicals. Leachate from municipal solid waste can contaminate groundwater and render it unusable or undesirable. Contaminated groundwater can reduce the service life of appliances and fabrics due to the presence of harmful or undesirable chemicals. More than 90 percent of the state's 126 closed municipal solid waste landfills show some evidence of degraded groundwater quality.

Little is known about the abandoned dumpsites because no record-keeping regulations existed at the time. Exact locations are not available for the majority of these dumpsites. Unlike today, pre-regulatory dumpsites had no environmental monitoring requirements. The N.C. General Assembly appropriated \$1.9 million after Hurricane Floyd to determine the exact location, surface conditions and ownership of approximately 280 abandoned dumpsites in 37 flood-prone counties. No groundwater, surface water or soil samples have been collected from these sites to determine their environmental impacts. Map 4.1 shows the locations of the pre-regulatory abandoned dumpsites identified so far in North Carolina.

Because many old, unlined MSW landfill facilities and dumpsites were located in relatively remote areas, the potential threat to surrounding communities was minimized. However, these communities have grown and continue to grow. New development around closed landfills and dumpsites may expose residents to environmental risks that were once considered "taken care of." Groundwater supplies may be contaminated and render well water useless. Methane gas could migrate into a structure and create the risk of inhalation or explosion. Some communities have taken corrective action to mitigate those risks again. Many more communities will need to do so in the future.

Map 4.1



In 1993, North Carolina changed its Solid Waste Management Rules. Spurred in part by the U.S. EPA's RCRA 40 CFR Part 258 Solid Waste Disposal Facility Criteria (Subtitle D), the legislation significantly improved groundwater monitoring programs for active municipal solid waste landfills. The changes included increased sampling frequency, routine detection monitoring for an expanded contaminant list, statistical analysis of water quality data, and an automatic elevation to Appendix II assessment monitoring when significant contaminant increases are detected. The rules formalized procedures for groundwater assessments and corrective action, and provided for at least 30 years of post-closure monitoring.

Corrective action can include many approaches. Improving landfill caps, adding buffers to control land use, supplying public water for areas neighboring landfills, voluntarily restricting deeds on contaminated property, sampling groundwater quarterly for state toxicologist review, replacing contaminated wells, and active cleanups are just a few. The highest priority is given to the landfills with documented water quality impacts to potable wells in order to minimize potential health threats.

Long-term Care of Lined Landfills

The fact that North Carolina now disposes of municipal solid waste only in lined landfills designed to keep leachate out of groundwater is an unqualified success. Because lined facilities reduce the infiltration of water that helps waste breakdown, they will probably contain degradable waste long after they close. This time may exceed the 30-year post-closure monitoring period currently required. The facilities' ability to protect human health and the environment while the waste degrades requires continuously operating control systems until the process is complete. Although landfill owners are responsible for a 30-year post-closure period, long-term management for these facilities is not completely defined.

Long-term Effects of Construction and Demolition Landfills

C&D landfills are permitted, constructed and operated at lower standards than North Carolina's municipal solid waste landfills. The distinction comes from the general perception that C&D waste is potentially less harmful and does not warrant stringent environmental controls. As the number of C&D landfills has grown, concern has increased over their environmental impacts and long-term care requirements. Some C&D waste contains potentially harmful components. A 1995 EPA study identified seven "potentially problematic" constituents of concern from C&D leachate sampling.^{6,7,8}

RECYCLING DEVELOPMENT

Paper fiber, plastic resins, glass, textiles, rubber, organic materials and metals enter North Carolina landfills daily. This is an enormous waste of potential manufacturer feedstock. Many mainstream end-use markets exist for these materials, and many North Carolina companies increasingly rely on supplies of recyclables. Furthermore, using recycled materials is a proven way to reduce the use of virgin materials, save energy and water, and reduce pollution.

As shown in Chapter Two, ample potential exists to increase the amount of materials already widely recycled. Despite available curbside and drop-off services, a strong private recovery infrastructure and adequate end-use demand, recovery rates for PETE, HDPE, aluminum and glass containers remain very low (e.g., 16 percent for PETE and 49 percent for aluminum cans). End-use demand and the value of newspaper, corrugated cardboard and office paper show that higher recovery rates for these materials are possible. Pallets and clean wood also have a wide range of potential markets and uses to complement viable source reduction. Material recovery for these items grew in the past decade then slowed over the past few years. Measures that increase the recovery of these materials would reduce the state's disposal burden and the value added would benefit the industrial economy.

Recycling Markets

Recycling programs surged immediately after the 1980s disposal crisis. The resulting supply often overwhelmed manufacturing demand. For example, in 1990 many local governments temporarily stopped collecting newspapers – a mainstay of public recycling programs – because Southeast mills could not absorb the supply. "Demand crises" are periodic and have affected plastics and other materials.

The rapid rise in recycling put many local governments and private waste generators in the unfamiliar role of interacting with commodity markets. Commodity markets are notoriously volatile due to shifts in the national and global economy and changes in the complex feedstock needs of individual product manufacturers. However, the 1990s brought unprecedented market development. The U.S. paper industry alone added 10 million tons of demand capacity for recovered fiber. The increase was partially motivated by state laws mandating recycled content standards in published newspapers and government-procured paper. Markets for more traditionally recyclable materials have also increased dramatically over the past decade. However, the state needs to increase the volume, affordability and accessibility of its infrastructure for recycling and composting to reduce the state's disposal rate. Some materials in particular – such as electronics, organic wastes and construction debris – have adequate end-use markets but underdeveloped collection and processing infrastructures.

⁶ U.S. Environmental Protection Agency, Construction and Demolition Waste of Landfills, (February 1995). < <http://www.epa.gov/epaoswer/hazwaste/sqg/const/cdrpt.pdf>> [4 August 2003].

⁷ Florida Center for Solid and Hazardous Waste Management, Characteristics of Leachate from Construction and Demolition Waste Landfills, Timothy Townsend, (August 1998).< http://www.floridacenter.org/publications/const_demo_pubs.htm [4 August 2003].

⁸ Florida Center for Solid and Hazardous Waste Management, The Management and Environmental Impacts of Construction and Demolition Waste in Florida, Timothy Townsend (June 1998). <http://www.floridacenter.org/publications/const_demo_pubs.htm> [4 August 2003].

Recycling markets remain subject to price swings as the supply-demand balance seeks stability in a dynamic economy. Markets may seem to occasionally “disappear” due to changes in locally accessible processing capacity, global transportation or a global recession. However, some markets have shown responsiveness to statutory action. For example, Southeast newspaper markets stabilized after North Carolina and other states passed minimum content laws. Unfortunately, the last 15 years demonstrated that low tipping fees can slow recycling market development. They also showed that buy recycled programs, legislative mandates and disposal price competition positively affect recycling markets. North Carolina’s state agency buy recycled programs have been relatively successful. State and executive policy [G.S. 143-58.2 and Executive Order (E.O.) No. 8 (superseded in 1999 by E.O. No. 156)] direct state agencies, public universities, community colleges and public school systems to purchase and use products that contain recycled material. These measures also establish goals for the proportion of expenditures agencies must make on paper products with recycled content.

The past decade showed that recycling depends on manufacturer feedstock shifts from virgin to recycled materials. These shifts depend on the development of new products made from recycled materials, “buy recycled” efforts and programs that “close the recycling loop.” In 1989, it was impossible to recycle fluorescent lights, textiles, carpet, oil filters, gypsum wallboard and computers. Recycling market expansion has made it feasible to recycle these and other discards. The “recycling economy” is growing. In addition to providing viable disposal alternatives, it has created a number of jobs.

Recycling Infrastructure

Physical and economic gaps exist between collection points and end-use facilities (e.g., a newsprint or glass plant). The paper, glass, plastic and metal industries all indicate a willingness and ability to pay for more recovered materials. However, processing and transportation to end-users can cost more than sale revenues. This makes recycling appear to be a “money-loser.” However most profit calculations only compare recycling profits to tipping fees, making this a short-term and incomplete calculation.

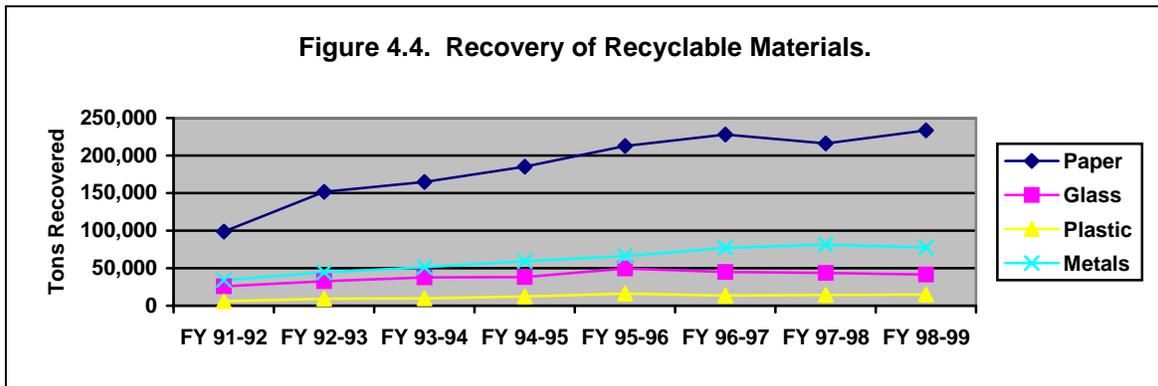
If local processing capacity is developed so materials can be consolidated and transported in large quantities, efficiency and recycling effectiveness will improve. Material recovery facilities (MRFs) and local baling or stockpiling operations for specific materials are good examples of what is needed. Figure 4.3 lists population centers served and not served by MRFs for FY 1999-2000. While some communities have other types of processing infrastructure, the absence of an MRF often means recyclables must be transported 80 miles or more.

Figure 4.3. Areas Served by MRFs in North Carolina	
Major Population Centers Served by MRFs	Major Population Centers Not Served by MRFs
Greensboro	Asheville
High Point	Fayetteville
Charlotte/Mecklenburg	Burlington/Alamance Co.
Winston-Salem	Wilmington
Raleigh/Cary/Wake Co.	Chapel Hill/Orange Co.
Durham	Kannapolis/Concord/Salisbury
Greenville	Gastonia/Shelby
Catawba County	Wilson/Rocky Mount
New Bern/Craven	Goldsboro
Davidson Co./Lexington/Thomasville	Statesville/Mooresville
Jacksonville	Most rural counties in the state

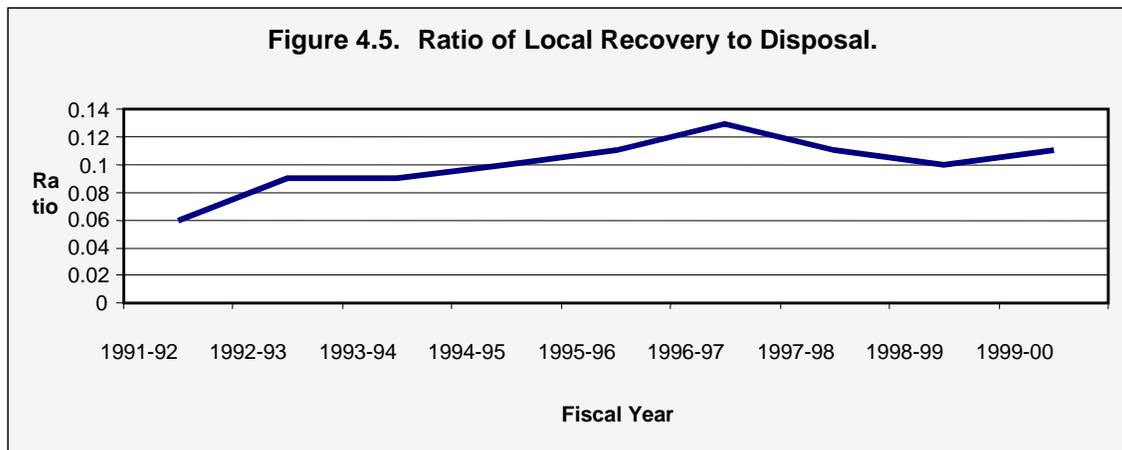
Recycling costs often exceed relatively low disposal costs. Leveling the economic playing field would help recycling markets for many materials. A surcharge on local tipping fees would make recycling more competitive, reduce waste and extend the state’s landfill capacity. It would also provide a funding mechanism for solid waste management programs. Incentives, public support and access to private capital are proven ways to effectively build recycling collection, processing and end-use capacity. Recycled content mandates and “buy recycled” programs also strengthen markets and add capacity. The promotion of full cost accounting, a partially accomplished goal of the 1992 State Plan, can help improve recycling program efficiency.

Local Recycling Programs

Figure 4.4 shows that local recycling programs experienced tremendous growth in the early to mid-1990s, and then slowed considerably.



Annual reports from local governments show recycling participation rates have leveled off around 50 percent. Local recovery efforts have failed to keep pace with dramatic increases in disposal. Figure 4.5 shows how the ratio of local recovery to disposal rose during the early part of the decade then declined.



A number of factors contributed to the drop in program development. A certain degree of slowed growth is typical as programs begin and mature. However, low participation and recovery indicate considerable room for program expansion and efficiency. Public interest and participation has waned, which slowed local recovery rates. Local governments do not consider recycling as a high priority now. Few recycling budgets expanded in the late 1990s and there were few attempts to boost participation and recovery with

policy incentives.⁹ In fact, some local governments that own disposal facilities deliberately slowed recycling to keep tonnage and tipping fees flowing to their landfills. Major, new local recovery investments were rare in the late 1990s and early 2000s. The change reflected overall fiscal constraints and recycling's falling importance in local budgetary priorities.

When compared to other states with large grant programs, North Carolina has not provided local governments with financial support like grants, loans or other distributions. The Solid Waste Management Trust Fund has annual revenues of only about 12 cents per capita. The state revolving loan fund to capitalize solid waste facilities, which was specified in Senate Bill 111, was never funded.

Educational Campaigns

Developing and implementing educational programs is an ongoing process. Brochures and program materials continue to be produced and distributed. DPPEA currently promotes solid waste education with the successful *Recycle Guys* series. Continuing these efforts increase awareness and participation levels throughout the state. However, local communities must increase their efforts to educate residents about waste, reduction, recycling and general solid waste issues. Their efforts are also needed to reverse declining participation rates and increase collection efficiency.

ILLEGAL DISPOSAL AND LITTER

Illegal dumping is handled most effectively and efficiently at the local level. North Carolina counties have been granted the authority to draft and enforce ordinances that address illegal disposal. Many local governments have some type of prevention program, though many counties have no programs at all. Local governments claim they have insufficient resources (time, funds, staff and equipment) and commitment to develop comprehensive programs. Surveys show that 50 percent of the counties without an illegal disposal ordinance feel their jurisdiction has a moderate to severe problem with illegal dumping.

Perhaps no waste issue attracts as much public anger as litter. No one can dispute that North Carolina has a pervasive litter problem. N.C. Department of Transportation statistics indicate as much as 38,000 tons of materials were discarded on state highways and waterways.

Current clean-up programs, penalty systems and educational efforts do not adequately address the litter problem. One possible solution is a bottle bill. Bottle bills are a proven way to increase recycling and reduce litter. Data from the Container Recycling Institute shows that deposits reduce litter by around one-third or higher.¹⁰

State	Beverage Container Litter Reduction	Total Litter Reduction
Iowa	77%	38%
Maine	69-77%	35-65%
Massachusetts	N/A	30-35%
Michigan	80%	38%
New York	70-80%	N/A
Oregon	83%	47%
Vermont	76%	35%

⁹ Durham's mandatory recycling ordinance is an exception. Recovery rates doubled immediately when it was enforced in January 2000.

¹⁰ Container Recycling Institute, Environmental Benefits of Bottle Bills (2003). <<http://www.container-recycling.org>> [4 August 2003].

However, container-related litter is only part of the problem. Anecdotal observation suggests construction wastes and materials, fast food packaging, plastic bags and film, and other miscellaneous debris make up a large part of the litter found on North Carolina roadsides.

Like public education, the goal to reduce illegal dumping and litter is continuous by nature. Some measures include an increase in monetary fines and community service for offenders, but more resources are needed. Funds to implement and improve local prevention and enforcement programs must be provided for communities to see further benefits.

CLIMATE CHANGE & NATURAL DISASTERS

The Effects of Natural Disasters

Climate change or global warming continues to be debated in many arenas. While no universal consensus exists, there is growing evidence that human activities contribute to a rise in the overall temperature of the planet. Warming effects are difficult to model, but one common prediction is an increase in extreme weather events. Hurricanes, ice storms and other natural disasters stress local disposal capacity and the state's solid waste infrastructure. In 1996, Hurricane Fran generated 700,000 tons of disposed material that increased the state's total of waste disposed by nine percent. Hurricane Floyd increased disposal by an estimated 329,782 tons and caused scattered construction debris crises. In the next decade of solid waste management, the state must consider and prepare for large-scale disasters.

Addressing Climate Change Through Waste Reduction and Methane Recovery

Increased publicity about climate change over the last decade has brought greenhouse gas emissions to state, national and international attention. Municipal solid waste landfills are a source of the greenhouse gas methane. Monitoring and reducing emissions are likely to be a future concern. A number of successful methane recovery programs exist at North Carolina landfills, but more are needed. Communities could use their landfill to harness an untapped source of energy for steam or electricity production. Adding methane recovery infrastructure will reduce the amount of greenhouse gases emitted by facilities.

When recycled materials are used in industrial production, energy and other resource demands decrease. This further reduces the greenhouse gases emitted by fossil fuel-based power sources. Existing models were used to calculate a quantitative value for the "upstream" benefits from local government recycling efforts. In addition to saving more than one million tons of landfill space, local government recycling programs reduce greenhouse gas emissions by almost 263,000 metric tons. The reduction is comparable to removing more than 197,000 automobiles from North Carolina roads. A 50 percent increase in local recycling efforts would reduce another 131,500 tons of greenhouse emissions – the equivalent of removing an additional 98,500 cars.

MEETING FUTURE SOLID WASTE CHALLENGES

Solid waste management has improved much in the past several years; however, much remains to be done. Old practices and responses no longer are adequate to meet the current challenges. Through a series of public meetings across the state involving solid waste professionals, local elected officials, environmentalists, industrial and commercial interests, and other interested citizens, a recognition that things "ought to be different" in the future emerged.

The results of these meetings were combined with research and analysis, which resulted in the following state goals and actions steps to meet them. The five goals listed below for 2013 are discussed in more detail in chapters five through nine.

1. Ensure long-term environmental protection by improving future landfill technology and addressing public health and environmental concerns associated with closed landfills.
2. Substantially increase the amount of waste recycled and composted.
3. Reduce litter and illegal disposal by 50 percent from 2000-2001 levels.
4. Implement policies and procedures to provide information to the public and ensure public participation throughout the decision-making process regarding waste management facilities.
5. Create and continually maintain 20 years of landfill capacity in the state.