Resource Responsibility

Solid Waste Management Plan for the H-GAC Region, 1992-2012

HOUSTON-GALVESTON AREA COUNCIL

Community and Environmental Planning Department

Prepared in cooperation with and financed primarily by

The Texas Natural Resource Conservation Commission

February 1994

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Prepared by:
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The Texas Natural Resource Conservation Commission
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Revisions to *Resource Responsibility: The Solid Waste Management Plan for the H-GAC Region, 1992-2012*

In September 1992, H-GAC received the Texas Natural Resource Conservation Commission's (TNRCC) preliminary review comments on the H-GAC Regional Solid Waste Management Plan. TNRCC review comments were summarized and distributed for review. On October 22, 1992, a public hearing was held to receive public input. Immediately following the public hearing, the Solid Waste Management Task Force (SWMTF) reviewed and approved the proposed plan revisions. On November 5, 1992, the Natural Resource Advisory Committee (NRAC) adopted the revisions and forwarded them to the H-GAC Board of Directors.

On November 17, 1992, the H-GAC Board of Directors adopted by resolution the revised final draft of *Resource Responsibility: The Solid Waste Management Plan for the H-GAC Region, 1992-2012* for submittal to the TNRCC. A copy of the resolution is on the following page.

After receiving TNRCC review comments on the plan and revising the plan accordingly, on August 17, 1993, the H-GAC Board of Directors adopted the revised final draft of *Resource Responsibility: The Solid Waste Management Plan for the H-GAC Region, 1992-2012* for submittal to the TNRCC.

In the January 7, 1994 issue of the *Texas Register*, the TNRCC announced the notice and availability of the regional plan and a 30-day period for public comment on the plan. No public comments were received.

On February 16, 1994, the TNRCC adopted *Resource Responsibility: The Solid Waste Management Plan for the H-GAC Region, 1992-2012.*

Houston-Galveston Area Council (H-GAC)

EXECUTIVE SUMMARY

Solid waste management is a major concern in the Houston-Galveston region, as it is throughout Texas and the nation. Rising disposal costs and public interest in resource conservation will bring changes in the region's approach to solid waste management.

The region as a whole has sufficient landfill capacity to last approximately 13 years, however, this landfill space is not evenly distributed within the region. Federal regulations have put new environmental safeguards on landfills. These regulations will also increase disposal costs, putting some communities out of the landfill business.

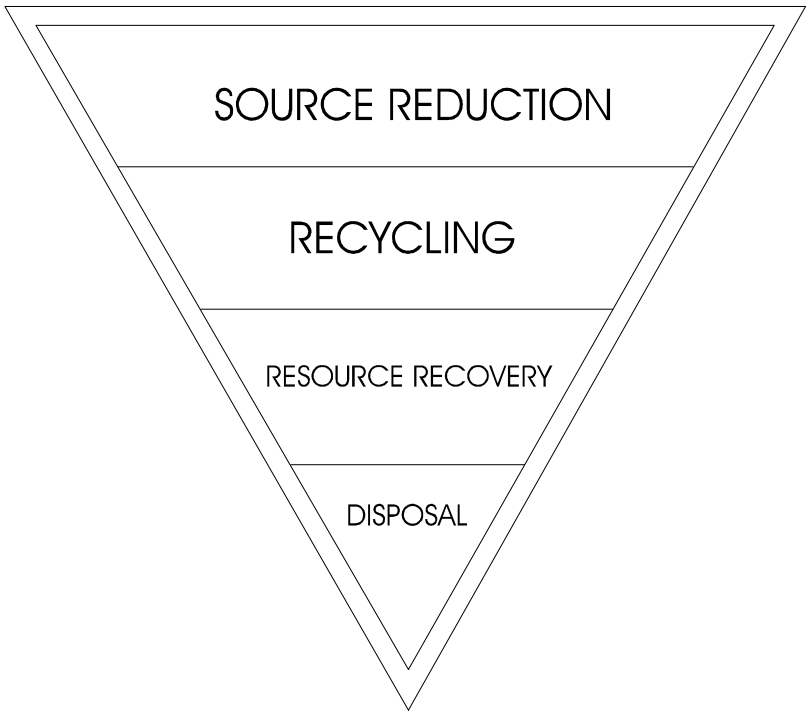
Resource Responsibility: Solid Waste Management Plan for the H-GAC Region 1992-2012 (Resource Responsibility), was adopted in December 1992. *Resource Responsibility* updates H-GAC's 1985 *Action Guide for Solid Waste Management 1985-2000*--Texas' first state-approved regional solid waste plan.

Reducing Dependence on Landfills

State legislation passed in 1991 set an ambitious goal of reducing or recycling 40% of Texas' municipal solid waste by 1994. H-GAC estimates the region's current recycling rate at 10%. Diverting an additional 30% of the "waste stream" from the region's landfills will clearly be a major effort. Since no single method of waste management can achieve results on this scale, *Resource Responsibility* recommends an *integrated* approach, based on a *hierarchy* of management techniques, as shown on the following page.

Source Reduction, which includes product reuse, reduces the production of waste. This method of waste management is the most desirable, since it conserves resources and keeps waste out of the collection system. Individuals can practice source reduction by choosing products with less packaging, re-using containers, and composting their yard waste. Businesses can reduce waste through electronic communication and other paperwork reduction strategies.

Solid Waste Management Hierarchy



Recycling is really the "second best" method of solid waste management, even though it has received the most attention. Recycling conserves natural resources and diverts waste from landfills. However, transporting and processing recyclable materials consumes energy and may cause pollution. Successful recycling also requires considerable investment in collection and processing "infrastructure" and stable markets for recycled products.

Resource Recovery is the reclamation of energy through the waste disposal process. Most commonly, resource recovery has meant the burning of waste to produce electricity and conserve landfill space. Incineration, encouraged in H-GAC's 1985 plan, does not appear to be a viable option today. The region now has a surplus of electric power and its urbanized areas face restrictions on emissions under the Clean Air Act. Other techniques, such as the extraction of methane gas from landfills for use as an alternative fuel, hold more promise and should be encouraged over disposal without resource recovery.

Disposal, or "landfilling," is the least desirable form of waste management. Landfilling generally does not include energy recovery and can lead to environmental degradation. However, landfills will continue to be the main destination for the region's waste until effective source reduction and recycling programs are in place, and will be the disposal option of last resort for materials which cannot be recycled.

Diverting yard waste and other materials which do not need to be landfilled can mean significant cost savings for citizens and local governments. Landfill operators can also conserve space by improving compaction techniques. These and other methods will extend the life of the region's landfills and reduce the need for siting new ones.

Managing Special Wastes

Improper disposal of household hazardous wastes (HHW), such as paints, pesticides, cleaners, and solvents poses a threat to the region's environment. These products can damage landfill liners and cause groundwater contamination or pollute the region's waterways if poured down a storm drain. There are also many businesses, such as print shops, photo labs, and laundries, which generate small quantities of hazardous wastes. Most of these "small quantity generators" do not fall under federal hazardous waste disposal regulations.

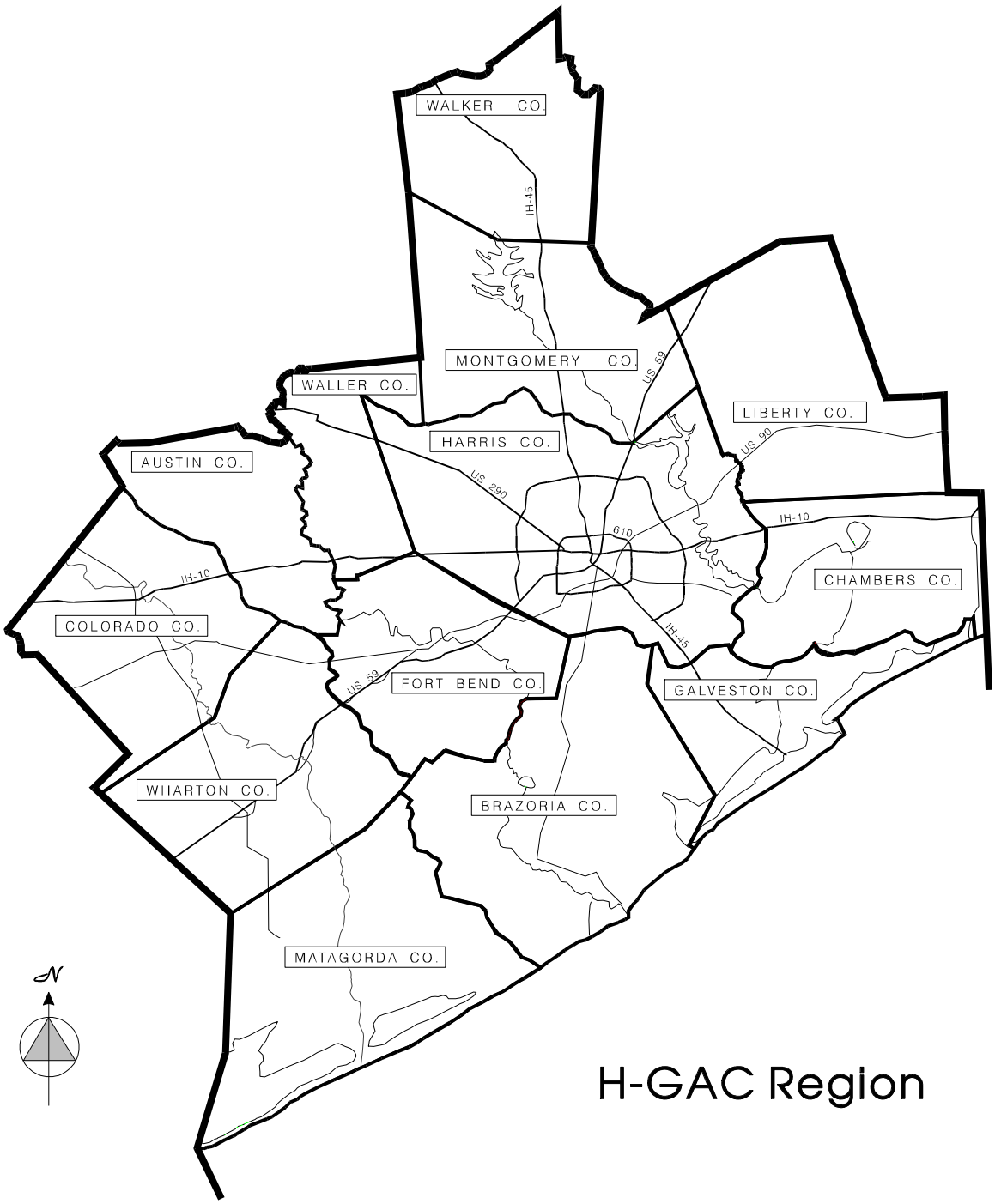
Other special wastes which are banned from landfills are used tires and motor oil. The State of Texas recently established programs to help recycle these materials. However, greater public awareness of these programs is needed. Sludge from wastewater treatment plants and industrial processes also has special disposal requirements. The most common form of sludge disposal in the H-GAC region is land application. However, this practice creates concern among the region's residents, particularly in areas where sludge disposal is concentrated.

Regional Characteristics

The recommendations in *Resource Responsibility* are based on a thorough analysis of the region's characteristics and current solid waste management system. This analysis is summarized below.

Physical Characteristics. The H-GAC region covers over 12,500 square miles, ranging from highly urbanized to rural areas, as shown on the following page. While the topography of the region is relatively flat, there is considerable diversity in soil types and vegetation. Environmental factors such as poor soil, faults, and groundwater recharge zones may present landfill siting problems in certain parts of the region. Land use patterns may also limit the availability of landfill sites, particularly in urbanized areas.

A major highway network serves the region, but gaps remain, particularly in rural areas and between communities separated by rivers or other bodies of water. Hauling costs for both recycling and disposal are major concerns in many parts of the region. However, the extensive rail network may have the potential to consolidate the transportation of recyclable materials.


WALKER CO.
IH-45
MONTGOMERY CO.
US 59
WALLER CO.
LIBERTY CO.
US 90
HARRIS CO.
AUSTIN CO.
US 290
610
IH-10
IH-10
CHAMBERS CO.
COLORADO CO.
IH-45
US 59
FORT BEND CO.
GALVESTON CO.
WHARTON CO.
BRAZORIA CO.
MATAGORDA CO.
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H-GAC Region

Population. Nearly 3.9 million people live in the H-GAC region, and the population is expected to grow by more than 40% over the next twenty years. Most of this growth will occur in the Houston metropolitan area, especially in counties adjacent to Harris County. In Houston and other cities, a large number of apartments present special problems for recycling programs. In rural areas, low population density makes collection of waste and recyclables more difficult.

Waste Generation. The H-GAC region produces 4.5 million tons of solid waste annually. An estimated 60% of this waste stream is composed of paper, cardboard, aluminum and yard waste. Residential collection accounts for an estimated 58% of the region's waste; the rest is generated by multi-family housing, businesses, and other activities. Many employment centers produce medical, industrial, seafood and other special wastes which present distinctive handling problems. For the most part, the region disposes of all its own waste within its boundaries. By a small margin the region is a "net importer" of solid waste, meaning that slightly more waste enters the region for disposal than is transported elsewhere.

Analysis of the Current Waste Management System

Six aspects of the solid waste management system were analyzed in detail: source reduction; recycling; collection and disposal; special waste; institutional options; and public education.

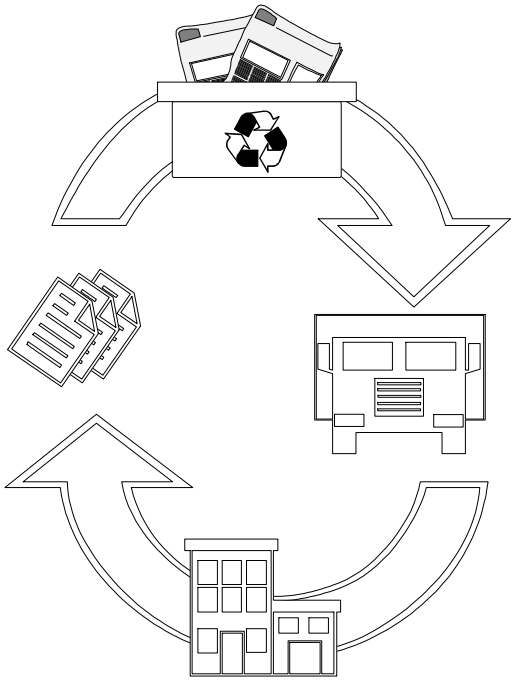
Source reduction. Paper products and yard waste account for the majority of the waste disposed of in landfills, and should be the main target of source reduction efforts. Many businesses and industries in the region have already taken a leading role in source reduction of waste, and their efforts have resulted in cost savings. Residential source reduction programs are less common. Unlike businesses, there is no direct financial incentive for private citizens to reduce their waste disposal since local garbage fees are generally not based on the volume of waste disposed.

The success of source reduction programs will depend largely on an informed public. A good example of a public education campaign for source reduction is the "Don't Bag It" program of the Texas Agricultural Extension Service, which encourages citizens not to dispose their yard waste. Volume-based, or "pay as you throw" garbage fees would also encourage residents to reduce waste.

Recycling. Many people view recycling as a simple matter of taking glass, paper or plastic to a drop-off center or setting these materials out for collection. However, the "re-cycle" is not complete until the materials are made into a new product and re-enter the consumer marketplace, as shown on the followning page. If demand for recycled products does not exist, "recyclables" become ordinary trash.

The recycling industry is still evolving and prices can fluctuate dramatically. It will be difficult for local governments and businesses to plan major investments in recycling until the markets stabilize. State support for developing markets will be critical to

"Closing the Loop"



achieving statewide recycling goals. End-markets exist for many recyclable materials in the region, including aluminum, scrap metal, paper and glass. A major paper recycling facility has recently opened, providing a newsprint market for the entire state. At this time, there is no major end-market for plastics in the region. Also, many small communities have difficulty in finding buyers for their recyclables since they cannot deliver large volumes of material.

Successful recycling also requires that an *infrastructure* be in place for the collection, transportation, and processing of recyclable materials. Currently 34 communities in the region have some form of recycling collection or drop-off program, including a major curbside pick-up program in the City of Houston. There are also many private retailers which have on-site drop off centers for recyclables. Yet despite these individual programs, the region's recycling infrastructure will have to be substantially expanded to meet statewide recycling goals.

Educational programs are needed to close the recycling loop. Citizens must be aware that recycling is not just putting materials out for collection--it also involves the choices they make as consumers in buying recycled products.

Collection and disposal. Roughly 90% of the region's solid waste ends up in landfills. Approximately 2,300 acres of landfill space are either currently available or permitted. Using projected population growth and waste generation rates, the region will have another 13 years of landfill capacity.

This disposal capacity is not evenly distributed throughout the region and some local governments face immediate problems because their landfills have closed due to environmental regulations. Others have concerns about increasing haul distances and major private landfills creating subregional monopolies.

The region has enjoyed very low disposal costs compared with other parts of the country, but the cost is going up. Environmental regulations will greatly increase the cost of landfill development and operation. Appropriate sites for new landfills are becoming scarce in urbanized areas, meaning longer haul distances to remote locations.

Because of the increased costs to develop and operate a landfill which meets environmental regulations, new landfills will have to handle more waste to be economical. It is also increasingly difficult to site a landfill due to public opposition. Most landfill permits are now contested, raising costs for local governments, citizens, and permit applicants. More emphasis needs to be placed on selecting appropriate sites and mitigating impacts on surrounding land uses.

Special Wastes. It is estimated that household hazardous wastes (HHW) represent 1% of the residential waste stream, yet there are currently few HHW disposal options for the region's residents. Several local governments have held "collection days" where citizens can take their HHW to centralized locations. These programs are generally held on an annual basis and are limited in the number of people they serve. There are also over 10,000 "small quantity" commercial generators of hazardous waste in the region, 70% of which are not federally regulated.

State legislation (1991) placed a fee on new tire sales to raise revenues for tire recycling. Through this program recyclers can receive a "bounty" on tires collected and recycled from priority clean-up sites and/or other "generators," such as gas stations and tire retailers. State law also established a fee on motor oil which is used to fund public used oil collection and recycling programs. While these programs are both currently operational, there is still a need for increased public awareness of recycling options for tires and used oil.

The disposal of sludge from wastewater treatment plants is an area of concern in some parts of the region. The primary method of disposal is land application, and many of these sites are concentrated in certain areas. Appropriate siting and management of land applications of sludge should be stressed, and minimization of sludge production should be a top priority.

Institutional Options. Many local governments in the region have privatized their solid waste management, particularly landfill operations. The vast majority of the region's waste is now disposed at private facilities and most of the future capacity is privately owned. To some extent, this has led to a regionalization of services which is more economical than individual municipal operations. This is especially true now that more stringent regulations have taken effect. Interlocal agreements, public/private partnerships,

or combinations of these arrangements may be needed in the future to address concerns about possible duplication of efforts, monopoly situations, and other management inefficiencies.

Multi-jurisdictional programs will also be important for recycling programs to be successful. Many small communities cannot generate enough recyclable materials for revenues to adequately offset collection and transportation costs. Cooperative arrangements among several communities would provide an "economy of scale," making recycling economically feasible.

Public Education. Public awareness is critical to the implementation of all new solid waste management initiatives. It is particularly important for source reduction, recycling and special waste disposal, all of which require considerable public acceptance and behavior change. Existing programs, such as those of the Texas Natural Resource Conservation Commission and Keep Texas Beautiful, provide a good starting point. Appropriate solid waste management should also be stressed in the school system, since attitudes about waste disposal can be formed at an early age. Finally, internal policies of the region's employers can go a long way to educate the public. People who are practicing source reduction and recycling at the work place will find it easier to do at home.

The Mission of *Resource Responsibility*

Overall Goal

The overall goal of *Resource Responsibility* is to reduce by 80% the per capita amount of waste disposed of in the region's landfills by the year 2012. The components of this reduction can be seen on the following page. By substantially reducing and recycling waste, the region's landfill availability will be extended appreciably, as shown on the next page. To achieve this goal, the region needs a new "infrastructure" for managing solid waste, markets for recycled materials, interlocal coordination, and widespread public education. Special emphasis must also be given to the proper management of special wastes.

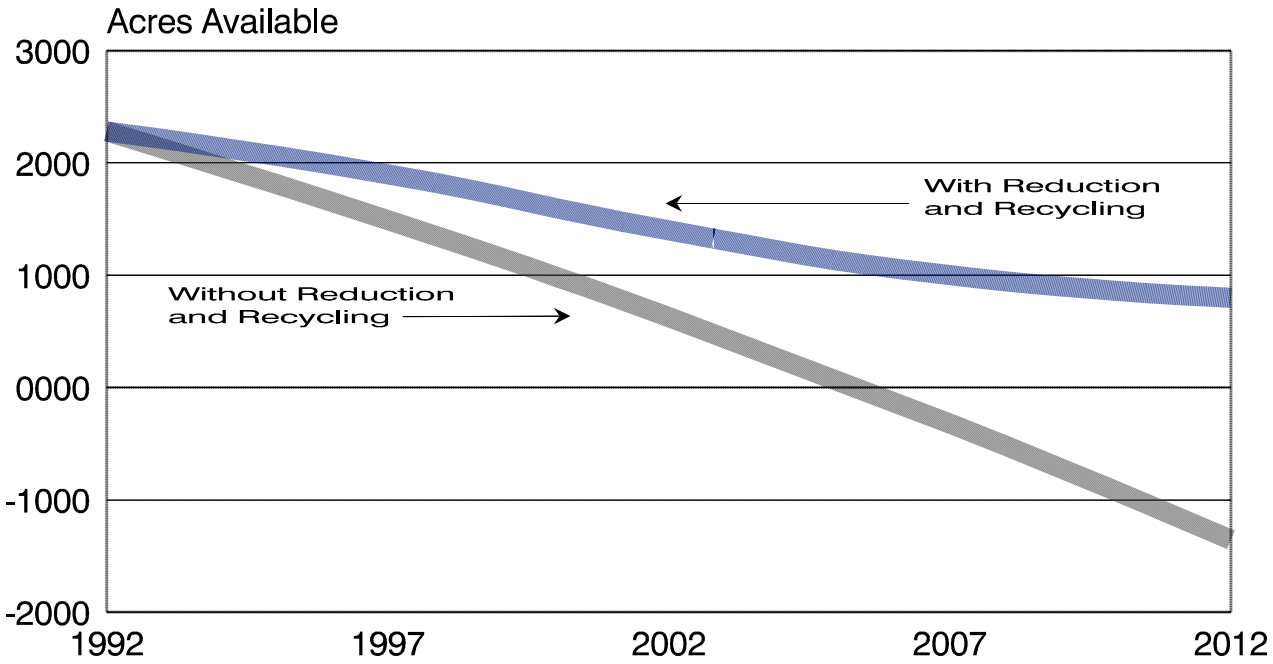
Resource Responsibility sets a series of goals and objectives to achieve these ends. They are the basis for the plan's recommendations and will guide H-GAC's solid waste management policy and programs over the next 20 years. Subregional plans, permit applications, and grant requests will also be reviewed by H-GAC, based on how well each meets the applicable goals and objectives. Goal and objective sets are based on the mission statements shown below.

Waste Reduction and Reuse

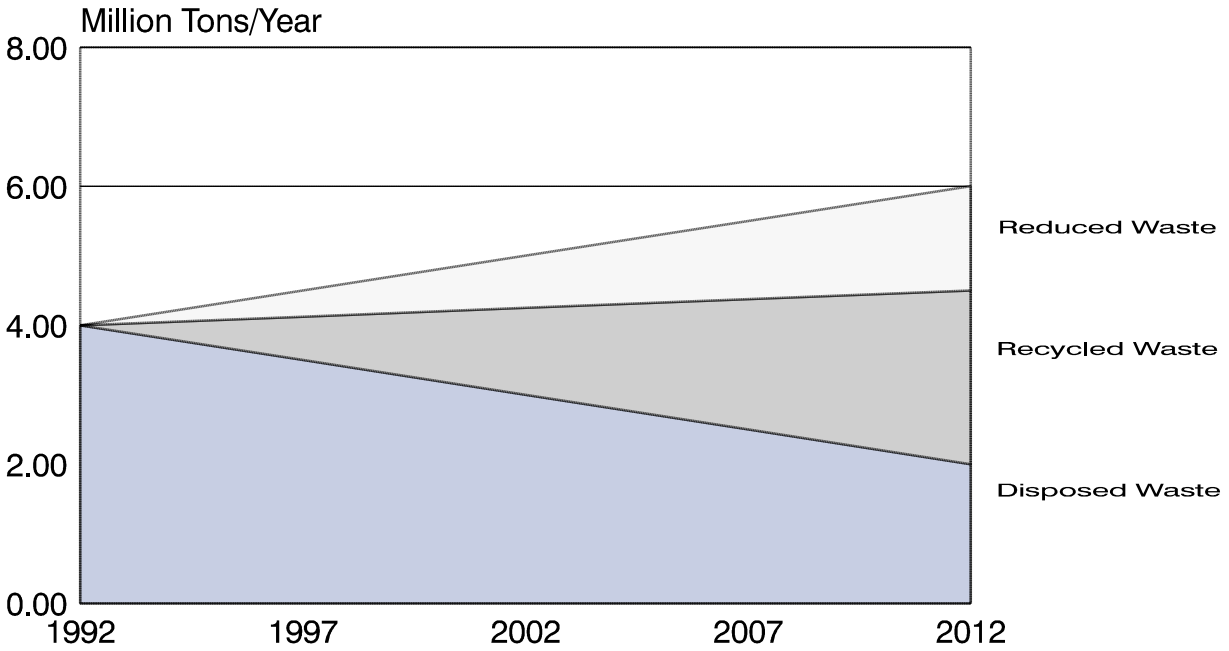
Understanding the diversity of the solid waste disposal issues and that they include source reduction and waste minimization by 2012, H-GAC proposes to reduce the region's total

waste stream volume by 15% through incentives, legislation, local actions, and public education.

Landfill Availability With and Without Waste Reduction and Recycling



The Effect of Waste Reduction and Recycling Goals on Waste Generation



Recycling
H-GAC proposes to achieve increasingly greater recycling goals through educational programs, market development, public and private partnership, and legislation. Municipal solid waste includes residential solid waste for single and multiple family structures, commercial solid waste, institutional solid waste, and industrial solid waste that exhibits characteristics similar to commercial solid waste.

H-GAC will make every effort to achieve the state recycling goal of 40% by 1994, with the implementation of the General Land Office market development study and state funding programs. Additionally, H-GAC has established regional recycling goals of 20% by 1997, 40% by the year 2002, and 65% by the year 2012.

Composting
To manage soils, recycle products, and reuse waste, H-GAC proposes to increase composting through a system of education, research and development, and market development.

Project Review/Siting Criteria
Provide for adequate solid waste disposal, handling, and management facilities while preventing adverse health, social, economic, and environmental impacts.

Special Waste
Provide for adequate capacity, management, treatment, and disposal of special wastes while minimizing risks to public health and the environment.

Institutional Options
Coordinate and maximize resources available to local governments for effective solid waste management in a regional working relationship.

Public Education
Provide a full range of information to assist government officials, community and business leaders, and educators in making sound decisions regarding the improvement and implementation of modern integrated solid waste management practices throughout the region.

Framework for Action

Resource Responsibility has identified a need for new directions for solid waste management in the region. As landfilling becomes more expensive and capacity diminishes, alternatives to disposal will become larger (and eventually more predominant) elements of the solid waste management system. In short, the region will need to develop an "integrated" system that includes waste reduction, recycling, and provisions for handling "special wastes."

The region currently lacks an "infrastructure" to fully implement programs to achieve the goals and objectives of this plan. For this reason, H-GAC recommends several broad policy initiatives for specific action steps and responsibilities. These recommendations, for the short term (1-5 year), mid-term (6-10 year) and long-term (11-20 year) time frames, are shown below.

Short-term (years 1-5)

- A new solid waste management "infrastructure" will be required to achieve the goals of *Resource Responsibility.*
- Additional planning at the subregional level will be necessary to develop this infrastructure.
- Solid waste management facilities should be appropriately sited with minimal adverse impacts to surrounding properties.
- Waste reduction policies should be established.
- State and local governments should adopt procurement and other policies that will help develop markets for recycled materials.
- A major education and technical assistance program will be necessary to address the waste reduction, recycling, and special waste goals and objectives of this plan.
- A regional pollution prevention education program should be established.
- Timely and reliable data must be available for monitoring progress and evaluating programs.
- The state's solid waste management fee should be committed to implementing the policy recommendations presented in this plan.
- H-GAC should review and evaluate all such grant requests to ensure consistency with the regional plan.
- Additional legislative mandates should not be imposed until the new solid waste system has been allowed to develop and better reporting systems are in place.

Mid-term (years 6-10)

- Economic incentives, such as volume-based garbage fees, should be provided for waste reduction and recycling.

- All public solid waste collection programs, whether operated by the local government or contracted, should provide options for the collection of recyclables and yard waste.

- Local governments should implement a program for managing special wastes.

- H-GAC should initiate a major program to promote the implementation of local Household Hazardous Waste collection programs.

- H-GAC will consider local government implementation of waste reduction, recycling and special waste management programs in its review of funding requests from the TNRCC.

- Subregions should move toward establishing solid waste authorities, districts, or joint powers of agreements to implement subregional plans.

Long-term (years 11-20)

- A fully integrated waste management infrastructure, adequate to handle the collection, transport, recycling and disposal of the region's solid waste, should be in operation.

- Develop a regional network of special waste disposal facilities for local collection programs to use.

- Depending on the achievement of waste reduction and recycling goals, options such as "flow control" should be studied.

Recommendations

Resource Responsibility makes a series of specific short-, mid- and long-term recommendations with responsibility for implementation grouped into the following three categories:

State-level Actions
Steps that should be the responsibility of state agencies and the Texas Legislature. These generally involve laws and regulations, funding programs, and the distribution of information.

H-GAC Actions
Steps that H-GAC should undertake as part of its ongoing state-funded plan implementation program include: technical assistance; distributing information; reviewing subregional plans, grants and permits; coordination; and education.

Local Actions
Steps that local governments should undertake to comply with the plan include the implementation of policies or the development of special projects, some of which will be eligible for state funding support.

These recommendations are summarized as follows.

State-level Actions

Short Term (years 1-5)

Legislative and Policy
Laws and policy changes recommended for consideration by the legislature and state agencies.

1. Prepare and implement a state plan for the development of recycling markets, including the following elements:
    - 1.1 Redesign procurement programs to stimulate recycling markets.
    - 1.2 Target products and end markets for development.
    - 1.3 Eliminate regulatory barriers to recycling.
    - 1.4 Support recycling technology research.
    - 1.5 Require minimum recycled product content for targeted materials.
    - 1.6 Establish a labeling system for pre- and post-consumer product content.
    - 1.7 Promote the use of available recycled products.
2. Establish incentives for reducing packaging.
3. Institute programs to encourage manufacturers to reduce toxicity of materials or to include instructions on labels for proper disposal techniques for HHW.
4. Modify liability laws that serve as barriers to local special waste collection programs.

Regulatory Measures

Recommended changes in TNRCC regulations and procedures regarding the issuance and enforcement of permits for solid waste management facilities.

1. Notify H-GAC of all permit applications and registrations received by the TNRCC and send copies of applications once administratively complete or registered.
2. Add the following requirements to all solid waste management facility permits in the H-GAC region:
    2.1 Require the placement of a sign on the proposed site.
    2.2 Place a 5-year review date between permit and facility development to determine if there has been a good faith attempt to develop.
    2.3 Require a permit review every five years.
    2.4 Require consideration of alternative technology and site options in landfill permits.
3. Expand H-GAC project review to include review of Type VII and VII-R sludge disposal facilities.
4. Expand H-GAC project review to include hazardous and industrial waste disposal facility siting.
5. Require every solid waste disposal site to have a certified operator.
6. Consolidate various special waste permit requirements into one regulatory agency.
7. Modify on-site industrial incinerators permits to allow for the incineration of HHW.
8. Increase monitoring and regulatory enforcement of solid waste facility permits, particularly for improper disposal of special wastes.
9. Expand Texas Review and Comment System (TRACS) review to include TNRCC-funded solid waste management projects.

Permit Review

Elements that TNRCC should incorporate into their review of solid waste management facility permits.

1. Require permit applicants to include a mitigation plan if the facility will be located within 1,000 feet of a residence or other "sensitive" land use.
2 Encourage host community benefits, such as recycling or composting programs, as part of all permit applications.

Grant Funding from Solid Waste Management Fees

Grants recommended for establishment by the TNRCC to be made available to regional councils, local governments, and others.

1. Provide ongoing funding for continued regional planning and implementation programs.
2. Provide funding to develop eight subregional plans in the H-GAC region.
3. Establish regional and subregional plan implementation programs, including the following elements:
    3.1 Education and public awareness campaigns.
    3.2 Waste reduction programs.
    3.3 Local pilot or "showcase" recycling programs.
    3.4 Establishment of a network of permanent HHW collection sites.

3.5 Development of institutional structures.

4. Establish a "fast-track" grant program for local governments to conduct preliminary engineering and financial feasibility studies to respond to Subtitle D mandates.
5. Implement a matching grant program to assist subregions and local governments with site selection, financial, and engineering studies for landfills, transfer stations and alternative disposal methods.
6. Encourage donation of environmental fines to local HHW collection programs.
7. Link various agencies' facility development loan programs to regional and Subregional plans.
8. Establish a grant or loan program to fund start-up collection systems in rural counties which currently offer only drop-off services.
9. Provide supplemental funds to local governments for enforcement of illicit disposal laws.
10. Support research for developing recycling techniques, particularly for special wastes, such as used oil, tires and sludge.
11. Establish business finance program to assist recyclers, particularly in less populated areas.

Technical Assistance and Information

Programs recommended for implementation by state agencies.

1. Establish a state "single point of contact" for recycling programs.
2. Revise reporting requirements so that waste reduction can be more accurately calculated.
3. Conduct annual monitoring of recycling rates, in conjunction with revised landfill permit reporting requirements.
4. Expand the existing Texas Natural Resource Conservation Commission (TNRCC) Waste Minimization program to include non-industrial waste reduction; establish minimization program for small quantity generators of hazardous waste.
5. Develop training programs for landfill operators to identify special wastes.
6. Maintain adequate staffing to provide technical assistance to regional councils and local governments.

Mid-term (years 6-10)

Policy and Programs

1. Evaluate options for manifest systems for small quantity generators of hazardous waste.
2. Develop statewide standards for solid waste management authorities to establish a consistent approach to regional solid waste management.

Long-term (years 11-20)

Policy and Programs

1. Develop state policy on "flow control" for solid waste management. Study possible cost-penalty structure for failure to meet waste reduction and recycling targets.

H-GAC Actions

Short-term (years 1-5)

Planning and Coordination

Actions recommended for H-GAC's plan implementation work program.

1. The Solid Waste Management Committee (SWMC) will oversee the implementation of *Resource Responsibility, The Solid Waste Management Plan for the H-GAC Region*.
2. Oversee and participate in the development of Subregional plans.
3. Establish regional local government recycling council and peer exchange program.

Information and Education

Actions recommended for H-GAC's plan implementation work program.

1. Continue publishing the Waste Matters newsletter on a regular quarterly basis.
2. Establish regional information clearinghouse on waste reduction, recycling, collection and disposal, institutional options and educational resources.
3. Utilize available expertise to develop educational tools which can be used by local governments on the following topics: waste reduction; recycling; volume-based garbage fees; citizen involvement in the siting process; special waste disposal; and, citizen monitoring efforts.
4. Develop a guide to financial and technical assistance resources available to local governments; produce updates and "For Your Information" briefs, as needed.
5. Promote the "Don't Bag It" program for yard waste at a regional level.
6. Promote Keep America Beautiful and/or Keep Texas Beautiful affiliation by cities in the H-GAC region.
7. Promote regionwide business membership in Texas Corporate Recycling Alliance.
8. Host a recycled products fair.
9. Develop regional recycling awards program.
10. Develop public awareness program on how to access self-reporting monitoring information for solid waste disposal facilities and how citizens can report violations of solid waste disposal laws.
11. Conduct special waste management and education programs for local governments and the private sector.
12. Promote local participation in scrap tire recycling fund program.
13. Coordinate with state annual recycling survey to monitor program results.
14. Continue to maintain an inventory of solid waste collection practices of H-GAC local governments.

Technical Assistance

Actions recommended for H-GAC's plan implementation work program.

1. Develop a model waste reduction program for use by local governments and private business, and provide follow-up technical assistance.
2. Provide technical assistance on the use of volume-based garbage fees by local governments.
3. Develop a model local government recycling policy and conduct follow-up training workshops.
4. Provide technical assistance to local governments in establishing household hazardous waste collection programs.
5. Assist in the establishment of permanent HHW collection sites.
6. Provide technical assistance to local governments in implementing public education programs.
7. Work with sludge generators to develop and finance the development of alternative regional sludge disposal sites.
8. Continue to develop recommendations for the composting of organic wastes, such as food waste, yard waste, and sludge.
9. Continue development of a regional geographic information system (GIS) for the H-GAC region with emphasis on physical features.

Permit Review

Elements that H-GAC will consider in reviewing solid waste management facility permits.

1. Continue to review all permit applications for landfills, transfer stations, materials recovery facilities and incinerators in the region.
    1.1. Encourage consistency with local comprehensive plans and zoning ordinances.
2. Initiate review of Type VII and VII-R sludge application permits.
3. Initiate review of hazardous and industrial waste disposal permits.

Mid-term (years 6-10)

Program and Policy

1. Establish recycling and special waste management programs as a criteria for H-GAC Projects Review of certain state-funded projects.
2. Encourage the formation of a network of multi-jurisdictional solid waste management structures throughout the region.

Long-term (years 11-20)

Program and Policy

1. Provide technical assistance to coordinate Subregional management systems at the regional level.
2. Provide technical assistance to integrated special waste collection programs.
3. Depending on the achievement of waste reduction and recycling goals, encourage the establishment c

Local Government Actions

Short-term (years 1-5)

Actions which H-GAC will encourage local governments to voluntarily adopt.

1. Adopt voluntary internal waste reduction and recycling policies.
2. Revise procurement procedures to promote the use of recyclables, and establish in-house recycling programs for employees.
3. Work with local retailers to promote the use of existing recycling programs.
4. Implement a voluntary internal program for managing special wastes.
5. Consider the siting of solid waste disposal facilities in local plans and zoning ordinances.
6. Counties should consider the development of landfill siting plans, as authorized by the County Solid Waste Control Act.
7. Develop mechanisms to promote early public involvement and dispute resolution in facility siting issues.

Mid-term (years 6-10)

Actions which H-GAC will evaluate in determining conformity with the plan as a part of H-GAC internal project review.

1. Adopt internal waste reduction, recycling and special waste management policies.
2. Consider adoption of volume-based garbage fees.
3. Establish recycling collection systems within all H-GAC local governments.
4. Work to form subregional multi-jurisdictional structures for solid waste management facility and program development.

Long-term (years 11-20)

Programs which will result from the implementation of subregional strategies.

1. Work through subregional management structures to coordinate solid waste management programs at a regional level.
2. Develop a regional network of special waste collection programs to feed into regional facilities.
3. Meet all waste reduction/recycling goals annually, with possible cost-penalties for non-attainment.

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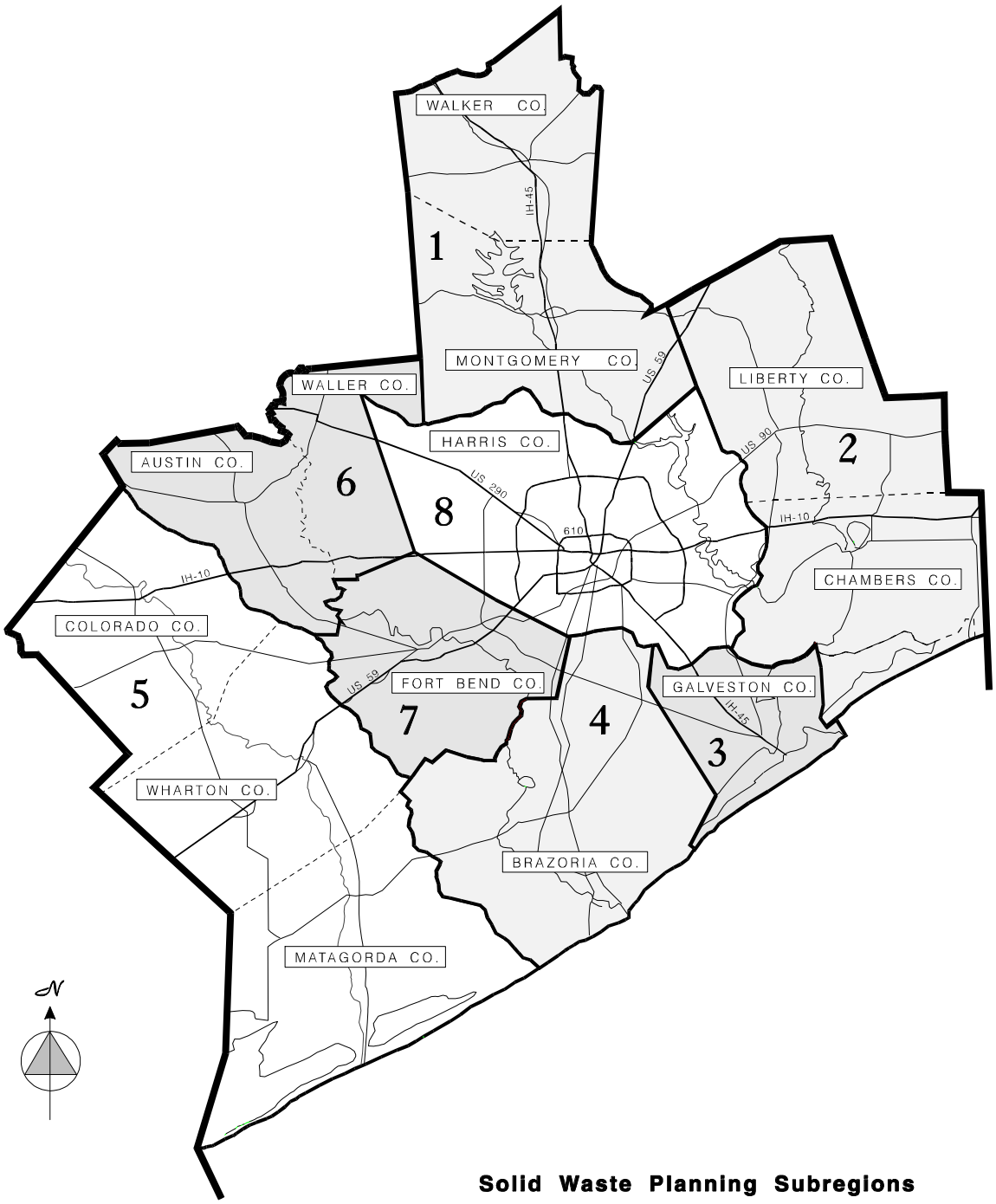

Solid Waste Planning Subregions

HOUSTON-GALVESTON AREA COUNCIL

Subregion Recommendations

A more detailed assessment of solid waste management issues, problems and opportunities was conducted in each of eight subregions, shown on the facing page, delineated for future planning, program and project development. The recommendations in this section are intended to provide guidance for more detailed subregional or local plans and to identify projects which may need immediate action. Actions with the potential for inclusion in a subregional plan or which may qualify for implementation grants have been identified in the plan. Key issues and recommendation highlights for each subregion are summarized below.

Subregion 1 (Montgomery and Walker Counties).
This fast-growing subregion has much of its population and employment concentrated along the IH-45/Missouri-Pacific Railroad corridor. This corridor has the potential of serving as an important transportation link to recycling markets in Houston and the emerging plastics market in Dallas-Fort Worth. The subregion has mid-term disposal capacity, which could be diminished by waste importation. Sam Houston State University and the Texas Department of Corrections (TDC) are major employers and could be resources for solid waste management. The Woodlands and the City of Huntsville also have established successful recycling programs.

Recommendation highlights:
- Develop multi-jurisdictional approaches to recycling and waste disposal.
- Long-term development of transportation cooperatives, including the rail corridor.
- Coordinate efforts with the Texas Municipal Power Agency lignite power plant and TDC to develop incineration and materials recovery facility (MRF) capabilities.

Subregion 2 (Chambers and Liberty Counties; Bolivar Peninsula of Galveston County).
This subregion has potential long-term disposal capacity at regional landfills, though some of its municipal facilities will close due to Subtitle D. Collection may be a problem, particularly in rural areas. A large regional tire shredding facility is located in Cleveland, at the northwest corner of the subregion.

Recommendation highlights:
- Study expansion of the service area for the Chambers County landfill.
- Strengthen waste collection, transportation and transfer systems.
- Clean up illegal tire dumps under the new TNRCC program.
- Encourage Trinity River Authority to establish HHW collection or drop-off program.

Subregion 3 (Galveston County, excluding Bolivar Peninsula).
This subregion has long-term disposal capacity, though siting future facilities may be difficult. The Gulf Coast Authority (GCA) is active in municipal and industrial waste management in the county and would be a logical agent for implementation programs. Subregion 3 has good access to Houston and other recycling markets via IH-45 and rail lines.

Recommendation highlights:

- Conduct compost and yard waste market development studies; focus on beach restoration.
- Study feasibility of converting Texas City Landfill to regional facility.
- Establish joint agreements between GCA, county and cities to study and possibly initiate the development of rail corridor transfer stations for recyclables, a yard waste/sludge co-composting facility, and long-term transfer and disposal capacity.

Subregion 4 (Brazoria County).
A county-wide task force has been studying options, including the establishment of a solid waste management authority, a public education campaign and an integrated approach to solid waste management. The subregion has substantial disposal capacity, but some facilities may close due to Subtitle D. There is considerable expertise in waste reduction and recycling in the subregion. The City of Pearland has received an EPA grant to develop a waste reduction program, which may be transferable to other communities. BASF in Freeport has won a statewide Keep Texas Beautiful award for its recycling program, which could be emulated by other major employers in the county.

Recommendation highlights:

- Forge an interlocal agreement for the county to form a solid waste management department and hire professional staff.
- Investigate county option of establishing a network of transfer stations to provide disposal at selected regional facilities.
- Examine options for transportation and disposal, along with cost-avoidance benefits of recycling and waste reduction.
- Explore feasibility of establishing an MRF at TDC prison facility.

Subregion 5 (Colorado, Matagorda and Wharton Counties).
The subregion is very large and has long haul distances. The future status of several public and private landfills in the subregion is in question and must be resolved. A worst-case scenario could leave the subregion with no disposal capacity within a reasonable haul distance.

Recommendation highlights:

- Conduct special feasibility study of expanding the El Campo landfill into a regional facility.
- Establish a transfer station network throughout the subregion to channel waste to appropriate regional facility, implementing quality control and recycling practices at these facilities.
- Study the establishment of a subregional solid waste management structure, possibly through the Lower Colorado River Authority.

Subregion 6 (Austin and Waller Counties).
This subregion has no dominant cities and has a large percentage of its population in unincorporated areas. A multi-jurisdictional management structure could be effective. Subregion 6 has good access to Houston recycling markets, but the internal transportation network is not well-developed. The subregion may face an immediate disposal capacity crisis if the Bellville and Sealy landfills close. Residents of Subregion 6 are also concerned about the large number of land applications of sewage sludge, mostly from Houston-area Municipal Utility Districts (MUDs).

Recommendation highlights:
- Conduct a study of future disposal options for the subregion, including upgrading the Bellville landfill to a regional facility or joint development of a new regional facility.
- Increase TNRCC inspection and monitoring of sludge disposal facilities.
- Establish cooperative between counties and cities to collect, store, market and transport recyclables.

Subregion 7 (Fort Bend County).
Fort Bend is the region's fastest growing county. Several cities in the county have successful recycling programs in place. The county owns a landfill and is the site of a major new private facility. Fort Bend County has a linkage with Houston and its recycling markets since a portion of the city extends into the county. The county also has a history of and potential for future public/private partnerships in waste management.

Recommendation highlights:
- Include the development of composting facilities and transfer stations for recyclables, possibly as host community benefits from the major landfills in the county.
- Utilize successful programs in Sugar Land and other cities as models for implementation throughout the county.
- Continue to explore public/private partnerships for compost market development, recycling and educational programs.

Subregion 8 (Harris County).
This subregion accounts for 72% of the region's population and a greater percentage of its waste generation. It is also the geographic center, transportation hub and primary recycling market for the entire H-GAC region and beyond. Many of the programs launched in this subregion will be valuable pilots for the other seven subregions, as well as the state and nation. Subregion 8 has the potential to be a major international marketplace for recyclable materials. Successful composting programs, both public and private, also exist.

The City of Houston operates a successful pilot recycling program, as do a number of other cities and private haulers. However, special collection problems may exist due to the high concentration of multi-family dwellings in urbanized areas. There are numerous corporate and retail recycling programs operating which can successfully operate in tandem with public programs.

This subregion currently has adequate disposal capacity, but siting of future facilities will be difficult due to environmental and transportation constraints as well as citizen opposition. It is currently a net exporter of solid waste, and this trend is expected to continue as other major private facilities outside the subregion come on line.

Special waste of all types is a concern. There are numerous illegal tire dumps and significant generators of sludge, medical waste, industrial and hazardous waste. Other problems include numerous small quantity commercial generators of hazardous waste and the improper disposal of hazardous household materials.

There are numerous citizen groups and non-profit organizations involved in public education on waste management issues. These efforts, along with support by the news media, can be very effective tools in promoting public acceptance of alternative waste management strategies.

Recommendation highlights:

- Support the expansion of Houston's curbside collection program as well as other local programs.
- Develop compost market at the subregion's golf courses, business parks, highway rights-of-way and public facilities.
- Develop a facility siting plan for the subregion to minimize protracted and expensive disputed permits.
- Develop capacity and programs to promote proper disposal of household hazardous wastes.
- Provide state funding support to enforce regulations against illegal dumping.
- Promote utilization of the state-funded program to clean up illegal tire dumps.

Implementing the Plan

To implement *Resource Responsibility,* state, regional and local agencies will undertake related but differing actions. The actions taken by state agencies and the Texas Legislature will generally involve laws and regulations, funding programs and the distribution of information. As part of its state-supported ongoing operations, H-GAC will provide technical assistance, distribute information, review subregional plans, grants, and permits, and support educational efforts. Although local governments are asked to strive for achievement of the Plan's overall goal, they must also be sensitive to local conditions and opportunities, since no regional or state plan can respond as quickly to specific circumstance as those who are on the scene. H-GAC will work closely to coordinate and monitor implementation efforts and act as an intermediary between state agencies and local governments. However, the plan's ultimate success will be achieved through the energy, creativity and support of the citizens of the H-GAC region.

PART I
Plan Overview

PART I

Plan Overview

A. Introduction

Background

In June 1985, the Houston-Galveston Area Council (H-GAC) adopted the *Action Guide for Solid Waste Management in the H-GAC Region 1985-2000.* The *Action Guide* was the first state-approved regional solid waste management plan in Texas and has been the basis for H-GAC's solid waste management policy for the past seven years. The *Action Guide* set forth regional goals and objectives and created a framework for local planning by subdividing H-GAC's thirteen counties into 25 planning areas, each with specific recommendations. From its approval by the Texas Department of Health (TDH) to the present, the *Action Guide* has been used by H-GAC in its review of permit applications for landfills and other solid waste management facilities. These reviews evaluate whether projects are consistent with regional plans and policy.

However, numerous issues emerged in the late 1980s that the *Action Guide* did not address. These issues included heightened public interest in waste reduction and recycling, the lessening viability of waste-to-energy facilities, the impacts of federal "Subtitle D" regulations, and concerns about "special" wastes that have different handling requirements.

In response to these issues, the H-GAC Board of Directors in early 1989 initiated a locally-funded effort to update the 1985 *Action Guide.* The first step was to establish a Solid Waste Management Task Force. At that time, H-GAC staff also began to update regional landfill capacity data and initiated a review of applicable legislation and regulations.

In 1989, after H-GAC's planning process had already begun, the 71st Texas Legislature enacted Senate Bill (S.B.) 1519. This bill, codified into Section 363.061 of the Health and Safety Code, stipulated that solid waste management plans be developed by the State of Texas as well as by regional planning agencies and local governments. The scope of the required regional plans included many of the same emerging issues, such as waste reduction, recycling, response to Subtitle D, and the handling of special wastes.

Senate Bill 1519 (Section 363.061 of the Health and Safety Code) also established a grant program to support regional planning and other solid waste management programs. The state grants are funded by a fee assessed on all landfills based on the amount of waste received. With the resources available through this grant program and the broadened scope required of the regional plans, H-GAC's update of the *Action Guide* expanded into the development of a new comprehensive solid waste management plan for the 13-county

region.

B. Plan Authority, Purpose and Scope

Legal Authority

As mentioned, the 71st Texas Legislature in 1989 enacted Senate Bill (S.B.) 1519. In addition to authorizing state funding support for long-range planning, this bill mandated the development of solid waste management plans by the State, regional planning agencies, and local governments. Subchapter O of the Texas Natural Resource Conservation Commission[1] (TNRCC) Municipal Solid Waste Management Regulations sets forth the purpose and required scope of the regional and local solid waste management plans.

Purpose and Scope

The purpose of this plan is to provide a comprehensive guide for long-range solid waste management in the 13-county Gulf Coast State Planning (H-GAC) region. The plan's scope encompasses the following aspects of municipal solid waste management:

- waste reduction
- recycling
- collection/disposal
- special wastes
- intergovernmental coordination
- public education

For the most part, baseline data for this plan are from 1990. Implementation activities are expected to commence in 1992. The goals, objectives and recommendations of this plan cover a 20-year period, with the following horizons:

- short range: years 1-5
- mid-term: years 6-10
- long range: years 11-20

Relationship of State, Regional and Local Plans

Recognizing the diversity of Texas' many regions, TNRCC placed regional solid waste management at the top of its planning hierarchy. In this way, TNRCC will be able to use the regional plans as "building blocks" to develop a statewide solid waste management plan. Local or subregional plans, necessary for addressing specific issues at smaller levels of geography, must comply with the broader goals of the regional plan.

Future Applications

[1]The functions of the TDH Bureau of Solid Waste Management moved to the Texas Water Commission (TWC) in March 1992. In September 1993, as required by recent legislation, the TWC merged with the Texas Air Control Board, creating the Texas Natural Resources Conservation Commission (TNRCC). As a result, the TWC, rather than TDH, is the agency which approves this management plan. For clarity, where regulatory authority or responsibility has passed to the TNRCC, TNRCC is used in place of TWC or TDH.

Once adopted by the H-GAC Board of Directors and approved at the state level, the H-GAC Solid Waste Management Plan will become official policy of H-GAC and of the State of Texas. The plan will have four primary applications as guidelines for:

Regional planning and action. The plan sets a regional agenda for solid waste management planning and implementation activities. This work will become part of a statewide solid waste management system. The plan will also guide the ongoing solid waste management programs conducted by H-GAC, including public education, technical assistance, and intergovernmental coordination.

Subregional and local planning. The plan outlines boundaries of planning subregions and makes recommendations for additional State funding for subregional plans. Subregional and local government plans must conform with the regional plan to receive State approval.

Monitoring results. State rules require that Councils of Government (COGs) monitor progress made toward achieving statewide waste reduction and recycling goals. This plan includes a follow-up system to track the progress made toward achieving these and other regional solid waste management goals.

Reviewing projects. The plan will serve as the basis for H-GAC's review of grant and permit applications to TNRCC for solid waste projects. H-GAC's review of other types of solid waste projects under the Texas Review and Comment System will also use the plan as a guide.

C. Planning Process

Background
A number of issues emerged in the late 1980s that were not fully addressed in H-GAC's 1985 *Action Guide.* Heightened public interest in waste reduction and recycling made these management alternatives more attractive than they had been in 1985. A surplus of electrical generation capacity, as well as growing public concerns about incineration, lessened the viability of waste-to-energy facilities. The proposed federal "Subtitle D" regulations, expected to effectively force the immediate closure of many small landfills, created concerns about disposal capacity and costs.

In response to these issues, the H-GAC Board of Directors in early 1989 initiated a locally-funded effort to update the 1985 *Action Guide.* A Solid Waste Management Task Force was established, and H-GAC staff began preliminary work required for the plan update.

When TNRCC established a matching grant program in 1990 to fund regional planning, resources became available to expand the scope of H-GAC's update into a more comprehensive solid waste management plan for the 13-county region. Subsequent revisions to State regulations, mandated by S.B. 1519 (1989), S.B. 1099 (1991) and S.B. 1340 (1991) also required H-GAC to modify and expand its planning process.

Advisory Committees
H-GAC has traditionally used advisory committees to assist its Board of Directors and staff in addressing regional planning issues. These committees are so constituted that members represent the viewpoints of the various subregions and professional specialties. Figure 1 shows the relationship of the committees created by H-GAC in the development of this plan. A brief description of the role of the H-GAC Board and each of these advisory groups follows.

Board of Directors. The H-GAC Board of Directors consists of 32 local elected officials selected by the major general-purpose governments within the 13-county Gulf Coast region. The H-GAC Board sets policy for the agency and is responsible for adopting and implementing the solid waste management plan.

Physical Resources Committee. This subcommittee of the H-GAC Board studies physical resource issues in depth and makes policy recommendations to the full Board. Its involvement in the planning process consisted of reviewing the initial scope of work for the planning process, providing input on the creation of planning subregions, and reviewing public comment on the draft plan.

Natural Resources Advisory Committee (NRAC). The NRAC is the Board-appointed standing H-GAC advisory committee on environmental issues. Its membership includes representatives of local governments, private industry, environmental organizations and citizen groups. The NRAC meets every other month and makes recommendations to the

H-GAC Board on natural resource issues, including environmental plans and regional policies.

For individual projects, the NRAC generally appoints a task force, which may include non-NRAC members who lend particular expertise. The Solid Waste Management Task Force (SWMTF), which serves as the steering committee for this plan, was established by the NRAC in 1989.

Solid Waste Management Task Force (SWMTF). This task force includes local government officials, solid waste management professionals, representatives of citizen organizations, and interested individuals. The SWMTF has been meeting on at least a quarterly basis since the spring of 1989 to provide guidance to staff in developing the solid waste management plan. A task force roster is shown in Figure 2.

To provide technical expertise and to afford opportunities for additional public involvement, the SWMTF also established the following subcommittees:

- Waste Reduction
- Recycling
- Projects Review/Siting
- Special Waste
- Interlocal Agreements
- Public Education

Each subcommittee met a minimum of four times to review data, identify problems, and develop a set of draft goals and objectives for the solid waste management plan. During this process, considerable public interest developed and representatives of additional interested groups were added to several of the subcommittees. Special working groups were also formed to address the issues of composting and tire disposal. Additionally, work groups with representation for local government and private industry were formed for each of the eight subregions.

Public Participation and Education

Beginning in December 1990, H-GAC staff conducted a series of thirteen public meetings on solid waste management issues -- one meeting in each of H-GAC's member counties. A total of over 300 people attended these meetings, and staff used the input received to refine the original plan outline and to identify problems and concerns.

In February 1991, staff began preparing and distributing a monthly newsletter, called *Waste Matters,* which detailed the planning process and other solid waste management issues. *Waste Matters* was mailed to all city and county officials, environmental and citizen groups, and any other interested individuals in the H-GAC region -- a circulation of over 600 people. Each issue listed upcoming meetings of H-GAC's solid waste planning committees, all of which were open to the public and included opportunities for public comment.

Figure 2: FY 1991-92 Solid Waste Management Task Force

of the H-GAC Natural Resources Advisory Committee

Mac Hall, Chairman
Malcolm Pirnie, Inc.

Barbara Bain
League of Women Voters (Citizen)

Dale Brown
City of Huntsville (Government)

Robert Chase
Clean Houston (Citizen)

Paul Davis
Solid Waste Consultant (Industry)

Ulysses G. Ford
City of Houston (Government)

Warren Klump
City of Bellville (Government)

Joyclene Odum
Waller County (Interested Individual)

Frank Parks
City of Weimar (Government)

Honorable Michael J. Pruett
Matagorda County (Government)

Rodney Smith
Waste Management of N.A. (Industry)

Bill Storey
City of Conroe (Government)

Joe Vickery
Galveston County (Government)

Mary Ellen Whitworth
Citizens Advisory Committee on Solid Waste Disposal Options (Citizen)

Don Brandon
Chambers County Engineer (Government)

Dennis Caputo
Proler International (Industry)

Fran Coppinger
Clean Pearland (Citizen)

Ron Drachenberg
Fort Bend County Engineer (Government)

Vance Kemler
Gulf Coast Authority (Industry)

Honorable Leonard Lamar
City of Palacios (Government)

Dr. Leo O'Gorman
Brazoria County (Government)

Honorable Sandra Pickett
City of Liberty (Government)

Terry Roberts
City of El Campo (Government)

Richard J. Somerville
US Environmental Solutions (Industry)

Mary J. Valentine
Browning-Ferris Industries (Industry)

Brent Watts
TNRCC (Government)

H-GAC also released two interim publications developed during the planning process -- the results of a regional recycling survey and a bibliography of literature and publications reviewed during the course of plan research. These items are available as separate Appendices to the plan.

In June 1991, the H-GAC Board of Directors approved a public participation process for completing the plan. A *Public Information Report,* containing summary background information and preliminary goals and objectives, was prepared in October 1991 and widely distributed. A series of nine public meetings was conducted throughout the region to receive input on the *Information Report.* The comments received were used in formulating recommendations and implementation strategies.

In April 1992, a *Draft Plan* was provisionally adopted by the H-GAC Board after it has been reviewed and approved by the SWMTF and the NRAC. After provisional adoption, the *Draft Plan* was widely circulated and a series of thirteen public meetings, one in each of H-GAC's counties, was held. From these public meetings, over 75 written and oral comments were received. Additionally, a public hearing was held. Each comment was reviewed by the SWMTF and the NRAC. Revisions based on this review were made, and the final plan was presented to the H-GAC Board for approval in June 1992. The H-GAC Board adopted by resolution the final draft of *Resource Responsibility: The Solid Waste Management Plan for the H-GAC Region, 1992-2012* for submittal to the TNRCC.

In September 1992, H-GAC received preliminary review comments from TNRCC. A formal public hearing was held on October 22, 1992 to discuss the review comments. Notification of the public hearing was published 15 days in advance in the Houston Chronicle and the Houston Post. Proposed revisions and public comments were reviewed by the SWMTF and the NRAC. The revision draft was presented to the H-GAC Board for approval in November 17, 1992. The H-GAC Board adopted by resolution the revisions to the final draft of *Resource Responsibility: The Solid Waste Management Plan for the H-GAC Region, 1992-2012* for submittal to the TNRCC.

After receiving TNRCC approval of the plan, H-GAC will undertake an extensive follow-up program. Staff will prepare and disseminate a final plan summary and will develop materials which can be used for presentations to local governments, interested organizations and the public.

Problem Identification

In mid-1988, H-GAC's Physical Resources Committee began to identify problems and issues to be addressed by the new solid waste management plan. The formation of the SWMTF in 1989 led to a more in-depth discussion of regional waste management problems. Several other means were used to identify solid waste management problems at the regional and local levels. These included:

- a survey of local governments
- an initial series of thirteen public hearings across the region

- meetings of the SWMTF, its subcommittees and working groups

Data Collection
In preparing the regional analysis, staff consulted the following general sources:

- Houston-Galveston Area Council
- State Department of Highways and Public Transportation
- *Texas Almanac*
- Texas Department of Health
- Texas Employment Commission
- Texas Natural Resources Information System (TNRIS)
- Texas Parks and Wildlife Department
- Texas Water Commission
- United States Geological Survey
- United States Bureau of the Census

Sources of waste stream data included the cities of Houston and Huntsville, City Public Service of San Antonio, TNRCC and the U.S. Environmental Protection Agency (EPA). Information on recycling markets was gathered through a regional survey of recyclers, from research conducted by non-profit institutes, and from various trade publications.

Survey of literature and publications. Staff surveyed over 150 publications as part of the data collection process for this plan. These sources ranged from newspaper articles to technical journals. A bibliography of the materials reviewed has been compiled in an interim report for use as a resource guide.

Local Government Survey. Staff gathered detailed information on local government solid waste management practices through a survey of local governments in the H-GAC region. Using a mailout survey form with a telephone follow-up, staff collected information on the solid waste management systems of 122 local governments shown in the Appendix 3.

Recycling Survey. Staff also conducted a regional survey of businesses and local governments involved with recycling. Again using a combination of a mailout form with a telephone follow-up, staff gathered information on over 50 recycling programs in the region. The survey results enabled staff to assemble specifications for materials collection and processing from across the region. The results of this survey are also available as an interim report of the plan.

Development of Goals and Objectives
Following problem identification and a review of existing conditions, each subcommittee developed goals and objectives for its area of responsibility. Each set of goals and objectives was then reviewed and approved by the SWMTF, NRAC, and H-GAC Board of Directors for inclusion in the draft plan document.

Interagency Coordination
H-GAC staff coordinated its efforts with TNRCC and the Municipal Solid Waste and Resource Recovery Advisory Council to ensure that H-GAC's planning process adhered to current policy. H-GAC has also maintained contact with the Texas General Land Office (GLO), TNRCC, and the Governor's Energy Management Center to ensure that the waste management programs of other agencies are considered in the plan.

H-GAC coordinated with adjacent Councils of Government (COGs), particularly the Brazos Valley Development Council (BVDC) and the Capitol Area Planning Council (CAPCO) on a number of solid waste planning issues which crossed regional boundaries. H-GAC also shared information and resources with COGs in Texas and other states through its participation in the National Association of Regional Councils (NARC) and the Texas Association of Regional Councils' (TARC) environmental programs. H-GAC staff also participated in activities of the Solid Waste Association of North America (SWANA).

H-GAC maintained a working relationship with several local governments that were in the process of preparing solid waste management plans or studies during the development of the regional plan (the City of Houston, Brazoria County, and Fort Bend County).

Determination of Planning Subregions
Based on information gathered in public meetings and surveys, H-GAC staff prepared six options for dividing the region into subregional planning areas. Each of these options attempted to organize the region into units with existing or potential relationships in solid waste management. Staff reviewed these options with local government officials and the H-GAC Physical Resources Committee. The SWMTF subsequently recommended a preferred option, identifying eight subregional planning areas, for incorporation in the plan.

Development of Recommendations
H-GAC staff worked with all of the committees and working groups to develop overall plan recommendations. Working groups were also established in each of the eight subregions to develop recommendations targeted toward those areas. These groups consisted primarily of local government solid waste management staff, private operators, and representatives of interested citizen organizations.

All the recommendations for plan implementation developed through this process were intended to be realistic steps toward achieving plan goals and objectives. They include proposed federal, state, regional and local actions, as well as recommendations for further planning at the subregional level.

Plan Adoption
On June 23, 1992 at its monthly Board meeting, the H-GAC Board of Directors adopted by resolution the final draft of *Resource Responsibility: The Solid Waste Management*

Plan for the H-GAC Region, 1992- 2012 for submittal to the TNRCC. A copy of resolution is in the preamble of this plan.

After receiving TNRCC review comments and revising the plan accordingly, on November 17, 1992, the H-GAC Board of Directors adopted by resolutions the revised final draft of *Resource Responsibility: The Solid Waste Management Plan for the H-GAC Region, 1992- 2012* for submittal to the TNRCC. A copy of resolution is in the preamble of this plan.

After receiving additional TNRCC review comments and revising the plan accordingly, on August 17, 1993, the H-GAC Board of Directors adopted by resolutions the revised final draft of *Resource Responsibility: The Solid Waste Management Plan for the H-GAC Region, 1992- 2012* for submittal to the TNRCC.

PART II
Recommendations and Action Plan

PART II

Recommendations and Action Plan

This section of the plan summarizes the findings of the regional analysis that has been conducted and sets forth the goals, objectives, recommendations and implementation strategies of the plan. The summary-level information presented is drawn from *PART III, Region Analysis.*

After the summary of findings, the following components of the *Recommendations and Action Plan* are presented:

Goals and Objectives
The desired long-term outcomes of the plan. They are the basis for the plan's recommendations and will guide H-GAC solid waste management policy and programs over the next 20 years. Subregional plans, permit applications and grant requests will also be reviewed by H-GAC for how well each meets the applicable goals and objectives.

Framework for Action
H-GAC's overall strategy to achieve the goals and objectives of the plan. Sets short-term (1-5 year) mid-term (6-10 year) and long-term (11-20 year) priorities for action.

Regional Recommendations
Steps which are recommended at the regional level to implement H-GAC's Framework for Action strategy. These are recommended actions to be carried out by the State, H-GAC and local governments in the H-GAC region. They include legislative, policy and regulatory initiatives, grants, technical assistance and education programs.

Subregion Recommendations
A more detailed discussion of solid waste management issues, problems, and opportunities in each of eight subregions delineated for future planning, program and project development. The recommendations in this section are intended to provide policy guidance on matters which should be addressed in subregional plans and to identify projects which may need immediate action. Actions with the potential for inclusion in the subregional plans or which may qualify for implementation grants are noted.

Implementation Plan
Describes H-GAC's work program for plan implementation. Recommends procedures for reviewing subregional plans, implementation grants and permit applications. Includes a detailed 5-year implementation timeline, with mid- and long-term milestones.

Monitoring and Evaluation
The procedures for monitoring progress on achieving goals and objectives and evaluating the success of implementation programs.

A. Summary of Findings

1. Regional Issues and Trends

To begin the regional planning process, an inventory of physical, demographic and economic characteristics was conducted, and an overview of the regional solid waste management system was developed. Based on an analysis of this information, a number of issues and trends that will affect solid waste management practices were identified.

a. Physical Characteristics

The research from which these conclusions were drawn is discussed in more detail on pages 163-172.

- The H-GAC region is large, encompassing over 12,500 square miles; vegetative and land use patterns are diverse.
- The region is well-served by a major highway network. However, there are gaps in intra-region transportation, particularly between areas separated by rivers or other bodies of water.
- The region has an extensive rail network, which may have the potential to consolidate the transportation of recyclable materials.

b. Demographic Characteristics

The research from which these conclusions were drawn is discussed in more detail on pages 173-179.

- The region currently has a population of 3.8 million people, and is expected to grow by more than 40% over the next 20 years.
- Most of this growth is expected to occur in the Houston metropolitan area, with the greatest percentage increases in several of the counties adjacent to Harris County.
- Inside Houston and other larger cities in the region, there are large numbers of apartments, which present special problems for recycling programs.
- Despite the region's large population and the presence of some highly urbanized centers, the overall population density is relatively low. This low density presents some problems in waste collection, particularly for recycling.

c. Economic Characteristics

The research from which these conclusions were drawn is discussed in more detail on pages 180-183.

- Numerous high-density employment centers exist in the region. Most of these are located in Harris County and are somewhat specialized (e.g. office, office/retail, medical and industrial).
- Many employment centers produce special wastes or present unique handling problems, particularly agricultural, seafood, medical, industrial and certain commercial operations.

- Major corporations and institutions, whose policies could have a significant impact on solid waste management, exist throughout the region.

2. Regional Solid Waste Management System

a. Waste Stream

The research from which these conclusions were drawn is discussed in more detail on pages 184-187.

- The H-GAC region produces 4.5 million tons of solid waste annually; an estimated 60% of this waste stream is composed of paper, cardboard, aluminum and yard waste -- materials which are relatively easily recycled or composted.
- Residential collection accounts for an estimated 58% of the region's waste; the rest is generated by multi-family housing, business and other activities.
- The H-GAC region, for the most part, disposes of all its own waste within its boundaries; the region is, by a small margin, a net importer of solid waste.

b. Current Waste Disposal System

The research from which these conclusions were drawn is discussed in more detail on pages 188-191.

- An estimated 90% of the region's solid waste is currently being landfilled.
- Approximately 2,300 acres of landfill space are available or currently permitted; at present waste generation rates, this would give the region another 13 years of disposal capacity.
- Landfills are not well-distributed throughout the region, and many local governments have concerns about haul distances and major private landfills creating monopolies in various parts of the region.

c. Institutional Responsibilities

The research from which these conclusions were drawn is discussed in more detail on pages 192-199.

- Federal laws and regulations have had a major impact on solid waste management with "Subtitle D" requirements. These regulations will upgrade environmental protection measures at landfills, but will also raise the costs of waste disposal and effectively limit future landfill development to large regional facilities.
- Reauthorization of the Resource Conservation and Recovery Act (RCRA) could impact waste reduction and recycling programs; however, Reauthorization may not occur in this congressional session.
- State laws and regulations, particularly S.B. 1519 (1989) and S.B. 1340 (1991) have created a good political "infrastructure" for solid waste management planning, and have established a funding source for follow-up implementation activities. (Section 363.061 of the Health and Safety Code)
- Regional councils of government are the state-designated lead agencies for regional planning.

- Local governments, those ultimately responsible for providing solid waste collection and disposal, are increasingly turning towards privatization of these services.
- The vast majority of existing and permitted waste disposal capacity is in the private sector.

3. System Analysis

As part of the planning process, six aspects of the solid waste management system in the H-GAC region were analyzed in detail: Waste Reduction/Reuse; Recycling; Collection and Disposal; Special Waste; Institutional Options; and Public Education. This analysis included a review of the current system and an evaluation of alternatives. The conclusions drawn from this analysis are summarized below.

Waste Reduction and Reuse

The research from which these conclusions were drawn is discussed in more detail on pages 205-212.

- o Waste reduction and reuse is the most environmentally sound method of solid waste management, hence its position at the top of the solid waste management hierarchy.

- o Individual business and industry programs have taken the lead in solid waste reduction programs, without much coordination or linkage.

- o Comprehensive local government solid waste reduction programs are virtually non-existent in the H-GAC region.

- o Waste reduction is an activity that must have broad acceptance from the public, and the key to successful waste reduction programs is public education.

- o Volume-based garbage fees are a means which local governments can employ to provide further incentives for waste reduction and recycling.

Recycling

The research from which these conclusions were drawn is discussed in more detail on pages 213-230.

- o Recycling goes beyond collection programs. Recycling is a resource recovery method involving the collection and processing of recovered products into raw materials for new products. The best way to sustain and strengthen recycling efforts is to manufacture products made with recycled materials.

- o The financial viability of a recycling program depends on markets. No widespread recycling effort should begin before markets have been identified.

- Material markets are not mature. An established market may quickly go out of business, thus requiring disposal of recovered materials. Additionally, markets fluctuate as prices rise and fall in relation to demand and supply changes.

- State support is needed for market development, both in terms of eliminating regulatory barriers and in funding research and business development.

- Components of a recycling operation will vary from program to program. Each community should design recycling programs based on their own characteristics, resources and needs.

- In today's market, transportation costs typically exceed material revenue. In addition to the development of local markets for materials, a unification of handling and transportation systems will be required to provide economies of scale, ensure adequate materials supply for end-markets, and stabilize prices.

- Effective recycling programs must be preceded by and followed up with education.

Collection and Disposal

The research from which these conclusions were drawn is discussed in more detail on pages 231-253.

- The H-GAC region does not have a short-term landfill capacity problem. There are capacity location and distribution problems.

- Collection programs should be modified to match an integrated solid waste management system. However, changes should be carefully studied before implementation. Convenience should be a key objective.

- There will always be a need for landfills in a municipal solid waste management program. Plans for future landfills in the H-GAC region should be for Type I and Type IV regional facilities.

- State implementation plans for Subtitle D criteria should be a high-priority concern of communities in the H-GAC region. These communities should be actively involved in the review and comment portion of the implementation process.

Special Waste

The research from which these conclusions were drawn is discussed in more detail on pages 254-272.

- The special waste category incorporates many types of wastes with each one having its own special characteristics and unique management, handling, and disposal requirements.

- Throughout the region, large quantities of special wastes are illegally disposed.

- Proper collection and disposal of special wastes are costly. Financing for special waste management programs is needed.

- Special waste education programs are needed to educate the region on consumer choices and disposal options.

Institutional Options

The research from which these conclusions were drawn is discussed in more detail on pages 273-279.

- Municipalities in the H-GAC region have been moving toward privatization in their solid waste management programs, particularly in landfill operations. The vast majority of the region's waste is now landfilled at private facilities and most of the future capacity is privately owned.

- Regionalization of municipal solid waste management services is more economical than individual municipal responsibility. This point is illustrated in recycling market development, recycling curbside pick-up, and landfill operation, all of which require certain economies of scale.

- Privatization of municipal solid waste management services has essentially created a form of regionalization. However, inefficiencies may exist due to the existence of separate, duplicative networks of residential and commercial facilities. There are also concerns that Subtitle D will create a monopolistic service situation, especially in rural areas.

- In addition to privatization, institutional options include solid waste management authorities, interlocal agreements, public/private partnerships, or combinations thereof. Each of these arrangements has its pros and cons.

Public Education

The research from which these conclusions were drawn is discussed in more detail on pages 280-286.

- Public Education programs are a key element in the success of implementing new solid waste management programs, particularly waste reduction and recycling and special waste disposal, which require considerable behavior modification.

- Good existing educational programs in the region, such as Keep Texas Beautiful and Keep America Beautiful, can be expanded and utilized, so there is no need to "reinvent the wheel."

- School districts and private educational institutions will be important elements in long-term public education on responsible solid waste management.

B. Goals and Objectives

H-GAC's approach to addressing the solid waste management issues of its region is based on the hierarchy of solid waste management methods set forth in Subchapter O of the Texas Municipal Solid Waste Management Regulations {25 TAC 325.561 (5)(A)(i-iv)}. These methods are summarized, in order of preference, below:

1. Minimization of waste production.
2. Reuse or recycling of waste.
3. Recovering energy or other beneficial resources from the processing or destruction of waste.
4. Landfilling.

Based on its analysis of the region, H-GAC's Solid Waste Management Task Force and its subcommittees formulated goals and objectives for this plan, in accordance with the preferred management methods in Subchapter O, with some modifications. The goals and objectives were developed under the following seven categories:

1. Waste Reduction and Reuse.
2. Recycling.
3. Composting.
4. Project Review/Siting Criteria.
5. Special Waste.
6. Institutional Options.
7. Public Education.

The goals represent long-term desired outcomes of the plan and the broad policies necessary for their achievement. The objectives are the types of actions which will lead the achievement of the goals.

The goals and objectives presented in this section of the plan provided the primary basis for the development of the strategies and recommended actions presented in Sections C, D, E and F. While not intended to be prescriptive or mandatory, they will be used as a policy guide for the development of future H-GAC projects and programs. Subregional plans, permit applications and grant requests reviewed by H-GAC for consistency with this plan will also be evaluated according to how well they meet these goals and objectives.

1. Waste Reduction and Reuse

Mission Statement
Understanding the diversity of the solid waste disposal issues and that they include source reduction and waste minimization by 2012, H-GAC proposes to reduce the region's total waste stream volume by 15% through incentives, legislation, local actions, and public education.

Goals and Objectives

Goal: *Provide and support incentives for waste reduction and reuse programs.*

Objectives:

- o support the use of reusable product containers
- o support or sponsor recognition programs: acknowledge industry, retailers, schools, governments, and individuals that have implemented outstanding waste reduction and recycling programs
- o encourage the use of a "green" labeling system to identify recyclable, non-toxic products that use a minimum amount of packaging
- o encourage the development of service fees that reflect consumer participation in reducing household waste and recycling

Goal: *Support legislation that will make waste reduction and reuse effective solid waste management practices.*

Objectives:

- o revise purchasing low bid laws that virtually eliminate the purchase of recycled goods where virgin materials are available
- o focus on the elimination of transportation tariffs on recycled goods that are higher than tariffs on virgin materials
- o establish tax incentives and create legislation that benefits recycling applicable to both new and existing businesses
- o focus on incentives to handle goods eliminated from landfills
- o reduce the liability of donating food and other products to charitable organizations
- o provide tax benefits to companies and individuals operating household hazardous waste programs
- o encourage the development of establish service fees that reflect consumer participation in reducing household waste and recycling
- o support legislation that will encourage and provide incentives for research leading to new manufacturing processes and alternative technologies that reduce the generation and toxicity of waste in manufacturing

Goal: *Support legislation that will encourage industry and retailers to adopt national standards in labeling and style of packaging.*

Objectives:

- o support the development of an uniform "green" labeling program, indicating recyclable products that use the minimum amount of packaging. Labeling should be expanded to include the amount of recycled content
- o establish limitations on multiple size containers: encourage bulk packaging
- o support the creation of a system that ranks packages according to ease of recycling and proportion of recycled material used

Goal: *Establish public education programs that raise awareness of waste reduction and reuse programs that can be implemented by industry, retailers, government agencies, and individuals.*

Objectives:

- o target grade school children for programs designed to educate and instill "green" lifestyle patterns as adults
- o encourage changes in consumption and lifestyle patterns that will reduce the use of products that are toxic or produce excess waste
- o recognition programs: acknowledge industry, retailers, schools, governments, and individuals that have waste reduction and recycling programs
- o create programs that target and lobby key industries that generate municipal solid waste, i.e. grocery stores, etc.
- o create programs that focus on major waste items; target items that are most common in the waste stream
- o create information that explains the life cycle of products in their reuse and marketing
- o raise public awareness of the status and magnitude of the problem and what materials are recyclable
- o raise public awareness of the potential use of a system that ranks packages according to ease of recycling and proportion of recycled material used

Goal: *Establish waste reduction programs at H-GAC and throughout the region that will set an example for other governments, businesses, and individuals.*

Objectives:

- o focus on major waste items: target items that are most common in the waste stream
- o support the creation of return/exchange programs: create motivation to return used materials to original company (i.e. broken toys to toy manufacturer) and identification of companies that utilize by-products
- o target and lobby key industries that generate waste: i.e. office buildings and government agencies
- o provide phone books and other publications by request only

- o utilize procurement procedures to encourage waste reduction

Goal: *Support the continued research and development of waste reduction and reuse programs.*

Objectives:

- o support the development of readily compostable and biodegradable packaging and products
- o support the creation of a system that ranks packages according to ease of recycling and proportion of recycled material used
- o support measures that will encourage and provide incentives for research leading to new manufacturing processes and alternative technologies that reduce the generation and toxicity of waste in manufacturing
- o support Texas universities' research programs, targeting worthy source reduction, recycling, waste-to energy or similar projects

2. Recycling

Mission Statement
H-GAC proposes to achieve increasingly greater recycling goals through educational programs, market development, public and private partnership, and legislation. Municipal solid waste includes residential solid waste for single and multiple family structures, commercial solid waste, institutional solid waste, and industrial solid waste that exhibits characteristics similar to commercial solid waste.

H-GAC will make every effort to achieve the State recycling goal of 40% by 1994, with the implementation of the General Land Office market development study and state funding programs. Additionally, H-GAC established regional recycling goals of 20% by 1997, 40% by the year 2002, and 65% by the year 2012. These overall goals are proposed to be achieved by the categorical reductions shown on Figure 3.

Figure 3: Regional Recycling Goals by Category: 1997, 2002, and 2012

Waste Stream Component	Recycling Goal by Year (%)		
	1997	2002	2012
Paper	35	50	70
Yard Waste	20	50	80
Plastics	5	25	45
Ferrous Metals	25	50	85
Rubber & Leather	5	10	50
Textiles	5	15	30
Wood	5	10	50
Food Waste	5	15	30
Aluminum	50	65	80
Glass	30	50	70

Goals and Objectives

Goal: *Establish education programs to achieve increased awareness and knowledge of recycling for the public, governmental agencies, businesses, institutions, schools, and industries.*

Objectives:

- o increase public awareness of the status and magnitude of the solid waste management crisis and the need for recycling
- o promote educational programs that inform the public about which materials are recyclable, the recyclability of consumer products, life cycle cost information of consumer products, and "precycling"
- o educate local governments on the comprehensive costs and benefits of recycling programs (i.e. predicted returns, cost avoidance calculations, net costs)

- o develop education programs that target businesses, institutions, schools, and industries that generate municipal solid waste (i.e. office recycling programs, designing for recyclability)
- o educate consumers on the terms "recycled," recyclable," and "biodegradable" with the understanding that definitions are currently being developed

Goal: *Stimulate market development and demand for recycled goods.*

Objectives:

- o encourage cooperative marketing arrangements for the public sector
- o encourage government agencies to buy products made from recycled materials, to use compost materials whenever possible, and to recycle their own waste paper
- o encourage cooperative purchasing of recycled products by local governments and other public agencies
- o educate public on how consumers can support the re-entry of recycled materials into the marketplace
- o establish procurement policies to facilitate the use of recycled goods

Goal: *Facilitate and support recycling efforts by local governments, other governmental agencies, businesses, institutions, schools, and industries.*

Objectives:

- o support the development of composting programs and/or other management techniques that beneficially use yard waste
- o investigate the availability of grants for recycling activities (i.e. development of regional processing centers, enforcement activities, and transfer stations)
- o establish an informational clearinghouse at H-GAC to assist with educational needs, market information, and technical assistance
- o promote public and private partnership efforts to encourage coordination and avoid the duplication of efforts
- o clarify market processing specifications to help ensure the acceptability of recyclable materials
- o provide workshops and seminars to support the development and implementation of local community recycling programs
- o develop and maintain market information for local government use
- o encourage businesses and industries to design products for maximum recyclability and to include recycled materials in their products
- o provide the necessary information needed to evaluate types of collection systems

Goal: *Support legislative actions that promote and advance recycling.*

Objectives:

- o support legislation that allows for the establishment of cooperative transportation networks

- encourage the development of uniform standards regarding the content of recycled products, product recyclability, and biodegradability
- support the amendment of freight regulations to assure that recyclable commodities may be shipped at a rate no higher than virgin materials and to expand what types of companies can ship recyclable materials
- support price preference for recycled products and the revision of purchasing low bid laws that virtually eliminate the purchase of recycled goods where virgin materials are available
- support the establishment of tax incentives to encourage market development
- support federal, state, and local grants to encourage recycling programs
- support the adoption of unified "green labeling" which indicates recyclability and proportion of recycled material used

3. Composting

Mission Statement
To manage soils, recycle products, and reuse waste, H-GAC proposes to increase composting through a system of education, research and development, and market development.

Goals and Objectives

Goal: *Establish education programs to achieve increased awareness and knowledge of composting for the public, governmental agencies, businesses, institutions, schools, and industries.*

Objectives:
- o educate consumers on the terms "composting," and "compostable"
- o create compost programs that focus on yard waste and other organic materials that are most common in the waste stream
- o educate private and public entities as to proper regulatory agencies and their requirements relating to composting (i.e., siting and operation requirements for composting facilities)
- o increase knowledge as to how to establish collection programs for both private and public community-based compost facilities and/or backyard compost programs

Goal: *Stimulate market development and demand for composting.*

Objectives:
- o encourage government agencies to use composted materials whenever possible and to compost their own compostable materials or to deliver their own compostable materials to private composting operations
- o educate public on how consumers can support the re-entry of composted materials into the marketplace
- o educate public and private entities on the importance of quality control in both collection and processing mechanisms
- o promote alternative uses and end-markets for compost depending on grade of compost product

Goal: *Facilitate and support composting efforts by local governments, other governmental agencies, businesses, institutions, schools, and industries.*

Objectives:
- o support the development of composting programs and/or other management techniques that beneficially use appropriate compostable materials
- o encourage economic incentives that promote composting and other management options for organic materials

- support legislation that will make composting an effective solid waste management practice
- identify and mitigate impediments that serve as disincentives to composting

Goal: *Advocate the continued research and development of compost programs and alternative management options for organic materials.*

Objectives:

- support the development of readily compostable and biodegradable packaging and products
- support the expansion of composting projects and related education materials by the Office of Waste Reduction in the Texas Natural Resource Conservation Commission
- encourage the investigation of alternative uses for compostable materials and compost products
- support the expansion and adoption of waste reduction programs similar to the "Don't Bag It" campaign for lawn clippings

4. Project Review/Siting Criteria

Mission Statement
Provide for adequate solid waste disposal, handling, and management facilities while preventing adverse health, social, economic, and environmental impacts.

Goals and Objectives

Goal: *Provide adequate solid waste capacity throughout the H-GAC region.*

Objectives:
- o encourage the development of facilities that reduce, reuse, or recycle waste materials
- o encourage appropriate distribution of facilities to minimize transportation costs
- o encourage development of facilities for which there is an apparent need
- o encourage the development of larger regional facilities to the extent practical and where such facilities would be the best alternative
- o encourage expansion and redevelopment of existing sites, where feasible, over siting of new facilities when they meet current environmental criteria
- o encourage development of transfer stations, where appropriate

Goal: *Provide for appropriate*[1] *environmental protection in the siting, operation and closure of solid waste management facilities.*

Objectives:
- o protect groundwater from non-point source discharges that may damage water supply
- o avoid aquifer recharge zones
- o avoid areas that flood
- o provide adequate run-off control to eliminate uncontrolled surface water run-off
- o identify and protect threatened and endangered species in facility siting and operation
- o provide for protection of wetland resources in facility siting and operation
- o protect air quality by minimizing air toxins, particulates, and ozone precursors
- o avoid areas that lack long term geologic stability

Goal: *Maintain appropriate buffers and setbacks from sensitive land uses.*

Objectives:
- o require consideration of the waste stream in siting disposal facilities
- o require consideration of facility type in site location
- o require consideration of the volume and hours of operation in facility siting
- o consider opportunities for mitigation for affected property owners, where impacts are not health-related

[1] Environmnetal protection measures should be appropriate for the type and impact of facility. However, these objectives may not be applicable to all types of solid waste management facilities. For example, material recovery facilities (MRFs) may not need to avoid aquifer recharge zones.

- o encourage long-range land use planning at the county level
- o require consideration of surrounding land use

Goal: *Provide for community participation opportunities early in the permitting and closure processes.*

Objectives:

- o encourage pre-development site visits and workshops
- o ensure adequate and early notification of potentially affected parties
- o promote community involvement in developing plans for issue resolution
- o encourage community involvement in the submittal of final post-closure plans
- o encourage applicants to use the "land use only" hearing option

Goal: *Minimize the negative visual impacts of solid waste disposal, handling, and management facilities.*

Objectives:

- o encourage landscaping and visual screening of sites
- o allow aerial buildup appropriate to surrounding topography and screening
- o ensure that final contour and post-closure use are provided for in the facility design

Goal: *Require sound operational practices for solid waste disposal, handling and management facilities to eliminate adverse health and aesthetics impacts.*

Objectives:

- o require a quality control plan to handle "surprise loads" to be incorporated into applications
- o promote state requirements of certified operators at each disposal site
- o provide for adequate monitoring and enforcement
- o consider past operational record of facility developer in application process
- o minimize nuisance and health issues, such as, dust, odor, noise, windblown trash
- o provide for appropriate operational standards for incinerators, MRFs, transfer stations and others
- o provide adequate litter control plan
- o minimize mud tracking on roadways

Goal: *Assure adequate infrastructure support for solid waste management sites while minimizing impacts to other infrastructure users.*

Objectives:

- o provide for adequate transportation access and route selection while minimizing destruction
- o insure adequate storm drainage to accommodate final cover run-off
- o provide for contaminated water management

Goal: *Establish public education programs that achieve public awareness and knowledge of solid waste management options and solutions.*

Objectives:

- o increase public awareness of different types of solid waste management facilities
- o increase public awareness of modern technologies in solid waste operations
- o develop programs that show the needs, and "pros" and "cons" associated with each type of facility
- o increase applicant awareness of TNRCC review options and the associated advantages of the options

5. Special Waste[2]

Mission Statement
Provide for the adequate capacity, management, treatment, and disposal of special wastes while minimizing risks to public health and the environment.

Goals and Objectives

Goal: *Provide for adequate capacity to dispose of special wastes.*

Objectives:
- o determine size of special waste stream
- o evaluate capacity levels at existing disposal sites
- o identify future disposal capacity needs and disposal options

Goal: *Encourage the proper management of special waste and minimize the adverse impacts on Municipal Solid Waste (MSW) disposal sites.*

Objectives:
- o ensure proper separation of special wastes from municipal and industrial wastes
- o reduce the occurrence of illegal dumping
- o minimize health risks and adverse environmental impacts associated with improper disposal
- o identify special wastes
- o identification of current special waste disposal sites
- o utilize fines to reduce special waste collection and disposal costs and increase enforcement programs
- o identify technical aspects of different facilities

Goal: *Promote awareness of general public, small quantity generators, MSW and industrial operators as to special waste identification and special handling needs.*

Objectives:
- o encourage educational and training opportunities for MSW operators to maintain quality control measures
- o increase awareness as to what constitutes special wastes, special handling needs, and the associated negative impacts of improper disposal
- o educate small quantity generators as to proper regulatory agencies and avenues of disposal
- o increase community knowledge as to how to establish collection programs

[2] The H-GAC definition of special waste is different than the TNRCC definition. The H-GAC definition is not as exhaustive. The H-GAC definition of special waste can be found in *Part III, Chapter C, Section 4.*

Goal: *Waste Reduction for special waste.*

Objectives:

- o increase public awareness of non-toxic substitutes for household hazardous waste
- o establish waste reduction goals for special waste (injunction with Waste Reduction/Reuse Subcommittee)

Goal: *Facilitate collection of special wastes.*

Objectives:

- o remove transportation cost barriers by encouraging the use of transfer stations
- o utilize locally based collection facilities, such as, mobile collection units and drop-off centers
- o encourage the development of special waste collection programs

6. Institutional Options

Mission Statement
Coordinate and maximize resources available to local governments for effective solid waste management in a regional working relationship.

Goals and Objectives

Goal: *Promote public/private and interjurisdictional joint action in solid waste management and resource recovery.*

Objectives:

- o support interjurisdictional cooperation in a full range of solid waste activities
- o encourage coordination of public and private interests in addressing solid waste problems
- o establish a clearinghouse to standardize information and assist local governments in exchanging this information and coordination of activities

Goal: *Identify financing alternatives appropriate to meet local government short and long term solid waste management needs.*

Objectives:

- o provide information on and assist local governments in obtaining financial support to solve solid waste issues
- o provide information on and assist local cooperative public and private sector initiatives to finance solid waste facilities and practices
- o lobby for legislation that provides funding resources to assist local governments in solid waste operations
- o develop standard procedures for determining and assessing the cost of local solid waste disposal programs and services
- o encourage cooperative development of solid waste management operations and facilities

7. Public Education

Mission Statement
Educate the public to provide a full range of information to assist government officials, community and business leaders, and educators in making sound decisions regarding the improvement and implementation of modern integrated solid waste management practices throughout the region.

Goals and Objectives

Goal: *H-GAC should begin an inventory of public information available and create a clearinghouse for this information to be used throughout the region.*

Objectives:
- o H-GAC should catalog the information by solid waste category
- o H-GAC should maintain the catalog for updates in technology and new publications
- o H-GAC should have a staff person responsible for the maintenance of the resources and library

Goal: *H-GAC should stress the continuing importance of education programs regarding the proper handling of solid waste management issues.*

Objectives:
- o Understanding the diversity of the region from other areas that have developed public education programs, H-GAC should continue to pursue grants and funding programs for model public education programs for use in the region
- o H-GAC should strive to provide information regarding solid waste management options available in the region
- o H-GAC should work with local governments and other agencies to network programs

Goal: *H-GAC should outline options and incentives necessary to carry out public education programs.*

Objectives:
- o H-GAC should pass on recommendations to other government agencies regarding community public education needs
- o H-GAC should study cost effectiveness of public education programs at the local and regional level

C. Framework for Action

H-GAC's solid waste management plan has identified in its findings, goals and objectives a need for new directions for solid waste management in the region. As landfilling becomes more expensive and capacity diminishes, alternatives to land disposal will need to become larger--and eventually the predominant--elements of the solid waste management system. In short, the region will need to develop an "integrated" system, which includes waste reduction, recycling and provisions for handling "special wastes."

However, the region currently lacks an "infrastructure" to fully implement programs to achieve the goals and objectives of this plan. For this reason, several broad policy initiatives are recommended which will lay a foundation for specific action steps and responsibilities.

H-GAC views the development of an integrated regional solid waste management system as a staged process. Short-term policies should focus on education, technical assistance, subregional planning, local capacity-building and coordination. However, in order to achieve longer-term goals, some new controls and changes in institutional structures may be required. General policy recommendations for the management of solid waste in the H-GAC region over the next 20 years are presented below. More detailed recommendations to implement these policies are presented in sections D and E.

H-GAC Solid Waste Management Policy Recommendations

Short-term (years 1-5)

- ***A new solid waste management "infrastructure" will be required to achieve the plan's goals.***

  To reach regional and state recycling goals, a substantial new infrastructure must be created, comprised of recycling collection programs, composting and materials recovery facilities, and transportation cooperatives. Adequate facilities for the collection and disposal of special wastes must be provided. Additionally, the regionalization of landfills resulting from Subtitle D will create longer haul distances, necessitating more transfer stations. As the new infrastructure is developed, every effort should be made to integrate the management system by consolidating these facilities whenever possible.

- ***Additional planning at the subregion level will be necessary to develop this infrastructure.***

  The regional plan lays a framework for more localized actions in eight planning subregions. State funding should be made available for each of these areas to develop its own plan, focusing on the specifics of facility and program development. In some

cases, a local government, authority or interlocal cooperative may wish to receive funding directly for this effort. In subregions where there is no logical lead agency, H-GAC may develop the subregional plan. After completion, review by H-GAC, and approval by the TNRCC, all subregional plans will become part of this regional plan.

o Solid waste management facilities should be appropriately sited with minimal adverse impacts to surrounding properties.

H-GAC recommends that the TNRCC adopt mitigation plan requirements for landfills and other solid waste management operations within 1,000 feet of residences and other sensitive land uses. Several other procedural requirements are recommended to encourage appropriate siting practices and minimize lengthy and expensive disputed permit hearings.

o Waste reduction policies should be established.

Local governments, businesses, institutions and citizens should all evaluate their waste disposal habits and look for ways to reduce waste generation. In almost every case, waste reduction policies will also result in *cost savings!* To provide an added incentive, local governments should consider volume-based, or variable-rate garbage disposal fees.

o State and local governments should adopt procurement and other policies that will help develop markets for recycled materials.

The best way to strengthen and sustain recycling efforts is to encourage the manufacture of products made with recycled materials. Recycling markets are relatively young and unstable, and if end markets do not exist, collection programs are futile. State and local governments should wield their collective purchasing power to stimulate markets by designing their procurement and other operational policies to favor recycled materials.

o A major education and technical assistance program will be necessary to address the waste reduction, recycling, and special waste goals and objectives of this plan.

Increasing waste reduction and recycling will require significant behavioral changes by the region's population, and there may be resistance to such programs because of costs or inconvenience. Without being linked to a major ongoing education program, none of these initiatives will be successful.

o A regional pollution prevention education program should be established.

A major educational campaign should also be developed to inform local governments, businesses and private citizens about their responsibilities under new laws covering used oil, tires and small quantities of hazardous waste. This campaign should also include information on how citizens can properly dispose of household hazardous waste

(HHW) and how they can report illegal dumping and violations of other laws pertaining to pollution prevention.

- ***Timely and reliable data must be available for monitoring progress and evaluating programs.***

  Numeric goals have been set for waste reduction and recycling at the state level, and H-GAC has set its own goals. It will be essential to have reliable data available on a timely basis to evaluate the effectiveness of implementation measures.

- ***The State's solid waste management fee should be expeditiously committed to implementing the policy recommendations presented in this plan.***

  Revenues from the state solid waste management fee, if strategically allocated, will help facilitate all of the initiatives cited above, with still enough remaining to dramatically upgrade the enforcement of solid waste management regulations. Ongoing funding should be provided for planning, implementation and technical assistance and new grant programs should be established to support strategic local initiatives, including assistance for communities which face immediate decisions on future landfill operations, due to Subtitle D.

- ***H-GAC should review and evaluate all such grant requests to ensure consistency with the regional plan.***

  While the state will have resources available to support implementation efforts, the demand will inevitably exceed available funding. H-GAC should review grant applications from this region to ensure the most effective allocation of funding to address priority issues and avoid duplication of effort.

- ***Additional legislative mandates should not be imposed until the new solid waste system has been allowed to develop and better reporting systems are in place.***

  Without the underpinnings of an educated public, stable recycling markets and the proper solid waste management infrastructure, short-term mandates on local governments will be met with resistance and could be counterproductive. Additionally, until a better monitoring system is in place, it will be impossible to fairly assess the performance of regions and local governments in responding to waste reduction and recycling goals. However, such measures may be needed long-term if voluntary compliance is ineffective.

Mid-term (years 6-10)

o Economic incentives, such as, volume-based garbage fees, should be provided for waste reduction and recycling.

Solid waste collection is a utility, like water or electricity. Yet this service is usually priced on a flat fee basis or is supported by property taxes. As a result, residents do not pay the true unit cost of solid waste disposal and there are no tangible incentives to reduce or recycle. All local governments should consider implementation of some form of volume-based or variable-rate pricing for solid waste collection and disposal. This service should be preceded by an extensive public education campaign and provided in conjunction with recycling, yard waste collection and increased enforcement of illegal dumping.

o All public solid waste collection programs, whether operated by the local government or contracted, should provide options for the collection of recyclables and yard waste.

After markets are developed and infrastructure is in place, recycling opportunities should be made a part of the regular solid waste collection service available to every resident in the H-GAC region. The form of collection (e.g. curbside pick-up, drop-off center) should be tailored to fit the size, characteristics and resources of the community.

o Local governments should implement a program for managing special wastes.

Local governments should implement policies for the proper management of the special wastes they produce internally, such as used oil, tires, and chemical products.

o H-GAC should initiate a major program to promote the implementation of local Household Hazardous Waste collection programs.

Local HHW collection programs are complicated and expensive. H-GAC should develop a detailed implementation strategy and provide technical assistance to local governments to begin establishing local collection systems throughout the region.

o H-GAC will consider local government implementation of waste reduction, recycling and special waste management programs in its review of funding requests from the TNRCC.

As a means of promoting local implementation of these recommendations, H-GAC will consider a community's waste reduction, recycling and special waste management programs in reviewing applications for project funding through the Texas Natural Resource Conservation Commission. Each local government will be asked to document its efforts in these areas in their funding applications.

o Subregions should move toward establishing solid waste authorities, districts, or joint powers agreements to implement subregional plans.

Almost all solid waste management operations require certain economies of scale. Because of Subtitle D, the development of new landfills will be cost-prohibitive to all but large local governments, the private sector, and multi-jurisdictional cooperatives. Additionally, there are major deficiencies in the infrastructure for collecting and disposing of special waste--an area where management solutions are very expensive. Since relatively few regional disposal facilities are likely to be developed in the future, there will also be a need to consolidate recycling, collection, and transfer operations to achieve reasonable cost efficiencies.

An appropriate management structure should be put in place at the subregion level to pool local resources and implement multi-jurisdictional programs to address these issues. Each subregion should exercise its options--existing or new authorities, joint powers or interlocal agreements, or other arrangements--to establish such a structure and begin developing the long-term projects and programs outlined in the subregional plans.

Long-term (years 11-20)

o A fully integrated waste management infrastructure, adequate to handle the collection, transport, recycling and disposal of the region's solid waste, should be in operation.

By the end of the 20-year planning horizon, subregional programs should form a coordinated regional system for solid waste management. Subregional system components should work towards creating a regional "waste-shed" from which recyclable materials can be cost-efficiently transported to markets. Public/private partnerships should be created to strategically deploy the future development of residential and commercial waste collection and transfer systems and assure adequate long-term disposal capacity.

o Develop a regional network of special waste disposal facilities which local collection programs can use.

Owing to the liabilities and expense associated with special waste disposal, only a limited number of permanent disposal sites are likely to be developed throughout the region, again, using public/private partnerships. Depending on their size and resources, local governments should establish some type of collection program in cooperation with retailers, industry, hospitals, businesses and other generators of special wastes. These participants could then have access to the facilities.

o Depending on the achievement of waste reduction and recycling goals, options such as "flow control" should be studied.

If state and regional waste reduction and recycling goals are not being met, some type of "flow control," where the destination of solid waste is determined by a management authority, may need to be studied and implemented. "Flow control" may help promote efficient use of disposal capacity, consistent volumes of recyclable materials and provide a means for monitoring waste generation rates. If waste reduction and recycling goals are not being met during the planning period, the imposition of cost penalties on entities should also be studied.

D. Recommendations for Regional Action

Based on the goals, objectives and policy framework laid out in *Sections B & C,* a series of specific short-, mid- and long-term recommendations are presented in this section.

Responsibility for implementation of these recommendations is grouped into the following three categories:

State-level Actions
Steps that should be the responsibility of state agencies and the Texas Legislature. These generally involve laws and regulations, funding programs, and the distribution of information.

H-GAC Actions
Steps that H-GAC should undertake as part of its state-funded ongoing plan implementation program. These steps generally involve technical assistance, distributing information, review of subregional plans, grants and permits, coordination and education.

Local Actions
Steps that local governments should undertake to comply with the plan. These may include the implementation of policies or the development of special projects, some of which will be eligible for state funding support.

A summary of the recommendations is presented on the following pages, for the short-, mid-, and long-term time frames. A more detailed description of the recommendations is presented, beginning on page 53.

1. Summary of Recommendations

State-level Actions

Short Term (years 1-5)

Legislative and Policy

Laws and policy changes recommended for consideration by the Legislature and State agencies.

1. Prepare and implement a state plan for the development of recycling markets, including the following elements:
    - 1.1 Redesign of procurement programs to stimulate recycling markets.
    - 1.2 Targeting products and end markets for development.
    - 1.3 Eliminating regulatory barriers to recycling.
    - 1.4 Supporting recycling technology research.
    - 1.5 Requiring minimum recycled product content for targeted materials.
    - 1.6 Establishing a labeling system for pre- and post-consumer product content.
    - 1.7 Promoting the use of available recycled products.
2. Establish incentives for reducing packaging.
3. Institute programs to encourage manufacturers to reduce toxicity of materials or to include instructions on labels for proper disposal techniques for household hazardous wastes.
4. Modify liability laws that serve as barriers to local special waste collection programs.

Regulatory Measures

Recommended changes in TNRCC regulations and procedures, regarding the issuance and enforcement of permits for solid waste management facilities.

1. Notify H-GAC of all permit applications and registrations received by the TNRCC and send copies of applications once administratively complete or registered.
2. Add the following requirements to all solid waste management facility permits in the H-GAC region:
    - 2.1 Require the placement of a sign on the proposed site.
    - 2.2 Place a 5-year review date between permit and facility development to determine if there has been a good faith attempt to develop.
    - 2.3 Require a permit review every five years.
    - 2.4 Require consideration of alternative technology and site options in landfill permits.
3. Expand H-GAC project review to include review of Type VII and VII-R sludge disposal facilities.
4. Expand H-GAC project review to include hazardous and industrial waste disposal facility siting.
5. Require every solid waste disposal site to have a certified operator.
6. Consolidate various special waste permit requirements at one regulatory agency.

7. Modify on-site industrial incinerators permits to allow for the incineration of household hazardous waste (HHW).
8. Increase monitoring and regulatory enforcement for solid waste facilities, particularly for improper disposal of special wastes.
9. Expand Texas Review and Comment System (TRACS) review to include TNRCC-funded solid waste management projects.

Permit Review

Elements that TNRCC should incorporate into their review of solid waste management facility permits.

1. Require permit applicants to include a mitigation plan if the facility will be located within 1,000 feet of a residence or other "sensitive" land use.
2 Encourage host community benefits, such as recycling or composting programs, as part of all permit applications.

Grant Funding from Solid Waste Management Fees

Grants recommended for establishment by the TNRCC, to be made available to regional councils, local governments and others.

1. Provide ongoing funding for continued regional planning and implementation programs.
2. Provide funding to develop eight subregional plans in the H-GAC region.
3. Establish regional and subregional plan implementation programs, including the following elements:
   - 3.1 Education and public awareness campaigns
   - 3.2 Waste reduction programs
   - 3.3 Local pilot or "showcase" recycling programs
   - 3.4 Establishment of a network of permanent HHW collection sites
   - 3.5 Development of institutional structures
4. Establish a "fast-track" grant program for local governments to conduct preliminary engineering and financial feasibility studies to respond to Subtitle D mandates.
5. Implement a matching grant program to assist subregions and local governments with site selection, financial and engineering studies for landfills, transfer stations and alternative disposal methods.
6. Encourage donation of environmental fines to local HHW collection programs.
7. Link various agencies' facility development loan programs to regional and subregional plans.
8. Establish a grant or loan program to fund start-up collection systems in rural counties which currently offer only drop-off services.
9. Provide supplemental funds to local governments for enforcement of illicit disposal laws.
10. Support research for developing recycling techniques, particularly for special wastes, such as used oil, tires and sludge.
11. Establish business finance program to assist recyclers, particularly in less populated areas.

Technical Assistance and Information

Programs recommended for implementation by state agencies.

1. Establish a state "single point of contact" for recycling programs.
2. Revise reporting requirements so that waste reduction can be more accurately calculated.
3. Conduct annual monitoring of recycling rates, in conjunction with revised landfill permit reporting requirements.
4. Expand the existing Texas Natural Resource Conservation Commission (TNRCC) Waste Minimization program to include non-industrial waste reduction; establish minimization program for small quantity generators of hazardous waste.
5. Develop training programs for landfill operators to identify special wastes.
6. Maintain adequate staffing to provide technical assistance to regional councils and local governments.

Mid-term (years 6-10)

Policy and Programs

1. Evaluate options for manifest systems for small quantity generators of hazardous waste.
2. Develop statewide standards for solid waste management authorities to establish a consistent approach to regional solid waste management.

Long-term (years 11-20)

Policy and Programs

1. Develop state policy on "flow control" for solid waste management. Study possible cost-penalty structure for failure to meet waste reduction and recycling targets.

H-GAC Actions

Short-term (years 1-5)

Planning and Coordination

Actions recommended for H-GAC's plan implementation work program.

1. The Solid Waste Management Committee (SWMC) will oversee the implementation of *Resource Responsibility, The Solid Waste Management Plan for the H-GAC Region*.
2. Oversee and participate in the development of subregional plans.
3. Establish regional local government recycling council and peer exchange program.

Information and Education

Actions recommended for H-GAC's plan implementation work program.

1. Continue publishing the Waste Matters newsletter on a regular quarterly basis.

2. Establish regional information clearinghouse on waste reduction, recycling, collection and disposal, institutional options and educational resources.
3. Utilize available expertise to develop educational tools which can be used by local governments on the following topics: waste reduction; recycling; volume-based garbage fees; citizen involvement in the siting process; special waste disposal; and, citizen monitoring efforts.
4. Develop a guide to financial and technical assistance resources available to local governments; produce updates and "For Your Information" briefs, as needed.
5. Promote the "Don't Bag It" program for yard waste at a regional level.
6. Promote Keep America Beautiful and/or Keep Texas Beautiful affiliation by cities in the H-GAC region.
7. Promote regionwide business membership in Texas Corporate Recycling Alliance.
8. Host a recycled products fair.
9. Develop regional recycling awards program.
10. Develop public awareness program on how to access self-reporting monitoring information for solid waste disposal facilities and how citizens can report violations of solid waste disposal laws.
11. Conduct special waste management and education programs for local governments and the private sector.
12. Promote local participation in scrap tire recycling fund program.
13. Coordinate with state annual recycling survey to monitor program results.
14. Continue to maintain an inventory of solid waste collection practices of H-GAC local governments.

Technical Assistance

Actions recommended for H-GAC's plan implementation work program.

1. Develop a model waste reduction program for use by local governments and private business, and provide follow-up technical assistance.
2. Provide technical assistance on the use of volume-based garbage fees by local governments.
3. Develop a model local government recycling policy and conduct follow-up training workshops.
4. Provide technical assistance to local governments in establishing household hazardous waste collection programs.
5. Assist in the establishment of permanent HHW collection sites.
6. Provide technical assistance to local governments in implementing public education programs.
7. Work with sludge generators to develop and finance the development of alternative regional sludge disposal sites.
8. Continue to develop recommendations for the composting of organic wastes, such as food waste, yard waste, and sludge.
9. Continue development of a regional geographic information system (GIS) for the H-GAC region with emphasis on physical features.

Permit Review

Elements that H-GAC will in reviewing solid waste management facility permits.

1.Continue to review all permit applications for landfills, transfer stations, materials recovery facilities and incinerators in the region.
    1.1. Encourage consistency with local comprehensive plans and zoning ordinances.
2. Initiate review of Type VII and VII-R sludge application permits.
3. Initiate review of hazardous and industrial waste disposal permits.

Mid-term (years 6-10)

Program and Policy

1. Establish recycling and special waste management programs as a criteria for H-GAC Projects Review of certain state-funded projects.
2. Encourage the formation of a network of multi-jurisdictional solid waste management structures throughout the region.

Long-term (years 11-20)

Program and Policy

1. Provide technical assistance to coordinate subregional management systems at the regional level.
2. Provide technical assistance to integrated special waste collection programs.
3. Depending on the achievement of waste reduction and recycling goals, encourage the establishment c

Local Government Actions

Short-term (years 1-5)

Actions which H-GAC will encourage local governments to voluntarily adopt.

1. Adopt voluntary internal waste reduction and recycling policies.
2. Revise procurement procedures to promote the use of recyclables, and establish in-house recycling programs for employees.
3. Work with local retailers to promote the use of existing recycling programs.
4. Implement a voluntary internal program for managing special wastes.
5. Consider the siting of solid waste disposal facilities in local plans and zoning ordinances.
6. Counties should consider the development of landfill siting plans, as authorized by the County Solid Waste Control Act.
7. Develop mechanisms to promote early public involvement and dispute resolution in facility siting issues.

Mid-term (years 6-10)

Actions which H-GAC will evaluate in determining conformity with the plan as a part of H-GAC internal project review.

1. Adopt internal waste reduction, recycling and special waste management policies.
2. Consider adoption of volume-based garbage fees.
3. Establish recycling collection systems within all H-GAC local governments.
4. Work to form subregional multi-jurisdictional structures for solid waste management facility and program development.

Long-term (years 11-20)

Programs which will result from the implementation of subregional strategies.

1. Work through subregional management structures to coordinate solid waste management programs at a regional level.
2. Develop a regional network of special waste collection programs to feed into regional facilities.
3. Meet all waste reduction/recycling goals annually, with possible cost-penalties for non-attainment.

2. Description of Recommendations

State-level Actions

Short Term (years 1-5)

Legislative and Policy

Laws and policy changes recommended for consideration by the Legislature and State agencies.

1. ***Prepare and implement a state plan for the development of recycling markets.***
   The Texas General Land Office (GLO), in coordination with Texas Department of Commerce (TDOC), Texas Natural Resource Conservation Commission (TNRCC) and the Railroad Commission of Texas (RRC), will be developing a statewide market development plan. The following recommendations pertain to how this plan could best facilitate local recycling efforts:

   1.1 Redesign procurement programs to stimulate recycling markets.
   GLO is currently assessing the impact total state purchasing could have on stimulating recycling markets. Once their report is complete, the state should revise its policies accordingly, particularly in currently marginal market segments, such as newsprint, plastics, construction and demolition and compost. The state should establish procurement goals for targeted materials and require contractors and grantees to do the same.

   Specifically regarding compost, state properties such as parks, wildlife refuges, highway rights-of way and office complexes should use compost wherever possible. Relationships should be established between local composting programs, public or private, and state district offices, to assure that a steady supply is available.

   1.2 Target products and end markets for development.
   Based on its market development strategy, the GLO should produce and periodically revise its targeted products and end markets list to distribute to local governments and the private sector. This list would show the recyclables upon which the state is focusing its market development efforts, particularly in "non-traditional" end markets. A clearinghouse of market information, based on this list, should also be made available to local governments, so they could design their programs around the same materials. The end markets on this list should also be included in TDOC's industrial recruitment programs.

1.3 Eliminate market barriers to recycling.

State laws and policies should be reviewed to eliminate, wherever possible, regulatory constraints on the use of recycled products. The following steps are recommended:

- encourage the federal government to reexamine tariffs, shipping laws and international trade policies to eliminate barriers to the sale and transport of recyclables or recycled products
- all levels of government should establish an allowable price variance of 15% from low bid for products with a minimum 10% recycled content
- other purchasing/bidding requirements should be reexamined to make sure they do not discriminate against the procurement of recycled products
- modify local liability laws for drop-off compost operations

1.4 Support recycling technology research.

Research into recycling technology should be supported by the state through the university system and through grant programs to others. Grant programs should be designed to help implement the state market development plan.

1.5 Require minimum recycled product content for some materials.

State rules already set post-consumer (recycled) paper content goals for newsprint. Strong consideration should be given to establishing such content requirements for low-grade cardboard (for packaging); asphalt (shredded tires--already part of federal highway law) and plastics. State efforts should be closely coordinated with the laws and regulations of the federal government and other major states.

1.6 Establish labeling system for pre- and post-consumer product content.

Currently, products which have very small percentages of recycled material can use the familiar "recycled" logo . A system should be established such that any product using the logo would be required to list the percentage of pre- an post-consumer content the product (or package) contains. State efforts should be closely coordinated with the laws and regulations of the federal government and other major states.

1.7 Promote the use of available recycled products.

The state should take a leading role in promoting the use of recycled products through a variety of mechanisms. A statewide conference on recycled products for local government purchasing agents should be conducted, possibly in conjunction with Texas Municipal League, Texas Association of Counties and state school district conventions. The GLO should also work with major manufacturers which utilize recycled materials in their products to develop educational advertising campaigns. Where appropriate, the TNRCC should also work with landfill permit holders to encourage the use of a compost mix as a cover material and for erosion control on construction projects.

2. ***Establish incentives for reducing packaging.***
   While this type of initiative will probably be the result of national legislation, states should have flexibility in meeting federal guidelines and may wish to adopt their own legislation, policies and programs. The following actions should be considered:
   - develop a uniform labeling system for targeted consumer products that indicates its ranking as far as the amount of packaging used
   - review and modify liability laws which are barriers to organizations donating food and other products to charitable organizations
   - provide grant funding for research that will lead to new manufacturing processes and uses of alternative technology to reduce the generation and toxicity of waste in manufacturing
   - develop state awards program to recognize manufacturers and retailers who have taken steps to reduce packaging

3. ***Institute programs to encourage manufacturers to reduce toxicity of materials or to include disposal instructions on labels .***
   Incentives should be offered to manufacturers who voluntarily reduce the toxicity of their products, such as recognition awards. State efforts should be closely coordinated with similar programs of the federal government and other major states, to achieve uniformity.

   The state should also encourage manufacturers to identify proper disposal for household hazardous wastes (HHW) on package labeling. Individual labeling requirements could be coordinated with public education campaigns. Again, state efforts should be closely coordinated with the laws and regulations of the federal government and other major states.

4. ***Modify liability laws that serve as barriers to special waste collection programs.***
   Provisions to reduce the general liability and CERCLA (Superfund) liability for special waste collection programs should be introduced in state legislation and regulations. In the new state used oil rules, a provision to reduce the liability of public collection stations was included. This provision could serve as an example for other types of collection programs.

Regulatory Measures

Recommended changes in TNRCC regulations and procedures, regarding the issuance and enforcement of permits for solid waste management facilities.

1. ***Notify H-GAC of all permit applications and registrations received by the TNRCC and send copies of applications once administratively complete or registered.***
   H-GAC should be notified by letter by TNRCC staff of applications, so that potential problems with consistency with regional planning can be identified and corrected at

an earlier stage in the permitting process. H-GAC should also receive the permit and registration once administratively complete so that review can begin.

2. Add the following requirements to all solid waste disposal facility permits in the H-GAC region.

2.1 Require the placement of a sign on the proposed site.

Applicants should be required to place a sign at proposed site after the application is administratively complete. The placement of a sign on the proposed site will supplement existing public notice requirements. The sign should include a description of the proposed facility and telephone number of contacts representing the applicant and the TNRCC where potential interested parties could receive further information.

2.2 Place a 5-year review date between permit issuance and facility development to determine if there has been a good faith attempt to develop.

Often times, once a permit is granted, there is a considerable time lag before the facility becomes operational. An review date would allow for a follow-up review after 5 years' time to account for any changes in land use patterns, transportation, infrastructure or other conditions.

2.3 Require a permit review every five years.

Fines and other administrative penalties for operational violations may not be sufficient to maintain high operational standards. A permit renewal process, including a review of each facility's record of violations, should be conducted by TNRCC every five years.

2.4 Require consideration of alternative technology and site options in landfill permits.

As part of the permit, an applicant should demonstrate that alternative site and technology options were considered prior to permit filing. Consideration of alternative disposal options such as materials recovery, baling and other compaction methods will encourage best use of limited resources. A description of the process used in selecting the facility site will help to demonstrate that environmental, land use and transportation issues have been considered in the siting process.

3. Expand H-GAC project review to include Type VII and VII-R sludge disposal facilities.

These facilities have the potential to negatively impact surrounding land uses much the same as landfills, but are not currently reviewed by H-GAC. Additionally, there may be public health concerns regarding the heavy metal contents of the sludge. TNRCC should allow H-GAC to comment on these applications, to encourage appropriate siting and promote the development of fewer, multi-jurisdictional facilities, rather than the current proliferation of small sites.

4. ***Expand H-GAC project review to include hazardous and industrial solid waste facility siting.***
   As with sludge disposal sites, hazardous waste facilities bring about many of the same siting concerns that landfills do. TNRCC should also allow H-GAC to review and comment on these permit applications.

5. ***Require every solid waste disposal site to have a certified operator.***
   Requiring a level of certification appropriate to the type of facility would encourage higher operation standards and operators of improved capability. TNRCC should institute and/or continue to offer Operator certification programs similar to the TDH certification program.

6. ***Consolidate regulatory permit requirements at one regulatory agency.***
   The state needs to streamline and clarify the regulatory process for operating special waste management programs. A single regulatory agency contact is needed to coordinate the regulatory process. For example, TNRCC and the GLO are involved in the establishment of household hazardous waste collection events. Organizers of special waste collection events may be confused as to which agencies they need to contact. It is anticipated that the Texas Natural Resource Conservation Commission, when established, will implement this recommendation.

7. ***Modify on-site industrial incinerators permits to allow for the incineration of household hazardous waste.***
   Private-public partnerships should be encouraged in household hazardous waste management. Private participation is limited due to on-site industrial permits restrictions that don't allow for the treatment of waste generated off-site. The potential for partnerships could be increased if the state would grant exemptions regarding this restriction.

8. ***Increase monitoring and regulatory enforcement for solid waste facilities, particularly for improper disposal of special wastes.***
   The state should retain adequate staff capability to provide for increased enforcement at waste disposal facilities. The increased enforcement budget should make adequate staffing available to increase routine inspection and monitoring programs for all types of waste disposal facilities and provide for rapid enforcement. Particularly important will be monitoring for hazardous wastes improperly entering a facility, making sure permitted hours of operation are observed and mitigation measures are implemented. Additionally, the state should establish a hotline to receive complaints and to direct these complaints to the appropriate agency. Complaints should be addressed in a timely manner. Funds from the state solid waste management fee could support the hotline.

9. ***Expand Texas Review and Comment Systems (TRACS) review to include TNRCC-funded solid waste management projects.***
   In order to ensure consistency with regional and local solid waste management plans, formal procedures to allow for TRACS review of TNRCC-funded projects should be implemented.

Permit Review

Elements that TNRCC should incorporate into their review of solid waste management facility permits.

1. ***Require permit applicants for landfills, transfer stations, materials recovery facilities and incinerators to include a mitigation plan if the facility will be located within 1,000 feet of a "sensitive" land use.***
   As part of the permit, an applicant should be required to submit a mitigation plan as a part of all applications where the facility will be located within 1,000 feet of a "sensitive" land use. The minimum separation distance (between facility property line and property line of existing sensitive land use) is intended to assure compatibility with surrounding uses by requiring mitigation of negative impacts on the surrounding property. Mitigation plans should be tailored to the characteristics of the site and its relationship to surrounding land uses. Mitigation plans should address view screening, odor, traffic impacts, and hours of operation. Provisions of the mitigation plan would be enforced by TNRCC as part of its ongoing inspection of permitted facilities. For the purposes of the permit review, "sensitive" land uses will include: residences, schools, religious facilities, health-care facilities, and recreational uses such as dedicated parks. The following chart shows the types of facilities which should fall under this review, the minimum separation distance and key issues of concern in siting.

Facility Type	Min. Separation Distance from Sensitive Land Use	Issues of Concern
Landfills (both Type I & IV)	1,000 feet	environmental concerns (odor, gases, groundwater and surface water), traffic impacts, land use compatibility, impact on high-visibility corridors.
Energy Recovery & Incineration Facility	1,000 feet	air quality, land use compatibility, impact on high visibility corridors, traffic impacts.
Transfer Station	1,000 feet	environmental concerns (odor and water quality), traffic impacts, land use compatibility.
Recycling Recovery Center	1,000 feet	traffic, minimal odor, noise (depending on technology).
Composting	1,000 feet	odor, surface runoff, vectors.
Sludge Land Application Site	same as TNRCC provisions	odor, water quality, impact on surrounding land uses.
Sludge Storage Facility	same as TNRCC provisions	odor, water quality, land use compatibility.

2. ***Encourage host community benefits as a part of all permit applications.***
   Permit applicants should document host community benefits to be provided. These benefits should further the goals and objectives of the higher levels of the solid waste management hierarchy: waste reduction, reuse and recycling. Negotiation should be encouraged between private operators and host communities to provide services such as recycling collection, construction of a MRF or establishment of a composting facility in conjunction with the facility being permitted.

Grant Funding from Solid Waste Management Fees

Grants recommended for establishment by the TNRCC, to be made available to regional councils, local governments and others.

1. ***Provide ongoing funding for continued regional planning and implementation programs.***
   Funding should be provided for H-GAC to undertake the follow-up and implementation activities outlined in this plan. State funding will also be used to keep the plan up-to-date, and to conduct reviews on permits and grant applications from the H-GAC region.

2. ***Provide funding to develop eight subregional plans in the H-GAC Region.***
   The H-GAC region should receive a funding allocation, based on its population, to develop eight subregional plans. In some cases, a local government, interlocal cooperative or solid waste management authority will prepare the subregional plan. Where no logical lead agency can be identified, H-GAC will prepare the plan.

3. ***Establish competitive implementation grants for regional councils and local governments, and non-profit organizations to develop projects and programs.***
   Competitive grants should also be made available to regional councils, local governments, and non-profit organizations to undertake specific implementation projects and establish pilot programs. The following types of grant programs are recommended.

   3.1 Education and public awareness campaigns.
   Public education is already an earmarked use of state solid waste management funds. Certain activities, such as television advertising campaigns, can best be initiated at the state-level. However, many public education programs will require making the public aware of *local* solid waste management options. Regional councils, local governments, and non-profit organizations, such as Keep Texas Beautiful, will be able to develop campaigns which are tailored to local populations and conditions.

Additionally, there are a number of state-funded solid waste management education campaigns and grant programs. All state agencies currently operating public education campaigns and administering grant funds should coordinate their resources to assure that programs are not duplicative and achieve their maximum impact.

3.2 Waste reduction programs.

Innovative local waste reduction pilot programs should be supported by grants to implement plan goals and objectives. Innovation and transferability should be stressed in the grant award process.

3.3 Local pilot or "showcase" recycling programs.

Direct grants for the establishment of community pilot or "showcase" programs should be provided. Innovation, transferability, prior local effort and capability should be stressed in the award of these grants.

3.4 Establishment of a network of HHW collection and disposal programs.

Grant funds made available to local governments to study the feasibility and implementation of special waste collection and disposal programs. Projects which should be considered include:

- Development of local HHW collection programs
- Establishment of a statewide network of 50-60 permanent HHW collection sites

3.5 Development of institutional structures.

A competitive grant program should be established for the development of multi-jurisdictional solid waste management programs. These grants should be used to study available implementation options, such as solid waste management districts or joint powers agreements. They could also be used for feasibility studies, including waste stream and financial analysis, for the development of specific facilities, such as landfills, transfer stations, and special waste handling and disposal facilities.

4. Establish a "fast-track" grant program for local governments to conduct preliminary engineering and financial feasibility studies to respond to Subtitle D mandates.

Several public landfills in the H-GAC region have the potential to serve as regional facilities, but will need substantial upgrading to meet the requirements of Subtitle D. Immediate decisions will need to be made on the future of these facilities before subregional plans are completed. The state should make "fast track" grants available for local governments with limited resources to assess the costs of Subtitle D compliance and the financial feasibility of expanding to a regional service area.

5. Implement a site-specific matching grant program to assist subregions and local governments with facility development.

A competitive site-specific grant should also be created to help local governments pay for site evaluation and engineering work leading up to a permit application for regional facilities identified in subregional plans.

6. ***Encourage donation to local collection programs for environment fines.***
   The state should continue to allow environmental fines to be donated to local HHW collection programs. Local program cash expenditures can be offset by these donations. With this additional funding, the scope of collection programs could be expanded to include other types of special waste collection events, such as white goods and waste from small quantity generators.

7. ***Link various agencies' facility development loan programs to regional and subregional plans.***
   The Texas Water Development Board and other state and federal loan programs for solid waste disposal facilities should be coordinated with regional and subregional plans to assure that priority projects are implemented and that resources are effectively allocated.

8. ***Establish state grant or loan program to fund rural collection systems.***
   A grant or loan program should be established to fund the start-up of rural collection systems where only drop-off programs now exist. The program, which would focus on capital expenditures and other start-up costs, would provide a matching grant or low-interest loan to the local government--a county in most cases.

9. ***Provide supplemental funds to local governments for enforcement of illicit disposal laws.***
   Local governments are in a better position to enforce laws against illicit dumping of waste, such as the **Solid Waste Disposal Act and Texas Litter Abatement Act**. Local efforts in this area should be supported by state funding.

10. ***Support research for developing recycling technologies.***
    Public and private research programs should be undertaken by the state university system and through research grants. These programs should be linked to the state's recycling market development plan. Creation of new, cost-efficient technologies should be a priority, as should recycling special wastes. In the case of used oil and tires, dedicated funds have already been established. Additionally, the state should provide special implementation grants to fund market studies on beneficial uses for sludge, such as co-composting with yard waste.

11. ***Establish business finance program to assist recyclers, particularly in less populated areas.***
    Various public grant and loan programs, administered by environmental and economic development agencies, should target the development of the recycling industry as a priority. Action steps should include:

- Texas Department of Commerce (TDOC) should target recycling as a growth industry and focus financing programs on research and development
- TDOC or the TNRCC should establish a grant or loan program to assist the start-up of recyclable material brokers in less populated counties which do not have the recycling end-markets of major urban centers

Technical Assistance and Information

Programs recommended for implementation by state agencies.

1. ***Establish state "single point of contact" for recycling programs.***
   Though GLO has been given lead responsibility for carrying out statewide recycling programs, there is still confusion at the local level about who to contact for information. Solid waste management programs are distributed through multiple state agencies, and those not well-familiarized with solid waste management often have difficulty finding information.

2. ***Revise reporting requirements so that regional waste reduction and recycling rates can be more accurately calculated.***
   Reports required by the state from landfill operators should be modified to clearly show the regional origin and amount of waste received annually, so waste reduction (or source diversion) can be accurately calculated. Without reliable data of this nature, it will be impossible to monitor the success of waste reduction programs. Additionally, many landfills also operate composting and materials recovery programs. These should be included in the reports as well and utilized in the state recycling monitoring program.

3. ***Conduct annual monitoring of recycling rates, in conjunction with revised landfill permit reporting requirements.***
   The state has already embarked upon an annual recycling monitoring program. The data collection for this program should be shared with regional agencies in a timely manner to measure the results of their implementation programs. Revising landfill permit reporting requirements to better calculate waste import/exportation, source diversion and on-site materials recovery will make this effort more effective. Through this process, the state should also work to create a standard definition for "participation" in a recycling program.

4. ***Expand the existing Texas Natural Resource Conservation Commission (TNRCC) Waste Minimization program.***
   This program currently focuses on industrial waste reduction. It should be expanded to include other major employers throughout the state and broaden its focus to overall waste reduction strategies. Also, the hazardous waste reduction program is currently directed at large generators. The program's objectives need to be expanded to include small quantity commercial generators of hazardous waste. Municipal governments could also be included in the program.

5. ***Develop training programs for landfill operators to identify special wastes.***
   The state already operates a certification program for landfill operators. The course curriculum should be expanded to include training programs regarding special waste identification and management.

6. ***Maintain adequate staffing to provide technical assistance to regional councils and local governments.***
   The state should retain adequate staff capability to provide limited technical assistance to COGs and local governments with implementation efforts. Model programs, presentations, help-line, etc.

Mid Term (years 6-10)

Programs and Policy

1. ***Evaluate options for manifest systems for small quantity generators of hazardous wastes.***
   The state should study options for all small businesses to manifest the generation, transportation, and disposal of their hazardous waste. A manifest system may help ensure hazardous waste are properly managed and thus preventing illegal disposal. Medical waste generators are required to use a manifest system which could serve as a model for small quantity generators.

2. ***Develop statewide standards for solid waste management authorities.***
   A consistent approach to the establishment of solid waste management authorities should be developed at the state level. Even though such efforts have been recently proposed as legislation, it is recommended that this occur early in the mid-term time frame, after regional and subregional plans are complete. The development of a state policy would provide for some uniformity of implementation mechanisms for regional plans, and avoid a "crazy quilt" of districts and authorities throughout the state.

Long Term (years 11-20)

1. ***Study "flow control" policies for solid waste management authorities and counties.***
   The state should study and consider legislation or regulations regarding "flow control" of solid waste by management authorities, or counties. This term refers to a management authority having the power to direct the destination of waste from various sources, and is currently used in other parts of the country. Such a mechanism could be valuable in the long-term planning horizon if regional waste reduction or recycling goals are not being met.

H-GAC Actions

Short Term (years 1-5)

Planning and Coordination

Actions recommended for H-GAC's plan implementation work program.

1. ***The Solid Waste Management Committee (SWMC) will oversee the implementation of Resource Responsibility, The Solid Waste Management Plan for the H-GAC Region.***
   The H-GAC Board of Directors should appoint the Solid Waste Management Committee (SWMC) or other ad hoc subcommittees that will oversee plan implementation, updates, subregional planning and to review policy issues. The SWMC should meet on a quarterly basis to review work programs, progress on plan implementation, and subregional plans. The SWMC should also serve as a regional forum for discussion of solid waste management issues. The six subcommittees and working groups which participated in the development of this plan should be maintained on an ad hoc basis to review specific issues, as they arise.

2. ***Oversee and participate in the development of subregional plans.***
   H-GAC will work with local governments in the eight planning subregions to identify the most appropriate entity to develop the plan. Lead agencies for subregional plans may include existing solid waste management or river authorities, counties, major cities, or multi-jurisdictional cooperatives. If no lead agency can be identified, H-GAC will prepare the subregional plan.

   H-GAC will also review the scope, work program and report format of subregional plans, to ensure consistency with the regional plan. All subregional plans reviewed and adopted by H-GAC will become part of the regional plan.

3. ***Establish regional local government recycling council and peer match program.***
   H-GAC should establish a local government recycling council which would meet at least quarterly to coordinate information efforts, share information, pool resources and set priorities for the joint development of markets, transportation and infrastructure. This council could also serve as the basis for establishing a speakers bureau and a peer match program, where representatives of similar communities could share information about recycling programs.

Information and Education

Actions recommended for H-GAC's plan implementation work program.

1. ***Continue publishing the Waste Matters newsletter on a regular quarterly basis.***
   This newsletter, which currently has a circulation of over 600, should continue to provide the following information on a regional level:
   - Progress reports on subregional plans and plan implementation activities
   - Dates, times and locations of all related committee meetings, workshops and other plan-related events
   - Schedule of outside conferences
   - Legislative and regulatory updates

2. ***Establish a regional information clearinghouse on waste reduction, recycling, collection and disposal, institutional options and educational resources.***
   H-GAC should maintain an inventory of materials on solid waste management and serve as a clearinghouse for distributing this information to local governments, school districts and citizen groups throughout the region.

   This information should be catalogued by solid waste management category and should be regularly updated to account for new technological and regulatory developments. Adequate staff resources should be dedicated to maintaining this information base and distributing materials.

3. ***Utilize available expertise to develop educational materials which can be used by local governments.***
   H-GAC has already sought funding from the Governor's Energy Management Center to develop a series of special publications on recycling. Additional funding should be pursued to expand the scope of this project to include waste reduction, volume-based garbage fees, citizen involvement in the siting process, special waste issues, and citizen monitoring efforts.

   Participation should be enlisted from federal and state agencies, school districts, Keep America Beautiful (KAB)/Keep Texas Beautiful (KTB), local media and other organizations. Programs could include development of brochures, issue papers, educational modules for schools and media campaigns.

4. ***Develop a guide to financial and technical assistance resources available to local governments.***
   H-GAC should work with the Comptroller's Office, GLO, TNRCC and other agencies to provide a comprehensive guide on the full range of solid waste-related grant and loan programs, as well as technical assistance programs. Periodic updates and "For Your Information" briefs should be distributed, as programs change or new programs come on line.

5. ***Promote the "Don't Bag It" program for yard waste at a regional level.***
   Yard waste is one of the major components of the residential waste stream, and one of the easiest to reduce. The educational "Don't Bag It" program should be instituted region-wide through a cooperative effort of H-GAC, County Agricultural Extension offices, local governments and citizen groups and combined with existing community compost efforts.

6. ***Promote Keep Texas Beautiful affiliation for cities in the H-GAC region.***
   H-GAC should work in concert with Keep Texas Beautiful (KTB) in providing membership information to all cities within the region. KTB offers many information and educational resources for local affiliates, and to recreate these programs would be duplicative. H-GAC staff should also provide technical assistance to local groups in completing the KTB certification process.

7. ***Promote regionwide membership in Texas Corporate Recycling Alliance.***
   H-GAC should work with the Houston Corporate Recycling Council, local chambers of commerce and other business groups to establish regional coverage of the Texas Corporate Recycling Alliance with particular emphasis on small businesses. This existing organization has many programs already in place for businesses to set-up in-house recycling programs and policies.

8. ***Host a recycled products fair.***
   H-GAC should work towards hosting an annual recycled products fair for local government purchasing agents, to highlight recycled products which are available.

9. ***Develop regional recycling awards program.***
   H-GAC should develop an awards program recognizing outstanding local recycling programs in the region. Award categories should include the local government, corporate, non-profit and volunteer sectors.

10. ***Raise public awareness on how citizens can report violations of solid waste disposal laws.***
    Information should be distributed on how citizens can report violations of solid waste management laws. As previously recommended, the state should to establish a hotline to receive complaints and to direct these complaints to the appropriate agency.

    The general public is also generally not aware that self-reporting monitoring information for solid waste disposal facilities is collected by the state. The level of public awareness should be raised about the availability of this information.

11. ***Conduct education programs on special waste management for local governments and the private sector.***
    H-GAC should conduct a series of regional workshops on special waste identification, minimization and disposal options. Topics should include: collection and disposal

techniques; how to report illegal dumping; and public education programs for household hazardous waste minimization.

12. Promote local participation in scrap tire recycling fund program.

H-GAC should inform local governments about the opportunities available under the scrap tire recycling program, and should continue to host workshops on scrap tire issues.

13. Coordinate with state annual recycling survey to monitor program results.

H-GAC should work in conjunction with the state recycling rate monitoring program to ensure an accurate report. The information will be used to measure the effectiveness of recycling programs and to make any necessary modifications to the regional plan.

14. Continue to maintain an inventory of solid waste collection practices of H-GAC local governments.

During the preparation of the regional plan, H-GAC conducted a survey of local government solid waste management practices. This survey should be conducted on a regular basis, and should include waste import/exportation data, collection, transportation and disposal programs, as well as local efforts in waste reduction, recycling and special waste handling. Survey results will be used in plan evaluation and for keeping H-GAC's solid waste database current.

Technical Assistance

Actions recommended for H-GAC's plan implementation work program.

1. Develop a model waste reduction program for use by local governments and private business, and provide follow-up technical assistance.

H-GAC should develop a model program and encourage voluntary adoption by local governments throughout the region. Program elements should include:

- conducting a waste audit and determining waste streams which could be reduced
- reducing paper waste through two-sided copying, eliminating unnecessary paperwork
- circulating materials rather than making multiple copies
- electronic records storage
- elimination of paper or Styrofoam cups
- culling mailing lists

This program should also be distributed to major private businesses groups throughout the region, with several additional special elements, such as:

- retail chains working with their suppliers to reduce packaging and develop alternative methods for display
- modifying the Clean Houston "Clean Builder Program" to address waste minimization in the construction industry

A series of follow-up training workshops should be conducted on these materials by H-GAC staff and other experts from state agencies and local organizations.

2. ***Provide technical assistance on the use of volume-based garbage fees by local governments.***
   H-GAC should provide information and training workshops to educate local governments about the benefits of adopting a volume-based garbage fee for meeting waste reduction goals, and to encourage local governments to adopt such a fee structure. Options for unit pricing and accounting for such a fee system should be developed.

3. ***Develop a model local government recycling policy and conduct follow-up training workshops.***
   H-GAC, in conjunction with appropriate state agencies, should develop a model recycling policy for adoption by local governments addressing procurement, employee recycling opportunities and distribution of educational materials. H-GAC should conduct annual follow-up training workshops on internal recycling policies for local governments in each planning subregion.

4. ***Assist local governments in understanding the issues involved with establishing HHW management programs.***
   H-GAC should provide technical assistance to local governments interested in developing programs for HHW reduction, disposal, and recycling/reuse opportunities. H-GAC should coordinate efforts with state agencies and private organizations already involved in HHW management.

5. ***Assist in the establishment of permanent HHW collection sites.***
   A state-level recommendation was to provide funding for the establishment of 50-60 permanent HHW collection sites throughout the state. H-GAC, using its geographic information system and other resources, should assist in the location of these sites in areas where they will be most convenient for the greatest population.

6. ***Provide technical assistance to local governments in implementing public education programs.***
   H-GAC's implementation program should include technical assistance in the design of effective public education strategies to inform residents of responsible solid waste management practices. The technical assistance should be linked to the implementation of plan recommendations.

7. ***Work with sludge generators to jointly develop and finance the development of a alternative regional sludge disposal sites.***
   H-GAC should work with major sewage sludge generators, such as Houston-area Municipal Utility Districts (MUDs) to jointly develop and finance the development of alternative regional sludge disposal sites. Currently, much of the sewage sludge is land applied in rural counties located away from the source generation sites.

8. ***Continue to develop recommendations for the composting of organic wastes, such as food waste, yard waste, and sludge.***
   H-GAC should continue to study current practices surrounding the management of organic wastes, such as food waste, yard waste, sludge, and MSW. Waste sources, impediments and problems of management options should be investigated. Additionally, H-GAC should continue to host workshops on composting issues.

9. ***Continue development of a regional geographic information system (GIS) for the H-GAC region with emphasis on physical features.***
   H-GAC should continue development of a regional GIS. Currently, the GIS contains data on solid waste management facilities, demographics, transportation facilities, and political boundaries. The GIS should be expanded to include data on land use, soils, wetlands, floodplains, aquifer recharge zones, and other environmentally sensitive areas, as more accurate data becomes available in an electronic form. An expanded GIS will enhance H-GAC's permit review process and could provide valuable information for subregional planning and facility siting studies.

Permit Review

Elements H-GAC will incorporate in reviewing solid waste management facility permits. The Permit Review recommendations apply to internal H-GAC reviews only. Additional recommendations may be found in state-level actions.

1. ***Continue to review all permit applications for landfills, transfer stations, materials recovery facilities and incinerators in the region.***
   As has been the practice in this region for the past seven years, solid waste management facilities should be reviewed by H-GAC for how well they meet the regional plan's goals, objectives and recommendations (as well as future approved subregional plans, which may be more, but not less, restrictive than the regional plan). Applications will be reviewed against applicable goals, objectives and recommendations. A modification in the existing review procedure is recommended below.

   1.1 Facility permits should conform with local comprehensive plans and zoning ordinances.
   As part of its internal review, H-GAC will solicit local government comments concerning the conformance between facility permit and local comprehensive plans, zoning ordinances, and infrastructure plans.

2. ***Review Type VII and VII-R applications for sludge disposal facilities.***

These facilities have the potential to negatively impact surrounding land uses much the same as landfills, but are not currently reviewed by H-GAC. A state-level recommendation of this plan is for TNRCC to allow H-GAC to comment on these applications to encourage appropriate siting and promote the development of fewer, multi-jurisdictional facilities, rather than the current proliferation of small sites. If this recommendation is instituted by TNRCC, the H-GAC SWMTF and its Projects Review/Siting Subcommittee will work to develop siting guidelines for these facilities.

3. ***Review hazardous and industrial waste disposal facility permits.***
   As with sludge disposal sites, hazardous and industrial waste facilities bring about many of the same siting concerns that landfills do. As previously recommended, TNRCC should also allow H-GAC to review and comment on these permit applications. If this recommendation is instituted by TNRCC, the H-GAC SWMTF and its Projects Review/Siting Subcommittee will work to develop siting guidelines for these facilities.

Mid-term (6-10 years)

Program and Policy

1. ***Establish local government implementation of plan recommendations as a criteria for projects review.***
   H-GAC should establish a policy to promote local government implementation of the following plan recommendations
   - internal waste reduction policies
   - internal recycling policies
   - internal special waste management practices
   - providing recycling opportunities for residents

   H-GAC should require documentation of local efforts to implement these programs as a criteria of its Projects Review function under the Texas Review and Comment System (TRACS). If TRACS coverage is expanded, local governments applying for any funding through the Texas Natural Resource Conservation Commission that is subject to TRACS review will be asked to furnish this documentation to H-GAC. H-GAC will maintain a database of communities that have implemented plan recommendations. This database will be published and updated periodically to ensure accuracy. H-GAC will note the presence or absence of these programs when reviewing solid waste fund requests and/or permit applications.

   H-GAC will widely distribute information about this policy before it goes into effect and provide examples of acceptable documentation.

2. ***Promote and support multi-jurisdictional structures for solid waste management.***
   H-GAC should encourage the development of multi-jurisdictional approaches to solid waste management throughout the region. This recommendation should be implemented by the following means:
   - projects review policies favoring multi-jurisdiction or regional facility development
   - providing information to subregions on management options
   - facilitation and technical assistance in developing multi-jurisdictional programs

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Long-term (11-20 years)

Program Policy

1. ***Work through subregional management structures to coordinate solid waste management programs at the regional level.***
   H-GAC should work with subregional system components to create a true regional "waste-shed" from which recyclable materials can be cost-efficiently transported to markets. The long-term development of Materials Recovery Facilities (MRF) along major rail corridors should be an integral part of this coordination effort. H-GAC will use its permit reviews to help promote this coordination, and will also provide facilitation and technical assistance in establishing public/private partnerships to strategically deploy the future development of residential and commercial waste collection and transfer systems and assure adequate long-term disposal capacity.

2. ***Develop a regional network of special waste collection programs to feed into regional facilities.***
   Owing to the liabilities and expense associated with special waste disposal, only a limited number of permanent disposal sites are likely to be established throughout the region. Depending on their size and resources, local governments should establish some type of collection program, in cooperation with retailers, industry, hospitals, businesses and other generators of special wastes, to efficiently bring these wastes to proper disposal facilities. H-GAC will consider local participation as part of its internal TRACS review of TNRCC-funded projects. Small local governments with limited resources should form cooperatives or work through another institutional structure to participate in the network.

   H-GAC will also encourage the development of long-term special waste management facilities, such as medical waste transfer stations and co-composting operations.

3. ***Depending on the achievement of waste reduction and recycling goals, study "flow control" as a waste management option.***
   If waste reduction goals are not being met, H-GAC should encourage solid waste management authorities or counties to study "flow control" measures which could direct the destination of solid waste and provide a mechanism for imposing cost-penalties entities exceeding regional waste generation goals.

Local Actions

Short Term (years 1-5)

Actions which H-GAC will encourage local governments to voluntarily adopt.

1. ***Adopt voluntary internal waste reduction policies.***
   H-GAC will encourage local governments to voluntarily adopt internal waste reduction policies and will also promote the voluntary initiation of volume-based garbage fees.

2. ***Institute voluntary internal recycling policies.***
   As with waste reduction, all levels of government should also assume a leading policy role in promoting recycling. Local policies should include:
   - establish price preferences for recycled materials for local government and its contractors
   - conduct a waste audit to determine which materials are recyclable
   - educate employees on recycling
   - provide recyclable collection containers for employees
   - regularly recycle office paper and cardboard
   - compost brush and landscape waste to use as mulch or for soil stabilization or purchase yard waste composted from a third party for this purpose

3. ***Promote the use of existing retail recycling programs.***
   Numerous retail establishments are currently active in recycling, particularly in the Houston area. Materials collected, primarily at grocery, variety and auto parts stores include: aluminum and steel cans, glass, newsprint, batteries, shopping bags (paper and plastic), Christmas trees and used oil. Local governments should work with retailers to provide this information to residents. The Clean Houston Recycling Hotline and related publications could be used as a model.

4. ***Implement a voluntary internal program for managing special wastes.***
   Local governments should implement policies for the proper management of the special wastes they produce internally, such as used oil, tires, and chemical products. Information should also be provided to employees and the residents of each community as to the nearest facility where household hazardous wastes (HHW) can be disposed.

5. ***Address solid waste facility siting concerns in comprehensive planning and zoning ordinances.***
   When a city is adopting or revising their land control controls, consideration should be given as to where solid waste facilities should be located. H-GAC will encourage cities to make such provisions in their plans and zoning ordinances.

6. ***Counties should consider the development of facility siting plans.***
   Under the County Solid Waste Control Act, counties have the authority to designate areas suitable for solid waste facilities. A county may designate land areas not in the territorial limits or extraterritorial jurisdiction of a municipality as suitable for use as solid waste facilities. H-GAC will encourage counties to exercise this option to avoid lengthy and expensive opposition to solid waste facilities.

7. ***Develop mechanisms to promote early public involvement in the siting process.***
   Counties and cities should establish a list of community organizations interested in solid waste issues and notify these groups when solid waste facility permit applications are filed. This will allow for earlier identification of potential problems with sites and offer opportunities for resolution. Currently, most citizens become aware of a permit application only after formal notice has been mailed, at which point the application is far along in its development, and both sides can become entrenched in a lengthy and expensive disputed hearing.

Mid-term (6-10 years)

Actions which H-GAC will evaluate in determining conformity with the plan as a part of project review.

1. ***Adopt internal waste reduction, recycling and special waste management policies.***
   The short-term voluntary internal programs should be adopted during this planning horizon. H-GAC will consider implementation of internal policies as part of its internal TRACS review of TNRCC-funded projects. H-GAC will widely distribute information about this policy before it goes into effect and provide examples of acceptable documentation.

2. ***Consider adoption of volume-based garbage fees.***
   All local governments in the H-GAC region should consider adopting a fee-for-service approach to solid waste collection and disposal by the end of the 10-year planning horizon, calculating these fees on a volume basis. This type of program will be most effective if instituted along with a recycling collection program and aggressive enforcement of illegal dumping. If this type of program is simply not feasible in a community, another type of strong incentive program should be implemented. H-GAC will provide assistance in designing and implementing these programs, but will also consider implementation (volume-based fees) as part of its internal TRACS review of TNRCC-funded projects if TRACS coverage is expanded. H-GAC will widely distribute information about this policy before it goes into effect and provide examples of acceptable documentation.

3. ***Establish recycling collection systems within all H-GAC local governments.***
   All local governments providing waste disposal services should offer some type of collection program for recyclables by the end of the 10-year planning horizon. Yard

waste collection should also be included in these programs. Options may vary depending on local conditions. One option for implementing collection programs would be to substitute one regular trash pick-up day with a pick-up of yard waste and/or recyclables. Implementation may be through public and private contract collection systems and/or through partnerships with existing retail programs. H-GAC will provide assistance in designing and implementing these programs, but will also consider implementation as part of its internal TRACS review of TNRCC-funded projects if TRACS coverage is expanded. H-GAC will widely distribute information about this policy before it goes into effect and provide examples of acceptable documentation.

4. ***Establish multi-jurisdictional management structures.***
   Local governments in all planning subregions should give strong consideration to the establishment of multi-jurisdictional solid waste management structures to achieve economies of scale and promote cost-efficient transportation and disposal. These structures may include existing solid waste management or river authorities, special districts, or interlocal agreements. H-GAC will provide technical assistance in the implementation of these efforts.

Long-term (11-20 years)

Programs which will result from the implementation of subregional strategies.

1. ***Work through subregional management structures to coordinate solid waste management programs at the regional level.***
   By the end of the 20-year planning horizon, all local waste management systems should be integrated into the larger regional system. In many cases, solid waste management authorities or other structures may be formed. Local solid waste management programs should integrate their efforts as much as possible with regional systems.

2. ***Provide opportunities for residents to properly dispose of special waste.***
   Local governments will be encouraged to establish or participate in special waste collection programs. The collection options may vary depending on the local resources, including HHW collection days, mobile pick-up or other means. When possible, local governments should be encouraged to work with private industries on these activities. H-GAC will consider establishment of some type of local special waste program as part of its internal criteria for its TRACS review of TNRCC-funded projects if TRACS coverage is expanded.

3. ***Meet all waste reduction and recycling goals annually.***
   During the 11-20 year planning horizon, each local government should begin to meet H-GAC's regional waste reduction and recycling goals. If regional goals are not being met, H-GAC and/or solid waste management authorities should study the institution of "flow control," where a solid waste management authority or county may direct the

destination of solid waste. Through a flow control system, cost penalties for exceeding waste generation rates could also be instituted.

E. Planning Subregion Recommendations

This section of the plan outlines solid waste management recommendations at a subregional level. The rationale for creating each subregion is described and a brief description solid waste management problems and opportunities is presented, followed by recommended actions.

For the most part, the recommendations presented in this section of the plan will provide the framework for the subregional plans which will follow. However, some of the recommendations, particularly those which pertain to immediate issues such as a landfill closing because of Subtitle D, will require immediate action. Recommended subregional plan elements and potential grant projects are noted in parentheses.

The recommendations for local governments contained in this regional plan should be construed as policy guidance on the matters to be addressed by local governments in their planning efforts. Failure to incorporate a specific recommendation shall not constitute grounds for the denial of a local solid waste management plan.

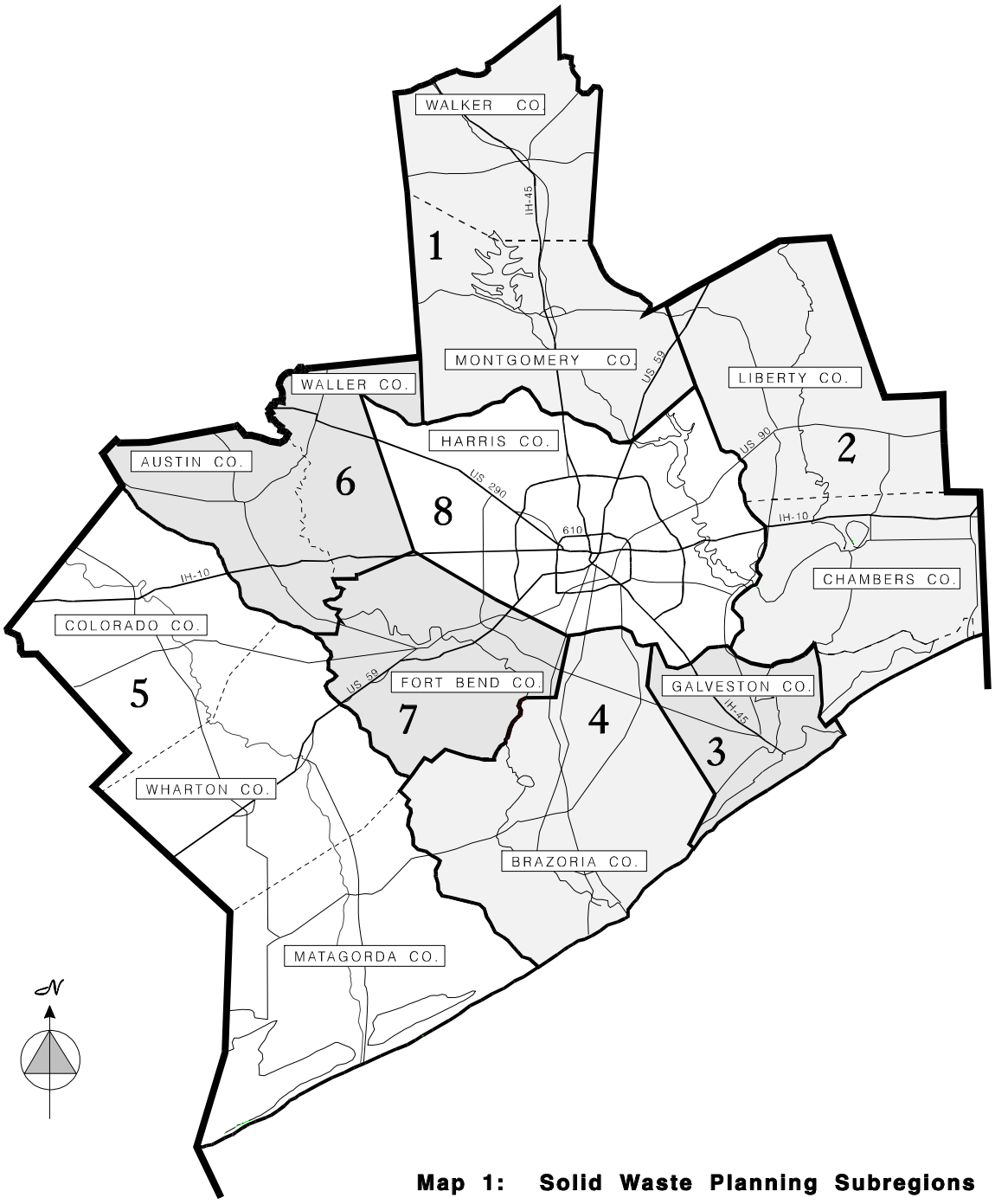
Background

Owing to the size and diversity of the H-GAC region, it would be difficult to effectively coordinate all implementation steps at a regional level. To achieve a more workable scale for future planning and implementation efforts, the H-GAC region has been divided into eight planning subregions, shown on Map 1 on the following page.

The eight subregions identified were determined by grouping areas with common solid waste management problems and, in some cases, to reflect interjurisdictional efforts already underway. One of the concerns in the establishment of subregions was their size. H-GAC's 1985 *Action Guide* had 25 planning areas of roughly equal population and land area. However, the SWMTF wanted to avoid splitting county boundaries and to provide more flexibility for local governments in establishing partnerships.

A number of scenarios -- primarily county-level groupings -- were reviewed by the H-GAC Solid Waste Task Force (SWMTF) and Physical Resources Committee before the final eight were adopted by the H-GAC Board. Unlike those in the *Action Guide*, these subregions vary considerably in size and land area. However, each has unifying features which are well-suited for follow-up planning and implementation.

After the subregions were established, an ad hoc working group was formed in each to work with staff in developing recommendations. In most cases, these groups consisted of solid waste management professionals from the public and private sector, elected officials, and other interested individuals and organizations.



Map 1: Solid Waste Planning Subregions

HOUSTON-GALVESTON AREA COUNCIL

Recommendations for all Subregions

1. Subregional Planning

1.1 Subregion recommendations should serve as the basis for subregional plans.
Subregional plans should follow-up on the recommendations presented in this plan. In some cases, H-GAC may play the lead role in subregional planning. However, some subregions have local governments, authorities, or consortiums thereof, which would be capable and interested in taking on this responsibility. In either case, before state funds for planning are dispersed, the scope of the subregional plan should be reviewed by H-GAC for consistency with the regional plan.

Generally, subregional plans should be oriented toward project development and implementation. However, certain policy issues such as facility siting criteria may also be addressed.

1.2 Once approved, each subregional plan will become part of H-GAC's overall plan.
H-GAC will review each completed subregional plan for consistency with the regional plan. Once approved by the TNRCC, each subregional plan will become a part of the regional plan.

2. Implementation

2.1 Certain subregion recommendations may require immediate action and should be eligible for state funding prior to development of a subregional plan.
In communities facing imminent closures of public landfills due to Subtitle D, "fast track" funding should be made available to the local government to determine a proper course of action. Remaining landfill capacity by subregion is shown on Map 2. Such grants are discussed in the Regional Recommendations section of this plan, under *State-level Actions, Short-Term: Grant Funding from Solid Waste Management Fees.* This approach is recommended to provide local governments immediate assistance and so that subregional planning will not be rushed to accommodate regulatory timetables.

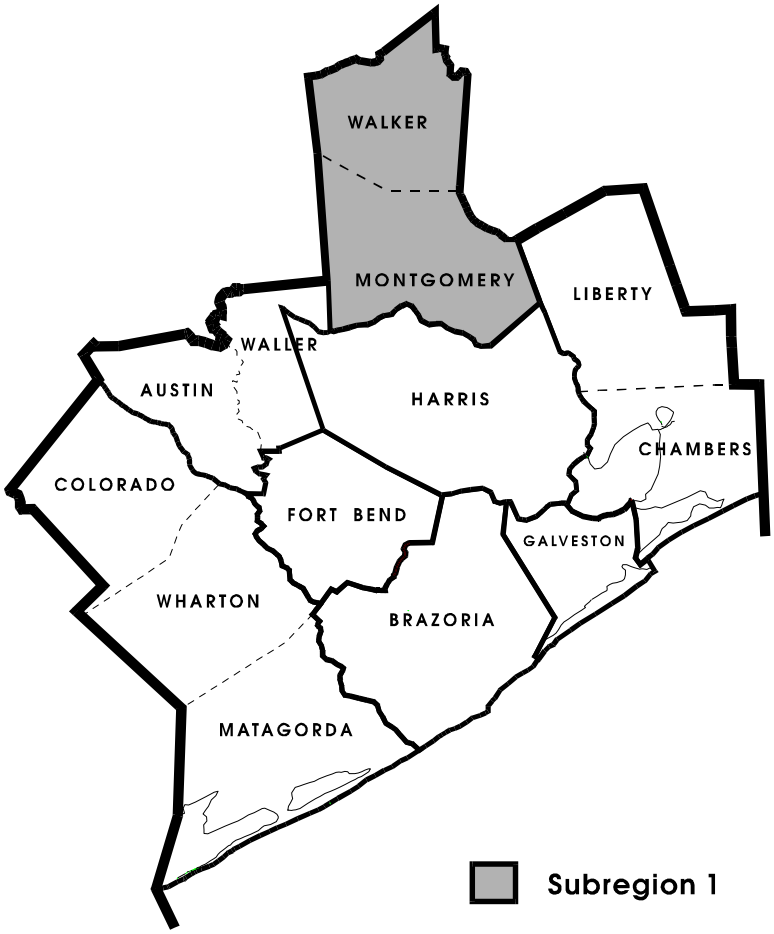
2.2 A standing committee should be formed in each subregion to coordinate planning and implementation efforts.
A standing committee should be formed in each planning subregion to oversee plan development and subsequent implementation programs. These committees should follow the model of the SWMC, but for the geographic boundaries of the subregion. The structure of all such subregional planning committees and subcommittees should be approved by the H-GAC Board of Directors.

Specific Subregion Recommendations

Background information, solid waste management problems, opportunities and recommendations for action for the eight planning subregions begin on the following page.

Population information is from the 1990 census and H-GAC population projections for the 13 county region. Waste importation and exportation numbers are from four different sources. The first is the H-GAC Survey of Local Governments, which provided staff with descriptions of where waste was being disposed of by a majority of the incorporated communities throughout the region. The second source of information was from landfill operators throughout the region. The third source of information was from adjacent council of governments that reported waste exportation to the H-GAC region. The final source was from comments received by staff at public meetings, which were verified before inclusion in the planning document. A more complete description of planning subregion organization and methodology for population projection is included in the Appendix 5.

Subregion 1



Subregion Overview

Subregion 1 includes Montgomery and Walker Counties. This subregion is growing faster than the H-GAC region as a whole, with much of its population and employment concentrated along the IH-45 and a Missouri-Pacific Railroad line. This corridor has the potential of serving as an important transportation link to recycling markets in Houston and the emerging plastics market in Dallas-Fort Worth. The subregion has mid-term disposal capacity, however, waste importation from surrounding areas may prematurely diminish this capacity. Also, a large portion of the subregion's population lives in unincorporated areas, where collection can be problematic.

Subregion 1 has two major public institutions, Sam Houston State University and the Texas Department of Corrections, which could be a tremendous resource for solid waste management. The Woodlands also has corporate and residential organizational capability to institute waste management policies and programs.

Population

Montgomery County	1990 Pop	Montgomery County	1990 Pop
The Woodlands*	29,205	Montgomery	356
Conroe	27,610	Stagecoach	340
Pinehurst	3,284	Woodloch	291
Willis	2,764	Kingwood (portion)*	47
Oakridge North	2,454	Unincorporated Area	104,399
Shenandoah	1,718		
Panorama Village	1,556	*Total*	*182,201*
Porter Heights	1,448		
Woodbranch	1,312	**Walker County**	
Patton Village	1,155	Huntsville	27,925
Roman Forest	1,033	New Waverly	936
Magnolia	940	Riverside	451
Cut and Shoot	903	Unincorporated Area	21,605
Splendora	745		
Chateau Woods	641	*Total*	*50,917*

* Census Designated Place

Subregion Information

Total population:	233,118
Incorporated:	54% of population
Unincorporated:	46% of population
Land Area:	1,833 square miles
Population density:	127 persons/sq. mile

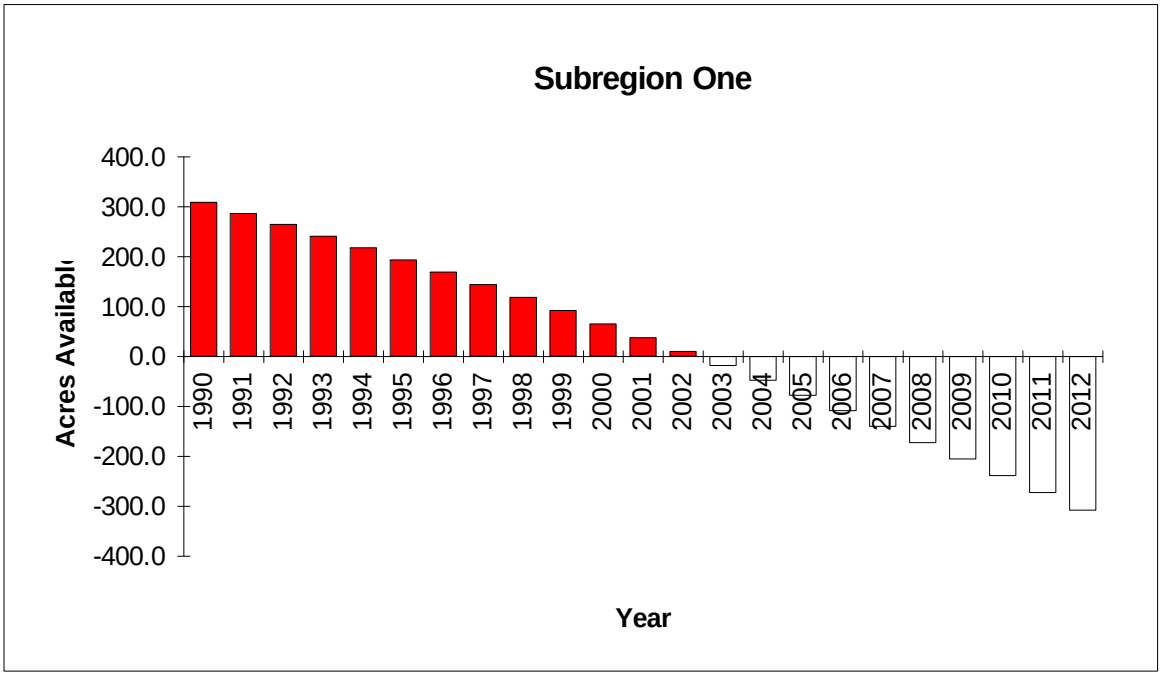
Waste Importation

Imports (from)	*tons/year*
Grimes County	21,234
Madison County	12,337
Houston (commercial)	226,300
Cleveland	8,061
Total	*267,931*

Exports (from)	*tons/year*
none	*0*

Net importation *267,931 tons/year*

Subregion One					
Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	233,118	243,163	539,281	21.41	309.0
1991	240,450	247,637	552,648	21.94	287.1
1992	247,781	252,111	566,016	22.47	264.6
1993	255,113	256,586	579,383	23.00	241.6
1994	262,444	261,060	592,751	23.53	218.1
1995	269,776	265,534	606,118	24.06	194.0
1996	277,107	270,008	619,485	24.59	169.4
1997	284,439	274,482	632,853	25.12	144.3
1998	291,771	278,957	646,220	25.65	118.6
1999	299,102	283,431	659,588	26.18	92.4
2000	306,434	287,905	672,955	26.72	65.7
2001	316,116	293,404	690,144	27.40	38.3
2002	325,797	298,903	707,333	28.08	10.2
2003	335,479	304,402	724,522	28.76	-18.5
2004	345,161	309,901	741,711	29.44	-48.0
2005	354,843	315,400	758,899	30.13	-78.1
2006	364,525	320,899	776,088	30.81	-108.9
2007	374,207	326,398	793,277	31.49	-140.4
2008	383,889	331,897	810,466	32.17	-172.6
2009	393,571	337,396	827,655	32.86	-205.4
2010	403,252	342,895	844,844	33.54	-239.0
2011	412,934	348,394	862,033	34.22	-273.2
2012	422,616	353,893	879,222	34.90	-308.1



Subregional Solid Waste Management System

Waste Reduction/Reuse

Problems

- o No significant existing waste reduction programs in place.

Opportunities

- o Major institutional and corporate players whose policies can have significant impact on the planning area waste stream.

Recommendations

- o Implement waste reduction programs at Texas Department of Corrections and Sam Houston State University. Establish waste reduction education programs for the employees of each of these institutions. *(potential subregional plan element)*
- o Implement the "Don't Bag It" program to coordinate efforts by Agricultural Extension Service and local governments. *(potential implementation grant)*
- o Work with major corporations and homeowners groups to implement waste reduction education programs, focusing on yard waste composting. Share program with other major residential developments. *(potential subregional plan element)*

Recycling

Problems

- o Transportation and access to markets is a problem, particularly in smaller communities located off main highway corridors.

Opportunities

- o Sam Houston National Forest, Sam Houston State University, and Texas Department of Corrections facilities all could be developed into large end markets for compost. Major development projects such as The Woodlands and Lake Conroe could also be developed as compost markets.
- o The Woodlands Community Association (WCA) operates a successful local recycling collection program which could serve as a model.
- o Interest exists in developing a curbside collection program in Huntsville. The City of Huntsville has already completed a recycling study and produced a report, Huntsville Recycles.

Recommendations

- o Support the City of Huntsville's and WCA's participation in a composting program using various feedstocks. *(potential implementation grant)*
- o Conduct a compost market development study. Identify end users (e.g. TDC, SHSH, National Forest, others). *(potential subregional plan element)*
- o Jointly develop a Materials Recovery Facility (MRF) with TDC-Huntsville, possibly using TDC labor. Develop composting operation in conjunction with this MRF. *(potential implementation grant)*

- o Support Huntsville and WCA recycling efforts. *(potential implementation grant)*
- o Arrange for joint local transportation cooperatives among smaller communities to Houston markets, eventually linking up with rail transfer points. *(potential subregional plan element)*
- o Develop rail MRF/Transfer stations along rail corridor extending from Huntsville to Houston. Possible locations: Huntsville, Conroe and The Woodlands. *(potential subregional plan element)*
- o Public/private partnerships-establish collection/transportation linkages between local governments and major retailers. *(potential subregional plan element)*

Collection and Disposal

Problems

- o Limited collection capacity in rural areas.
- o Walker County will be without a landfill if the City of Huntsville facility closes due to Subtitle D.
- o The TDC landfill may also close because of Subtitle D.
- o Excess capacity at the Western Waste facility may be consumed by waste importation from Harris and other surrounding counties.
- o Montgomery County's Clean Air Act non-attainment status for ozone may eliminate incineration as a viable future disposal option.

Opportunities

- o There is presently more than adequate disposal capacity within the subregion, at the Western Waste and Security Landfills.
- o Western Waste facility has overcome concerns over its proposed expansion, relating to its proximity to residences and airport.
- o There may be potential for using TDC incinerator for municipal solid waste.

Recommendations

- o Study long-term landfill capacity scenarios, taking into account waste importation and multi-county use of private facilities. *(potential subregional plan element)*
- o Investigate the development of transfer stations if Huntsville facility closes. Rail transfer stations should be considered. *(potential implementation grant)*
- o For rural, less populated areas, establish registration-only transfer stations. *(potential implementation grant)*
- o Investigate the range of host community benefits available as the result of hosting a regional landfill. *(potential subregional plan element)*
- o Investigate the development of a multi-jurisdiction incinerator. Involved parties may include Huntsville/Walker County/TDC. *(potential implementation grant)*
- o Study the feasibility of Subregion 1 and other adjacent government agencies working with the TMPA (lignite power plant). *(potential subregional plan element)*

Special Waste

Problems

o There are no household hazardous waste programs or collection sites in Subregion 1.

Opportunities

o The City of Huntsville already operates a used oil collection program at its landfill.
o Several private service stations accept used oil from "do-it-yourselfers."

Recommendations

o Encourage development of public collection sites for used oil in accordance with TNRCC program. Coordinate these efforts with major institutional players. *(potential subregional plan element)*
o Promote cities' and counties' attempt to establish at least one permanent drop-off site, coordinate with education programs for household hazardous waste. *(potential subregional plan element)*

Institutional Options

Problems

o No existing mechanism, such as an authority or joint powers agreement currently in place.

Opportunities

o Already is a successful public/private partnership in City of Conroe/Western Waste landfill arrangement.
o Adjacent counties from Brazos Valley Development Council willing to work with subregion in planning efforts.

Recommendations

o Investigate range of host community benefits available from private solid waste firms. *(potential subregional plan element)*
o Investigate subregion authority that may include Grimes and Madison Counties. *(potential subregional plan element)*

Public Education

Problems

o No uniform public education system currently in place.

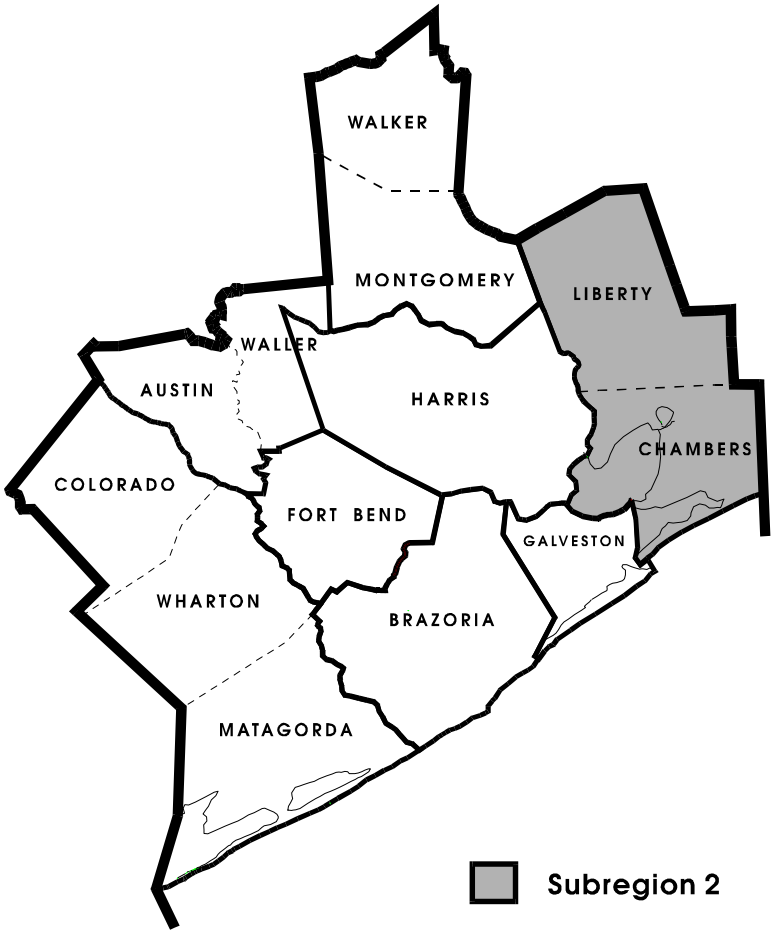
Opportunities

o University, TDC and corporate entities can have an impact in distributing information and establishing educational programs.
o "Woodland Recycles" has volunteers trained by the Museum of Natural Science Environmental Education Office to provide in-service programs for schools.

Recommendations

- o Establish a local branch of the Corporate Recycling Alliance of Texas. *(potential subregional plan element)*
- o Distribute education modules for school districts. *(potential subregional plan element)*
- o Expand in-service program as offered by the Museum of Natural Science Environmental Education Office and like programs to include other schools in Subregion 1. *(potential subregional plan element)*

Subregion 2



Subregion Overview

Subregion 2 includes Chambers and Liberty Counties, plus the Bolivar Peninsula of Galveston County, which has better transportation linkages to the subregion than to Galveston County. This subregion combines two active local government solid waste management programs (City of Liberty and Chambers County) and potentially has long-term disposal capacity at the private Hazelwood landfill and the Chambers County landfill, which are regional facilities. Chambers County is also studying the possibility of expanding its service area to include portions of Jefferson and Harris Counties. Waste importation may diminish the long-term capacity.

Subregion 2 has good access to Houston recycling markets, particularly the Champion Paper de-inking plant. A large portion of the population lives in unincorporated areas, and collection may be a problem, particularly in rural areas. Additionally, there are no large employers or institutions whose programs would have a major impact on the waste stream. A large regional tire shredding facility is located in Cleveland, at the northwest corner of the subregion.

Population

Chambers County	1990 Pop
Baytown (portion)	2,724
Winnie	2,238
Anahuac	1,993
Stowell	1,419
Mont Belvieu (portion)	1,323
Old River Winfree	1,233
Beach City	852
Cove	402
Unincorporated Area	7,904
Total	*20,088*

Galveston County	
Bolivar Peninsula	*2,807*

Liberty County	1990 Pop
Liberty	7,733
Cleveland	5,124
Dayton	5,151
Ames	989
Daisetta	969
Hardin	563
Plum Grove	480
Kenefick	435
Devers	318
Dayton Lakes	191
North Cleveland	176
Unincorporated Area	28,597
Total	*52,726*

Subregion Information

Total population:	75,621
Incorporated:	52% of population
Unincorporated:	48% of population
Land Area:	1,847 square miles
Population density:	41 persons/sq. mile

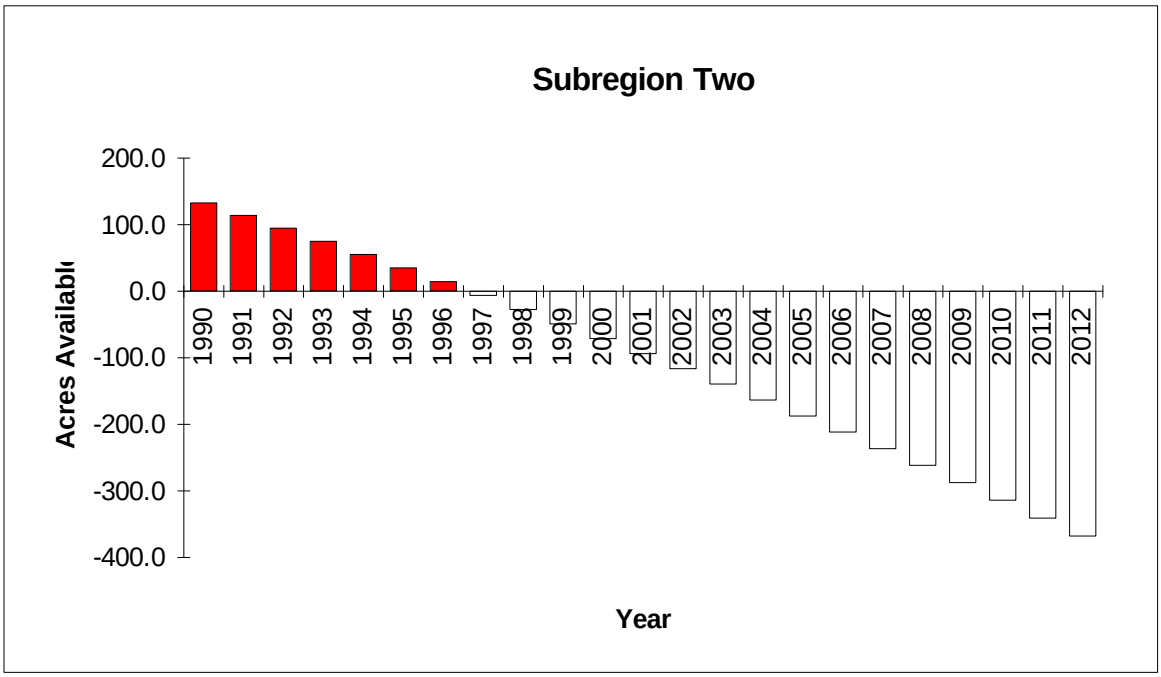
Waste Importation

Imports (from)	*tons/year*
Baytown	69,164
La Porte	31,580
Deer Park	31,288
Morgans Point	386
Pasadena	90,039
Total	*222,457*

Exports (from)	*tons/year*
Cleveland	8,061
Total	*8,061*

Net importation *214,397 tons/year*

Subregion Two					
Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	75,621	189,480	300,167	18.52	133.0
1991	77,206	192,910	305,845	18.87	114.1
1992	78,791	196,339	311,523	19.22	94.9
1993	80,376	199,769	317,201	19.57	75.4
1994	81,961	203,198	322,879	19.92	55.4
1995	83,546	206,628	328,557	20.27	35.2
1996	85,131	210,058	334,235	20.62	14.6
1997	86,716	213,487	339,913	20.97	-6.4
1998	88,301	216,917	345,591	21.32	-27.7
1999	89,886	220,346	351,269	21.67	-49.4
2000	91,472	223,776	356,947	22.02	-71.4
2001	93,057	228,005	363,530	22.42	-93.8
2002	94,642	232,235	370,114	22.83	-116.7
2003	96,227	236,464	376,697	23.24	-139.9
2004	97,812	240,693	383,281	23.64	-163.6
2005	99,397	244,923	389,864	24.05	-187.6
2006	100,982	249,152	396,448	24.45	-212.1
2007	102,567	253,381	403,031	24.86	-236.9
2008	104,152	257,611	409,615	25.27	-262.2
2009	105,737	261,840	416,198	25.67	-287.9
2010	111,482	266,070	427,492	26.37	-314.2
2011	113,483	270,299	434,547	26.80	-341.0
2012	115,484	274,528	441,601	27.24	-368.3



Subregional Solid Waste Management System

Waste Reduction/Reuse

Problems

- o No significant existing waste reduction programs in place, particularly a problem in the area of yard waste.

Opportunities

- o Local governments could have significant impact on overall management practices.

Recommendations

- o Adopt governmental policies to establish waste reduction goals. *(potential subregional plan element)*
- o Implement the "Don't Bag It" program to coordinate efforts by Agricultural Extension Service and local governments. *(potential implementation grant)*
- o Work with school districts to distribute information. *(potential subregional plan element)*

Recycling

Problems

- o Lack of large or high-density population centers makes curbside recycling less practical.
- o Transportation and access to markets is a problem, particularly in smaller communities located off main highway corridors.

Opportunities

- o Potential to exploit rail corridor leading to Houston recycling markets.
- o City of Liberty has an established recycling program. Several small programs exist in Chambers County.
- o Options exist for private collections of recyclable materials as well.

Recommendations

- o Establish a public yard waste composting collection facility on county-owned property. *(potential implementation grant)*
- o Establish a yard waste composting facility in private landfill inactive space as a host community benefit. *(potential subregional plan element)*
- o Conduct a study to establish drop-off centers throughout the subregion. *(potential subregional plan element)*
- o Study the use of transfer stations for collection of recyclables in central locations of the subregion. *(potential implementation grant)*
- o Work with "special" populations to assist with recycling. *(potential subregional plan element)*
- o Educate the public on landfill cost avoidance. *(potential subregional plan element)*

Collection and Disposal

Problems

- o City of Dayton will close its landfill as a result of Subtitle D. City of Liberty is currently studying the issue.
- o Excess disposal capacity may be consumed by waste importation from Harris County and other surrounding counties.
- o Some long-term capacity may exist outside the subregion, but these facilities will have a higher transport cost.
- o Clean Air Act non-attainment status for ozone in Chambers and Liberty Counties may eliminate incineration as a disposal option.
- o Collection is still difficult in some rural areas. Currently, 75-80% is handled by private transporters, the rest at drop-off locations.
- o Some communities have limited access to major transportation arteries.

Opportunities

- o Significant capacity exists at the Hazelwood landfill, which has a permit amendment application in at TNRCC for additional future capacity.
- o There could be potential long-term capacity at the Chambers County landfill. The County is also planning to hire an operator for the landfill.
- o There is also potential long-term capacity outside the subregion at BFI-McCarty Rd., Jefferson County, Security Landfill-Montgomery County and Western Waste in Conroe.

Recommendations

- o Investigate County option of establishing transfer-stations throughout the region to dispose of waste within the subregion or to export waste to adjacent subregions (include the cost of transfer in the studies). *(potential implementation grant)*
- o Subregion 2 will need to study the use of registration-only permits and other means of transferring waste to regional facilities. *(potential implementation grant)*
- o Study integrated system of MSW that includes adequate study of roadway network and costs of transport. *(potential subregional plan element)*
- o Study convenience/transfer station use. All MSW programs. *(potential subregional plan element)*
- o Support grants to help develop rural collection programs. *(potential implementation grant)*
- o Study conversion of Chamber County landfill into regional facility. *(potential implementation grant)*
- o Study of when waste-to-energy may be cost-effective and efficient. *(potential subregional plan element)*

Siting

Problems

- o Extensive flood plain will make siting of new facilities difficult.

- Citizen opposition to several hazardous waste disposal facilities in the subregional has raised public opposition to all facilities.
- The subregion may be unwilling to accept Houston waste, even though this importation may be necessary to economically operate a Subtitle D-compliant facility.

Opportunities

- The lower population density affords a wider range of acceptable sites for a regional facility.
- The Trinity River Authority may be interested in getting involved in solid waste issues because of the S.B. 818 River Basin program.

Recommendations

- Work in conjunction with River Basin assessment program to identify suitable landfill sites within the subregion. *(potential subregional plan element)*
- Locate transfer stations/convenience centers in areas without landfill capacity or limited access to landfills. *(potential implementation grant)*

Special Waste

Problems

- Forest products, industrial and oil-related wastes present special problems.
- Clean Air Act requirements may impede medical waste disposal.
- No existing household hazardous waste (HHW) programs.
- Numerous illegal tire dumps.
- Seafood waste presents an odor problem.

Opportunities

- Trinity River Authority may be able to sponsor a HHW program, similar to a pilot project currently being conducted by the Lower Colorado River Authority.
- Safe Tire Disposal established a major tire shredding facility in Cleveland in April 1992.

Recommendations

- Encourage Trinity River Authority to adopt HHW amnesty program for Subregion 2. *(potential subregional plan element)*
- Work with Safe Tire Disposal and retailers to establish collection trailers for used tires. *(potential subregional plan element)*
- Work to identify illegal tire dump sites, inform them of state program and potential buyers for the tires. *(potential subregional plan element)*
- Study opportunities for composting seafood, oyster shells, along with agricultural waste. *(potential subregional plan element)*

Institutional Options

Problems

- o No existing mechanism, such as an authority or joint powers agreement currently in place.

Opportunities

- o Due to location, opportunities exist to work with surrounding subregions.

Recommendations

- o Investigate host community benefits from solid waste firms. *(potential subregional plan element)*
- o Study the financial and technical feasibility of establishing a region-wide system. *(potential implementation grant)*

Public Education

Problems

- o No uniform public education system currently in place.

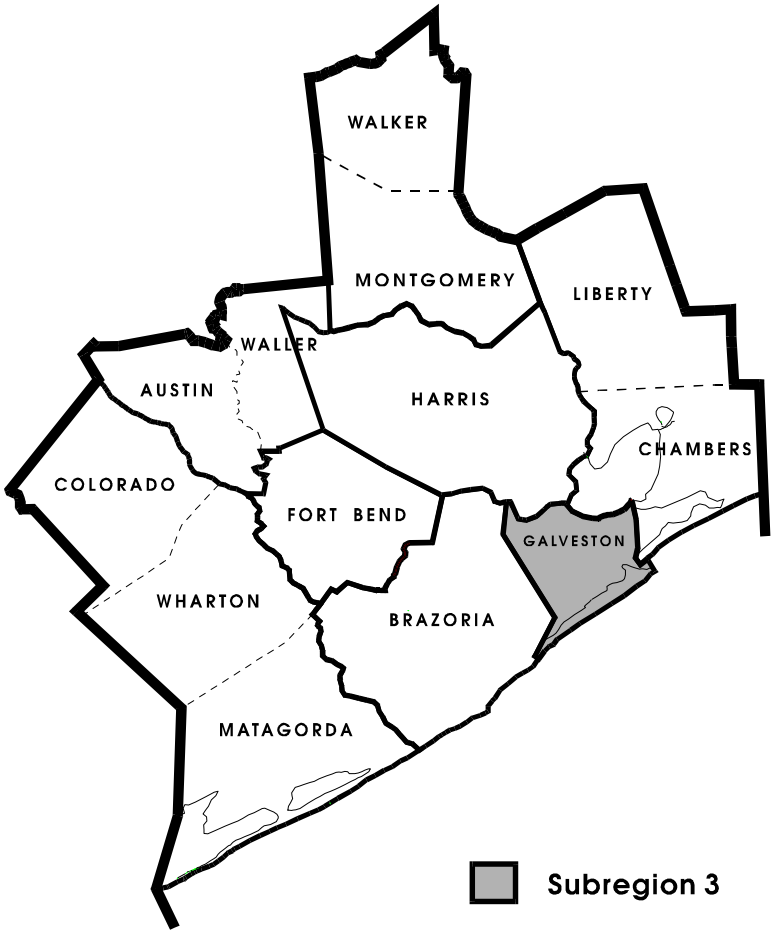
Opportunities

- o Keep America Beautiful/Keep Texas Beautiful organization offers City affiliations.

Recommendations

- o Have counties, cities, and school districts adopt internal education programs. *(potential subregional plan element)*

Subregion 3



Subregion Overview

Subregion 3 includes Galveston County, excluding the Bolivar Peninsula, which has better transportation linkages with Subregion 2. This subregion has existing long-term disposal capacity, though siting future facilities may be problematic. The Gulf Coast Authority (GCA) is active in municipal and industrial waste management in the county and would be a logical agent for implementation programs.

The subregion has excellent highway and rail access to Houston recycling markets (and to emerging plastics markets in Dallas-Fort Worth). Major corporations and institutions (Amoco, Union Carbide and University of Texas Medical Branch) could have an impact by implementing waste reduction and recycling policies. Industries may also be willing to "host" a household hazardous waste (HHW) collection program. Additionally, four colleges in the subregion could assist with education programs.

Population

Galveston County*	1990 Pop	Galveston County*	1990 Pop
Galveston	59,070	San Leon	3,328
Texas City	40,822	Bayou Vista	1,320
League City (portion)	30,026	Clear Lake Shores	1,096
Friendswood (portion)	14,979	Kemah	1,094
La Marque	14,120	Jamaica Beach	624
Dickinson	9,497	Tiki Island	537
Santa Fe	8,429	Unincorporated Area	18,233
Hitchcock	5,868		
Bacliff	5,549	*Total*	*214,592*

*Minus Bolivar Peninsula

Subregion Information

Total population:	214,592
Incorporated:	92% of population
Unincorporated:	8% of population
Land Area:	342 square miles
Population density:	627 persons/sq. mile

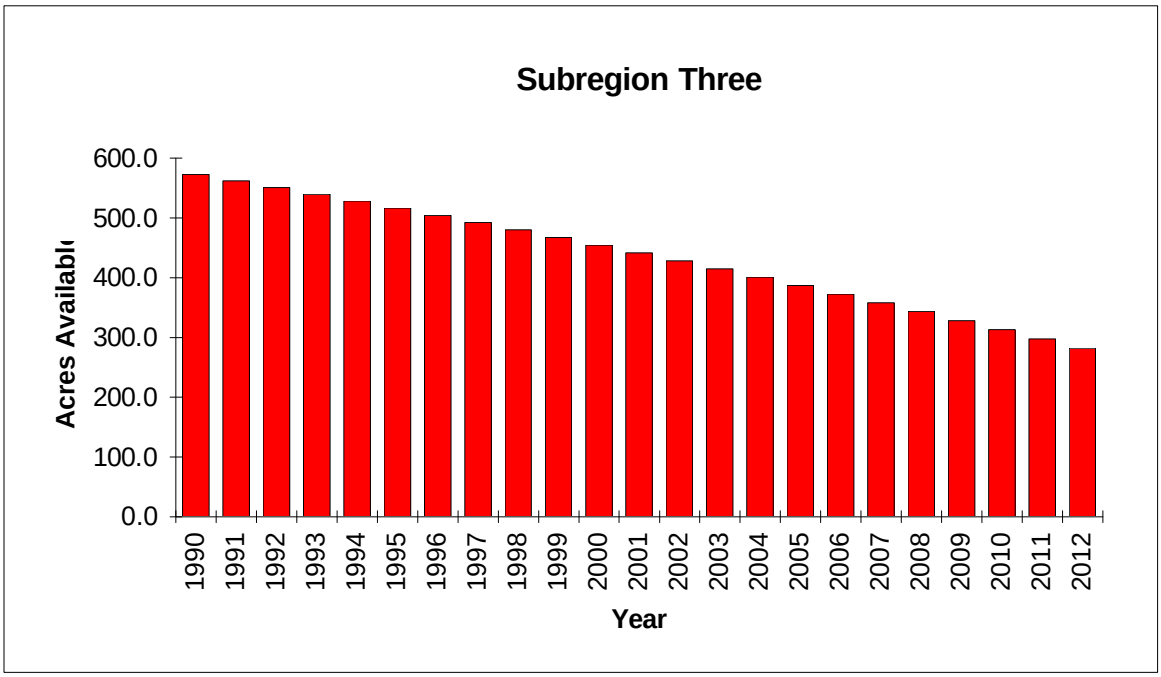
Waste Importation

Imports (from)	*tons/year*
Brookside Village	1,663
Danbury	1,637
Harris County (commercial)	22,630
Manvel	4,224
Pearland	21,156
Seabrook	7,564
Webster	5,293
Total	*64,167*

Exports (from)	*tons/year*
None	*0*

Net importation *64,167 tons/year*

Subregion Three					
Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	214,592	56,710	307,188	10.69	573.0
1991	218,805	57,787	313,178	10.89	562.1
1992	223,017	58,865	319,168	11.10	551.0
1993	227,230	59,942	325,158	11.31	539.7
1994	231,443	61,020	331,148	11.52	528.2
1995	235,655	62,097	337,138	11.73	516.4
1996	239,868	63,175	343,128	11.94	504.5
1997	244,081	64,252	349,118	12.14	492.4
1998	248,293	65,330	355,108	12.35	480.0
1999	252,506	66,407	361,098	12.56	467.5
2000	256,719	67,485	367,088	12.77	454.7
2001	261,757	68,808	374,290	13.02	441.7
2002	266,795	70,130	381,492	13.27	428.4
2003	271,832	71,453	388,694	13.52	414.9
2004	276,870	72,776	395,895	13.77	401.1
2005	281,908	74,098	403,097	14.02	387.1
2006	286,946	75,421	410,299	14.27	372.8
2007	291,984	76,744	417,501	14.52	358.3
2008	297,022	78,067	424,703	14.77	343.5
2009	302,060	79,389	431,905	15.02	328.5
2010	307,098	80,712	439,107	15.27	313.2
2011	312,136	82,035	446,309	15.53	297.7
2012	317,173	83,357	453,511	15.78	281.9



Subregional Solid Waste Management System

Waste Reduction/Reuse

Problems

- o No significant existing waste reduction programs in place.
- o Residential yard waste management is an issue.

Opportunities

- o Major institutions and corporate players (UTMB, NASA, Petrochemical Companies) can play a major role in education and policies.
- o Texas City is studying the implementation of a "Don't Bag It' program.

Recommendations

- o Distribute waste reduction information through school districts. *(potential subregional plan element)*
- o Implement the "Don't Bag It" program to coordinate efforts by Agricultural Extension Service and local governments. *(potential implementation grant)*
- o Work with county, cities, UTMB, NASA to establish waste reduction policies and education programs. Form corporate waste reduction group. *(potential subregional plan element)*

Recycling

Problems

- o Transportation and access to markets are problems from some areas, particularly for Galveston Island.

Opportunities

- o Population concentrated along major highway and rail corridors to Houston (and Dallas) recycling markets.
- o Texas City has a 1,000-home pilot recycling project being conducted by BFI and is considering the possibility of installing a manned recycling drop-off center; La Marque is also considering a pilot program.
- o The City of Galveston has a pilot curbside collection program.
- o League City has a curbside collection program.
- o Dickinson and Galveston currently operating drop-off centers.
- o E&D is already providing curbside collection in north Galveston County.
- o BFI-Hitchcock could participate in a collection/recycling program as a host community benefit.
- o Texas City has a brush collection program and is studying the use of a wood chipping facility at the city landfill; and Galveston is interested in establishing a yard waste composting program.
- o Potential for developing a composting facility at Gulf Coast Authority transfer station.
- o Existing beach nourishment program using Christmas trees has been successful, could be expanded to include brush.

Recommendations

- o Develop a long-term transportation plan for recyclables, utilizing IH-45/SPRR corridor. Potential transfer stations located on Galveston Island, mid-county and north county. *(potential subregional plan element)*
- o Work toward expanding curbside collection on island and south county through host community benefits. *(potential subregional plan element)*
- o Utilize drop-off centers in less populated parts of the county. *(potential subregional plan element)*
- o Establish commercial and multi-family recycling cooperatives on Galveston Island. *(potential subregional plan element)*
- o Conduct compost market development study, identify end users in the subregion such as nurseries and beach restoration projects. *(potential subregional plan element)*

Collection and Disposal

Problems

- o Current landfill capacity adequate, but siting future facilities will be difficult, owing to flood plain, subsidence and land use patterns.
- o Capacity could be diminished if Texas City facility closes due to Subtitle D.
- o The combination of waste importation and population growth, particularly in the northern part of the county, could diminish capacity faster than anticipated.
- o Incineration may not be a viable option, due to Clean Air Act non-attainment status for ozone.

Opportunities

- o Short-term waste disposal capacity is adequate, long-term contracts are in place.
- o Most of the county's population is within cities which have well-established municipal or contract collection programs.

Recommendations

- o Begin long-term planning for future landfill capacity for the county. *(potential subregional plan element)*
- o Study feasibility to convert Texas City Landfill to regional facility. *(potential implementation grant)*
- o Begin long-term planning for establishing transfer station network, which could feed to landfills inside or outside the county. *(potential subregional plan element)*

Special Waste

Problems

- o Several major special waste generators in the county, such as University of Texas-Medical Branch (UTMB) and the Texas City petrochemical complex.
- o One impact of Clean Air Act may be creation of additional industrial sludges from air pollution control scrubbers.

o Fifteen illegal tire dumps have been identified in the county, though these are not a serious health problem.

Opportunities

o GCA already takes a leading role in addressing industrial waste and sludge issues.
o UTMB may have excess medical waste disposal capacity.
o County already has good medical waste inspection program in place at landfills.
o City of Galveston already has a used motor oil recycling program.
o Industries may be willing to serve as "hosts" for HHW drop-off program (Union Carbide in Texas City has done so in the past).
o Two private firms planning construction of tire processing facilities in Galveston County.

Recommendations

o Investigate opportunities under TNRCC scrap tire program. *(potential subregional plan element)*
o Study the possibility of developing a tire monofill/recycling facility. *(potential subregional plan element)*
o Investigate the feasibility of GCA taking a leading role in establishing a co-composting (yard waste/sludge) facility. *(potential implementation grant)*
o Attempt to reestablish HHW collection program and identify a willing "host" industry. *(potential subregional plan element)*
o Identify medical waste disposal options at UTMB. *(potential subregional plan element)*

Institutional Options

Problems

o No existing mechanism, such as an authority or joint powers agreement now in place.
o Geographic barriers and distinctions between north and central county and Galveston Island may inhibit joint project development.

Opportunities

o GCA represents an existing vehicle for implementing multi-jurisdictional projects.
o There is an existing county-wide economic development effort aimed at linking the different segments of the county together. Perhaps a similar structure could be established to plan and implement waste management programs.
o Groupings of cities, particularly League City-Friendswood-Dickinson and Texas City-Hitchcock-Galveston-La Marque are well-positioned for joint efforts.

Recommendations

o Establish joint agreements between GCA, county and cities to study and possibly initiate the following projects: development of rail corridor transfer stations for recyclables; development of long-term disposal capacity; and, developing a yard waste/sludge co-composting facility. *(potential implementation grant)*

Public Education

Problems

o No uniform public education system currently in place.

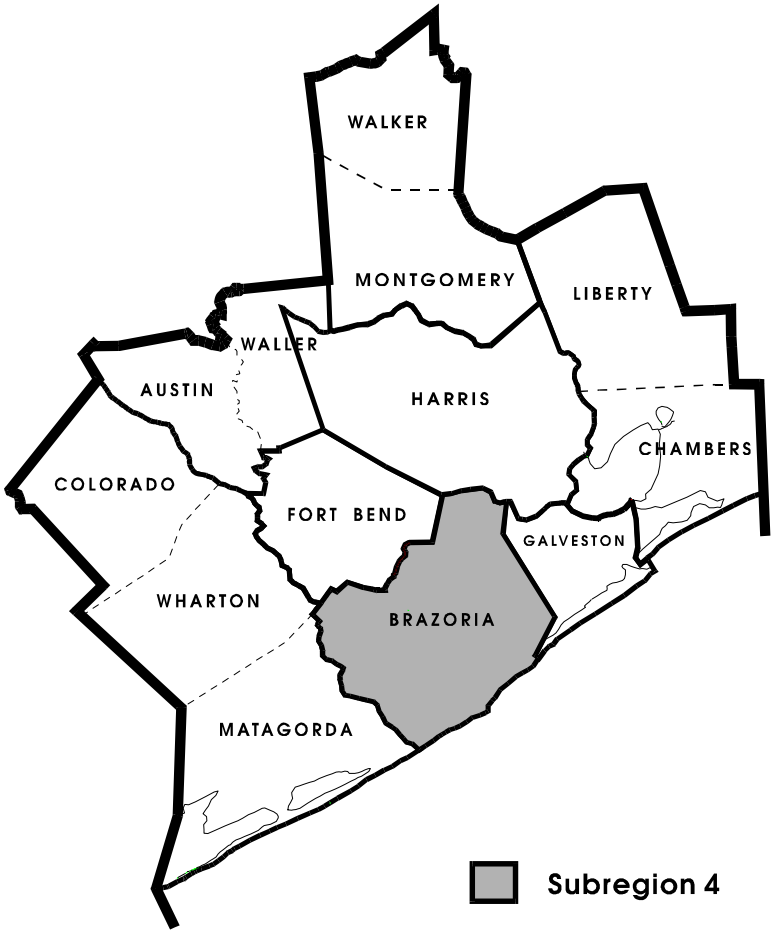
Opportunities

o Dickinson, a KTB affiliate, existing education programs available.
o There are four colleges in the county which could assist with education programs.
o Major corporate and institutional players could also participate.

Recommendations

o Encourage other cities to become KTB affiliates; use programs throughout the county. *(potential subregional plan element)*
o Distribute education modules for school districts. *(potential subregional plan element)*
o Work with major corporate/institutional entities (Union Carbide, Amoco, UTMB, colleges, etc.) to establish education programs for their employees/students. *(potential subregional plan element)*
o Study the extent of illegal disposal in the subregion. *(potential subregional plan element)*

Subregion 4



Subregion Overview

Brazoria County was established as Subregion 4 to take advantage of the county-wide solid waste planning efforts which are already underway. For the past two years, a county-wide task force has been studying options including the establishment of a solid waste management authority, public education and an integrated approach to solid waste management. The county has substantial disposal capacity at this time, but some facilities may close due to Subtitle D.

Brazoria County has considerable expertise in waste reduction and recycling. The City of Pearland, a Keep Texas Beautiful (KTB) affiliate, has received an EPA grant to develop a waste reduction program, which may be transferable to other communities. BASF in Freeport has won a statewide KTB award for its recycling program, which could be emulated by other major employers in the county. Brazoria County also has good access to Houston recycling markets and some of the petrochemical manufacturers in the southern part of the county may be potential end markets as well.

Population

Brazoria County	1990 Pop	Brazoria County	1990 Pop
Lake Jackson	22,776	Danbury Village	1,447
Alvin	19,220	Holiday Lakes	1,039
Pearland (portion)	17,234	Oyster Creek	912
Angleton	17,140	Hillcrest	695
Freeport	11,389	Iowa Colony	675
Clute	8,910	Bailey's Prairie	634
West Columbia	4,372	Surfside Beach	611
Manvel	3,733	Liverpool	396
Sweeny Town	3,297	Bonney	339
Richwood	2,732	Quintana	51
Brazoria	2,717	Unincorporated Area	65,318
Wild Peach Village	2,440		
Jones Creek	2,160	*Total*	*191,707*
Brookside Village	1,470		

Subregion Information

Total population:	191,707
Incorporated:	66% of population
Unincorporated:	34% of population
Land Area:	1,407 square miles
Population density:	136 persons/sq. mile

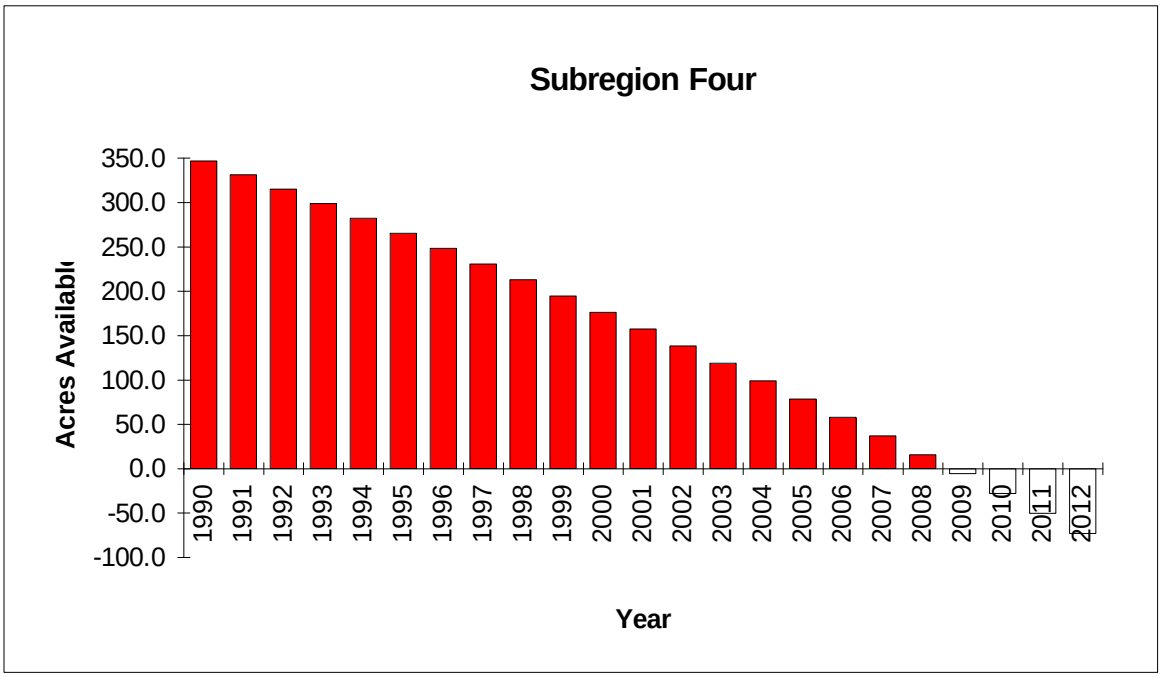
Waste Exportation

Imports (from)	*tons/year*
none	*0*

Exports (from)	*tons/year*
Brookside Village	1,663
Danbury	1,637
Manvel	4,224
Pearland	21,156
Total	*28,680*

Net exportation *28,680 tons/year*

Subregion Four					
Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	286,973	-23,884	297,889	15.38	347.0
1991	292,701	-24,383	303,810	15.69	331.3
1992	298,429	-24,882	309,730	16.00	315.3
1993	304,157	-25,382	315,651	16.30	299.0
1994	309,886	-25,881	321,572	16.61	282.4
1995	315,614	-26,380	327,492	16.91	265.5
1996	321,342	-26,879	333,413	17.22	248.3
1997	327,070	-27,378	339,333	17.53	230.7
1998	332,798	-27,877	345,254	17.83	212.9
1999	338,526	-28,377	351,175	18.14	194.8
2000	344,254	-28,876	357,095	18.44	176.3
2001	351,082	-29,485	364,136	18.81	157.5
2002	357,909	-30,094	371,176	19.17	138.4
2003	364,736	-30,704	378,217	19.53	118.8
2004	371,564	-31,313	385,258	19.90	98.9
2005	378,391	-31,922	392,298	20.26	78.7
2006	385,218	-32,531	399,339	20.62	58.0
2007	392,046	-33,141	406,379	20.99	37.1
2008	398,873	-33,750	413,420	21.35	15.7
2009	405,700	-34,359	420,460	21.72	-6.0
2010	412,528	-34,969	427,501	22.08	-28.1
2011	419,355	-35,578	434,541	22.44	-50.5
2012	426,182	-36,187	441,582	22.81	-73.3



Subregional Solid Waste Management System

Waste Reduction/Reuse

Problems

o Yard waste--both urban and rural management practices.

Opportunities

o Large institutional (TDC) and corporate (BASF, Dow, Monsanto, Phillips) employers; policy impacts achievable.

o City of Pearland waste reduction program established through EPA grant transferable to other communities.

Recommendations

o Implement the "Don't Bag It" program to coordinate efforts by Agricultural Extension Service and local governments. *(potential implementation grant)*

o Establish corporate waste reduction goals, implementation programs at large employers such as Dow, Phillips, BASF and Monsanto. *(potential implementation grant)*

o Establish institutional waste reduction programs at the TDC, local governments and school districts. *(potential subregional plan element)*

Recycling

Problems

o Transportation and access to markets is a problem, particularly in smaller communities and rural areas.

Opportunities

o Possible sites for MRFs, recycling transfer stations and compost facilities, such as old county landfill, closed cells at existing landfills, county or TDC property.

o BFI-Fort Bend, located near the county line, has large inactive space (200+ acres) which could also be used for this purpose.

o Cities of Alvin, Lake Jackson and Pearland already have recycling programs.

o Several successful corporate recycling programs in place, including award-winning BASF program.

Recommendations

o Establish public yard waste composting facility on county property. *(potential implementation grant)*

o Conduct compost market development study; identify end markets in the subregion, such as agriculture, nurseries, beach restoration, state parks and wildlife refuges. *(potential subregional plan element)*

o Establish transfer stations for recyclables in south and western portions of the county. *(potential subregional plan element)*

- o Utilize drop-off centers in less-populated areas until markets are better developed. *(potential subregional plan element)*
- o Continue to encourage private sector recycling programs, such as those employed by BASF and other major manufacturers. *(potential subregional plan element)*
- o Explore feasibility of establishing a MRF at TDC prison facility and having TDC provide the labor. *(potential subregional plan element)*

Collection and Disposal

Problems

- o Limited collection capacity in rural areas.
- o Disposal capacity adequate, but could diminish if waste importation increases.
- o Excess capacity may also be consumed if Alvin closes its landfill.
- o There is interest in developing a waste-to-energy facility, but Clean Air Act restrictions may limit the viability of this option.

Opportunities

- o Opportunities to work internally on capacity issues or to establish arrangement with surrounding subregions.
- o Potential long-term capacity at BFI-Fort Bend.
- o Possible long-term capacity at Alvin landfill, if it remains open.

Recommendations

- o Investigate county option of establishing a network of transfer stations to provide for disposal at selected regional facilities, inside or outside of the subregion. Cost options for transportation and disposal, along with cost-avoidance benefits of recycling and waste reduction, should be examined. *(potential subregional plan element)*
- o City of Alvin should assess the cost of upgrading its landfill to Subtitle D requirements and analyze financial feasibility of expanding to serve the subregion. *(potential subregional plan element)*
- o Investigate the long-term feasibility of waste-to-energy. *(potential subregional plan element)*
- o County should seek grant funding to assist with collection programs in rural areas. *(potential subregional plan element)*

Special Waste

Problems

- o Existing medical waste disposal facilities are inadequate, and personnel are not well trained in its handling. Extent of this problem is not well-known.

Opportunities

- o Sanifill of Texas, Inc. landfill has a tire splitter/shredder and Brazoria County has acquired a tire shredder.
- o DOW Chemical has a HHW collection program.

Recommendations

- o Investigate opportunities under TNRCC scrap tire recycling program. *(potential subregional plan element)*
- o Promote city/county/private efforts to establish HHW drop-off site in north and central parts of the county. *(potential subregional plan element)*

Institutional Options

Problems

- o No existing mechanism, such as an authority or joint powers agreement currently in place.

Opportunities

- o Considerable study completed of solid waste management as a county-wide issue.
- o Some interest exists in forming a solid waste management authority or in having the county serve in this function.
- o Since there are no dominant cities, subregion well-suited for cooperative arrangements.

Recommendations

- o Forge an interlocal agreement for county to form a solid waste management department and hire professional staff. *(potential subregional plan element)*
- o Investigate host community benefits from private solid waste firms. *(potential subregional plan element)*
- o Study the financial and technical feasibility of establishing a county-wide solid waste management system to provide for recycling, transportation and long-term disposal capacity. Options may include formation of a district or authority, or having the county play this role. If a countywide arrangement is determined impractical, the western portion of the county may need to work in conjunction with Subregion 7 and the eastern portion with Subregion 3. *(potential subregional plan element)*

Public Education

Problems

- o No uniform public education system currently in place.

Opportunities

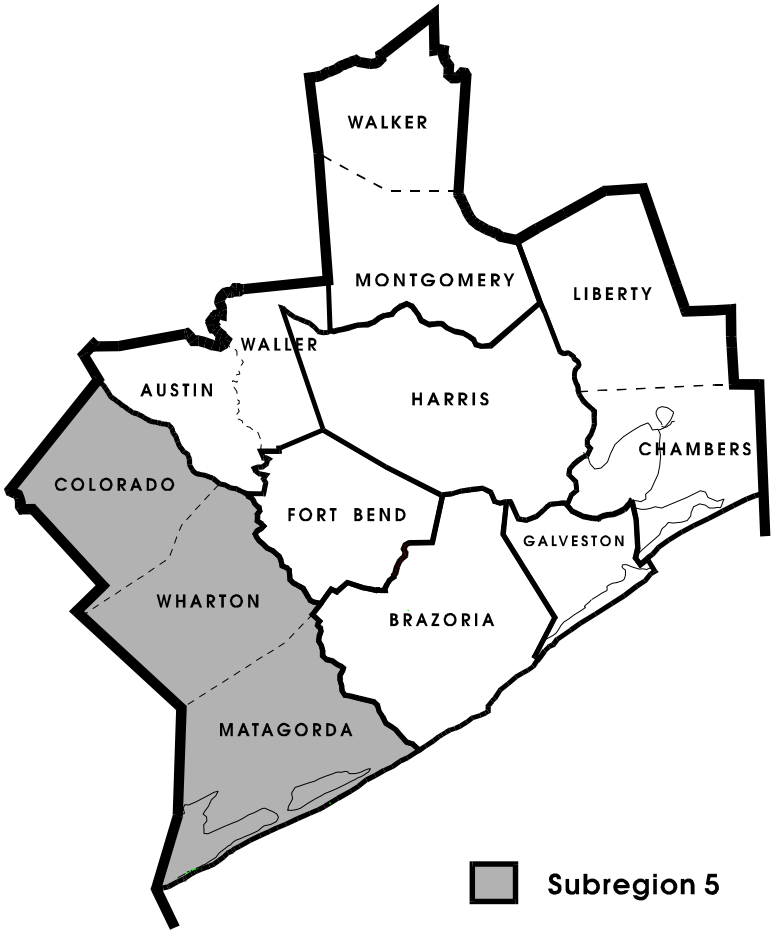
- o Lake Jackson and Pearland are KTB cities, have programs in place.

Recommendations

- o Establish a local branch of the Corporate Recycling Alliance of Texas. *(potential subregional plan element)*
- o Establish a County-wide Keep Texas Beautiful affiliate. *(potential subregional plan element)*
- o Distribute education modules for school districts. *(potential subregional plan element)*

- o Establish educational program for veterinarians, doctors and dentists and their staff members for proper medical waste handling techniques. *(potential subregional plan element)*
- o Enlist corporate involvement in education efforts by providing information on waste reduction, recycling and HHW to employees. *(potential subregional plan element)*

Subregion 5



Subregion Overview

Subregion 5 includes Colorado, Matagorda and Wharton Counties. The subregion is very large and currently has significantly long haul distances for solid waste disposal. The subregion has long-term disposal capacity, however, there are several issues of concern. Matagorda County's landfill will close due to Subtitle D, and the private Tricil/Laidlaw landfill in Colorado County may close if a hazardous waste disposal permit at the same site is denied. The City of El Campo has long-term landfill capacity but would probably need to upgrade to a regional facility to make Subtitle D compliance cost effective. A worst-case scenario could leave the subregion with no disposal capacity within a reasonable haul distance.

Subregion 5 is also distant from major Houston recycling markets. However, the plastics industry is growing in Wharton County and a major international plastics company is located in nearby Calhoun County. Subregion 5 also has several options for forming multi-jurisdictional relationships with counties in surrounding planning areas. The Lower Colorado River Authority (LCRA) may also be a vehicle to implement solid waste management programs for the subregion.

Population

Colorado County	1990 Pop
Eagle Lake	3,551
Columbus	3,367
Weimar	2,052
Unincorporated Area	9,413
Total	*18,383*

Matagorda County	1990 Pop
Bay City	18,170
Palacios	4,418
Van Vleck	1,534
Markham	1,206
Unincorporated Area	11,600
Total	*36,928*

Wharton County	
El Campo	10,511
Wharton City	9,011
East Bernard	1,544
Boling-Lago	1,119
Unincorporated Area	17,770
Total	*39,955*

Subregion Information

Total population:	95,266
Incorporated:	60% of population
Unincorporated:	40% of population
Land Area:	3,177 square miles
Population density:	30 persons/sq. mile

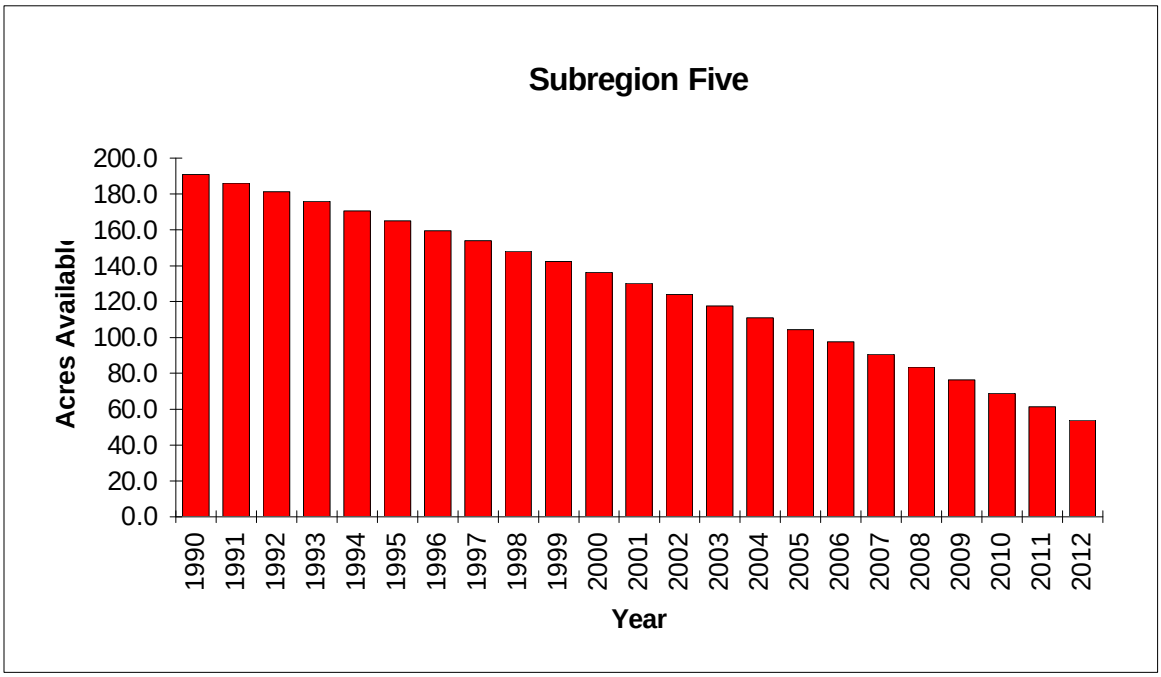
Waste Importation

Imports (from)	*tons/year*
Austin County (rural, part)	3,883
Cuero	7,601
Flatonia	1,211
Ganado	847
Harris County (commercial)	10,415
Hallettsville	3,075
Jackson County (pt.)	5,939
La Grange (pt.)	4,526
Lavaca County (pt.)	2,356
San Felipe	699
Schulenberg	3,082
Waelder	1,951
Washington County (pt.)	900
Total	*42,603*

Exports (from)	*tons/year*
Wharton (pt.)	7,928
Total	*7,928*

Net Importation *38,558 tons/year*

Subregion Five					
Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	58,338	30,093	100,128	4.58	191.0
1991	59,301	32,648	104,112	4.76	186.2
1992	60,264	35,203	108,096	4.95	181.3
1993	61,228	40,893	115,629	5.29	176.0
1994	62,191	41,647	117,573	5.38	170.6
1995	63,154	42,401	119,517	5.47	165.1
1996	64,117	43,154	121,461	5.56	159.6
1997	65,081	43,907	123,404	5.65	153.9
1998	66,044	44,660	125,348	5.74	148.2
1999	67,007	45,414	127,291	5.82	142.4
2000	67,970	47,598	130,855	5.99	136.4
2001	68,957	49,273	133,869	6.13	130.3
2002	69,944	50,948	136,884	6.26	124.0
2003	70,931	52,624	139,898	6.40	117.6
2004	71,918	54,299	142,913	6.54	111.1
2005	72,905	55,975	145,927	6.68	104.4
2006	73,892	57,650	148,942	6.82	97.6
2007	74,879	59,325	151,956	6.95	90.6
2008	75,866	61,001	154,971	7.09	83.5
2009	76,853	62,676	157,985	7.23	76.3
2010	77,840	64,352	161,000	7.37	68.9
2011	78,827	66,027	164,014	7.51	61.4
2012	79,814	67,702	167,029	7.64	53.8



Subregional Solid Waste Management System

Waste Reduction/Reuse

Problems

- o No significant existing waste reduction programs in place.
- o Yard waste--both rural and urban management practices.

Opportunities

- o Large governmental and institutional employment base, several large private employers in and around the subregion, such as the South Texas Nuclear Project (STNP) and Formosa Plastics. Substantial impacts achievable through government, institutional and corporate policy.

Recommendations

- o Implement the "Don't Bag It" program to coordinate efforts by Agricultural Extension Service and local governments. *(potential implementation grant)*
- o Work with school districts to distribute information. *(potential subregional plan element)*
- o Adopt governmental and institutional policies to establish waste reduction plans. *(potential subregional plan element)*
- o Work with STNP and Formosa to develop waste reduction plans and employee education programs. *(potential subregional plan element)*

Recycling

Problems

- o Most communities' population base too small or density too low to make curbside recycling practical.
- o No large recycling markets exist within the subregion. Transportation costs to Houston significant.

Opportunities

- o Several possible sites exist for MRFs, recycling transfer stations and composting operations. These include the Matagorda County landfill, closed cells of other existing landfills, and county precinct barns.
- o Cities of Bay City, Eagle Lake, Palacios, Columbus, and Weimar, and Wharton County have existing drop-off recycling programs. Colorado County has established drop-off centers sponsored by private industry.
- o Plastics industry is becoming established in the subregion--possible market for recyclables.
- o Possible end markets for compost, such as agriculture, surrounding state parks and wildlife refuges.

Recommendations

- o Establish public yard waste composting facility on county-owned properties (e.g., landfill, precinct barns). *(potential implementation grant)*
- o Explore options of establishing recycling/compost facility in private landfill inactive space as a host community benefit. *(potential subregional plan element)*
- o Conduct a compost market development study. Investigate possible end markets in agriculture, nurseries and surrounding state parks and wildlife refuges. *(potential subregional plan element)*
- o Establish program to use brush and yard waste in Matagorda Island beach restoration program. *(potential subregional plan element)*
- o Establish transfer stations for recyclables in central locations of the region. *(potential subregional plan element)*
- o Utilize drop-off centers until markets develop for curbside. *(potential subregional plan element)*
- o Continue to encourage public/private recycling partnerships between local governments and retail operations. *(potential subregional plan element)*
- o Educate public on landfill costs avoided by recycling. *(potential subregional plan element)*
- o Work with "special" populations to sort recyclables. *(potential subregional plan element)*

Collection and Disposal

Problems

- o Limited collection capacity in rural areas.
- o Relatively long haul distances throughout subregion.
- o Private disposal capacity may decrease if substantial waste importation occurs (Tricil/Laidlaw-Colorado County).
- o Tricil/Laidlaw facility may close if Tricil hazardous waste permit at the same site is denied (currently under review at the TNRCC). Closure of this facility would be a loss of capacity for this subregion and surrounding planning areas.
- o Matagorda County landfill will close due to Subtitle D; no short-term disposal options exist for the county, and transportation costs will greatly increase when this facility closes.
- o Significant public concerns about waste importation may impact El Campo landfill expansion to a regional facility.

Opportunities

- o Subregion has several options to establish working relationships internally or with surrounding areas.
- o LCRA may be willing to take a leading role in solid waste management.
- o El Campo landfill could serve as a regional facility, several operational options available.
- o Long-term capacity may also be available at BFI-Fort Bend, Sanifill of Texas, Inc.-Brazoria County or Tricil/Laidlaw-Colorado County.

- o Once disposal capacity is established, subregion would be well-suited for establishing a network of transfer stations. Transfer stations already exist in Weimar and Wharton.
- o Some waste, particularly Colorado County's, could be handled by the LCRA Fayette Power Project waste-to-energy facility, if developed.

Recommendations

- o Conduct comprehensive waste movement study, addressing relative disposal and transportation costs and options. *(potential subregional plan element)*
- o Establish a transfer station network throughout the subregion to channel waste to appropriate regional facility. Quality control and recycling practices should be implemented at these transfer stations. *(potential subregional plan element)*
- o Implement convenience/registration-only transfer in rural areas. *(potential subregional plan element)*
- o Pursue grant or loan programs to develop rural collection system. *(potential subregional plan element)*
- o Determine feasibility of using the LCRA Fayette Power Project generator to burn MSW from the subregion; determine feasibility of another waste-to-energy facility in the subregion. *(potential subregional plan element)*
- o Study potential joint landfill development arrangement: Colorado and Fayette Counties (collaborate with CAPCO subregion), and possibly including H-GAC Subregion 6; Wharton and Matagorda Counties (collaborating with Golden Crescent RPC Subregion). *(potential subregional plan element)*
- o Work with LCRA on a potential sponsor for these studies and as a possible solid waste management authority. *(potential implementation grant)*

Siting

Problems

- o Concerns over Colorado River watershed protection may limit some siting options.

Opportunities

- o Lower population density allows for more siting options for regional facilities.
- o LCRA beginning to look at location of MSW facilities and take a more active role in MSW issues.

Recommendations

- o Locate potential sites that will not conflict with watershed protection efforts. *(potential subregional plan element)*

Special Waste

Problems

- o Lack of medical waste disposal.
- o Nine "7R" municipal sludge disposal sites create possible odor and groundwater infiltration problems. Also monitoring and enforcement to determine if the sludge is adequately dried is difficult.

- o Interest in establishing a HHW permanent collection facility, but no implementing agency has been identified.
- o Seafood waste disposal has been identified as a problem in coastal Matagorda County; creates odor problems when disposed in municipal landfills.

Opportunities

- o LCRA study of HHW amnesty days in Austin could be beneficial to subregion in setting up a similar program.
- o Matagorda County Navigation District (MCND) currently conducting composting experiment with seafood and agriculture waste.

Recommendations

- o Investigate opportunities under the TNRCC Scrap Tire program. *(potential subregional plan element)*
- o Investigate feasibility of developing a co-composting-facility (yard waste and sludge). *(potential subregional plan element)*
- o Study feasibility of implementing composting program for seafood, oyster shells, and agricultural waste, with MCND or LCRA as potential leading agent. *(potential subregional plan element)*
- o Support increased TNRCC monitoring and inspection of special waste facilities. *(potential subregional plan element)*
- o If Tricil permit is granted, negotiate the establishment of drop-off sites and an HHW education program as a host community benefit for subregion 5. *(potential subregional plan element)*

Institutional Options

Problems

- o No existing mechanism, such as an authority or joint powers agreement currently in place.

Opportunities

- o Due to location, opportunities to work with surrounding regions.
- o LCRA has the potential to be unifying force and to provide funding for MSW efforts.

Recommendations

- o Study the financial and technical feasibility to establish a subregional solid waste management program, examining the following options: Subregion 5 form a special district, authority or joint powers agreement (JPA); form a district, authority or JPA including counties from adjacent Capital Area Planning Council (CAPCO) and Golden Crescent Regional Planning Commission (GCRPC) planning areas; LCRA take on the role as a regional solid waste management authority. *(potential subregional plan element)*
- o Conduct special financial feasibility study of expanding the El Campo landfill into a regional facility; assess engineering cost of meeting Subtitle D standards and potential

contractual/transportation arrangements between surrounding communities. *(potential implementation grant)*

Public Education

Problems

o No uniform public education system currently in place.

Opportunities

o Keep America Beautiful affiliation for cities.
o Agricultural Extension Service has several good programs in the subregion.

Recommendations

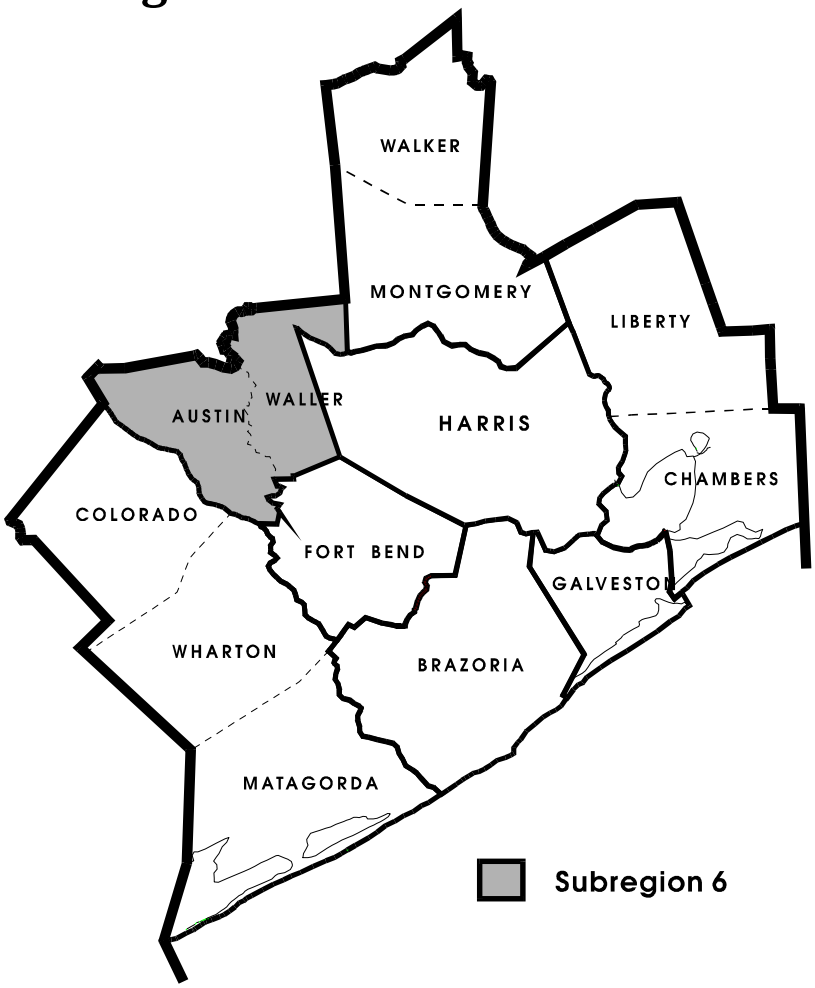
o Study TEA standards for education modules. *(potential subregional plan element)*
o Distribute education modules for school districts. *(potential subregional plan element)*
o Have county, cities and school districts adopt internal solid waste management policies and education programs. *(potential subregional plan element)*
o Educate public about the benefits of an integrated MSW program. *(potential subregional plan element)*

General

Recommendations

o Develop a core of trained citizens to report operational complaints. *(potential subregional plan element)*
o Study the extent of illegal disposal in the subregion. *(potential subregional plan element)*
o Develop beach clean-up solutions. *(potential subregional plan element)*

Subregion 6



Subregion Overview

Subregion 6 includes Austin and Waller Counties. The subregion has no cities over 5,000, and nearly half of the population lives in unincorporated areas. Since there are no dominant cities, Subregion 6 is well-suited for the establishment of a solid waste management district or other interlocal arrangement. Opportunities also exist to conduct joint implementation efforts with the Lower Colorado River Authority (LCRA) or a subregion of the Brazos Valley Development Council (BVDC) planning area.

Subregion 6 has good access to Houston recycling market, via major highways, though the internal transportation network is not well-developed. The subregion may face an immediate disposal capacity crisis if the Bellville landfill closes. Subregion 6 has also, reluctantly, become the regional center for the land application of sewage sludge, mostly from Houston-area Municipal Utility Districts (MUD's).

Population

Austin County	1990 Pop	Waller County	1990 Pop
Sealy	4,541	Prairie View	4,004
Bellville	3,378	Hempstead	3,551
Wallis	1,001	Brookshire	2,922
San Felipe	618	Waller (portion)	1,323
Unincorporated Area	10,294	Katy (portion)	843
		Pine Island	571
Total	*19,832*	Pattison	327
		Unincorporated Area	9,849
		Total	*23,390*

Subregion Information

Total population:	43,222
Incorporated:	53% of population
Unincorporated:	47% of population
Land Area:	1,170 square miles
Population density:	37 persons/sq. mile

Waste Exportation

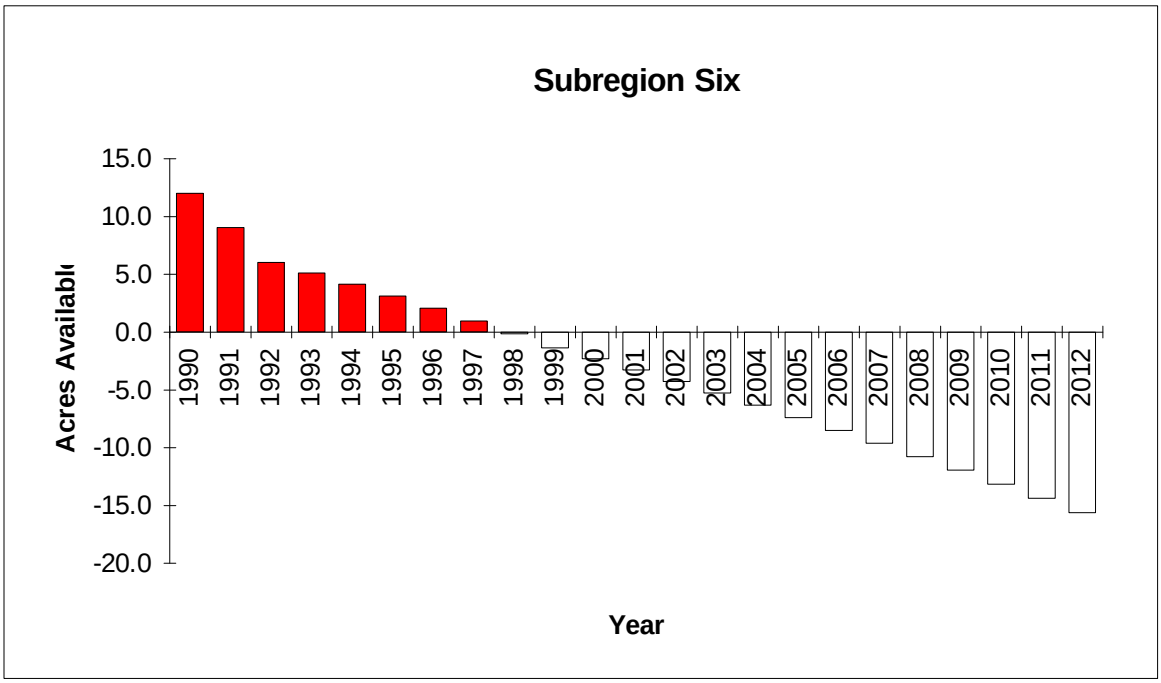
Imports (from)	*tons/year*
None	*0*

Exports (from)	*tons/year*
Hempstead	0*
Katy (Waller pt.)	954
San Felipe	699
Austin County (rural, part)	3,883
Total	*5,536*

Net Exportation *5,536 tons/year*

* Hempstead will begin exporting waste in late 1992 to Brazos Valley Solid Waste Management Landfill

Subregion Six					
Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	43,222	-4,892	43,400	2.85	12.0
1991	44,199	-4,582	44,858	2.94	9.1
1992	45,176	-4,272	46,316	3.04	6.0
1993	46,154	-33,884	13,892	0.91	5.1
1994	47,131	-34,205	14,636	0.96	4.1
1995	48,108	-34,526	15,379	1.01	3.1
1996	49,085	-34,846	16,123	1.06	2.1
1997	50,063	-35,167	16,867	1.11	1.0
1998	51,040	-35,487	17,610	1.16	-0.2
1999	52,017	-35,808	18,354	1.20	-1.4
2000	52,994	-40,331	14,339	0.94	-2.3
2001	54,606	-41,589	14,739	0.97	-3.3
2002	56,218	-42,847	15,139	0.99	-4.3
2003	57,829	-44,106	15,539	1.02	-5.3
2004	59,441	-45,364	15,939	1.05	-6.3
2005	61,053	-46,622	16,339	1.07	-7.4
2006	62,664	-47,881	16,739	1.10	-8.5
2007	64,276	-49,139	17,139	1.12	-9.6
2008	65,888	-50,397	17,540	1.15	-10.8
2009	67,499	-51,656	17,940	1.18	-12.0
2010	69,111	-52,914	18,340	1.20	-13.2
2011	70,723	-54,172	18,740	1.23	-14.4
2012	72,334	-55,430	19,140	1.26	-15.7



Subregional Solid Waste Management System

Waste Reduction/Reuse

Problems

o No existing major employment centers; waste reduction programs may be more difficult to put in place, particularly in commercial sector.

Opportunities

o Major Stewart and Stevenson facility coming on-line in Sealy; opportunity to educate new residents of the subregion.

Recommendations

o Implement the "Don't Bag It" program to coordinate efforts by Agricultural Extension Service and local governments. *(potential implementation grant)*

o Work with school districts to distribute waste reduction information. *(potential subregional plan element)*

o Adopt governmental policies to establish waste reduction goals and create programs. *(potential subregional plan element)*

o Work with Stewart and Stevenson to develop employee education program. *(potential subregional plan element)*

Recycling

Problems

o Transportation and access to markets is a problem, particularly in smaller communities located off main highway corridors.

o No major population centers to generate significant recycling volumes.

Opportunities

o Good access to Houston recycling markets, via US 290 and IH 10.

o Potential sites exist for recycling and composting facilities at municipal landfills which will close due to Subtitle D.

o The cities of Sealy and Bellville have been operating a drop-off recycling center and could share their experience with other communities.

o Sealy is a KAB affiliate and has developed a solid waste management plan which addresses recycling and yard waste.

o The Bellville School District operates a recycling program which employs mental retarded school-aged children.

Recommendations

o Establish public yard waste composting facility, preferably at closed landfill site. *(potential implementation grant)*

o Establish transfer stations for collection/storage of recyclables. *(potential subregional plan element)*

- o Work with "special" populations to sort recyclables. *(potential subregional plan element)*
- o Use drop-off centers in less populated areas. *(potential subregional plan element)*
- o Work with retailers to establish public/private partnerships for recycling. *(potential subregional plan element)*

Collection and Disposal

Problems

- o Lack of disposal capacity. Currently only 12 permitted acres (3 years capacity) remain in the subregion. All landfills in the region may close due to Subtitle D. No sites within the subregion planned for long-term capacity.
- o River barrier between Austin and Waller Counties; limited bridge crossings.
- o Siting made difficult by extensive sand and gravel extraction in Austin County.

Opportunities

- o Opportunities exist to export waste to private facilities (Austin County to Tricil in Colorado County; Waller County to Western Waste in Conroe and Brazos Valley landfill in Brazoria County).
- o One of the existing landfills (Bellville or Sealy) could be brought up to Subtitle D standards and serve as a regional facility. Bellville has conducted a study on regionalizing its landfill.
- o Austin County could also participate in the development of a regional facility in Subregion 5.

Recommendations

- o A special study of short- and long-term disposal options for the subregion is needed. Options addressed should include: upgrading the Bellville landfill to a regional facility; working with Prairie View A&M to develop a regional facility; Waller County developing a landfill to serve the county and its communities exploring joint developments of a landfill with Subregion 6 and CAPCO; establishing a network of transfer stations to augment existing drop-off collection program and exporting waste to adjacent subregions and to the Brazos Valley Development Council's planning region. *(potential implementation grant)*
- o Subregion 6 should study the use of transfer stations as part of the drop-off collection programs already under way in the subregion and the use of registration-only permits in rural areas not receiving pick-up service. *(potential implementation grant)*

Special Waste

Problems

- o There are 24 "7R Beneficial Use" land applications of sewage sludge in the subregion.
- o Sludge disposal sites present odor and possible groundwater contamination problems.
- o Number and remoteness of sites makes monitoring and enforcement difficult, particularly for determining if the sludge is adequately dry before application.

- o A medical waste incinerator is in the permitting process in Waller County, creating resident concerns.
- o No HHW programs in place.
- o Austin County has two illegal tire dumps, containing over 50,000 tires according to the TNRCC tire survey.

Opportunities

- o Several closed or soon-to-be closed landfills could serve as sites for special waste disposal facilities.

Recommendations

- o Investigate opportunities under TNRCC scrap tire recycling program. *(potential subregional plan element)*
- o Study possibility of developing a tire monofill at a closed landfill or a landfill with remaining capacity. *(potential subregional plan element)*
- o Increased TNRCC inspection and monitoring of "7R" and "7" sludge facilities. *(potential implementation grant)*
- o H-GAC review of "7R" and "7" sludge facilities. *(potential implementation grant)*
- o Investigate the feasibility of establishing a co-composting facility (yard waste and sludge). *(potential subregional plan element)*
- o Promote county/cities joint participation in establishing a permanent drop-off site for HHW and concurrent education program. *(potential subregional plan element)*

Institutional Options

Problems

- o No existing mechanism, such as an authority or joint powers agreement currently in place.
- o No leading solid waste management program which can be built on by other local governments.

Opportunities

- o Since there are no dominant cities, subregion well-suited for cooperative arrangements.
- o Waller County has already studied solid waste management options from a county-wide perspective.
- o LCRA may be a vehicle for implementing solid waste management programs in the subregion.

Recommendations

- o Forge an interlocal agreement for both counties to form a solid waste management department and hire professional staff. *(potential subregional plan element)*
- o Study and evaluate the multi-jurisdictional options, including: forming a solid waste management district or authority; LCRA assuming responsibility for solid waste management in the subregion; working with adjacent subregion in the Brazos Valley Development Council planning area. *(potential implementation grant)*

o Establish cooperative between counties and cities to collect, store, market and transport recyclables. *(potential subregional plan element)*

Public Education

Problems

o No uniform public education system currently in place.

Opportunities

o Sealy is a KTB city.

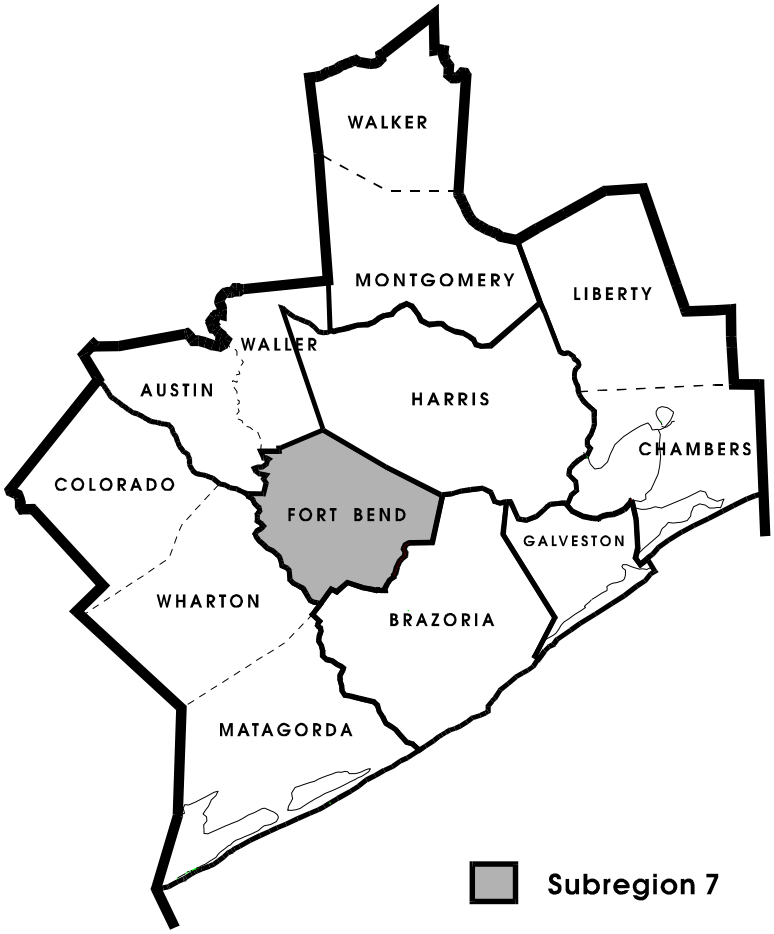
Recommendations

o Develop a program to educate residents about waste disposal issue and options, particularly the lack of landfill capacity. *(potential implementation grant)*

o Have counties, cities and school districts adopt internal solid waste management education programs for employees. *(potential subregional plan element)*

o Distribute education modules for school districts. *(potential subregional plan element)*

Subregion 7



Subregion Overview

Subregion 7 encompasses Fort Bend County, which has the H-GAC region's fastest growing county population. The county currently operates its own landfill and has had a history of involvement in solid waste management issues. Several cities in the county have successful recycling programs in place, and several large institutions, corporations and development projects provide the potential to achieve substantial impacts through their policy.

Fort Bend County has good access to Houston's recycling markets and also has a built-in linkage with Houston since a portion of the city extends into the county. By virtue of its geographic location, Fort Bend County may also be in a position to work on joint projects with surrounding subregions 5, 6 and 8.

Population

Fort Bend County	1990 Pop	Fort Bend County	1990 Pop
Missouri City (portion)	32,219	Pleak	746
Houston (portion)	27,027	Simonton	717
Sugar Land	24,529	Katy (portion)	709
Rosenberg	20,183	Arcola	666
First Colony*	18,327	Fulshear	557
Mission Bend (portion)*	14,195	Kendelton	496
Richmond	9,801	Beasley	485
Pecan Grove	9,502	Orchard	373
Stafford (portion)	8,090	Thompsons	167
Town West*	6,166	Unincorporated Area	40,479
Meadows	4,606		
Fresno	3,182	*Total*	*225,421*
Needville	2,199		

* census designated places.

Subregion Information

Total population:	225,421
Incorporated:	82% of population
Unincorporated:	18% of population
Land Area:	876 square miles
Population density:	257 persons/sq. mile

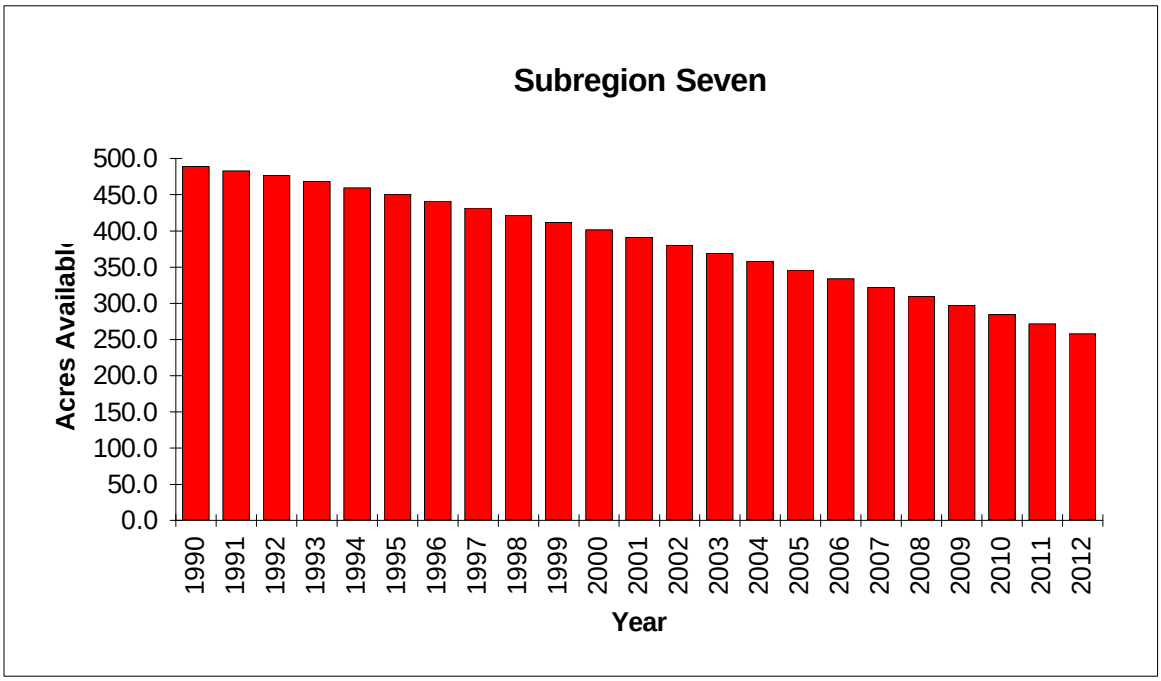
Waste Exportation

Imports (from)	*tons/year*
Wharton (pt.)	7,928
Katy (Harris + Waller pt.)	8,255
Total	*16,184*

Exports (from)	*tons/year*
Arcola	754
Meadows	5,212
Stafford	9,154
Sugar Land	27,755
Total	*42,874*

Net Exportation *26,690 tons/year*

Subregion Seven					
Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	225,421	-23,588	228,530	5.83	489.0
1991	234,040	-24,015	237,806	6.07	482.9
1992	242,659	-24,442	247,082	6.31	476.6
1993	251,278	41,437	331,434	8.46	468.2
1994	259,897	42,149	341,999	8.73	459.4
1995	268,516	42,860	352,563	9.00	450.4
1996	277,135	43,571	363,128	9.27	441.2
1997	285,754	44,283	373,692	9.54	431.6
1998	294,373	44,994	384,257	9.81	421.8
1999	302,992	45,705	394,821	10.08	411.8
2000	311,611	46,417	405,386	10.35	401.4
2001	319,229	47,294	415,005	10.59	390.8
2002	326,847	48,171	424,624	10.84	380.0
2003	334,465	49,049	434,243	11.08	368.9
2004	342,083	49,926	443,862	11.33	357.6
2005	349,702	50,803	453,482	11.57	346.0
2006	357,320	51,681	463,101	11.82	334.2
2007	364,938	52,558	472,720	12.06	322.1
2008	372,556	53,435	482,339	12.31	309.8
2009	380,174	54,312	491,958	12.56	297.2
2010	387,792	55,190	501,577	12.80	284.4
2011	395,410	56,067	511,197	13.05	271.4
2012	403,029	56,944	520,816	13.29	258.1



Subregional Solid Waste Management System

Waste Reduction/Reuse

Problems

- o Yard waste--both urban and suburban management practices.
- o No significant existing waste reduction programs in place.

Opportunities

- o Large governmental and institutional employment base. Substantial impact achievable through government policy.

Recommendations

- o Implement the "Don't Bag It" program to coordinate efforts by Agricultural Extension Service and local governments. *(potential implementation grant)*
- o Work with school districts to distribute information. *(potential subregional plan element)*
- o Encourage interaction between Sugar Land and other local governments to share information on in-house program; encourage adoption by all. *(potential subregional plan element)*
- o Establish corporate waste reduction goals; work with large employers such as Frito-Lay, Imperial Sugar and Houston Lighting and Power. *(potential subregional plan element)*

Recycling

Problems

- o Transportation and access to markets is a problem, particularly in smaller communities.
- o No end markets located in Fort Bend County.

Opportunities

- o City of Sugar Land already operates a successful in-house office recycling program which could serve as a model.
- o Possible sites for composting facilities or MRFs exist at the old county landfill or the closed cells of several existing landfills.
- o BFI-Fort Bend landfill has a large areas of inactive space which could be used as a compost or recycling facility.
- o Cities of Sugar Land, Richmond and Rosenberg have already had success with privately-operated recycling programs.
- o City of Sugar Land has successful business recycling subcommittee.
- o Rosenberg operates a drop-off center.
- o Portions of the City of Houston are in Fort Bend County, so county will benefit from Houston's curbside collection program and market development.
- o Living Earth Technology, Inc., the largest yard waste recycler in Texas, has a yard waste composting facility in Fort Bend County.

o Numerous large "master-planned" developments, commercial and highway landscaping projects and a state park which could be developed as markets for compost.

Recommendations

o Establish a public yard waste composting facility on county-owned property and/or require government agencies to deliver their own compostable materials to private composting operations. *(potential implementation grant)*

o Conduct compost market development study. Investigate possible end markets, as mentioned above. *(potential subregional plan element)*

o As host community benefit, establish said facility in public and/or private landfill. *(potential implementation grant)*

o Site transfer stations for recyclables in central and western parts of the county. *(potential subregional plan element)*

o Utilize drop-off centers until markets develop for curbside. *(potential subregional plan element)*

o Continue to encourage public/private partnerships for recycling. *(potential implementation grant)*

o As host community benefit, establish MRF at BFI-Fort Bend landfill. *(potential implementation grant)*

o Investigate possibility of establishing MRF at TDC prison facility with TDC providing labor. *(potential subregional plan element)*

o Investigate possibility of private operator establishing drop-off center or collection sites as part of contracts to operate county's landfill. *(potential subregional plan element)*

Collection and Disposal

Problems

o County has contract with Laidlaw to operate their landfill operation and is undecided as to whether to operate as a regional landfill.

o Capacity for central and western parts of the county could be greatly diminished if county landfill closes.

o Limited collection capacity in rural areas.

o Subsidence in the northeastern part of the county could present siting problems.

Opportunities

o Fort Bend County has potential long-term capacity at BFI-Fort Bend.

o County may also have access to disposal capacity in surrounding subregions.

Recommendations

o Investigate option of establishing transfer stations in western Fort Bend County. *(potential implementation grant)*

Special Waste

Problems

- o Currently 14 "7R" sludge disposal permits, creating potential odor and ground water infiltration problems.
- o Number of sludge disposal sites also presents enforcement and monitoring problems.
- o No off-site medical waste disposal facilities.
- o No established HHW collection programs.

Opportunities

- o Fort Bend County already owns a tire splitter/shredder.

Recommendations

- o Investigate opportunities under TNRCC scrap tire recycling program. *(potential subregional plan element)*
- o Study possibility of developing a tire monofill at Fort Bend County facility if it closes. *(potential subregional plan element)*
- o Investigate the feasibility of establishing a co-composting facility (yard waste and sludge). *(potential subregional plan element)*
- o Support increased TNRCC inspection and monitoring of "7R" and "7" sludge facilities. *(potential implementation grant)*
- o Have H-GAC review "7R" and "7" sludge facilities. *(potential implementation grant)*
- o Promote city and county attempts to establish drop-off sites and education programs for HHW. *(potential subregional plan element)*

Institutional Options

Problems

- o No existing mechanism, such as an authority or joint powers agreement currently in place.

Opportunities

- o County currently involved in public/private partnership in landfill operation. Has history of taking lead role in solid waste management.
- o A county-wide solid waste planning effort has already been initiated.
- o Linkage exists between Fort Bend County and City of Houston.
- o Fort Bend County and its municipalities and private sector have track record of cooperation in economic development efforts.
- o County's location would permit establishment of relationships with adjacent subregions.

Recommendations

- o Study the possibility of western cities working with subregion 5. *(potential implementation grant)*

Public Education

Problems

o No uniform public education system currently in place.

Opportunities

o Sugar Land and Rosenberg are KTB-affiliate cities.

Recommendations

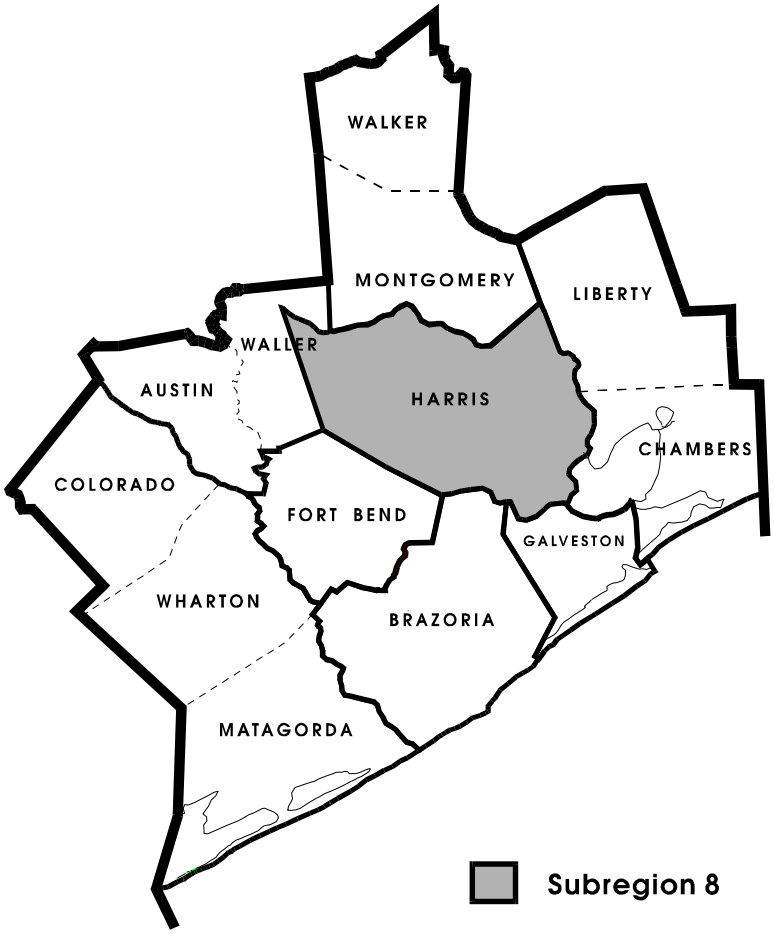
o Establish a local branch of the Corporate Recycling Alliance of Texas or similar business group. *(potential subregional plan element)*

o Distribute education modules for school districts. *(potential subregional plan element)*

o Have county, cities and schools adopt internal education programs. *(potential subregional plan element)*

o Continue to use KAB education programs, encourage other cities to become affiliates. *(potential subregional plan element)*

Subregion 8



Subregion Overview

Subregion 8, Harris County, encompasses 72% of the region's population and a greater percentage of its waste generation. The City of Houston accounts for 57% of the population of the county, which also has fifteen additional cities over 10,000 in population. Harris County was designated as its own subregion to take advantage of such a large population already covered by existing government entities with the staff and resources to taking a leading role in developing solid waste management efforts.

Harris County is also the geographic center, transportation hub and primary recycling market for the entire H-GAC region and beyond. Many of the programs launched in this subregion will be valuable pilots for the other seven subregions, as well as the state and nation.

Population

Harris County	1990 Pop	Harris County	1990 Pop
Houston (portion)	1,603,524	Webster	4,678
Pasadena	119,363	Missouri City (portion)	3,957
Baytown (portion)	61,126	Hunters Creek Village (portion)	3,954
Kingwood (portion)*	37,350	Taylor Lake Village	3,394
Spring*	33,111	Spring Valley	3,392
La Porte	27,910	Bunker Hill Village	3,391
Deer Park	27,652	El Lago	3,269
Channelview	25,564	Piney Point Village	3,197
Cloverleaf	18,230	Barrett	3,052
South Houston	14,207	Hedwig Village	2,616
Bellaire	13,842	Crosby	1,811
West University Place	12,920	Sheldon	1,653
Humble	12,060	Pearland (portion)	1,463
Aldine	11,133	Southside Place	1,392
Mission Bend (portion)*	10,750	Shoreacres (portion)	1,316
Galena Park	10,033	Hilshire Village	665
Jacinto City	9,343	Morgan's Point	341
Friendswood (portion)	7,835	Stafford (portion)	307
Seabrook (portion)	6,685	League City (portion)	133
Highlands	6,632	Waller (portion)	170
Katy (portion)	6,453	Unincorporated Area	682,809
Tomball (portion)	6,370		
Nassau Bay	4,320	*Total*	*2,818,199*
Jersey Village	4,826		

* census designated places

Subregion Information

Total population:	2,818,199
Incorporated:	76% of population
Unincorporated:	24% of population
Land Area:	1,734 square miles
Population density:	1,625 persons/sq. mile

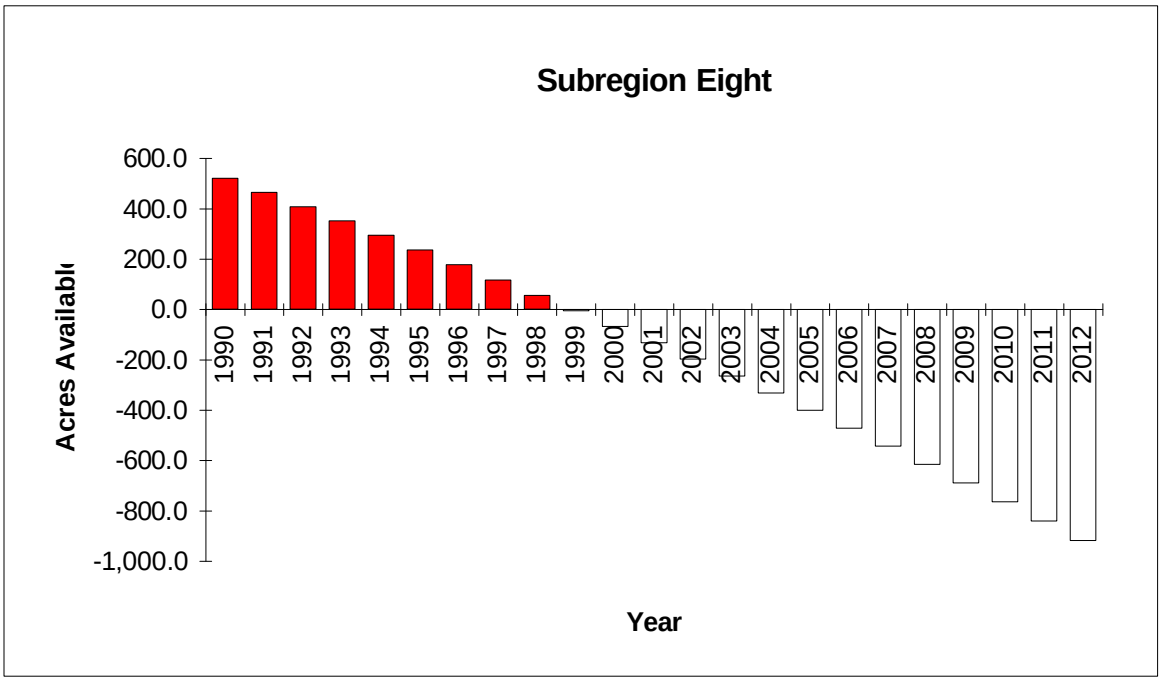
Waste Exportation

Imports (from)	*tons/year*
Arcola	754
Meadows	5,212
Stafford	9,154
Sugar Land	27,755
Total	*42,874*

Exports (from)	*tons/year*
Baytown	69,164
Deer Park	31,288
Harris County (commercial)	260,245
Katy (Harris pt.)	7,302
La Porte	31,580
Morgan's Point	386
Pasadena (part)	90,039
Pearland (Harris pt.)	1,655
Seabrook	7,564
Tomball	7,208
Webster	5,293
Total	*511,724*

Net Exportation *468,851 tons/year*

Subregion Eight					
Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	2,818,199	-414,362	2,721,805	54.71	521.0
1991	2,869,301	-421,406	2,771,690	55.71	465.3
1992	2,920,403	-428,450	2,821,575	56.71	408.6
1993	2,971,504	-501,593	2,796,619	56.21	352.4
1994	3,022,606	-509,706	2,845,294	57.19	295.2
1995	3,073,708	-517,820	2,893,969	58.17	237.0
1996	3,124,810	-525,933	2,942,644	59.15	177.9
1997	3,175,912	-534,046	2,991,318	60.12	117.7
1998	3,227,013	-542,159	3,039,993	61.10	56.6
1999	3,278,115	-550,273	3,088,668	62.08	-5.4
2000	3,329,217	-558,386	3,137,343	63.06	-68.5
2001	3,392,235	-568,940	3,196,747	64.25	-132.7
2002	3,455,253	-579,493	3,256,151	65.45	-198.2
2003	3,518,271	-590,046	3,315,555	66.64	-264.8
2004	3,581,288	-600,600	3,374,959	67.83	-332.7
2005	3,644,306	-611,153	3,434,363	69.03	-401.7
2006	3,707,324	-621,707	3,493,767	70.22	-471.9
2007	3,770,342	-632,260	3,553,171	71.42	-543.3
2008	3,833,360	-642,814	3,612,575	72.61	-615.9
2009	3,896,378	-653,367	3,671,979	73.80	-689.8
2010	3,959,395	-663,921	3,731,383	75.00	-764.8
2011	4,022,413	-674,474	3,790,787	76.19	-840.9
2012	4,085,431	-685,028	3,850,191	77.39	-918.3



Subregional Solid Waste Management System

Waste Reduction/Reuse

Problems

- o Yard waste.
- o Industry not organized uniformly to adopt waste reduction policies.

Opportunities

- o Houston Chamber of Commerce Environment Committee is working with General Land Office, Air & Waste Management Association and Environmental Protection Agency to develop waste reduction programs.
- o Clean Houston and Houston Corporate Recycling Council excellent potential vehicles for promoting waste reduction policies.
- o Major retailers and manufacturers located in Houston could impact packaging and waste reduction.
- o Citizens Environmental Coalition, Civic Associations and other groups with capacity for broad outreach.
- o Successful Christmas tree/beach erosion program.

Recommendations

- o Work with local governments, school districts and citizen groups to develop an information distribution campaign on waste reduction programs. *(potential subregional plan element)*
- o Work with Corporate Recycling Council to establish corporate waste reduction goals. *(potential subregional plan element)*
- o Work to distribute information through CRC and professional organizations. *(potential subregional plan element)*
- o Implement the "Don't Bag It" program to coordinate efforts by Agricultural Extension Service and local governments. *(potential implementation grant)*

Recycling

Problems

- o Markets for paper, especially mixed, are weak.
- o Local market for plastics has collapsed, plastics recycling is currently limited.
- o Collection of recyclables is a problem, particularly in unincorporated areas of the county.
- o Significant percentage of housing is multi-family; more difficult to establish collection programs.
- o Scavenging of recyclables is a problem.

Opportunities

<u>Recycling</u>

- o City of Houston already has solid waste management study and database.

- o City of Houston pilot curbside collection program has very high participation. Numerous smaller cities also have curbside, drop-off or buy-back programs, publicly or privately operated.
- o Several grocery store chains (Apple Tree, Fiesta, Kroger, Randall's and Whole Foods) have on-premise recycling for customers. Other types of retailers have begun to establish customer drop-off recycling programs as well.
- o Many of these stores also have internal recycling programs for paper and cardboard.
- o Houston is a major end-market for recyclables throughout the region and state.
- o Port of Houston gives access to international recycling markets.
- o The Steel Can Institute has a local office in Houston, can be a resource in recycling programs. Several other major recyclers, such as Proler, are located in the area.
- o Champion Paper de-inking plant will provide a major regional market for newsprint and magazines.

Compost

- o Major parks and open space, golf courses, commercial projects potential markets for compost.
- o Living Earth Technology, Inc., the largest yard waste recycler in Texas, has a yard waste composting facility in Harris County. It provides services to Jersey Village, Bunker Hill/Piney Point, West University, Bellaire, Spring Valley, and many areas of West Houston via BFI.
- o City of Houston currently has a contract with a private company that has a permit application for a municipal solid waste composting facility. If the permit is received they will compost a portion of the City of Houston's municipal waste after front end recycling.
- o Public and private Christmas tree collection efforts have been successful.

Recommendations

Recycling

- o Promote Houston as a major international marketplace for recyclable materials. *(potential subregional plan element)*
- o Site transfer stations and drop-off/buy-back centers for collection of recyclables throughout the county. Develop a series of publicly-owned MRFs. *(potential subregional plan element)*
- o Conduct a special market development effort focused on plastics. *(potential subregional plan element)*
- o Work with "special" populations (e.g., handicapped) to perform materials sorting. *(potential subregional plan element)*
- o Work with major end-markets in Houston/Harris County to promote relationships with outlying areas. *(potential implementation grant)*
- o Continue to encourage public/private partnerships for recycling. *(potential implementation grant)*
- o Support the citywide expansion of the City of Houston's curbside recycling program. *(potential implementation grant)*

- o Investigate contract opportunities for the City of Houston to run recyclable collection programs for surrounding cities/villages. *(potential subregional plan element)*
- o Develop multi-family recycling program. *(potential implementation grant)*
- o Develop small commercial recycling program. *(potential subregional plan element)*

Compost

- o Develop compost market development strategy, targeting municipal parks, golf courses, commercial developments, and universities. *(potential subregional plan element)*
- o Establish formal connection with HL&P and SDHPT to use mulch from the City of Houston's program. *(potential subregional plan element)*
- o Establish yard waste/composting facility on county or city-owned properties and/or require government agencies to deliver their own compostable materials to private composting operations. *(potential subregional plan element)*
- o As host community benefit, require development of such facility in private landfill. *(potential subregional plan element)*

Collection and Disposal

Problems

- o Limited collection capacity in rural areas.
- o Harris County's Clean Air Act non-attainment status for ozone may limit incineration as a future disposal option.
- o Type IV capacity may be in question, depending upon State of Texas response to Subtitle D.
- o Population density and land use patterns will make facility siting difficult.
- o Virtually all Harris County sites met with strong, organized citizen opposition.
- o Private landfills are not well-distributed throughout the county.
- o Aquifer recharge zones, subsidence, faults and flood plains located in various parts of the county all impediments to facility siting.

Opportunities

- o Potential short- to long-term disposal capacity at private landfills.
- o Potential long-term capacity outside the subregion (i.e. BFI-Fort Bend, Hazelwood-Chambers County, Chambers County landfill, Western Waste-Conroe and E&D-Galveston.
- o Network for citizen involvement in siting issues already in place.

Recommendations

- o City of Houston should seek its own disposal capacity to provide alternative to private landfills. *(potential subregional plan element)*
- o A network of transfer stations should be established around the county. *(potential subregional plan element)*

o A special siting study and plan for Harris County should be developed, taking into account land use conflicts, transportation and environmental factors. *(potential implementation grant)*

Special Waste

Problems

o Limited household hazardous waste "amnesty day" programs.
o Harris County has 85 illegal tire dumps according to a TNRCC tire survey. Additionally, Harris County Mosquito Control District has identified over 2,000 sites.
o Industrial complex will be generating additional sludge and other classified hazardous waste, owing to Clean Air Act.
o No off-site commercial hazardous waste disposal facilities for small generators.
o No off-site medical waste disposal facilities.
o Thousands of small-quantity businesses/generators unaware or unwilling to properly dispose of hazardous waste.
o High volumes of municipal sewage sludge from multiple generators (MUD's) creates disposal problems.
o Major special waste generators exist in Harris County, particularly in petrochemical and medical complexes.
o Recycling programs for used oil and restaurant grease undermined by scavenging and theft; "black markets" exist.

Opportunities

o Several tire recyclers are located in Harris County.
o Sanifill of Texas, Inc. is developing a tire monofill in Harris County.
o Industries in the county may be potential hosts for HHW collection days.
o In eastern Harris County, a public/private HHW collection program already exists.
o City of Houston is planning a pilot HHW collection day, and establishing a permanent annual collection program.
o Scrap tire, used oil and lead acid battery recycling programs created by state legislation will provide opportunities for retailers and entrepreneurs to establish businesses in these areas.
o Medical waste disposal capacity may be established in surrounding subregions.

Recommendations

o Promote opportunities under TNRCC scrap tire recycling program. *(potential implementation grant)*
o Promote the establishment of permanent public drop-off sites for HHW. *(potential implementation grant)*
o Encourage industrial participation in HHW disposal. *(potential subregional plan element)*

- o Link HHW abatement efforts with other EPA and TNRCC-sponsored planning programs ("319" and "604" federal programs, State River Basin Assessment Program, Houston, Harris County and Pasadena NPDES stormwater permit requirements). *(potential subregional plan element)*
- o Develop public collection sites for used oil in accordance with TNRCC program. Coordinate collection efforts with major institutional players. *(potential subregional plan element)*
- o In association with various trade associations, educate small quantity generators to recognize special/hazardous wastes and employ proper disposal techniques. *(potential subregional plan element)*

Institutional Options

Problems

- o Long-term waste disposal capacity is moving outside of Harris County; future interlocal arrangements could be more difficult because of biases against waste importation.
- o Some communities on the fringes of Harris County, such as Baytown, La Porte and Tomball, may be able to forge more suitable working relationships with other subregions.

Opportunities

- o Size and impact of Houston's solid waste program allows it to take the lead on projects for the subregion and the region as a whole.
- o Gulf Coast Authority may serve portions of the county.
- o Clear Lake Council of Cities may also take the lead on special projects.

Recommendations

- o Investigate host community benefits from private and public solid waste management facilities. *(potential subregional plan element)*
- o Study the financial and technical feasibility of establishing a county-wide waste management system, either through joint powers, interlocal agreement or management district. *(potential subregional plan element)*
- o Study the benefits of multi-jurisdictional efforts on waste reduction, recycling/composting and special waste projects. *(potential subregional plan element)*
- o Houston's landfill study may include host community benefits, such as recyclable collection, if located in one of the surrounding subregions. *(potential subregional plan element)*

Public Education

Problems

- o Large and diverse population to be reached.

Opportunities

- o Clean Houston, Corporate Recycling Council and other active KAB/KTB programs already in place.
- o Large solid waste and public relations firms located in the Houston area may be willing to lend their expertise.

Recommendations

- o Continue to utilize KAB/KTB education programs. *(potential subregional plan element)*
- o Develop roundtable work groups to provide in-service training to teachers concerning solid waste management. *(potential subregional plan element)*
- o Harris County pursue KTB designation. *(potential subregional plan element)*
- o Establish Speaker's Bureau for solid waste presentations to schools, civic clubs, others. *(potential subregional plan element)*
- o Pursue state and federal funding to develop education materials which could be models for the entire region. *(potential subregional plan element)*
- o Develop a training program for citizen monitors to report illegal dumping in Harris County. *(potential subregional plan element)*

F. Implementation Plan and Timetable

This section provides an overview of how plan implementation efforts will be conducted. The timing of actual steps will be in large part determined by the availability of state funding for implementation efforts. Follow-up funding programs are currently being studied by the Texas Natural Resource Conservation Commission (TNRCC). H-GAC will propose that the grant programs recommended as *State-level Actions* in this plan be adopted by the TNRCC. Potential grant projects have also been identified in the *Section E., Subregion Recommendations.*

H-GAC will provide input to the TNRCC in developing their follow-up grant program. However, its final form may necessitate changes and additional details be added to this section.

1. H-GAC Annual Work Program

A major recommendation of this plan is that the state continue funding H-GAC to conduct implementation efforts. Without a sustained follow-up effort, the plan will have little chance of promoting changes in the region's solid waste management practices.

Assuming adequate funding is provided, most of the short-term plan recommendations will be initiated by H-GAC through its annual work program. This work program will be developed annually with oversight from the Solid Waste Management Committee (SWMC) and adopted by the Board of Directors, prior to submittal to the Texas Natural Resource Conservation Commission (TNRCC).

2. Subregional Plans

Along with implementation actions initiated by H-GAC, there will be a need for additional planning at the subregion level. H-GAC has identified the need for eight subregional plans. All subregional planning should be initiated during the first year after the adoption of the regional plan, if possible. A funding formula based on a subregion's population needs to be established, with appropriate minimum and maximum amounts, similar to the state's current regional allocation formula. It is expected that subregional plans will not require more than two-years to complete, and some may be completed in one year.

If sufficient funds are not available to begin all subregional plans during the first year after regional plan adoption, the awarding of subregional planning grants will need to be prioritized. H-GAC will base the prioritization on the following factors:

- lack of short term solid waste disposal capacity
- problems or opportunities which require immediate action
- subregions where there is a readiness to proceed toward solutions to problems

H-GAC will work with local governments in each subregion to identify one agency/entity to apply for subregional planning funding. Subregional planning proposals may be submitted by existing authorities, such as waste disposal or river authorities, counties, cooperatives of local governments or a lead local government. For subregions where no lead agency can be been identified, H-GAC may prepare the subregional plan.

H-GAC will provide guidance in terms of subregional plan scope, format and recommendations to ensure consistency with the regional plan. H-GAC will also participate in the planning process when subregional plans are being developed, to maintain coordination throughout the region. After review by H-GAC and adoption by the TNRCC, subregional plans will become part of H-GAC's regional plan.

3. Implementation Grants

H-GAC has recommended that eleven state grant programs be established to assist regional councils and local governments implement the solid waste management plans. Two of these would provide ongoing funding for H-GAC's regional plan implementation efforts and for subregional planning. The remaining nine would be competitive grant programs for which a variety of entities could apply.

Funding for these programs would be drawn from the solid waste management fee administered by the Texas Natural Resource Conservation Commission (TNRCC). It is anticipated that this funding will provide a major impetus for short-term local implementation steps.

H-GAC will review all grant applications from the solid waste management fund in this region to determine consistency with the regional plan. These grants are likely to be awarded on a competitive basis, and requests will probably exceed the funds available. If the state bases implementation grant awards on regional allocations, H-GAC will need to prioritize applications.

The top priority for immediate local funding should be the recommended "fast track" grants to support local governments in responding to Subtitle D mandates. Since fast-approaching deadlines are involved, these funds should be made available as soon as possible, even prior to completion of regional planning.

During the first year after plan adoption, H-GAC's top priorities will be to direct funding to:

- o multi-jurisdictional or regional projects
- o communities in subregions facing loss of disposal capacity due to Subtitle D or other factors
- o communities in subregions where other solid waste management emergencies or short-term opportunities require immediate action
- o programs which have the potential to serve as a pilot or model for communities throughout the region

If sufficient funding remains after priorities are met, H-GAC will encourage the award of grants to cover a broad range of solid waste management activities, (e.g. waste reduction, recycling, special waste and public education) and the distribution of funding in the eight planning subregions. H-GAC will also establish other criteria for applications, such as local capability and prior local efforts.

4. Permit and Project Review

As it has for the past seven years, H-GAC will continue to review solid waste management projects and facility permit applications for consistency with the regional plan. Project review will continue to be submitted to the TNRCC for their consideration through the Texas Review and Comment System (TRACS). H-GAC staff will review projects following the 6-step process outlined below

Step 1. Staff Review. The first step is a staff review of the project for how well it meets the goals, objectives and recommendations of Resource Responsibility. This includes recommendations for the H-GAC region and subregional recommendations.

Step 2. Local Government Contact. Contact is made with the elected officials in the jurisdiction where the project is located. Local officials are sent a letter detailing the project review process, Board meeting dates, and highlights of the application (local officials are county commissioners in whose precinct the project is and, if applicable, council members whose district the project is in or mayor in at-large district communities) . They are given a date to respond, so that their technical comments, and consistency with local plans and ordinances can be included in the project review.

Step 3. Site Visit and Applicant Contact. This step includes a site visit and coordination with the applicant. The applicant is generally asked to visit the site with staff and/or discuss the permit review. Staff utilizes this meeting with the applicant to obtain answers to any questions concerning the project and utilizes the site visit to check surrounding land use and traffic circulation patterns.

Step 4 Final Review Drafted. The final review is drafted with staff recommendation of consistent, consistent with comment, or inconsistent with regional plans and policies of H-GAC. The draft review is mailed to H-GAC Projects Review Committee (a committee of the Board of Directors), Board of Directors and the applicant.

Step 5. Project Review and Board Meeting. Staff presents the review to the Projects Review Committee. The committee generally asks questions concerning the project. If present, the applicant will have the opportunity to answer any questions concerning the project, otherwise staff will answer any questions. The committee will then make a finding concerning the consistency of the project. The Project Review Committee then reports their findings to the Board of Directors. The Board of Directors will then vote on the project. Historically the Project Review Committee has met prior to the Board of Directors meeting on the third Tuesday of every month.

Step 6. Review Submittal. The findings of the H-GAC Board of Directors is then submitted to the State through the TRACS network.

The entire project review process, as utilized by H-GAC staff now, usually takes place within a 30 day period from time of receipt of the plan to Board action.

5. Implementation Timetable

The implementation timetable is presented on the following pages.

G. Monitoring and Evaluation

This section describes how the implementation of the solid waste management plan will be monitored and evaluated. The primary basis for monitoring the impact of the plan's recommendations will be a reduction in per capita waste disposal in the H-GAC region. Individual program elements will also be assessed and evaluated for their effectiveness in achieving plan goals and objectives.

1. Monitoring Waste Disposal

The primary goal of an integrated solid waste management system is to reduce the amount of waste requiring disposal. This goal can be accomplished by waste reduction and recycling.

H-GAC will use a baseline 6.2 lbs/person/day waste generation rate, which is derived from the Texas Department of Health's *Permitted Facility Information 1990 Annual Report.* The success of waste reduction and recycling efforts will be based on meeting goals for reducing this figure in the H-GAC region. H-GAC's waste reduction and recycling goals are as follows:

- Make every effort to achieve the State recycling goal of 40% by 1994, with the implementation of the GLO market development study and state funding programs.
- Achieving a 15% reduction in waste generation by the year 2012.
- Achieving recycling rates of 20% by 1997, 40% by the year 2002 and 65% by the year 2012.

It should be noted that the H-GAC 1997 recycling goal is below the 1994 state goal of 40%. While H-GAC's longer-term goals "catch up" with and eventually exceed the targets set by S.B. 1340, it is felt that the region's current "infrastructure" for recycling is not adequate to realistically meet the state goal for 1994. However, H-GAC and its local governments will make every effort possible to reach the state goal by 1994 with the assistance of the state. In order to achieve this the General Land Office (GLO) must develop and implement the market development study, also mandated in S.B. 1340, as quickly as possible. The state should also create an assistance program to assist local governments in developing the infrastructure necessary to implement recycling programs.

Figure 5 shows projected waste generation for the H-GAC region, assuming a constant waste generation rate of 6.2 lbs/person/day. Figure 6 shows the impact of attaining H-GAC waste reduction and recycling goals on the amount of waste disposed in the region. Figure 7 shows the impact of the 40% recycling goal on waste generation. Figure 8 shows the region's landfill capacity, at current disposal rates. Figure 9 shows how this capacity will be extended by achieving waste reduction and recycling goals and Figure 10 shows how this capacity will be affected by the State 40% recycling goal.

Figure 5: Waste Generation in the H-GAC Region

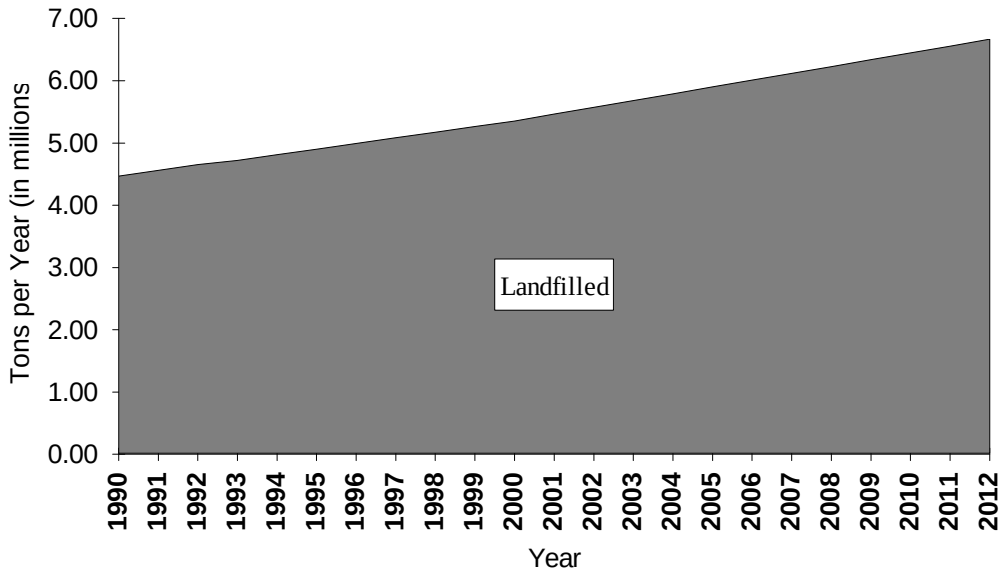


Figure 6: Effect of Waste Reduction and State Goal of 40% Recycling by 1994 on Waste Generation

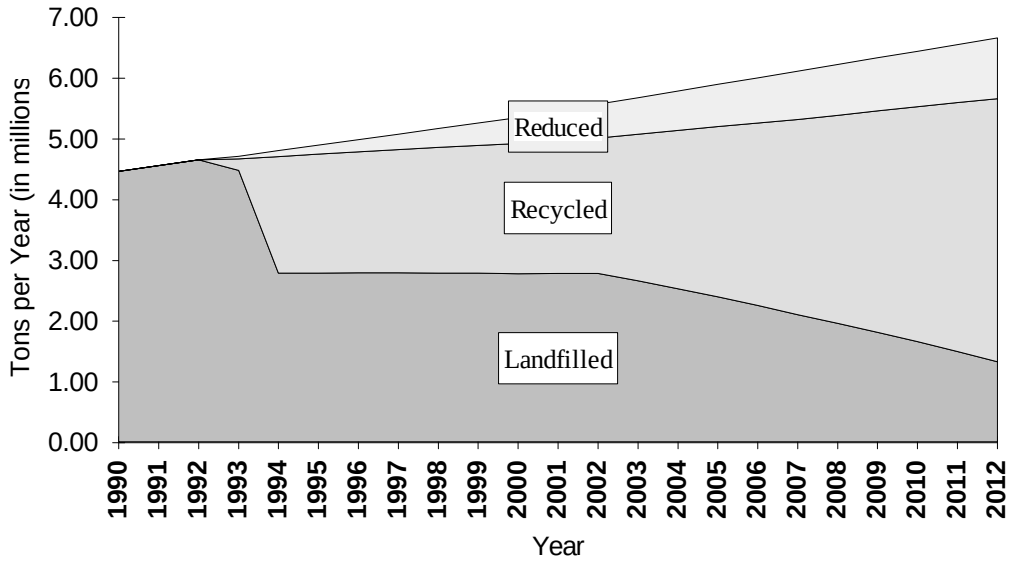


Figure 7: Effect of Waste Reduction and Recycling Programs on Waste Generation

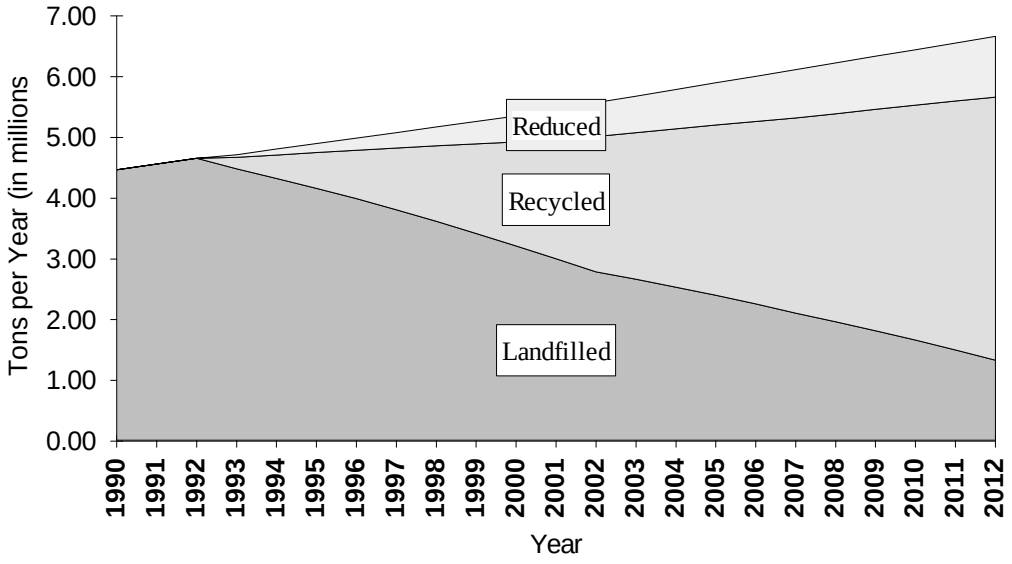


Figure 8: H-GAC Region Total Landfill Availability without Waste Reduction and Recycling

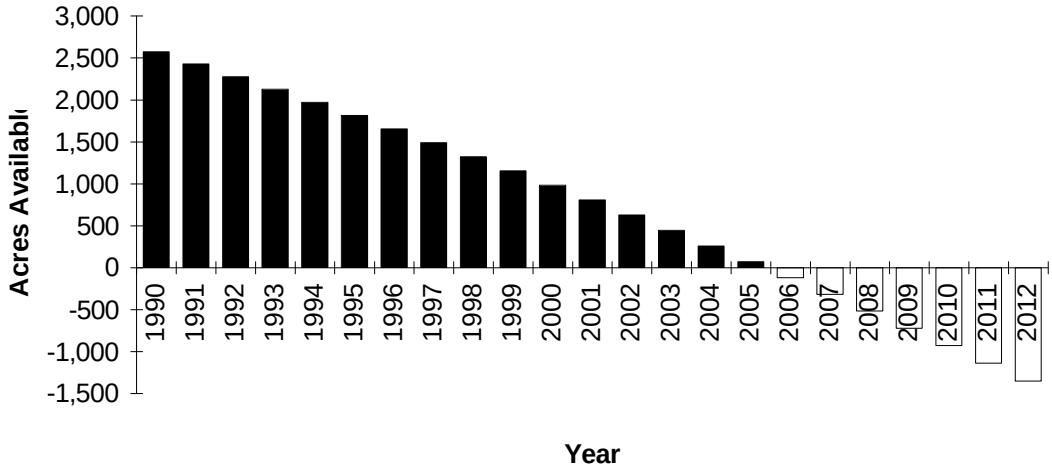


Figure 9: H-GAC Region Total Landfill Availability with Waste Reduction and State Recycling Goal of 40%

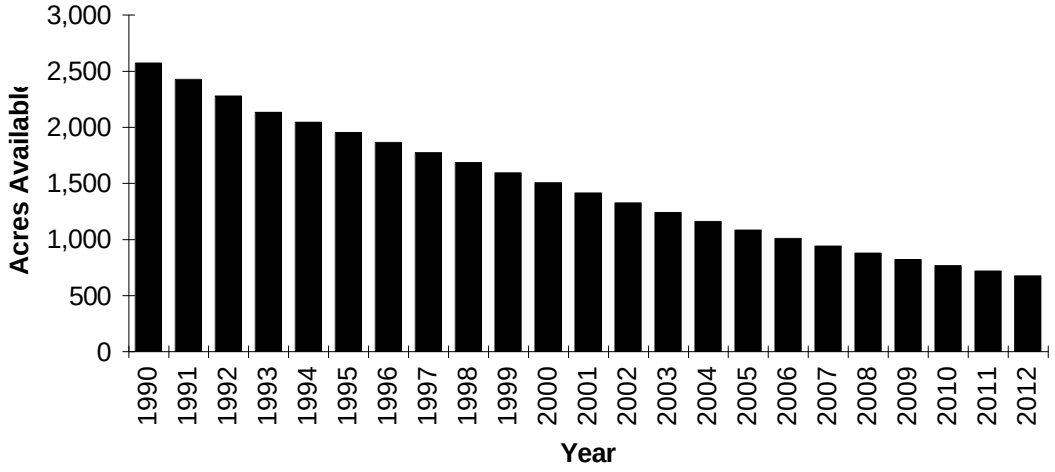
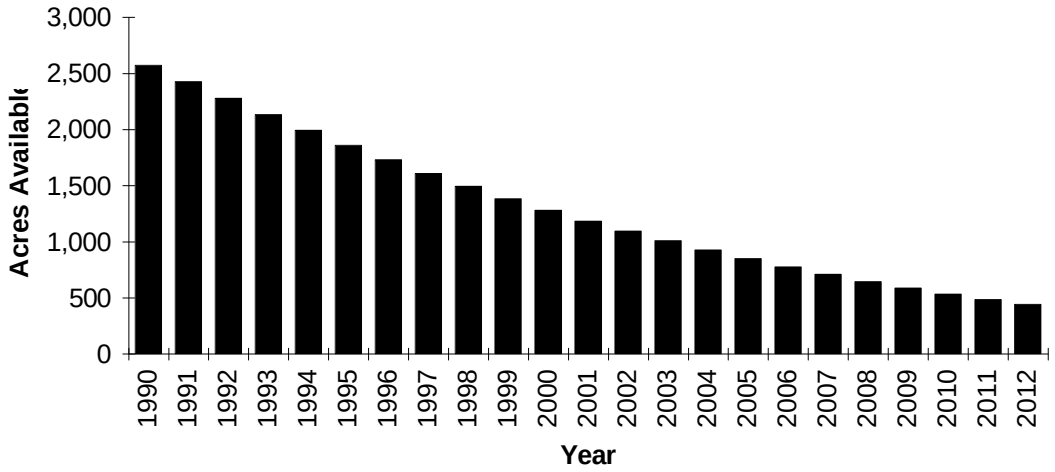


Figure 10: H-GAC Region Total Landfill Availability with Waste Reduction and Recycling Goals



H-GAC's annual monitoring program will employ self-reporting data from landfills in the region from the state's *Permitted Facility* annual report, along with data from the state's recycling monitoring program, to determine regional waste reduction, recycling and disposal rates. Adjustments will be made to these figures to account for waste import/exportation and for recyclables which are not normally in the municipal solid waste stream, such as auto salvage.

H-GAC has recommended that state landfill reporting requirements be modified to provide better accounting for waste import/exportation and for on-site materials recovery programs. These modifications, along with a timely provision of the annual *Permitted Facility* reports will be essential for H-GAC to conduct a meaningful monitoring effort.

For the first ten years of the planning period, H-GAC will use its monitoring effort as an informational and evaluation tool. In years 11-20, H-GAC assess the progress of achieving regional goals at the subregional and local levels. If waste reduction and recycling targets are not being met, H-GAC may recommend the study of "flow control" by local governmental entities, cost penalties by the state authorized management entities or other measures to assure compliance throughout the region. The results of the annual regional monitoring program will be included in an annual report of plan implementation efforts.

2. Program Evaluation

In addition to calculating annual waste, reduction and disposal rates, H-GAC will also conduct a qualitative evaluation of plan implementation efforts. This evaluation will be based on two annual surveys, one for local government activities and programs and one for area recyclers. The evaluation will be detailed, along with monitoring data, in an annual report which will be submitted to the Texas Natural Resource Conservation Commission (TNRCC).

Annual Survey of Activities and Programs

H-GAC will conduct an annual survey of local government solid waste management programs, similar to the survey used in the development of this plan. The survey will include the following elements:

- o waste reduction programs
- o recycling and composting programs
- o collection and disposal arrangements
- o special waste programs
- o interlocal agreements
- o educational programs

H-GAC will tabulate the results of this survey for use in keeping the plan database current and for the purpose of evaluating progress in plan implementation.

Annual Recyclers Survey

H-GAC will continue to conduct an annual recyclers survey, based on the model developed in gathering data for this plan. The survey will be sent to all public, non-profit and private entities in the region which are involved in recycling. Sources for the survey mailing list will include H-GAC's existing recyclers database, *Clean Houston's* recycling inventory, and the TNRCC's *Recycle Texas: A Reuse, Recycling and Product Directory.*

Information gathered in the survey will include: size of operation, hours, materials accepted, processing requirements and future plans. H-GAC will also continue to monitor prices in a wide range of materials categories. Close coordination with the TNRCC recycling rate monitoring program will be maintained so that information can be shared and efforts will not be duplicated. Information gathered in this survey will be used in program evaluation, and will be compiled into a report which will be available to local governments and the general public.

Annual Report

The results of monitoring efforts and the local government and recyclers surveys will be presented to the H-GAC Solid Waste Management Committee (SWMC), for review and evaluation. Progress will be assessed on each of the plan's recommendations, as well as on subregional planning efforts. The SWMC will also maintain its various subcommittees and working groups: Waste Reduction/Reuse; Recycling; Projects Review/Siting; Special Waste; Interlocal Agreements; Public Education; Composting; and, Tires. These groups will meet on an ad hoc basis to assist with evaluation and to advise the SWMC on special issues which may arise during plan implementation. A report, containing results of the monitoring, survey and evaluation efforts will be presented annually to the H-GAC Board of Directors and submitted to the TNRCC.

Plan Revisions and Updates

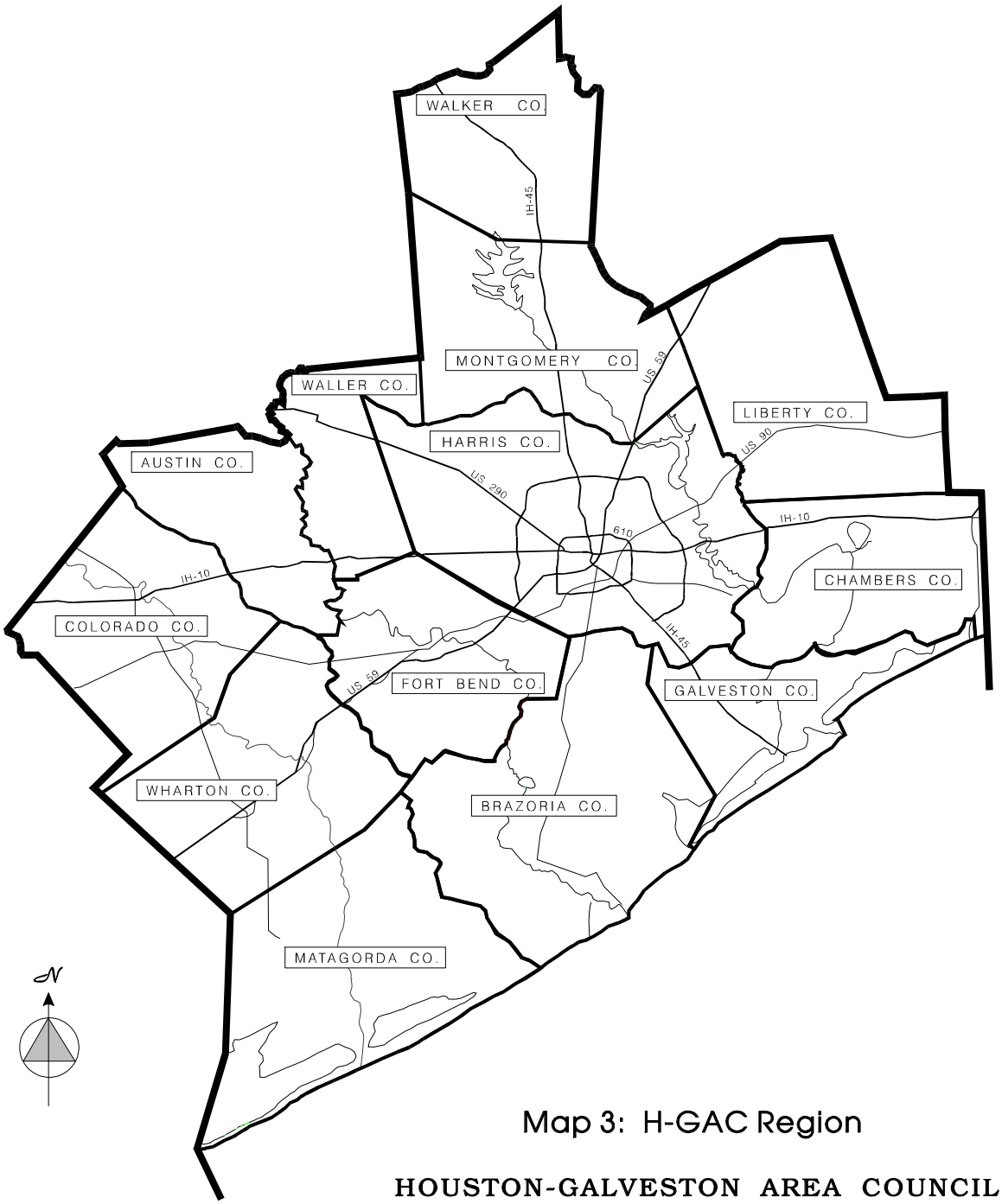
It is recommended that the H-GAC solid waste management plan be updated every five years. This update should include current base data, review of legislation, technology and recycling markets. Goals, objectives and recommendations may also be revised as part of this update, depending on conditions. Plan updates will require a public hearing and must be adopted by the H-GAC Board before submittal to the TNRCC.

Additionally, upon the recommendation of the SWMC, the H-GAC Board may also amend the plan when it is deemed necessary. Examples of conditions which may require plan amendments include:

- significant changes in legislation or regulations
- changes in available funding
- the availability of new technology
- changes in recycling markets
- opportunities or threats which require immediate action

Plan amendments will also require a public hearing and adoption by the H-GAC Board before formal submittal to the TNRCC.

PART III
Region Analysis



Map 3: H-GAC Region

HOUSTON-GALVESTON AREA COUNCIL

PART III
Region Analysis

A. Region Description

1. Physical Characteristics

H-GAC's planning area is the Gulf Coast State Planning Region -- a diverse area of southeast Texas encompassing approximately 12,500 square miles along the upper Texas Gulf Coast (see Map 3 on facing page). The region includes thirteen counties: Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Walker, Waller and Wharton.

Four of H-GAC's counties -- Brazoria, Chambers, Galveston and Matagorda -- have direct coastal frontage on the Gulf of Mexico. Galveston Bay and its complex estuarine system are also located within the region. There are several large bodies of freshwater in or adjacent to the region, including Lake Livingston, Lake Conroe and Lake Houston. Major drainage systems in the region include the Colorado, Brazos, San Bernard, San Jacinto and Trinity river basins.

Topography

The region's topography is characterized by rolling pine and hardwood forest in the north with elevations up to 450 feet (in Walker County), sloping gently toward the southeast to flat coastal plains along the Gulf of Mexico with elevations at or near sea level. Given the flat character of much of the area, there is high potential for flooding during heavy rains and many low lying areas are classified as wetlands in the region.

Climate

The climate in the region is characterized by high humidity and moderate, subtropical conditions. The average annual rainfall is 45 inches and the mean annual temperature is 68F.

Soils

For the most part, predominant soil types within the region follow the boundaries of the coastal plain and the inland forested areas. The soils along the coastal plain are generally clay and clay loam and are very slowly permeable. The soils farther inland are made up of a sandy loam surface and clay subsoil, resulting in a perched water table. Some parts of the region, particularly in Austin, Colorado, and Wharton counties, have had extensive sand and gravel extraction.

Geology/Hydrology

Large volumes of water are withdrawn from the region's aquifers for use by cities, industry and agriculture. Irrigated agriculture accounts for the largest use of groundwater

within rural counties, while withdrawals for municipal and industrial purposes are the most significant uses in the urbanized areas.

The major aquifer underlying the region is the Gulf Coast Aquifer that stretches along the coastal lowlands of Texas. The Brazos Aquifer, a minor aquifer, extends from the Brazos River into Waller, Austin, and Fort Bend counties. In general, the primary water- bearing formations in the region both thicken and dip downward in the direction of the Gulf of Mexico, therefore occurring at greater depths along the coast. A generalized geologic cross section of the region is shown in Figure 11. While water can be pumped from most formations underlying the region, groundwater recharge potential and the rate of water flow vary considerably. Areas of high groundwater recharge potential occur primarily in Montgomery County and the northern portions of Waller and Austin counties where outcrops of Lagarto Clay and Oakville Sandstone are found. These formations are characterized by highly-permeable sands and gravels. Recharge of both major and shallow localized aquifers occurs in these areas. Galveston Island and the Bolivar Peninsula are also overlain by sands and gravels with a high groundwater recharge potential. However, only shallow aquifers of local significance are affected. Areas of moderate recharge potential occur primarily in the western and eastern portions of the H-GAC region. These areas are composed primarily of interbeded sands, silts, and clays. In general, only recharge of shallow aquifers of local significance occurs.

Although isolated recharge areas are present, the majority of the central and southern portions of the region is overlain by the impermeable Lissie Formation and Beaumont Clays. Ground water recharge of water-bearing formations in the Houston area occurs primarily by water moving slowly from recharge areas in the north. Continuous pumping of groundwater resources in the Houston area since 1880 has led to a significant lowering of the water table.

Surface conditions can greatly influence the amount of groundwater recharge that occurs in an area. Higher precipitation and lower evapotranspiration of surface waters result in higher recharge of aquifers. Evapotranspiration is generally greater in areas with higher temperatures, higher winds, more vegetative cover, lower humidity, and where the soils have good holding capacity. In general, evapotranspiration of surface waters reduces the overall effects of precipitation. Research stations for the upper Texas coast are located in Chambers and Fort Bend counties. The precipitation and evapotranspiration data gathered at these points, along with the net precipitation levels, are shown in Table 1. Surface cover such as manmade impervious surfaces and vegetative cover can also affect ground water recharge. Impervious surfaces such as parking lots and concrete-lined drainage ways reduce ground water recharge by preventing water from entering the ground and by increasing surface runoff. Vegetative cover can increase groundwater recharge by retarding runoff and thus encouraging ponding in areas where recharge can occur.

Table 1: Precipitation and Evapotranspiration, 1990

Month	Precip-itation	Evapo-transp.*	Net Precip.	Precip-itation	Evapo-transp.	Net Precip.
	Fort Bend County			***Chambers County***		
January	6.53	2.33	4.20	9.21	2.27	6.94
February	2.06	2.12	-0.06	3.51	2.41	1.10
March	4.38	3.70	0.68	4.98	3.53	1.45
April	6.03	4.07	1.96	3.58	5.03	-1.45
May	2.83	5.34	-2.51	3.55	5.50	-1.95
June	0.44	7.80	-7.36	5.46	7.50	-2.04
July	2.84	6.17	-3.33	4.52	6.61	-2.09
August	3.03	7.13	-4.10	0.36	7.42	-7.06
September	2.32	4.52	-2.20	5.30	4.94	0.36
October	1.88	4.35	-2.47	4.65	4.21	0.44
November	2.06	2.54	-0.48	4.72	2.79	1.93
December	2.08	2.33	-0.25	3.59	2.03	1.56
Total	36.48	52.40	-15.92	53.43	54.24	-0.81

* Evapotranspiration was calculated using pan evaporation climatological data and multiplying by a factor ranging from .70-.80, provided by the State Climatologists.

Source: *Climatological Data: Texas, 1990 Annual Report.*

Subsidence and Faults

Extensive extraction of groundwater and the resulting decline in artesian pressure causes surface subsidence and exacerbates fault activation. In response to severe subsidence in the greater Houston area, the Texas Legislature created the Harris-Galveston Coastal Subsidence District to regulate the withdrawal of groundwater within Harris and Galveston counties. Through the implementation of its 1976 District Plan, the Subsidence District has recorded considerable progress in controlling subsidence in past problem areas, particularly in southeastern Harris County and Galveston County. The District's successes are attributable to both the increased availability of surface water and the conservation of water by industry. Fort Bend County has also formed a Subsidence District to regulate groundwater withdrawal within its borders. An initial district plan was developed for Fort Bend County in 1990.

Subsidence. In the Harris-Galveston District, subsidence has more recently become an issue in western and north central Harris County, where increased groundwater withdrawal has occurred due to extensive development. Even with the implementation of the District's 1985 plan and regulations on withdrawal, it is predicted that additional subsidence will occur. Although there may be some development of surface water supplies and construction of treatment and transmission systems, this is not expected to offset significantly the anticipated subsidence.

The Fort Bend District has experienced its greatest subsidence in the northeastern part of the county. This area is most susceptible to subsidence due to the degree of water level decline and the thickness of the compressible clay found there.[1]

Faults. Active surface faults are found sporadically throughout the region. These are faults verified by surface evidence of movement, cracked roads and structures, and land-surface subsidence. In Harris County, faults are found along Interstate 10 (generally eastward from Dairy Ashford toward downtown Houston) and along Westheimer Road. A group of surface faults are found near NASA's Johnson Space Center and around Ellington Field east of Interstate 45 in the southeastern part of the county. Other surface faults are found in the Baytown area along the San Jacinto River and in northern Harris County, stretching from Tomball west to Waller County.[2]

Protected Areas

Federally protected areas are lands under federal control where the siting and operation of landfills will be restricted.

Wetlands. Extensive salt and freshwater marshes along the Texas Gulf Coast provide many benefits to the region. Some of these are filtering of pollutants, storage of floodwater, replenishment of groundwater supplies, and wildlife habitat. An increased level of human activity in sensitive areas is affecting wetlands and the entire coastal environment. *The Region II Wetlands Regional Concept Plan* was completed by the U.S. Fish and Wildlife Service (USFWS) in 1989. The Region plan identified nine areas within the region as high-priority wetland sites for possible acquisition. Wetlands proposed for acquisition as a result of the plan must be evaluated and ranked on a national priority scale through USFWS's Land Acquisition Priority System (LAPS). Acquisition may then occur. USFWS priority wetlands in the region include those shown in the table below.

Table 2: National Priority Wetlands in the H-GAC Region

Wetland	County	USGS Location	Size (acres) .
Freshwater Lake	Brazoria	Freeport	1,100
Hoskins Mound	Brazoria	Christmas Point, Danbury Hoskins Mound, Oyster Creek	32,000
Middleton Marsh	Chambers	High Island, Stanolind	3,700
Horseshoe Marsh	Chambers	High Island	1,000
Lower Marsh	Chambers	High Island	5,200
Robinson Bay Marsh	Chambers	Frozen Point, Lk. Stephenson	13,300
Delhomme Marsh	Chambers	Cove	2,176
Pierce Marsh	Galveston	Virginia Point	1,360
Wirt-Davis	Liberty	Davis Hill	20,500

Source: U.S. Fish and Wildlife Service, 1989.

[1]*Ground-water Withdrawals, Water-Level Changes, Subsidence, Water Quality in Fort Bend County, Texas, 1969-87.* U.S. Geological Survey.

[2]*Land and Water Resources in the Houston-Galveston Area Council.* Bureau of Economic Geology.

There are many more wetlands in the eight county region. The U.S. Department of Interior is in the process of completing a National Wetlands Inventory. The inventory for the H-GAC region, while not complete yet, is contained on over 140 United States Geological Survey maps, listing identified areas of standing water which are possible wetlands.

Federal Resources. The Sam Houston National Forest is located in Walker and Montgomery Counties in the H-GAC region and Big Thicket National Preserve in Liberty County. The National Forest and Preserve areas are protected from development which will have a negative impact on the resource. There are also four wildlife refuges in the region which are protected from solid waste management facilities. They are the Anahuac National Wildlife Refuge in Chambers County, Attwater Prairie Chicken Refuge in Colorado County, Big Boggy Wildlife Refuge in Liberty County, and San Bernard Wildlife Refuges in Brazoria County. The Addicks and Barker Reservoirs are in Harris County. The flood control projects are protected areas operated by the U.S. Army Corps of Engineers.

State Resources. There are numerous state and local parks and refuges which will impact the siting of solid waste management facilities. H-GAC is working on creating a database of these resources from Texas Park and Wildlife and local government sources.

Land Use

The overall pattern of land use in the region is very diverse. The Houston metropolitan area includes heavy industry, high-rise office and residential buildings, large apartment complexes, regional shopping malls and single-family residential subdivisions. While most of the higher-intensity land uses are located in Harris County, there are urban and suburban areas elsewhere in the region, particularly in Fort Bend, Galveston and Montgomery counties.

Industrial activities, primarily petroleum and petrochemical industries, are also prominent. Much of this activity is located in the eastern portions of Houston and Harris County, as well as in Pasadena, Baytown, Deer Park, and La Porte. Other concentrations of heavy industry are located in the Brazosport and Texas City areas.

However, the majority of the region's total land area remains undeveloped. The non-urbanized counties are predominantly agricultural. There also are large forested areas in the northern part of the region and along the river and tributary systems.

Existing land use and trends for the Houston metropolitan area and the non-metropolitan counties are discussed below.

Houston Consolidated Metropolitan Statistical Area (CMSA). The Houston CMSA[3] is the Census Bureau-defined metropolitan area including and surrounding Houston. The

[3] Consolidated Metropolitan Statistical Areas (CMSAs) are large Metropolitan Areas (MAs) of more than 1,000,000 person in which two or more Primary Metropolitan Statistical Areas (PMSAs) have been

CMSA includes Brazoria, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller counties. General land use characteristics of the CMSA counties are described as follows.

Brazoria County contains two suburban areas: the Pearland-Manvel-Alvin area in the northern part of the county and the Brazosport area in the southern portion. Brazosport also has considerable industrial development. The remainder of the county is mostly rural with a few medium-sized communities. There are two national priority wetlands located in Brazoria County, Freshwater Lake

Fort Bend County is a rapidly-growing area and one of the region's major suburban areas. Most of the growth is in the county's northeast sector, which includes a portion of the City of Houston. Much of the new development in the county is single-family residential or mixed-use "master planned" communities, although there also is some light manufacturing. West of the Brazos River, the county is much more rural in character.

Galveston County includes three areas with distinct land use patterns: the highly-urbanized eastern portion of Galveston Island; the Texas City-La Marque area, which is highly industrialized; and League City-Friendswood, a fast-growing suburban area. Land availability in Galveston County is limited due to existing development and natural barriers, and much of its open land does not have good transportation access.

Harris County encompasses the highly-urbanized central city of Houston, which includes the full spectrum of land use types and intensity. Major high-rise office and commercial developments are located in the Central Business District, the Galleria area, the Texas Medical Center, Greenway Plaza, Greenspoint/Northbelt, and Clear Lake City/NASA. Other developed commercial areas include Plaza Del Oro, Bellaire, Westchase, Sharpstown, West Houston, Brookhollow, and Northwest Crossing. The county also has numerous major retail centers and extensive urban and suburban residential development.

Additionally, there are vast industrial concentrations around the Houston Ship Channel and in the city's near northwest and northeast quadrants. However, despite the level of urbanization, there is still a considerable amount of undeveloped land in Harris County and the City of Houston. This is due in part to "leapfrog" development which has left less attractive parcels of land vacant but surrounded by urban or suburban land uses.

Liberty County features numerous highly-forested areas. Its predominant land use is agriculture. Rice and soybeans are the primary crops, and there are also some lumbering activities. The county has three primary towns: Cleveland, Dayton and Liberty. Some industrial development is also scattered throughout the county. The Trinity River bisects the county, and major flooding along its course has limited development in the county.

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designated. PMSAs consist of a large urbanized county or cluster of counties that demonstrate very strong internal economic and social links, in addition to close economic and social links with other portions of the larger Metropolitan Area.

However, completion of a new freeway between Liberty County and Houston may spur development activity in the area.
After Fort Bend, Montgomery County is the fastest-growing suburban area in the region. The Woodlands, a master-planned "new town," is located in southern Montgomery County, which has attracted considerable residential, commercial and light industrial development. The Kingwood and Porter areas in the southeast portion of the county are also growing rapidly. Conroe, a medium-sized city in central Montgomery County, is also growing and may eventually "link up" with The Woodlands to the south. Lake Conroe, to the northwest, is a major recreational destination in the H-GAC region. With the exception of several small towns, most of the rest of the county is agricultural or wooded. Significant portions of northern Montgomery County consist of the Sam Houston National Forest.

Waller County also includes forested areas but is primarily an agricultural area. Key crops are rice and corn, with several thousand acres irrigated for rice production. Aside from several small towns, the county is largely undeveloped. However, Waller County is traversed by two major highways, Interstate 10 and U.S. 290, and will undoubtedly face additional development pressure during the planning horizon.

Non-CMSA counties. The non-CMSA counties in the region, with the exception of Chambers County, are not adjacent to Harris County. All of these non-CMSA counties are more rural in character. A general description of land use patterns in these counties follows.

Austin County is largely agricultural though it does contain several small towns and Stephen F. Austin State Park. However, its location less than fifty miles from Houston on Interstate 10 will probably make it an attractive location for future development, especially in the vicinity of Sealy.

Chambers County has considerable coastal frontage along Trinity and Galveston bays, but it remains largely agricultural -- primarily rice and soybeans. There are ten existing county parks as well as the Anahuac National Wildlife Refuge within Chambers County. The western portion of the county is accessible to Interstate 10 and adjacent to Baytown, so it will likely experience additional development. Much of the land in the eastern portion is situated much farther from Interstate 10, which traverses the northern part of the county.

Colorado County is primarily agricultural with rice, corn, grains and cotton its major crops. Several thousand acres are currently irrigated for rice fields. There are three small towns in the county, which is traversed by the Colorado River.

Matagorda County is a coastal county that, aside from one medium-sized and one small town, is primarily agricultural and undeveloped. Thousands of acres in the county are irrigated for rice and turf. The San Bernard National Wildlife Refuge is located in the

eastern part of the county and extends into Brazoria County. Matagorda County is the site of the South Texas Nuclear Power Plant, a major employer in the area.

Walker County, which includes the medium-sized City of Huntsville, is highly forested. Sam Houston National Forest accounts for 54,029 acres in the county -- roughly 10% of the county's total acreage. The state prison system owns an additional 21,200 acres in the county. Most of the remainder of the county is agricultural or undeveloped.

Wharton County, one of the leading rice-producing counties in the state, is agricultural and also largely undeveloped. However, the small towns in the county have recently been successful in attracting a number of manufacturing interests to the area.

Transportation

Major limited-access interstate and state highways radiate from the Houston metropolitan area throughout the H-GAC region as shown on Map 4. Even though the region has an extensive transportation system, there are still potential barriers to the transport of solid waste within the region. Certain parts of the region, particularly in the rural counties, do not have good transportation linkages. This may increase travel distances and costs for waste transport.

Other transportation barriers occur naturally. For example, only major roadways have crossings on the Brazos and San Bernard rivers. Galveston Bay separates the Bolivar Peninsula and Crystal Beach from the rest of Galveston County. The western and eastern portions of Chambers County are separated by Trinity Bay and Lake Anahuac. In the northern part of the region, Sam Houston National Forest restricts transportation between Walker and Montgomery counties, except by one major freeway and rail corridor.

Railroads. The H-GAC region has an extensive rail network as shown on Map 4. Major railroads include the Missouri-Pacific; Atchison, Topeka & Santa Fe; Missouri-Kansas-Texas; Galveston- Houston & Henderson; Chicago, Rock Island & Pacific; and Southern Pacific. There is potential for using rail as a means of solid waste transport, particularly in highly-populated corridors. However, the necessary infrastructure of transfer stations and loading facilities is not currently in place.

Physical Characteristics and Solid Waste Management

As mentioned above the physical characteristics discussed will have a significant impact on solid waste management activities and sites in the H-GAC region. H-GAC is in the process of establishing a database of these characteristics and has more detailed information on them for review in its library. These documents include the 1974 *Texas Outdoor Recreation Plan: Regional Environmental Analysis, 1990 Texas Outdoor Recreation Plan*, and the 1975 *Land and Water Resources in the Houston-Galveston Region* a map set completed by the Bureau of Economic Geology. Current census data and population projections are available through the Data Services Department. Long range transportation plans for the region are also available from the Transportation

Department at H-GAC. The continued development of H-GAC's Geographic Information System (GIS) will include much of the information discussed in this planning document.

2. Demographic Characteristics

Population Growth

The region's population grew from nearly 3.3 million in 1980 to almost 3.9 million in 1990. This represented a 19% increase over the decade. It is expected that population will continue to grow at this pace and increase by more than 40% over the next twenty years. Among the region's 13 counties, Harris, Brazoria, Fort Bend, Galveston, and Montgomery counties should experience the greatest growth.

Most of the counties in the region have experienced growth in the last ten years with the exception of Colorado, Matagorda and Wharton counties. The percentage growth of population in each county from 1980 to 1990, as well as the projected percentage growth from 1990 to 2010, are shown in Table 3. Census tract level population data by subregion is included in the Appendix 4.

Table 3: Population Growth, 1980, 1990 and 2010 Projection

County	1980	1990	% Growth 1980-90	2010 Projection*	% Growth Projected
Harris	2,409,547	2,818,199	17.0	3,959,395	40.5
Fort Bend	130,846	225,421	72.3	387,792	72.0
Galveston	195,940	217,399	11.0	311,916	43.5
Brazoria	169,587	191,707	13.0	280,500	46.3
Montgomery	128,487	182,201	41.8	325,499	78.7
Liberty	47,088	52,726	12.0	76,450	45.0
Walker	41,789	50,917	21.8	77,754	52.7
Wharton	40,242	39,955	-0.7	53,274	33.3
Matagorda	37,828	36,928	-2.3	54,188	46.7
Waller	19,798	23,390	18.1	38,179	63.2
Chambers	18,538	20,088	8.4	30,214	50.4
Austin	17,726	19,832	11.9	30,932	56.0
Colorado	18,823	18,383	-2.3	24,566	33.6
H-GAC Region	3,276,236	3,897,146	19.0	5,650,659	50.0

* 2010 projections are H-GAC forecasts as of 7/23/91. Methodology is provided in Appendix 5.

Source: U.S. Census, 1980, 1990.

Population Density

The average population density in the 13-county region has increased over the last decade from 263 persons per square mile to 315 persons per square mile. Table 4 illustrates the trend in population densities for all thirteen counties. Map 5 illustrates the distribution of population across the region.

Household Size

Household sizes in 1980 and 1990 for all counties in the region are shown in Table 5.

Table 4: Population Density (persons/sq. mi.), 1980 and 1990

County	1980	1990
Harris	1,398	1,625
Galveston	491	545
Fort Bend	151	257
Montgomery	118	174
Brazoria	119	136
Walker	53	65
Waller	39	46
Liberty	40	45
Wharton	37	37
Chambers	30	33
Matagorda	33	33
Austin	27	30
Colorado	20	19
H-GAC Region	263	315

Source: U.S. Census, 1980, 1990.

Table 5: Household Size, 1980 and 1990

County	1980	1990
Fort Bend	3.20	3.14
Chambers	2.96	2.88
Brazoria	3.00	2.86
Montgomery	3.09	2.84
Liberty	2.88	2.79
Matagorda	2.87	2.79
Wharton	2.86	2.77
Waller	2.93	2.76
Harris	2.75	2.72
Galveston	2.79	2.64
Austin	2.71	2.62
Colorado	2.67	2.57
Walker	2.54	2.49
H-GAC Region	2.87	2.76

Source: U.S. Census, 1980, 1990.

Smaller household sizes generally occur in areas with a greater percentage of multi-family dwellings. However, the smaller household sizes seen in both Austin and Colorado counties may be due to the large number of older families with no children living at home. Walker County's small household size can be attributed to the transient Sam Houston State University population. (Inmates of the state prison system are listed as residing in "Group Quarters" and are not represented in household figures.) Some of the larger household sizes, particularly in Brazoria, Chambers, Fort Bend and Montgomery counties, reflect the large amount of suburban and single-family housing development in these parts of the region.

Cities

Five of the region's cities had populations of 40,000 or more in 1990. Their combined population accounted for 49% of the 1990 regional total -- down from 57% in 1980. An additional twenty-three cities had populations between 10,000 and 40,000 in 1990. Forty two cities had populations under 1,000. Approximately 80% of all cities have a population under 25,000. Maps 6 and 7 show the cities' populations. All cities over 10,000 population and their 1980-90 growth are shown in Table 6.

Table 6: Cities over 10,000 Population, 1980 and 1990

City	1980	1990	% Growth
Houston	1,611,382	1,630,553	1.2
Pasadena	112,560	119,363	6.0
Baytown	57,339	63,853	11.4
Galveston	61,902	59,070	4.8
Texas City	41,201	40,822	0.9
Missouri City	20,487	36,176	76.6
League City	16,578	30,159	81.9
Huntsville	26,816	27,925	4.1
La Porte	19,226	27,910	45.2
Deer Park	22,648	27,652	22.1
Conroe	20,447	27,610	35.0
Sugar Land	11,599	24,529	111.5
Friendswood	10,719	22,814	112.8
Rosenberg	17,840	20,183	13.1
Alvin	17,877	19,220	7.5
Bay City	17,837	18,170	1.9
Pearland	13,958	18,697	34.0
Angleton	13,929	17,140	23.1
South Houston	13,293	14,207	6.9
La Marque	15,372	14,120	-8.1
Bellaire	14,950	13,842	-7.4
W. University	12,010	12,920	7.6
Humble	6,729	12,060	79.2
Freeport	13,444	11,389	-15.3
El Campo	10,462	10,511	0.5
Galena Park	9,879	10,033	1.6
Richmond	10,555	9,801	- 7.1
Clute	9,577	8,910	- 7.0

*Source: U.S. Bureau of the Census 1980, 1990.

The distribution of population between urban and rural areas also has implications for solid waste management planning. Table 7 illustrates this distribution, by county, in 1980. Figures for 1990 have not yet been released by the U.S. Census Bureau. These newer figures may show significant changes from 1980, particularly in those counties like Montgomery which experienced substantial growth.

Table 7: Distribution of County Population, 1980*

County	% Urban	% Non-Urban
Harris	96.4	3.6
Galveston	92.6	7.4
Fort Bend	74.2	25.8
Brazoria	63.6	36.4
Matagorda	59.5	40.5
Walker	57.3	42.7
Wharton	48.4	51.6
Colorado	41.7	58.3
Waller	41.0	59.0
Liberty	40.0	60.0
Austin	38.0	62.0
Montgomery	22.7	77.3
Chambers	5.0	95.0
H-GAC Region	87.9	13.1

*1990 data is not yet available from the Census Bureau.

Note: A generalized definition of the Census Bureau's "urban" classification is households in places of 2,500 or more people, or households in suburban areas with population density of greater than 1,000 persons per square mile.

Source: *County and City Data Book (1983).* U.S. Bureau of the Census.

3. Economic Characteristics

From 1970 until the early 1980s, the Houston-Galveston region was one of the fastest growing in the country. Beginning in late 1982, sharply-falling oil prices resulted in a severe economic downturn throughout the region. However, the economy has improved in recent years, and renewed job growth is expected to continue. Historic and projected employment growth by county is shown in Table 8.

Major Employment Centers

The Houston CMSA is the tenth-largest urban concentration in the United States (in terms of population). It incorporates approximately 8,000 square miles, contains almost 3.6 million people and employs more than 1.7 million workers. There are a number of major employment centers scattered throughout the region. These employment centers produce varying types and quantities of waste.

Table 8: Employment Growth, 1980, 1990 and 2010 Projection

County	1980	1990	% Growth 1980-90	2010 Projection*	% Growth Projected
Harris	1,360,407	1,571,982	15.6	2,275,482	44.8
Galveston	76,543	83,474	9.11	123,115	47.5
Brazoria	54,894	77,391	41.0	116,891	51.0
Fort Bend	33,033	57,211	73.2	117,061	104.6
Montgomery	20,821	48,008	124.6	103,303	115.2
Walker	12,089	21,356	76.7	34,513	61.6
Wharton	10,918	13,790	26.3	19,357	40.4
Liberty	11,566	12,393	7.2	18,174	46.7
Matagorda	14,031	12,227	-12.9	19,111	56.3
Colorado	6,127	9,888	61.4	14,399	45.6
Chambers	7,580	7,463	-1.5	11,000	47.4
Waller	5,397	7,342	36.0	12,098	64.8
Austin	4,350	6,233	43.3	10,488	68.3
H-GAC Region	1,617,756	1,928,758	19.2	2,874,992	49.1

* 2010 projections are H-GAC forecasts as of 7/23/91.

Source: U.S. Census, 1980, 1990.

Activity centers. Activity centers produce much of the waste paper generated in the region. These centers are primarily office-oriented and are mostly found in and around Houston. Such areas include the Central Business District, Greenspoint/Northbelt, the Texas Medical Center, Plaza Del Oro, Clear Lake/NASA, Greenway Plaza, Bellaire/ Pin Oak, Galleria/Post Oak, Westchase, Sharpstown, West Houston, Brookhollow and Northwest Crossing. H-GAC's 1988 employment estimates for these activity centers are shown by industry category in Table 9. Employment growth projections by economic sector based on 1990 census data are not available. However projections are provided to the year 2010 based on H-GAC's 1985 population estimates. This information is shown in Appendix 8.

Table 9: Activity Center Employment Estimates, 1988

Activity Center	Retail	Office	Industrial	Medical	Education	Govt.	**Total**
Houston CBD	14,829	89,862	9,723	2,678	817	22,996	**140,905**
Galleria/Post Oak	21,843	55,614	5,498	1,250	266	742	**85,213**
Medical Center	2,598	4,085	497	26,418	8,996	122	**42,710**
West Houston	9,216	24,362	5,489	298	192	125	**39,682**
Greenway Plaza	7,210	18,815	3,267	1,870	2,058	1,072	**34,298**
Greenspoint	6,689	17,078	5,061	625	503	429	**30,321**
Plaza Del Oro	6,531	8,055	2,551	6,293	69	1,273	**24,772**
Clear Lake/NASA	6,447	7,430	1,479	1,811	2,091	4,008	**23,266**
Westchase	3,683	12,495	2,201	467	83	105	**19,034**
NW Crossing	3,815	10,438	3,666	31	463	34	**18,447**
Brookhollow	5,327	9,084	1,999	93	86	541	**17,130**
Sharpstown	5,653	6,676	1,343	242	7	13	**13,934**
Bellaire/Pin Oak	2,063	6,762	3,742	225	471	291	**13,554**

Source: *1988 Estimates of Employment for 13 Counties by Census Tract: Technical Methodology.* H-GAC.

Industrial centers. Industrial concentrations in the region include the Houston Ship Channel corridor, the near Northwest and near Northeast quadrants of Houston, Freeport in Brazoria County, and portions of the Texas City-La Marque area, Galveston, Brazosport, Baytown, Deer Park, La Porte and Pasadena. The primary industries are petrochemicals and petroleum-based products. These areas produce a considerable amount of special and hazardous wastes.

Institutional centers. Institutional centers in the region produce waste ranging from common municipal solid waste to industrial hazardous waste. These centers include the medical centers, university systems, and correctional facilities.

The most significant medical-related concentration is located in Houston, where more than 42,000 people are employed in the Texas Medical Center alone. Other hospitals and medical activities are found throughout the region, though far less concentrated.

The university systems found throughout the region include some major facilities, as well as several junior and community colleges. These institutions are listed by county in Table 10.

Several major prison facilities are also located in the region. These facilities house as well as employ many people in the counties in which they are located. The facilities include the Huntsville, Ellis I & II, Goree and Wynne facilities in Walker County; the Central and Jester I, II & III facilities in Fort Bend County; the L.V. Hightower facility in Liberty County; and the Darrington, Ramsey I, II & III and Retrieve facilities in Brazoria County. These prison units generally have their own solid waste management facilities.

Other specialized centers. There are a number of other specialized employment centers which, while not as large as the ones previously listed, create somewhat unique waste streams. With a total of 194,030 scheduled landings each year, the two major airports in

the region -- Houston Intercontinental and Hobby -- generate a significant amount of economic activity in the Houston area. In 1990, 17.5 million passengers and 398.4 million pounds of air freight was transported through Houston Intercontinental Airport. During the same year, more than 8 million passengers and 12.2 million pounds of air freight arrived or departed from Hobby Airport. Waste generated at these two airports includes large quantities of waste paper and cardboard, beverage and food containers, and food wastes.

Several coastal areas generate seafood wastes from the fishing and shrimping industries. These include Freeport in Brazoria County, Palacios in Matagorda County, and numerous areas on Galveston Bay, including Galveston Island.

Farming and ranching activities generate significant quantities of agricultural waste. Counties in the region with 500,000 acres of land in farms and ranches include Wharton, Brazoria, Colorado and Matagorda counties. The timber industry, which also generates a unique waste stream, is prevalent in Walker, Liberty and Montgomery counties.

Tourism and conventions are becoming increasingly important elements of the regional economy, particularly in Harris and Galveston counties. Harris County's attractions include amusement parks, major cultural facilities, the NASA Johnson Space Center Visitors Center, professional sporting events and other special events both downtown and across the area. In Galveston County, Galveston Island's beaches are a major attraction as are the city's restored historical areas. Galveston Bay and its surrounding communities provide a myriad of recreational and entertainment diversions. Additionally, Brazoria, Chambers and Matagorda counties all have beaches and access to the fishing and boating opportunities of the Gulf of Mexico. Likewise, Lake Conroe and Lake Livingston serve as major freshwater recreational destinations in the region.

Table 10: Colleges and Universities

County	Institution
Brazoria	Alvin Community College
	Brazosport College
Galveston	University of Texas Medical Branch
	National Maritime Research Center
	Texas A&M Maritime Academy
	Galveston College
	College of the Mainland
Harris	Rice University
	University of Houston/Clear Lake
	University of Houston/Downtown
	University of Houston/Main Campus
	Texas Southern University
	University of St. Thomas

Table 10: Colleges and Universities (Continued)

County	Institution
Harris (continued)	Houston Baptist University
	Houston Community College System
	Lee College
	San Jacinto College
	North Harris County Junior College
	Univ. of Texas Health Science Center
	Baylor College of Medicine
	Texas Women's University
Walker	Sam Houston State University
Waller	Prairie View A&M University
Wharton	Wharton County Junior College

Source: *Texas Almanac* (1990).

B. Overview of the Current Solid Waste Management System

1. Solid Waste Characterization

In order to develop future solid waste management programs in the H-GAC region an understanding of the amounts and characterization of solid waste in the region is necessary. Solid waste characterization should be discussed in terms of both solid waste generation and composition, and the solid waste disposal system. The purpose of this section is to provide a general overview and estimate of both waste generation and composition, and disposal operations that affect the waste stream in the H-GAC region.

a. Composition of Waste

Detailed waste composition analysis has not been conducted for the H-GAC region, and the Texas Natural Resource Conservation Commission does not intend for regional planning efforts to include detailed waste characterization studies. However, that level of detail may be applicable as part of a sub-regional or local planning effort. The waste stream characterization estimates used in this plan are presented in two forms. The first is in waste stream characterization and the second is in residential/commercial split.

Waste Stream Characterization

For regional planning purposes, H-GAC has calculated the waste stream by using a national percentage characterization and state-level waste generation figures, as applied to local population totals. The waste stream characterization used is from Environmental Protection Agency's (EPA) *Characterization of Municipal Solid Waste in the United States: 1990 Update*. An EPA estimate for sludge generation was added to the *Characterization* totals therefore the percentages per waste stream category have changed. H-GAC's local government survey indicated that a large amount of wastewater treatment plant sludge, once dried, is being landfilled, therefore it has entered the municipal waste stream. The per capita waste generation figure is the 1989 rate calculated by TNRCC of 6.2 pounds per person per day (lbs/person/day). The 6.2 lbs/person/day figure was applied to H-GAC's 1989 population total to arrive at a total tonnage figure. This total was then broken down according to EPA's percentage, with the sludge modification, of materials in the waste stream. The results of these calculations are shown in Table 11.

It should be noted that the Texas generation rate is well above EPA's projection of 4.0 lbs/person/day. There are several possible reasons for this variation that must be considered when discussing regional waste characterization. The first, as previously discussed, is the amount of sludge being landfilled. Other possible variations from national averages in the H-GAC region are in the "Food Waste", "Yard Waste" and "Other" categories. The climate in the H-GAC region creates a longer growing season, likely producing more yard waste than the national average. The region's agriculture and seafood sectors will most likely produce more "Food Waste" than the 7.0% shown in

Table 11, and agricultural waste is not even a category in the EPA study. Also, in recent years, a large amount of low level contaminated soils from underground gasoline storage tanks have been landfilled as part of mitigation efforts at contaminated sites. Despite these variations, the waste stream figures should be acceptable for general planning purposes.

Table 11: Municipal Solid Waste Characterization of the H-GAC Region

Materials	National Tons Generated*	Percent of Waste**	Tons Generated Year 1989
PAPER AND PAPERBOARD	71.8	38.2%	1,653,656
Corrugated	23.1	12.3%	532,026
Newsprint	13.3	7.1%	306,318
Books and Magazines	5.3	2.8%	122,067
Office Paper	7.3	3.9%	168,129
Commercial Printing	4.1	2.2%	94,429
Other Paper	18.7	10.0%	430,688
GLASS	12.5	6.7%	287,893
METALS	15.3	8.1%	352,381
Ferrous	11.6	6.2%	267,165
Aluminum	2.5	1.3%	57,579
Other Non-ferrous	1.1	0.6%	25,335
PLASTICS	14.4	7.7%	331,653
RUBBER AND LEATHER	4.6	2.4%	105,945
Tires	1.9	1.0%	43,760
Other	2.7	1.4%	62,185
TEXTILES	3.9	2.1%	89,823
WOOD	6.5	3.5%	149,704
FOOD WASTE	13.2	7.0%	304,015
YARD WASTE	31.6	16.8%	727,793
SLUDGE	7.7	4.1%	177,342
OTHER INORGANIC	2.7	1.4%	62,185
OTHER ORGANIC	3.7	2.0%	85,216
TOTAL MSW GENERATED	**187.9**	**100.0%**	**4,327,605**

* Figure in million tons per year produced nationally
** Percentage by Weight

Table 11 includes calculations for subcategories in each waste stream. For example Paper and Paperboard is broken down into the categories of corrugated, newsprint, books and magazines, office paper, commercial paper, and other paper. These calculations will be important in discussion concerning source reduction and recycling. In recycling efforts it is important to distinguish between newsprint and other types of paper since newsprint is more readily recycled in the H-GAC region due to the Champion Paper de-inking facility opening.

Certain special wastes must also be studied in the regional solid waste management plan. Two of these special wastes are tires and sludge, both of which are included in the waste generation figures. The remaining special wastes do not appear as separate categories in

the waste characterization study. They are household hazardous waste, small quantity commercial waste generators, and medical waste. These special waste streams are found in different elements of the waste characterization study. More detailed discussion concerning tires, sludge, household hazardous waste, small quantity waste generators, and medical waste will be found in *Section C, Part 4. Special Waste.*

The EPA Waste Characterization report included projections for future years waste generation by category. These waste projections were applied to the H-GAC regional population projections to create waste characterization totals for the years 1997, 2002, and 2012. Table 12 shows the projected waste generation figures for the H-GAC region. This table is intended to show the categories of waste that will be entering the waste stream if no source reduction program is implemented, and what quantities could be available for recycling.

Table 12: Projected Municipal Waste Characterization of the H-GAC Region

Materials	Tons Generated Year 1997	Tons Generated Year 2002	Tons Generated Year 2012
PAPER AND PAPERBOARD	2,071,051	2,358,934	3,062,422
Corrugated	668,550	765,856	1,008,174
Newsprint	363,342	402,565	490,190
Books and Magazines	164,715	198,828	303,210
Office Paper	237,384	289,651	404,280
Commercial Printing	138,070	166,917	227,408
Other Paper	498,990	535,117	629,161
GLASS	268,873	252,831	240,041
METALS	392,410	414,839	442,181
Ferrous	283,407	294,560	303,210
Aluminum	75,091	85,913	88,436
Other Non-ferrous	33,912	36,820	37,901
PLASTICS	450,545	517,935	649,375
RUBBER AND LEATHER	118,692	130,097	146,552
Tires	48,446	51,548	55,589
Other	70,246	78,549	90,963
TEXTILES	99,314	105,551	116,231
WOOD	179,249	206,192	257,729
FOOD WASTE	319,741	326,471	346,165
YARD WASTE	799,353	844,405	909,630
SLUDGE	205,894	228,284	282,996
OTHER INORGANIC	65,402	71,185	78,329
OTHER ORGANIC	72,668	73,640	83,383
TOTAL MSW GENERATED	**5,043,192**	**5,530,363**	**6,615,034**

Residential/Commercial Split

In preparing plans for future waste management policy it is important to not only understand the characterization of the waste stream, but also the source of waste entering

the waste stream. In H-GAC's Regional Solid Waste Management Survey several local governments responded to a question concerning source of waste generation. The results of this are shown in Table 13. More than 40% of the waste generated in communities responding to the survey was generated by the commercial sector. This number is important to understand so that programs and policy be implemented to serve this source of waste generation as well as the homeowner. Future studies may be completed to understand the differences in waste characterization form municipal (residential) waste and commercial waste.

Table 13: Commercial Waste Generation

Community	County	Municipal Waste*	Commercial Waste*	Total Waste*	Percent Commercial
Sealy	Austin	32	44	76	57.9%
Brazoria	Brazoria	210	70	280	25.0%
Pearland	Brazoria	30,250	24,000	54,250	44.2%
Chambers County	Chambers	14,000	6,000	20,000	30.0%
Kendleton	Fort Bend	4	1	5	20.0%
Rosenberg	Fort Bend	8,820	5,180	14,000	37.0%
Sugar Land	Fort Bend	10,000	1,800	11,800	15.3%
Galveston	Galveston	37,845	22,244	60,089	37.0%
Bellaire	Harris	6,300	350	6,650	5.3%
Houston	Harris	435,346	334,654	770,000	43.5%
La Porte	Harris	9,662	7,892	17,554	45.0%
Tomball	Harris	3,098	5,766	8,864	65.0%
Liberty	Liberty	10,675	7,175	17,850	40.2%
Palacios	Matagorda	5,096	1,750	6,846	25.6%
Huntsville**	Walker	5,391	14,890	20,281	73.4%
TOTAL		**576,729**	**431,816**	**1,008,545**	**42.8%**

* In Tons per year. From H-GAC Survey of Local Governments.

** A portion of the Huntsville waste stream was excluded from this report since it is a mixture of commercial and municipal waste

Other Types of Waste

In the H-GAC region there are many other types of waste for which there is no estimate on quantity. Agriculture waste is produced throughout the region. This type of waste enters landfills through private haulers or individual carriers. Fertilizer and pesticide waste is a concern from this industry. The Texas Natural Resource Conservation Commission has sponsored pilot amnesty-day programs to collect this waste and was overwhelmed by the volume collected. Industrial waste is handled through the Hazardous and Industrial Waste Division of the Texas Natural Resource Conservation Commission. There are numerous on-site and commercial permits in the H-GAC region. There are two non-hazardous industrial waste permits in the region. Once of which is adjacent to the

Western Waste facility in Montgomery County, the other is the BFI facility in Chambers County which is adjacent to the county run landfill.

b. Current Waste Disposal System

Since the completion of the *Action Guide for Solid Waste Management* in 1985 there have been some significant changes in the solid waste disposal system throughout the region. In 1985 there were sixty-six permitted Type I, II and III landfills, of these thirty-seven were Type I, seventeen where Type II, and twelve where Type III (Type IV landfills were not discussed in the 1985 plan). By the end of 1991 there were twenty-four landfills active in the H-GAC region, twenty-three where Type I, one was Type II, there were no active Type III landfills, and twelve additional Type IV facilities were active. While there has been a decrease in number of landfills, it has been the small community landfill that has been closing. The decline in numbers was greatest in Type II and Type III facilities. Type I facilities have become larger and are permitted with more aerial expansion than ever before.

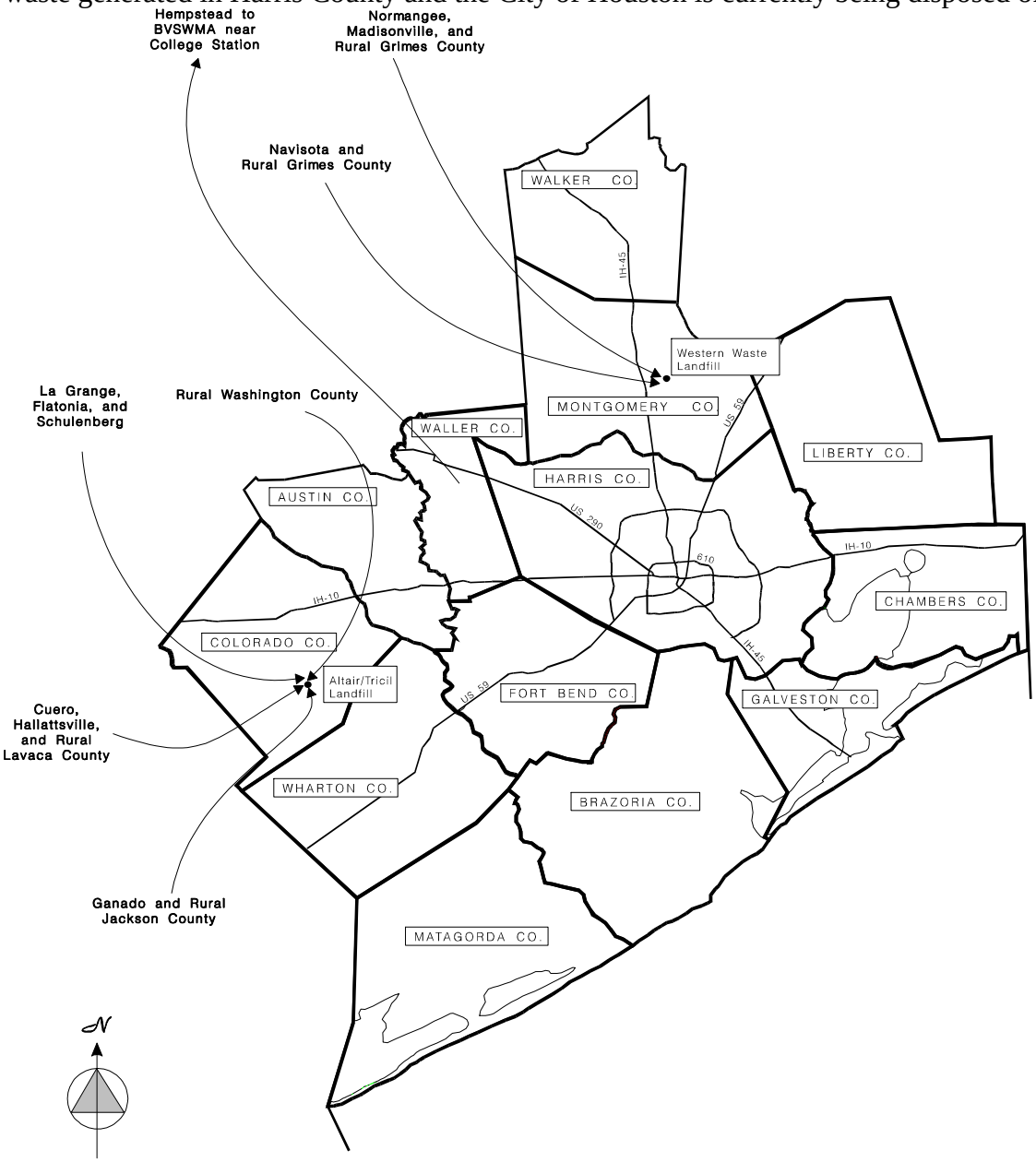
Throughout the same time horizon, from 1985 to 1991, the H-GAC region has seen an increase in municipal recycling programs. Where there where only two active programs discussed in the 1985 plan, more than twenty five municipal programs and many other private programs have been identified in 1991, capturing up to eleven percent of our waste stream at this time. In 1985 the waste generation rate was estimated at 25 pounds per person per week (5 pounds per person per day in a five day week), in 1991 it's estimated at 6.2 pounds per person per day in a seven day week an increase of almost 75% in waste generation. In 1985 six active plans for incineration units were discussed and many more were proposed, in 1991 not one of the units is operational. In 1985 most of the waste being handled in the region was being disposed of in a landfill, through 1991 this remains true.

Import/Exportation

The H-GAC region currently has adequate disposal capacity to serve the region. The problem with the disposal capacity is in its location and distribution. Private solid waste disposal facility operators are willing to operate landfills where they know they will get capacity to efficiently operate under new state and federal landfill criteria. The capacity is generated near large population bases, such as Houston, Harris County, Fort Bend County, Galveston County, and Montgomery County. Municipalities and other public landfills have realized the economies of scale involved in current landfill operations and have closed or are studying the possibility of becoming a regional facility. Therefore waste migration is becoming more and more prevalent in the H-GAC region. While waste migration is discussed in more detail at the subregion level, some general trends should be noted. Waste migration is shown on Map 8.

The first trend is that the region is a net importer of municipal solid waste. Large private landfills in Montgomery County and Colorado County serve as regional facilities providing capacity for Grimes, Madison, San Jacinto, Fayette, Jackson, and Lavaca Counties. Another trend is that virtually all municipal solid waste generated in the

H-GAC region is being disposed of in the H-GAC region. The only estimate for exportation is starting in 1992, communities in Waller County will be exporting to a regional facility in Brazos County. The final trend is that most of the municipal solid waste generated in Harris County and the City of Houston is currently being disposed of



Map 8: Waste Migration

HOUSTON-GALVESTON AREA COUNCIL

in Harris County. Most of what is being exported from Harris County originates from utility districts or commercial waste haulers. However, this is expected to shift when BFI-Fort Bend opens in 1993.

Disposal Capacity

The current disposal capacity of the H-GAC region is shown in Table 14: H-GAC Region Total Landfill Availability. The import/export population is taken from the H-GAC Survey of Local Governments (included in Appendix 3), *Draft Report on Regional Solid Waste Management Characteristics and Practices* in the Golden Crescent Regional Planning Commission, and discussions with the Capital Area Planning Council, City of Weimar, Brazos Valley Development Council, and Deep East Texas Council of Governments. Acres per Year was calculated using the region's average landfill depth, and an average landfill compaction density of 700 pounds per cubic yard. Table 14 is intended to show the total landfill capacity of the region and how long it will last without an increase in waste reduction programs or new landfill permits.

Table 14: H-GAC Region Total Landfill Availability

Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	3,897,146	49,985	4,469,238	144	2,575
1991	3,976,702	52,925	4,562,645	147	2,428
1992	4,056,257	55,864	4,656,052	150	2,279
1993	4,135,813	32,321	4,719,473	152	2,127
1994	4,215,368	32,896	4,810,203	155	1,973
1995	4,294,924	33,471	4,900,933	157	1,815
1996	4,374,479	34,046	4,991,663	160	1,655
1997	4,454,035	34,621	5,082,393	163	1,491
1998	4,533,590	35,197	5,173,123	166	1,325
1999	4,613,146	35,772	5,263,853	169	1,156
2000	4,692,701	36,347	5,354,583	172	984
2001	4,788,497	37,037	5,463,832	176	808
2002	4,884,293	37,728	5,573,081	179	629
2003	4,980,089	38,419	5,682,330	183	447
2004	5,075,884	39,109	5,791,579	186	260
2005	5,171,680	39,800	5,900,828	190	71
2006	5,267,476	40,490	6,010,078	193	-122
2007	5,363,272	41,181	6,119,327	197	-319
2008	5,459,068	41,872	6,228,576	200	-519
2009	5,554,863	42,562	6,337,825	204	-723
2010	5,650,659	43,253	6,447,074	207	-930
2011	5,746,455	43,943	6,556,323	211	-1,141
2012	5,842,251	44,634	6,665,572	214	-1,355

From H-GAC Survey of Local Governments, TDH 1990 Landfill Database, and industry contacts

The capacity numbers for the region show that there currently isn't a landfill *capacity* crisis in the region. However, the crises the region may be facing landfill *location* crises. The landfill acreage available is in fewer larger landfills than the many small landfills available just a few years ago. Landfill disposal capacity will always be needed for a

certain portion of the waste stream, and local governments must begin to work together to find those solutions.

2. Roles, Responsibilities and Institutional Arrangements

A host of public agencies at the federal, state and local levels share responsibility for solid waste management in the H-GAC region. Numerous private entities also play important roles. The duties of the governmental agencies may have a policy, regulatory or fiscal orientation, but they all have an impact on the region's overall waste management system.

An element of increasing significance will be the availability of grant and finance programs to assist local governments meet goals and comply with regulatory mandates. Existing public finance programs for solid waste management are shown in Figure 12.

a. Federal Role

The primary federal enabling legislation for solid waste management is the Resource Conservation and Recovery Act (RCRA), first enacted in 1976. The objectives of RCRA are to protect the public health and the environment while preserving material and energy resources. A RCRA reauthorization bill is currently being studied by Congressional subcommittee. Several new waste management policies have been proposed, including national recycling goals, purchasing programs and standards for recycled products, and revisions to the "Subtitle D" requirements for landfill siting and operation.

Other federal enabling legislation which affects solid waste management includes the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/Superfund), the Water Pollution Control Act (Clean Water Act), the Safe Drinking Water Act, the Energy Policy and Conservation Act and the Clean Air Act Amendments of 1990.

Federal Agencies

Environmental Protection Agency. The U.S. Environmental Protection Agency (EPA) is responsible for developing the regulations to implement RCRA and most other solid waste-related legislation. EPA's long-awaited "Subtitle D" regulations, which were finally approved on September 11, 1991, are expected to have an immediate impact on landfill siting, design and operations. Congress directed EPA in 1987 to develop strengthened requirements for protecting groundwater and for postclosure maintenance of landfills. EPA first issued a preliminary rule in August 1988, but Subtitle D became mired in review. Now that Subtitle D is on track, solid waste managers across the country are assessing their programs and preparing to comply.

EPA regulations resulting from other types of environmental legislation also affect municipal, industrial and special waste management. For example, EPA's implementation of the Clean Air Act's requirements will become increasingly relevant to solid waste management, especially in the area of air emissions from incinerators and landfills. A secondary impact of EPA's air regulations will be an increase in scrubber sludge from mandatory air pollution control devices required of industry.

Figure 12
Funding Programs for Solid Waste Management

Federal Programs

Environmental Protection Agency: The EPA offers grants for Solid Waste Management, Solid Waste Disposal Research, and Pollution Prevention for Small Businesses.

Farmer's Home Administration: The FmHA offers grants for technical assistance and training in solid waste management and direct project grants to help fund solid waste disposal projects in rural areas.

State Programs

Texas Natural Resource Conservation Commission: Using funds generated by the Solid Waste Disposal Fee, the Texas Natural Resource Conservation Commission (TNRCC) Municipal Solid Waste Division currently administers grant programs in the following categories:

Demonstration or Pilot Projects, Feasibility Studies	Technical Assistance
Public Education and Awareness Research	Information Exchange
Solid Waste Enforcement/Litter Abatement	Regional, Local Planning

Funding, when available, is announced in the Texas Register.

Texas Water Development Board: The Texas Water Development Board offers a Water Quality Enhancement Loan Program. Loans can potentially be used for the construction of facilities for management of municipal solid waste, land purchase, equipment, composting facilities, and incinerators.

Texas Department of Commerce: The Texas Department of Commerce (TDOC) offers grant programs in the following areas:

Energy-Related Inventions Program	Texas Capital Fund
Small Business Innovation Research	Texas Enterprise Zone
Texas Rural Economic Dev. Program	Texas Exporters Loan Program

Solid Waste facilities, such as recycling centers and composting operations are potentially eligible projects under these programs. TDOC is also working on a new business development program to assist small recycling operations.

For the most part, EPA does not directly permit or regulate individual facilities. It delegates its permitting and enforcement authority to the appropriate state agencies. To receive this delegated authority, a state's requirements must be at least as stringent as EPA's national standards.

Another role of EPA in waste management is that of policy and research. EPA was the lead agency in developing *Solid Waste Dilemma: Agenda for Action.* This document established the hierarchy for integrated solid waste management which has been adopted by TNRCC and H-GAC. The report contained many recommendations for local government action as well. EPA also conducts extensive research on the nation's waste stream and on special waste and other management issues. Funding from EPA supports demonstration projects at the state, regional and local levels.

EPA has developed procurement policies for recycled goods. Guidelines are in place for the purchase of paper, oil, tires, cement and insulation material by entities which receive federal funds. EPA also has been working to educate school-age children about recycling through a teachers roundtable program.

Other federal agencies. Most of the solid waste management issues with which other federal agencies are involved pertain to facility siting. A landfill, incinerator or recycling operation will fall under the same siting requirements as other types of facilities with respect to wetlands and habitat protection. As a result, the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service may be involved in the permitting process of such facilities. The Federal Aviation Administration also has requirements which limit airport siting and operations in the vicinity of active landfills because of the danger of bird strikes. While the Farmer's Home Administration does not play a policy role in solid waste, the FmHA does provide grant programs for projects related to solid waste and the elimination of water pollution.

b. State

Legislation

The Texas Solid Waste Disposal Act of 1969 was the seminal state legislation for solid waste management. This Act established the regulatory programs for solid waste collection, handling, storage and disposal, dividing responsibility for implementation and enforcement between Texas Department of Health and what is now the Texas Natural Resource Conservation Commission. The Act also enabled counties to exercise licensing, planning and management authority for solid waste.

The Comprehensive Municipal Solid Waste Management, Resource Recovery and Conservation Act of 1983 required local governments to assure provision of solid waste services to all persons within their jurisdictions by 1989. Designated regional planning agencies, such as H-GAC, and local governments were authorized by this Act to develop solid waste management plans. Senate Bill (S.B.) 1519 of 1989 modified the 1983 Act and section 363.061 of the Health and Safety Code, *requiring* council of governments

(COGs) and local governments to develop solid waste management plans and establishing a funding source for planning, enforcement and research. This funding mechanism is a fee on solid waste disposal.

The Texas Legislature in 1991 passed two additional bills which will have major impacts on solid waste management -- S.B. 1340 and S.B. 2. This legislation is discussed in the "Impacts of Legislation" section of this plan summary.

Agencies

Senate Bill 2, passed in the first special legislative session of 1991, consolidates all of the solid waste management functions of Texas Department of Health (TDH) with elements of the Texas Water Commission (TWC), the Texas Air Control Board (TACB) and the environmental programs of several other agencies into the Texas Natural Resources Conservation Commission (TNRCC). The TDH/TWC/TACB consolidation into the Texas Water Commission became effective on March 1, 1992. As of this writing, the Legislature was still debating possible amendments to S.B. 2. Because operating procedures for TNRCC had not yet been finalized, this section outlines state agency solid waste management responsibilities as they existed prior to the passage of S.B. 2.

Texas Natural Resource Conservation Commission. The TNRCC Municipal Solid Waste Division is responsible for permitting and enforcement for landfills, transfer stations, incinerators and disposal facilities for grease, sludge and special wastes. The Municipal Solid Waste Division also develops regulations which must meet or exceed EPA standards to maintain the state's delegated regulatory authority.

In addition to its regulatory function, TNRCC Municipal Solid Waste Division has a major planning and education role. It is also the agency responsible for collecting and administering the funds generated through the waste disposal fees established by S.B. 1519. Besides funding regional and local planning, TNRCC has a variety of technical assistance and demonstration grant programs. Many of these programs are listed in Figure 12. TNRCC also maintains a database on landfills from which waste generation and disposal capacity information can be obtained.

The Water Commission Hazardous Waste Division is responsible for permitting hazardous waste disposal facilities and non-hazardous industrial waste disposal sites. The latter type of facility may accept municipal solid waste if permission is received from the Municipal and Hazardous divisions of the TNRCC.

The TNRCC Renew Program maintains a cross-reference of industrial by-products to encourage inter-industry recycling, and it also conducts industrial waste minimization audits. TNRCC has also been involved in promoting the proper disposal of household hazardous waste (HHW), though the focus of this effort has been on eliminating HHW from municipal storm drainage systems.

Finally, the consolidated TWC/TACB have joint permitting authority on incinerators. It will also be involved under the federal and state Clean Air Acts in regulating methane gas emissions from landfills.

Texas General Land Office. Senate Bill 1340 establishes the GLO as lead state agency on recycling and education programs. GLO is currently coordinating a market development study and implementation program as well as a recycling awareness campaign. GLO is coordinating these efforts with TNRCC and the Texas Department of Commerce.

Other state agencies. Several other state agencies are involved in waste management to a certain extent. The Railroad Commission of Texas (RRC) regulates intrastate trucking and rail operations, both of which impact the recycling industry. The RRC also regulates the disposal of oil field sludge. The Texas Department of Agriculture regulates animal and agricultural waste disposal and has been involved in efforts to promote recycling and composting. The Governor's Energy Management Center administers a demonstration grant program to fund recycling projects. This program is capitalized by the state's Oil Overcharge Fund and has a finite lifespan. The Texas Water Development Board also has a grant program for communities aiming to develop solid waste management facilities.

State criminal justice and correctional agencies may also play a greater role in waste management. These agencies generally have their own waste management facilities and an existing supply of inmate labor, but they may be interested in forging partnerships with local governments in areas such as recycling and composting.

c. Regional

Houston-Galveston Area Council. H-GAC in 1985 became the first COG in Texas to receive state approval of a regional solid waste management plan. Since that time, TDH (and now TNRCC) permitted facilities in the region have been required to conform with the plan's goals, objectives and recommendations. The plan also remains a policy guide for H-GAC and its local governments with respect to solid waste management.

Under S.B. 1519 (363.061 of the Health and Safety Code), H-GAC will have an expanded role in regional solid waste management, including review of local plans and a broader range of facilities. H-GAC will also develop a monitoring system to track the results of plan implementation. Aside from the mandates of legislative and regulatory requirements, H-GAC plans to take an active role in providing technical assistance and information resources to its member governments throughout the short and long-term horizons of this plan.

Gulf Coast Waste Disposal Authority. The Gulf Coast Waste Disposal Authority (GCA) covers Harris, Galveston and Chambers counties and was established primarily to provide industrial wastewater treatment. GCA does operate an industrial solid waste

disposal facility and several municipal transfer stations, but it is not heavily involved in municipal solid waste management. However, GCA is currently studying a number of municipal solid waste management options, including incineration and composting, and it has the authority to undertake regional management programs.

d. Local

There is a growing trend in the region toward privatization of solid waste management activities. Sixty-six percent of the local governments responding to an H-GAC survey reported that some aspect of their solid waste management program (i.e. collection, transfer, recycling, or disposal) is operated by the private sector.

State enabling legislation requires local governments to provide waste collection and disposal for all residents within their jurisdictions. Other state legislation gives cities and counties various authorities pertaining to licensing and planning for waste collection and disposal. Home-rule cities may also exert control over facility siting through zoning and nuisance ordinances. However, the methods of meeting local waste management responsibilities vary considerably. The roles of most H-GAC member governments fall into one of the following categories:

1. Local government provides collection and owns and operates landfill.
2. Local government contracts with the private sector for collection and/or disposal.
3. Local government bills residents on behalf of a private service which operates on the basis of contracts with individuals.
4. Combination of these within the same local government jurisdiction.
5. Private disposal without local government involvement.

In spring 1991, H-GAC staff conducted a survey on solid waste management activities of all local governments in the 13-county Gulf Coast Region. A total of 122 local governments responded to the survey or to a telephone follow-up. However, many local governments did not respond to certain survey questions. A general overview of local waste management roles and responsibilities based on this survey follows.

Service area. Of the forty-five respondents to this question, thirty-eight (84%) provide waste management services only within their jurisdiction while seven (16%) have some form of cooperative agreement with areas outside their boundaries.

Public versus private service. Of the fifty-six local governments responding, twenty-two (39%) provide public waste management service while thirty (54%) use variations of a private contract arrangement. The remaining four (7%) use some combination of public and private services.

Landfill ownership and future plans. The majority of the region's landfill capacity is privately owned. Of the seventy-two local governments responding to this question, seventeen (24%) own a landfill while fifty-five (76%) do not. Of those seventeen local

governments which own landfills, four have expansion plans, and the remaining facilities are awaiting closure.

Recycling and other programs. Local government interest in recycling programs has increased tremendously over the last several years. There are currently twenty-six local government-operated recycling programs within the region. Virtually every local government which answered the survey was at least considering some type of recycling and/or public education programs.

e. Other Local Government and Private Entities

Municipal utility districts. Municipal utility districts (MUDs) are sometimes involved in contracting with private waste haulers on behalf of the subdivisions they serve. However, this is sometimes the responsibility of the individual homeowner. MUDs also impact the waste management system through sludge disposal. There are approximately 350 MUDs in the H-GAC area, most of which contract individually with sludge collection and disposal site operators.

Independent school districts. While not directly responsible for waste collection or disposal, school districts have the potential to play a major role in regional solid waste management. Firstly, as a group, school districts represent a major segment of total employment and waste production in the H-GAC region. Implementation of region-wide recycling and waste reduction programs would have a significant impact on the overall waste stream. Also, with their combined purchasing power, school districts' procurement policies can help to stimulate markets for recycled products. Finally, school districts have an excellent opportunity to reach children and parents with information about issues such as waste reduction, recycling, and proper management of household hazardous waste.

Non-profit organizations. Non-profit organizations play a major coordination and educational role in the H-GAC region's solid waste management system. There are ten licensed Keep America Beautiful affiliates in the H-GAC region, all of whom are active in promoting recycling and litter abatement. Clean Houston, Inc., the largest of the affiliates, operates a wide variety of programs, including a recycling hot-line and an elementary education program.

Civic clubs, homeowners associations and churches also play an active role, particularly in organizing volunteer recycling efforts. One of the largest of these programs is "Woodlands Recycles" -- a joint effort of the Woodlands Homeowners Association and the Woodlands Corporation. In some cases, homeowners associations collect and market recyclable materials using their own volunteer labor. In others, the association contracts with a private firm to provide collection of recyclables.

Private Sector. Solid waste management is a highly privatized operation in the H-GAC region. In addition to most of the region's landfill capacity and waste collection being

privately contracted, there is also a trend toward privatization of recycling efforts. Browning-Ferris Industries (BFI) and Waste Management of North America (WMNA) both operate curbside collection programs in the Houston area which each serve approximately 20,000 homes. Tricil provides drop-off recycling receptacles in Colorado County and Western Waste provides composting services to their clients in Montgomery County. There are at least two additional hauler/brokers which contract with individual communities to provide curbside service.

Retail stores also are becoming major actors in regional recycling by serving as convenient drop-off centers. There are over a dozen chain stores in the H-GAC region which collect a wide variety of recyclable materials and special waste, including used batteries and motor oil.

The Houston Corporate Recycling Council, part of the Texas Corporation Recycling Council, is a group of major corporations in Houston which share information on recycling and coordinate joint recycling efforts.

Finally, a few corporate, government and non-profit entities have contributed staff and resources to household hazardous waste collection "amnesty days."

3. Current Management Goals and Priorities

a. Integrated Solid Waste Management Hierarchy

In developing this plan, H-GAC has followed the hierarchy of municipal waste management methods recommended by the EPA, adopted by the Texas Natural Resource Conservation Commission, and mandated in solid waste management planning in Texas. This hierarchy, listed in descending order from most preferred to least preferred, shall be followed when economically and technologically feasible in the final disposition of municipal solid waste, excluding sludge.

I. Minimization of waste production
II. Reuse or recycling of waste
III. Incineration
    A. Waste-to-energy
    B. Incineration without energy recovery
IV. Land disposal

Shown below are the management methods, listed in descending order from most preferred to least preferred, which shall be followed when economically and technologically feasible in the final disposition of municipal sludge. These methods were recommended by the EPA, adopted by the Texas Natural Resource Conservation Commission, and mandated in solid waste management planning in Texas.

I. Minimization of sludge production and concentrations of heavy metals and other toxins in the sludge
II. Treatment of sludge to reduce pathogens and recover energy, produce beneficial by-products, or reduce the quantity of sludge, if the treatment does not threaten public health, safety or the environment
III. Marketing and distribution of sludge and sludge products, if the marketing and distribution does not threaten public health, safety or the environment
IV. Land application for beneficial use, if the application does not threaten public health, safety or the environment
V. Land treatment
VI. Landfilling the dried sludge

This preferred hierarchy for sludge management has been incorporated into the Project Review/Siting Criteria and Special Waste Goals and Objectives.[4] Additionally, the H-GAC Technical Assistance Recommendations promote the preferred hierarchy.[5] These recommendations encourage alternative forms of sludge management over landfilling.

[4] Specifically, Project Review/Siting Criteria Goal 1, Objective 1 and Special Waste Goals 1 and 4.
[5] Specifically, Technical Assistance Recommendation 7.

b. H-GAC 1985 Regional Plan

The H-GAC *Action Guide for Solid Waste Management in the H-GAC Region 1985-2000* was approved by TDH in 1985. From that time until the present, H-GAC has reviewed all permit applications for solid waste disposal facilities in the region for consistency with the plan and has assisted local governments on solid waste management issues.

The overall goal of the *Action Guide* was to bring solid waste disposal under effective management control at a regional level, while protecting public health and the environment and promoting appropriate use and conservation of natural resources. Recommendations of the *Action Guide* focused on planning, public participation, coordination, regulation, management, and financing aspects of solid waste management.

As mentioned in earlier sections, some current issues, like waste reduction and recycling, were not addressed in particular detail in the *Action Guide.* Also, incineration was emphasized as a preferred technology for waste disposal, a recommendation which is less feasible today in light of regulations and financial considerations. The region was divided into 25 solid waste planning areas to provide a framework for local action. However, without an intensive follow-up implementation program, relatively few of these projects have materials. As a result, H-GAC has used the *Action Guide* primarily as a policy guide for reviewing permit applications. Nonetheless, development of the *Action Guide* provided H-GAC with an excellent foundation on which to build future solid waste planning efforts, and many of its recommendations are valid today and are included in this plan.

c. Local Government Plans

City of Baytown Comprehensive Plan

While the city's new comprehensive plan is not yet complete, draft elements of the Environmental Issues portion of the plan identify two issues that will be addressed in the final plan. They are:

1. A lack of recycling programs, and
2. A lack of public education programs about environmental issues and recycling

The City of Baytown has also passed a bond election to upgrade its sewage treatment system, including enhanced sludge disposal and drying. A recycling program is being organized by private citizens, who will operate a facility that will accept any drop-off materials for which there is a market. Baytown also funds the Keep Baytown Beautiful office and is beginning a public education campaign.

City of Bellaire

In 1985 the City of Bellaire contracted with a consulting firm to complete the *Solid Waste Collection and Disposal Plan.* Among the plan's conclusions:

1. Short-term and long-term disposal methods should employ private landfills
2. Transfer stations should be utilized if long-term capacity is at the BFI McCarty Road landfill or the BFI Fort Bend County landfill
3. A resource recovery facility is not the most economical solution for the city, and
4. Privatization may allow significant reductions in the city's operating budget.

City of Bellville Solid Waste Management Plan

The City of Bellville is involved in a study concerning the continued operation of its Type 2 landfill. The city must decide whether to upgrade its landfill to proposed Subtitle D standards, including a regional facility for use by the county and adjacent communities, or close the current facility and switch to a private facility.

Brazoria County Solid Waste Management Task Force

In November 1989 the Brazoria County Commissioners Court appointed the Brazoria County Solid Waste Management Task Force (BCTF) to determine the magnitude of the municipal solid waste disposal problem in Brazoria County. The BCTF was charged with the responsibility of suggesting both long-term and short-term courses of action to the Commissioner Court. The BCTF had two major recommendations:

1. A Solid Waste Public Education Program should be enacted for Brazoria County through the Commissioner Court, and
2. A Solid Waste Management Special Authority should be created to address the needs of Brazoria County in planning and implementing an integrated approach to waste management

The BCTF also adopted the state's hierarchy of solid waste management and agreed on waste reduction goals of 25% by 1992, 40% by 1996, and an ultimate goal of landfilling only 10-20% of the residential waste stream.

The BCTF was reappointed in January 1991. It is now studying the issues involved in the creation of a solid waste authority -- or some alternative -- and other issues such as incineration, recycling and implementation of the public education program.

Chambers County Municipal Solid Waste Evaluation

The Chambers County Commissioners Court funded a study by a consulting firm to determine the future direction of solid waste disposal services for Chambers County. The Gulf Coast Waste Disposal Authority served as a go between and in an oversight function during the study. The plan, completed in 1991, concluded:

1. Landfill capacity at the existing 40-acre site can be increased by as much as 30% through minor modification to current landfilling techniques.
2. Proposed Subtitle D rule changes will have a major impact on the County landfill. Development costs associated with Subtitle D will be approximately $5 million (1990 dollars) and will increase the solid waste disposal cost $65-$90 per ton of solid waste, not including post-closure cost.

3. The landfill has outstanding potential for development into a major regional facility. This would mean increasing the size of the landfill by an additional 307 acres and providing disposal services to adjacent communities and counties.
4. Waste to energy/incineration does not appear to be an economically viable alternative to landfilling.
5. The county should explore various financing techniques for development of the regional facility.

City of Houston: Comprehensive Plan and Zoning

The City of Houston is in the early stages of developing a comprehensive plan and zoning ordinance. The work plan includes the study of solid waste management facilities. How the plan and zoning ordinance will affect the siting, development and operation of solid waste management facilities is not known at this point.

City of Houston: Citizens Advisory Committee on Solid Waste Disposal Solutions

The Citizens Advisory Committee on Solid Waste Disposal Solutions (CAC) was established in June 1990 to examine long-term disposal options for the city's residential waste stream. The CAC is in the process of finalizing a report to present to the public which will outline its recommendations to the city and its Solid Waste Department. Among the key recommendations of the draft report:

1. The city should initiate an integrated plan to meet long-term waste disposal needs, including source reduction, recycling (including composting), waste combustion and landfilling.
2. The city should implement an aggressive source reduction and recycling program.
3. The city should initiate actions to acquire its own landfill for waste generated by the residential sector.
4. The city should continue to examine combustion, either in the form of waste-to-energy or for volume reduction.
5. The city should establish a dedicated waste management enterprise fund for the collection and disposal of solid waste.

Huntsville Solid Waste Disposal Study

In 1986 the City of Huntsville completed a study of solid waste management options. At the time of the study the City's landfill had approximately six years of life under current operation and plans had to be made for future capacity. The study concluded with four recommendations that the City of Huntsville should:

1. Devote some additional study to identification of a suitable relocated landfill site.
2. Evaluate in greater detail the potential for firm power sales to electric utilities.
3. Explore with selected utilities the possibility of securing a long-term take-or-pay contract for powered sales.
4. Evaluate various financing methods for incinerator facilities.

At the time of the study the city also had the option to increase capacity of their exiting landfill up to twenty years by adding both acreage and aerial build-up. Which was the option chosen to implement.

In 1991 the Huntsville Sanitation Department completed *Huntsville Recycles,* a study to determine the future path of recycling in Huntsville. The City is studying the use of recycling to further extend the life of their landfill and to reduce the amount, and ultimately cost, of transporting waste to a regional landfill in the future.

Waller County Waste Management Committee

The Waller County Waste Management Committee (WWMC) was appointed in January 1989 to study waste disposal practices and offer recommendations to the Commissioners Court for establishing a solid waste management program for the county. The WWMC reported on the current status of landfills in the county, potential disposal sites outside of the county, and the issues surrounding landfill-based disposal. The WWMC recommended seven actions the county could undertake to solve its waste management problems:

1. Develop a public education program for the county concerning landfill issues and possible actions facing the county.
2. Establish a solid waste management department for the county.
3. Hire a certified, professional engineer to head the department.
4. Organize the waste management department to operate all types of solid waste management activities, including sludge regulation, litter abatement, septic permits and floodplain management.
5. Create an official solid waste management plan to be approved by TNRCC.
6. Develop and operate a landfill for the county and its municipalities.
7. Empower the waste management department to exercise the county's authority to permit and govern all waste disposal sites in Waller County.

A second option presented to the Commissioners Court was the creation of a regional waste management district with Austin County.

C. System Analysis and Evaluation

1. Waste Reduction and Reuse

Waste reduction in its most basic form keeps materials from becoming waste. Waste reduction programs, also referred to as source diversion, attempt to limit both the quantity and toxicity of waste entering the waste stream. While recycling programs conserve resources, they also require transportation, handling and processing. Hence, waste reduction is more energy-efficient and is the most-preferred method in the Solid Waste Management Hierarchy.

However, waste reduction is not a solid waste management program which can be solely undertaken by a government or private firm, like landfilling or collection. It is an activity that must have broad acceptance from the public and industry. The Environmental Protection Agency's (EPA) *Decision-Makers Guide to Solid Waste Management* outlines five basic categories of source reduction programs. They are product reuse, reduced material volume, reduced toxicity, increased product lifetime, and decreased consumption.

a. Types of Waste

Waste reduction programs can affect all of the waste steams in the H-GAC region. Successful waste reduction programs have already been initiated by several of the industrial and hazardous waste generators in the region. In fact, industry has been implementing waste reduction programs for several years now to eliminate unnecessary cost in production and disposal, as well as for the environmental benefits. Most successful programs have started by focusing on a major waste stream and have grown from there. Local governments in the H-GAC region can take the same approach by starting with waste reduction programs focusing on several of the major waste streams and move on from there. Some of the most-often targeted waste streams are yard waste, office waste, and municipal waste.

Yard Waste

Yard waste can be reduced successfully through "Don't Bag It" programs. Eight cities and all county agricultural extension offices have been asking citizens to utilize these programs, and all local governments in the H-GAC region could easily work with their county extension services to implement these types of programs in their communities. The ease of this system is well documented in the Texas Agricultural Extension Service publication, *Don't Bag It: Lawn Care Plan.*

Other communities in the region have initiated mulching programs to handle trees and limbs in their waste stream, with several focusing solely on Christmas trees. The mulch can be used as a soil additive or as a base for composting. Communities in the region that have parks and recreation facilities may find benefits in implementing a mulching program. The Texas General Land Office (GLO) has initiated a Christmas tree program

in which the trees are collected and used to stabilize dunes to protect Texas beaches from further erosion. These collection programs generally are operated in the Gulf Coast area.

Governmental Offices
If a local government entity is to implement a waste reduction program, one of the first places to start is in its own governmental facilities. Four communities in the H-GAC region have already done this. More communities will have to study the possibility of implementing waste reduction programs such as double-sided copying, purchasing of recycled and recyclable goods, and modification of internal operating procedures to set examples for citizens, business and industry to follow.

Municipal Waste Stream
There are currently no municipal waste reduction programs operating in the region. However, several environmental and consumer-oriented groups have informally initiated public awareness and information efforts that target the municipal waste stream in general and consumer information. These programs have made industry respond to changing markets, such as packaging of products. If communities in the H-GAC region adopt public education programs on waste reduction to reduce both the amount and toxicity of the waste entering the municipal waste stream, then much valuable landfill space could be saved. One of the most effective methods to implement municipal waste reduction programs is the volume-based garbage fee. When the consumer pays the real cost of garbage disposal, waste reduction programs area more successful.

b. Activities and Programs

There have been no formal local government waste reduction programs. However, a number of communities have adopted policies and programs which are a form of waste reduction. Katy and Sugar Land have initiated yard waste clipping collection and chipping programs. Palacios is involved in a liquids collection and reduction program. The following cities have adopted "Don't Bag It" or backyard composting programs: Bellaire, Houston, Huntsville, Jersey Village, Palacios, Rosenberg, Sugar Land and Taylor Lake Village. All county agricultural extension offices also promote the "Don't Bag It" program. The City of Baytown has a chipper which chips tree limbs into a mulch which is then given to city residents. The City of Huntsville has contracted to separate yard waste from the waste stream to a local composting company. Huntsville pays the local contractor $10 a ton to take the yard waste. Western Waste Industries provides composting services to residents in the Montgomery County area. Living Earth Technology, Inc. provides composting services to residents in the Harris County area.

Other communities have adopted internal policies to reduce their waste stream. Missouri City and Piney Point Village utilize double-sided copying and in-house recycling at all municipal facilities. Angleton and Galveston attempt to purchase recycled products whenever possible.

Commercial sector efforts in waste reduction programs have been effective in reducing the municipal waste stream as well. The McDonalds fast food chain adopted several new

policies recently. They eliminated the use of styrofoam packaging, began asking distributors to deliver products in reusable crates and boxes, and began using recycled paper where possible. Target has been working with suppliers to provide merchandise in an environmentally sensitive manner. Several major food store-chains have initiated the use of reusable grocery bags and in house plastic bag recycling programs.

c. Impact of Changes in Legislation and Regulations

Federal

The Resource Conservation and Recovery Act (RCRA), is currently being studied by Congressional subcommittees for reauthorization. Waste reduction options being discussed include Federal procurement procedures, container deposit requirements, environmental labeling, and packaging and product design standards. While many different scenarios are being discussed under each of the above-mentioned options, it can be safely stated that RCRA reauthorization will impact future waste reduction programs.

Federal bills which have been introduced during the 102nd US Congress that may affect waste reduction programs are numerous. House Resolution 997, if passed, would require a 10 cent refundable deposit for beverage containers nationwide. The resolution includes a state exemption from the requirement if a 70 percent recovery rate for beverage containers is obtained in that state. House Resolution 231, if passed, would establish a national goal of 25 percent waste reduction by 1994 and 40 percent by 2000. Senate Bill 615, if passed, would create a system under which the EPA would regulate environmental marketing claims. And Senate Bill 832, if passed, would require the Federal government to establish a procurement program for recycled paper.

State

Senate Bill 1519 of the 71st State Legislature in 1989 created the Recycling and Waste Minimization Branch of the Texas Natural Resource Conservation Commission Municipal Solid Waste Division. The Branch has since focused on the implementation of recycling programs in Texas. However, some work is beginning in waste minimization efforts. Staff has been working on backyard composting and waste reduction programs in recent months. Under realignment of state agencies the Branch will be working more closely with hazardous waste minimization staff, currently located in the Texas Natural Resource Conservation Commission RENEW program to produce more municipal solid waste minimization programs.

In the 72nd State Legislative session, which concluded in 1991, several bills were passed that impact waste reduction efforts. Senate Bill 1340, the Omnibus Recycling Bill, set a recycling and waste reduction rate goal of 40% by 1994. The bill mandates state agency reduction and recycling programs beginning in September 1991. County, school district and local governments are required to begin these programs by 1993. Senate Bill 830 requires the Texas Air Control Board (TACB) and TNRCC to develop plans to reduce the release of hazardous substances into the air, land and water. The bill also requires the TNRCC to develop a pollution prevention plan to be implemented by hazardous waste

generators. House Bill 1022 established source reduction as the highest rated priority in management of municipal solid waste, sludge and hazardous waste. The bill adopted the EPA hierarchy of solid waste management and mandated that all governments in the state adopt the same policy in their planning process. H-GAC has complied with this requirement in the planning process and has stated such in ***Part Three, C.*** *Current Management Goals and Priorities,* ***1.*** *Integrated Solid Waste Management Hierarchy.*

d. Evaluation of Current System

Understanding that waste reduction is an activity that covers several areas of solid waste management, the region's current system has been evaluated according to the five categories outlined by the EPA.

Product Reuse

Reusable products reduce the waste stream of the disposable equivalents with each use. Product reuse may be as simple as using cloth bags when shopping, or as complicated as design of packaging materials to be reused for another purpose after initial use. Product reuse has been occurring for many years, however, recent trends in product packaging and purchasing have created a disposable society where ease-of-use and disposability have become marketing tools.

Since Earth Day 1990 there has been a renewed interest in product reuse. These efforts have grown at a grass-roots level and will continue to so as long as public interest is maintained and information concerning reuse is available. However, for effective region-wide programs to be successful, H-GAC and local governments will have to support these efforts and provide public information concerning product reuse throughout the region.

Reduced Material Volume

Reduced material volume is a result of bulk packaging, using concentrates, or lighter material in product design and packaging. Reduced material volume has lately been occurring at the national level. Industry has responded to citizen and governmental concerns by providing more "environmentally friendly" products in both design and packaging.

This category of waste reduction can also be addressed by the individual and local governments through selective purchasing. The selection of products in bulk, concentrated, or a lighter design will allow the purchaser to reduce material volume. It will also send a message to industry concerning product design and merchandising.

Reduced Toxicity

The reduced toxicity of product design and packaging will eliminate many leachate and hazardous waste disposal issues in municipal landfills. Industry in recent years has experimented with reduced toxicity in production and facility operations and found an actual cost savings in disposal and production. Individuals and local governments can experience the same benefits in their daily operations. Examples of reduced toxicity is the

elimination of lead based paints, the use of rechargeable batteries, and the planting of native vegetation requiring less chemicals for maintenance.

Increased Product Lifetime
Examples of increased product lifetime are longer-life tires and rechargeable batteries. Both local governments and individuals can take initiative to favor these types of products in purchasing decisions. Again, the consumer can control how industry designs certain products by buying products designed to last longer, are easily repaired, and/or are built for continued use over disposable products.

Decreased Consumption
Decreased consumption is the purchase and use of products that are constructed to last longer, be less toxic in disposal, and packaged to reduce waste from entering the waste stream. Once again buying practices and how products are used once purchased can decrease the waste stream. The Texas Natural Resource Conservation Commission (TNRCC) is currently working to decrease consumption through its RENEW program. As a part of this program, government and industry are giving what was once thought to be waste to parties who can make use of the product.

e. Evaluation of Alternatives

Opportunities for implementation of the waste reduction programs mentioned to this point all begin with public education programs. Public education and publicity programs will encourage waste reduction at the regional, local, and individual level. Continued research into the development and design of products will further increase the effectiveness of waste reduction programs throughout the region. Industry and academia are responding to public calls for "environmentally-friendly" products by supporting research to develop products that are less toxic and that will result in less waste.

The use of financial incentives and disincentives are increasing throughout the country. Volume-based waste disposal fees are the most highly publicized of these programs. By charging the individual or company for the amount of waste disposed, waste reduction becomes more viable when real cash savings can be obtained. Another example is the high disposal cost of hazardous substances. As hazardous materials become more difficult to dispose, industry is finding ways to eliminate or reduce those hazardous substances. This trend will continue as disposal fees rise.

However, financial incentives and disincentives present a double-edged sword to most local governments. Much like a ban, increased cost and decreased ease of disposal encourages illegal dumping. To obtain the desired result of waste reduction incentives, enforcement of illegal disposal regulations must be addressed in waste reduction plans.

The final consideration in implementation of waste reduction is governmental regulation of packaging and product design. Governmental regulation can occur in two basic forms. The first is uniform packaging guidelines or regulations. This could occur at the state or national level where industry is given specific guidelines to follow in the design, development, and packaging of products. The second form of regulation could be a uniform packaging code, or "green code." The packaging code would rate products and their packaging based on ease of reuse and disposal. Examples of these programs are

Canada's "Environmental Choice" program or the private "Green Cross" and "Green Seal" programs in the United States.

Waste reduction is often thought of as a method of solid waste management that must be addressed at the state or national policy-making level. While it is true that many aspects of waste reduction should be initiated at the national level; individuals, local governments, and regions can have an impact on solid waste management. The most basic level of this action is the individual. Environmental groups have long held this approach as being the most effective by initiating grass roots "boycotts" and "buycotts," letter writing campaigns, and protests. Strategy for waste reduction programs can be built around the same grass roots concepts, focusing on the collective purpose of saving landfill space, reducing the toxicity of waste entering the landfill and reducing disposal cost. Government agencies must begin the waste reduction efforts by setting examples for citizens and local businesses to follow. The following is a list of alternative elements of a waste reduction program which could be used in the H-GAC region.

Product Reuse

Product reuse programs which could be initiated in the H-GAC region include waste stream audits to determine the amount of reusable materials currently being discarded and alternatives for items currently being disposed. Then programs could be initiated such as the use of ceramic cups and glasses in the office, purchase of retreaded tires, and the use of composted or chipped tree waste whenever possible.

Reduced Material Volume

The initial step in reducing material volume is a study of agency (government, business or individual) purchasing policies and habits to determine if the purchase of bulk items or other waste reduction alternatives are feasible. Agencies can then implement those methods shown to be effective. Possible alternatives include the utilization of double-sided copying, the purchase of recycled and recyclable goods, and cooperative purchasing to eliminate multiple sales and packaging.

Reduced Toxicity

Toxicity of current products and practices around the office and home should be studied and documented. This audit ranges from the types of paints used to a study of the vegetation and the care required for maintenance. Programs that can be implemented to initiate toxicity reduction programs include the reuse of paints collected at HHW collection programs, the use of native vegetation and "Don't Bag It" programs to reduce the use of lawn chemicals, and the purchase of less toxic materials and chemicals.

Increased Product Lifetime

A study on agency purchasing policies should also identify items which can be replaced with long life products. For example, when new tires must be purchased they should be long life tires. Good product design, ease of maintenance, and availability of replacement parts will make the continued use and upkeep of equipment and products more feasible.

Decreased Consumption
Decreased consumption can be initiated through waste exchange programs, where one agency's waste can be utilized by another. The purchase of products that will last longer, require less maintenance, can be reused, are built better, and will decrease consumption. Often, the purchase of such products result in reduced capital.

Opportunities for Development
Education programs are the most important aspect of waste reduction programs. There are three types of waste reduction education programs that should be initiated in the H-GAC region. First, local government officials must be educated about the benefits of waste reduction programs and what type of programs can be implemented at the local level. Second, business and industry must be educated about the benefits and barriers of waste reduction programs. Third, citizens must be educated about the waste reduction programs they can initiate at home and at work.

Funding for the development of education programs could possibly be obtained from the EPA, or state funding programs (the previous two are already in place). Funding may also be available at the regional level through H-GAC or at the local level through a government agency or a Keep America Beautiful affiliate. The state, EPA, and industry should be encouraged to continue to support waste education studies at universities and in industry. These studies should be designed to help industry adapt to new markets emerging from the recent environmental movement and local governments to implement toxicity and quantity waste reduction programs. The state, EPA, industry, and H-GAC must also initiate recognition programs that celebrate the successes of waste reduction programs.

Financial incentives that increase participation in waste reduction programs are considered beneficial if they can be properly implemented. The most common of these is a variable waste disposal fee. If citizens and businesses are charged for the actual amount of waste disposed and if it is possible for collection crews to properly measure this, they will more acutely aware of the benefits of waste reduction and recycling. It must be remembered that the potential for illegal disposal increases as variable disposal rates increase.

Governmental regulations can also have an impact on waste reduction programs. Legislative bodies must study current purchasing laws to determine how they affect waste reduction and recycling programs. They must then study the benefits and barriers to packaging and labeling laws. After much discussion, H-GAC's Waste Reduction and Reuse Subcommittee determined that some form of uniform labeling is needed to rate products and their packaging according to ease of reuse and disposal, and the toxicity of the product.

f. Conclusions

- Waste reduction is the EPA's and Texas Natural Resource Conservation Commission's most preferred method of solid waste management. It should be the most preferred integrated solid waste management method in the H-GAC region as well.

- Individual business and industry programs have taken the lead in solid waste reduction programs, without much coordination or linkage. A uniform or recommended package labeling program may be necessary to unify different industry labeling programs.

- There is a public perception that waste reduction should be implemented by industry and business. However, it is an activity that must have broad acceptance from the public, that when educated will implement waste reduction at the individual level.

- Comprehensive local government solid waste reduction programs are virtually non-existent in the H-GAC region. Future local programs will have to prioritize waste reduction by both the government agency and for citizens as well. Government agencies in the H-GAC region will have to set examples for small businesses and private citizens can follow in their day-to-day operation.

- The key to successful waste reduction programs is public education. While other methods of solid waste management can be implemented by a municipal crew or private contractor, waste reduction remains an activity in which every individual in the region should participate. Public education programs should be targeted toward major items in the waste stream and in a format easily distributed throughout the service area.

2. Recycling

Recycling is a resource recovery method involving the collection and processing of waste products into raw materials for new products. Discarded, used, surplus by-products and other elements of residential, institutional, commercial, and industrial solid waste can be converted into valuable new raw materials and products. The recycling process encompasses five essential elements which are: *Identification and Separation; Assessment; Collection and Processing; Markets for Collected Materials; and Re-entry of Recycled Products/End-Markets.* The EPA and the Texas Natural Resource Conservation Commission have endorsed a hierarchy of integrated waste management and recycling, the second step of the hierarchy, can reduce the depletion of landfill space, save energy and natural resources, provide useful products, and prove economically beneficial.

While a different process, composting is essentially recycling. Composting is the controlled biological decomposition of organic materials through microbial activity. Depending on the specific application, composting can serve as both a volume reduction and a waste treatment measure.

a. Types of Waste

The exact type, quantity, and quality of materials available for recycling will vary depending upon collection approach, processing technology, and the availability of markets. Generally, materials in the municipal solid waste stream that are considered potentially recyclable include paper and paperboard, glass, ferrous and non-ferrous metals, and plastics. Additionally, organic materials may be recycled through the composting process.

Paper and Paperboard

Paper of all types represent the largest component of the municipal solid waste typically representing about 38.2% by weight. Much of this waste paper can be recycled. The recycling of paper conserves trees and landfill space. Additionally, recycled fiber takes less energy to process than virgin fiber. Recycled paper is used primarily by paper mills that produce newsprint, stationery, towels, tissue, napkins, insulation, roofing paper, packaging, and paperboard.

Glass

The municipal solid waste stream contains 6.7% glass by weight. Recycled glass primarily from glass bottles and jars can be processed into raw material for new glass containers. Cullet (crushed, high quality glass) can replace some or all of the virgin materials used to produce glass. Glass is crushed and melted down for use in the manufacturing of containers, bottles/jars, fiberglass, asphalt, brick and door surfacing products.

Ferrous Metals

Ferrous metals are primarily in the form of tin cans, bimetal steel cans, and appliances (white goods). By weight, metal accounts for 8.1% of the municipal solid waste stream.

Steel can recycling conserves natural resources, reduces dependence on foreign sources, and feeds new steel production.

Aluminum
Typically, aluminum is usually the only non-ferrous metal that can be economically recovered from municipal solid waste. It represents approximately 1.3% by weight of the typical municipal solid waste stream. Beverage cans compromise about 80% of the aluminum content of solid waste. It is one of the most commonly and easily recycled metals. Recycled aluminum saves 95% of the energy required to refine raw materials.

Plastics
Plastics, by weight comprise of 7.7% of the national waste stream, however by volume they account for 30% of the waste stream. The focus of plastic recycling has been on primarily on PET (polyethylene terephthalate) soft-drink containers and blow-mold grade polyethylene (HDPE) such as milk containers. Recycled PET is made into polyester fiber that is used sleeping bags, jackets, comforters, jackets, pillows, upholstery filling, carpets, and floor tiles. HDPE can be recycled into flower pots, plastic lumber, and trash cans. The other types of plastics are not as easily to identify and separate.

Organic Materials
Organic materials, such as yard waste (leaves, grass clipping, and brush); food scraps; non-recyclable paper; food and seafood by-products; livestock manure; municipal sewage sludge; and other decomposable organic materials, may also be recycled through the composting process. Composting is the biological decomposition of organic materials through controlled aerobic conditions and converted into soil enriched products like soil conditioners, mulch, or low grade fertilizer. Currently, the most common type of composting is yard waste compost. Using H-GAC averages, it is estimated that 16.8% of all municipal solid waste by weight is yard waste.

b. Activities and Programs

Recycling activities within the H-GAC region are primarily influenced by the availability of markets. Houston and nearby communities have relatively easy access to end-markets. Many large end-markets are drawn to the Houston-Galveston region because of Houston's large population base, which can supply a sufficient amount of recyclable materials to serve as fuel stock. Port and rail make it a national/international distribution center. Smaller communities located farther away from the Houston area do not benefit as much from the Houston-based markets. These communities must pay higher transportation costs in order to get their recyclable materials to end markets, thus increasing their costs of recycling.

Existing Programs

Markets
The success of a recycling operation hinges on the availability of markets. Collected recyclable materials are still considered waste if markets are not found for reprocessing

and manufacturing of new products. No recycling effort should begin before markets have been identified and agreements signed. Such agreements should specify all the necessary criteria, prices and responsibilities, including transportation.

A list of area recyclers by types of materials accepted is shown in Table 15. Within the H-GAC region, there are 5 major end-users, 5 brokers, and 44 processors. Of these processors, 5 processors deal with paper; 22 with ferrous and non-ferrous metals; 2 with plastics; 5 with compost; and 10 with multiple materials. (This information was primarily compiled through a phone survey of existing recycling programs in the Houston metropolitan area. The purpose of the survey was to identify area recyclers and their methods of operation. Municipal recycling information was obtained through the H-GAC Regional Solid Waste Management Survey).

Paper. Markets for all paper grades are available within the Houston urbanized area. According to the H-GAC recycling survey, there are 18 buyers for various types of paper grades. The buyers may either recycle the paper into other paper products or recycle it into cellulose insulation and/or hydromulch. Nationally, consumption of paper and paper products totaled 85 million tons in 1989 and which 25% or 21.4 million tons were reclaimed for domestic use.

The majority the paper markets require that collected materials meet certain minimum specifications. For example, newspapers are required to be dry, baled or bundled, and be free of contaminants. The high grade, office paper markets often require that the paper be sorted by color and bundled. While the markets are present, the prices paid for materials are low. Prices can fluctuate dramatically depending on market conditions and paper grades.

Glass. The largest glass end-user within the H-GAC region is Anchor Glass which handles approximately one million pounds of glass each month. Nationally, glass recycling markets are increasing. Fifteen percent of the glass bottles and jars manufactured are recycled each year, principally as raw material for new glass containers. The glass industry has increased its interest in recovered glass materials because the use of cullet in their production processes allows them to decrease their consumption since cullet is easier to melt than virgin raw materials. Markets for glass have high standards for cleanliness and color sorting. Resale value is low, but the market is relatively stable. Color separation increases the market value of the glass material.

Ferrous Metals. The markets for ferrous and non-ferrous metals are plentiful in the H-GAC region. There are approximately 24 different buyers. Nationally in 1988, the recycling rate for all steel cans produced in the United States was 15%. Common buyers of recycled metal are detinning companies; steel mills; iron and steel foundries; and scrap metal processors and dealers. Market stability and prices paid for materials will vary depending on the existing industry demand, the quality of the materials recovered, and the associated transportation costs.

Aluminum. There are approximately 35 buyers of aluminum within the H-GAC area. Over half of the aluminum cans thrown away each year in the United States are recycled. In 1989, more than 49.4 billion aluminum cans (60.9% of the nation's total) were recycled and reused. The market for aluminum is relatively strong due to the high cost of producing aluminum cans.

Plastics. The markets for plastic are very limited both nationally and within the H-GAC region. About 1% of all plastics are recycled in the United States. Within the H-GAC region, there are only two buyers. However, depending on the market, these buyers may suspend buying at certain times. Plastic recycling has been plagued by collection and storage problems, rigid specifications, lack of processing equipment, transportation limitations, and inadequate markets and prices.

Organic Materials. Currently, the only strong compost market is for yard waste compost. There are 5 yard waste compost operations located within the H-GAC region. Primarily, yard waste compost is used commercially as a soil amendment; however, there is a small retail market in existence. The yard waste compost is blended with other materials to create an enriched soil which is sold to either horticultural or agricultural end users. In rural areas, the markets for yard waste compost suffer from economic constraints, such as high freight costs to transport yard waste to processing sites which are located near Houston. At the present time, there are no other types of compost markets because they are not economic feasibility due to high processing costs in comparison to low land disposal fees, large capital investment required for equipment, and lack of consumer acceptability.

Collection and Processing

Thirty-two municipalities/communities in the H-GAC region have voluntary recycling programs in operation. A summary of the programs is given in Table 16, on the following page. Fifty-nine percent of the programs are offered on a citywide basis. Pilot programs account for 27% of the programs, including the City of Houston's one remaining pilot program (a second program was recently completed for the city by BFI).

Numerous types of recycling programs are offered, and in some cities multiple programs are underway. The cities of Houston, Pearland, Oak Ridge North, Rosenberg and West University Place offer two types of collection methods. Collection programs utilized are curbside commingled, curbside separated, drop-off and buy-back. Drop-off and buy-back centers, the most popular collection methods, represent 69% of the programs. Of the fifteen curbside collection programs, 80% of them are curbside commingled.

Recycling efforts can be managed using one of three operating styles: public, public/private, and private. In 38% of the recycling programs, local governments are in charge. Combined public/private efforts account for 46% of the programs. Private entities, either for-profit or non-profit, operate 16% of the programs. Private entities involved in recycling are shown on Table 17.

Table 17: Private Entities Involved With Municipal Recycling Programs

Company	Cities Served
Waste Disposal Companies	
Best Waste Systems (Waste Watchers)	League City, Friendswood
Browning-Ferris Industries	Houston, Sugar Land, El Lago, Rosenberg, Richmond, Shoreacres
Purvis Disposal Company	Meadows
Tricil/Laidlaw, Inc.	Columbus, Eagle Lake, Weimar
Waste Management of North America	Houston (21 subdivisions)
Private Recycling Companies	
ASK Recyclers	Spring Valley
Concept Recycling	Palacios
Gulf Coast Recycling Services	Lake Jackson
K & B Recycling	Liberty
Non-Profit Organizations	
Brazoria Valley Special Industries	Bellville and Sealy
Clean Pearland	Pearland (drop-off)
Dickinson Beautiful	Dickinson
Keep Kingwood Beautiful	Kingwood
The Woodlands Community Association	Woodlands

Recycling programs have both start-up costs and ongoing operating costs. Start-up costs are one-time costs necessary to initiate the program. These may include: planning costs for activities; publicity costs to promote the new program; and initial capital costs if new equipment is needed. Operating costs include labor and operating collection costs, material processing costs, marketing, cost of shipping materials, overhead and promotion. Costs can be offset by avoided disposal costs, material sale revenue and in-kind services.

The cost of recycling programs can vary greatly due to the specific economics of an area, the program structure, and a community's resources. In 1988, the Glass Packaging Institute conducted a survey that illustrates the wide disparity in costs. The survey found that expenditures for collection vehicles ranged from 25 to 83% of capital expenditures, and total operating costs ranged from $46 to $227 per ton of material collected. Based on its 27,000-home curbside collection pilot program, the City of Houston estimates its net costs to be between $1.00 and $1.39 per household per month. As of January 1992, the program has generated a total of $144,966.51 in revenue and saved $122,582.94 in disposal costs.

Composting. The municipalities of Bellaire, Katy, Taylor Lake Village, Baytown, and West University Place have local composting programs in operation. The City of Sugar Land, in cooperation with a city volunteer organization, promotes backyard composting. The cities of Houston, Huntsville, Rosenberg, Palacios and Jersey Village either

participate in or promote the "Don't Bag It" campaign. The cities of Huntsville and Sealy collect yard waste separately from other solid waste. Yard waste is estimated to be 6% of Huntsville's total waste stream by weight. The City of Pearland recently received an EPA grant to study integrated solid waste management, which includes composting.

Commercial composting operations include Western Waste; Waste Reduction Systems, Inc.; Organic Matters; Living Earth Technology; and Nature's Best, Inc., which has offices in both Houston and Brenham.

Materials Recovery Facilities. Waste Reduction Systems, Inc., owns and operates the WRS Recovery Center. This materials recovery facility (MRF) is operated in tandem with the company's sanitary landfill. The facility and landfill are located at 100 Genoa-Red Bluff Road, near Beltway 8 and Old Galveston Highway. The center opened in April 1991. The WRS recovery facility occupies 50,000 square feet and has the capacity to handle 300 tons of commingled materials per day. Dry materials, such as aluminum, steel, wood, glass and plastic, are sorted by both automated and manual separation processes. Each type of material is handled differently depending on the purchasing requirements of the various mills that use the materials.

Planned Programs

Markets

Champion International Corporation has built an $85 million recovered fiber de-inking facility at its Sheldon, Texas, newsprint mill. Company officials expect the facility to take in 175,000 tons of used newsprint each year. The de-inking facility will consume more than 500 tons per day of old newspapers and magazines to manufacture 400 tons per day of deinked pulp. Champion estimates that the Houston-Galveston area will supply more than half of the recovered material required, thereby establishing a long-term market for old newspapers and magazines in the metropolitan area. The Champion project will have a positive impact on paper recycling. Based on the Champion facility impact, the paper recycling rate for Houston is expected to increase to 30-35% by late 1993 to mid-1994. Currently, the national recovery rate is 35%.

Occidental Chemical Corporation has announced plans to build a post-consumer plastics recycling plant in the Dallas area. Construction is expected to take 12 to 18 months after engineering studies are completed. The project will cost more than $5 million. The plant will have the adequate capacity to process up to 40 million pounds of plastics. All types of plastics will be recycled. The pellets resulting from the recycling will be used to produce the company's new line of recycled products, used to make non-food containers, such as, detergent bottles, grocery bags and bottles for shampoos and waxes.

The Bassichis Company, a division of Houston-based Allwaste, is opening a new secondary glass processor facility in Houston to serve the existing Anchor Glass Container Corp. which is located in Houston. The $500,000 facility will have the ability to process over 50,000 tons of container cullet per year.

Collection and Processing

Recycling. The City of Houston plans to expand its curbside collection to all of Houston's 400,000 single-family households over the next three years. The city also plans to expand the range of materials collected to include used motor oil and telephone books on a limited basis. The net program cost is expected to be approximately $4 million per year. Long-term plans for the city include four or five additional buy-back centers and two processing centers.

Thirteen municipalities in the region are currently studying the feasibility of implementing a recycling program of some type. The municipalities are: Hitchcock, Deer Park, Humble, Jacinto City, Katy, La Marque, Nassau Bay, Pasadena, Pearland (curbside), Taylor Lake Village, Webster, Conroe, Hempstead, Wharton, San Felipe, Clute and Sweeney.

Composting. The City of Houston has contracted with WPF Co. of Ohio to compost its municipal solid waste. The application was originally submitted to TNRCC in January 1991. In May 1991, the application was amended due to a change in facility location. The proposed mixed waste composting center is to be located along the Houston Ship Channel. Limited front-end separation of recyclables will occur prior to composting, and there will be final screening of the compost. It is estimated that the facility will be able to handle 1,000 tons per day. The city will be under contract to provide WPF with 750 tons of municipal solid waste per day for four days each week. The city will need to deliver 30% of its waste stream to fulfill its contract. The proposed tipping fee is $17 per ton. It is estimated that the permitting process will take approximately two years. This proposed facility would reduce the city's need for landfilling and/or incineration.

c. Impact of Legislation and Regulations

Federal

The Resource Conservation and Recovery Act of 1991 (RCRA '91) has been introduced in the U.S. Senate by Senators Baucus, Burdick and Chafee. The bill, which emphasizes planning and regulation, would establish a national hierarchy for the management of waste; set quantified goals for recycling; provide for minimum recovery and utilization rates for newsprint, mixed paper and other types of paper products; and promote the procurement and use of recyclable and recycled products. RCRA '91 would positively impact regional councils of governments such as H-GAC due to its strong planning requirement, and it would continue to encourage state and regional planning as the basic strategy for coherent solid waste management and practices. However, as introduced, RCRA '91 has no provisions for funding of state and local government planning. Instead, the regulatory consequences are the catalysts for plan implementation.

Other federal legislation has been introduced which has the potential to affect recycling, interstate transportation of waste, and composting. The National Recycling Markets Act

of 1991 (H.R. 2746) has been introduced with the goal of promoting markets for recycled materials. The bill would set minimum content standards for manufacturers, establish recycling rate goals for products and packaging, and set standards for labeling of products. If passed, this bill would establish a uniform set of definitions and standards, thus helping to reduce some of the confusion associated with recycling.

U.S. Representative Towns has introduced a bill (H.R. 2580) in the House of Representatives which would ban completely the exporting and importing of solid waste from the United States. This ban would include the export of scrap metal, paper, glass, plastics and any other recyclable materials. The impact would be a dramatic reduction lessening of potential external markets for recyclable materials.

State

Senate Bill 1340. In 1991 the 72nd Texas Legislature enacted a comprehensive recycling law, S.B. 1340. The bill:

- sets a state recycling goal of 40% by January 1, 1994
- mandates the General Land Office to conduct, in cooperation with the Texas Department of Health, the Texas Natural Resource Conservation Commission and the Texas Department of Commerce, a market development study/implementation program
- mandates the General Land Office to conduct a recycling awareness campaign
- provides for recycling and preference for recycled products by state agencies, state courts or judicial agencies, university systems or institutions of higher education, counties, municipalities, school districts and special districts
- provides for the development of specifications for recycled products
- mandates the Municipal Solid Waste Management and Resource Recovery Advisory Council to develop recommendations for a state composting program
- requires development of standards for diversion of household hazardous waste
- mandates a state newsprint recycling program
- addresses rates for intrastate transportation of recyclable materials and the disposal of lead-acid batteries.
- creates the Waste Tire Recycling Program as well as a Used Oil Program, both to be administered by the Texas Natural Resource Conservation Commission

The bill also addresses environmental education, reclaimed asphalt paving, fossil fuel combustion recycled material, and the duties of the Interagency Coordination Council. The bill is effective September 1, 1991, with some exceptions.

Impact. Overall, the implementation of S.B. 1340 should positively impact recycling, although some of the benefits will be slow to develop. The market development study and implementation program, the recycling awareness campaign, the governmental entity recycling requirement, and the newsprint recycling program will have immediate benefits.

However, short-term problems may emerge if there are no markets for the collected goods. Provisions of S.B. 1340 should encourage the development of these new markets, but it will take time. The provision that allows a governmental entity to give preference to recycled products should stimulate the buying of recycled materials. It should be noted, however, that no set price preference was determined.

Implementation of S.B. 1340. In order to implement the requirements of S.B. 1340, new regulations addressing transportation of recyclable materials, measurement of recycling rates, and newsprint recycling have been adopted by various agencies. In addition, a public awareness campaign has been initiated and a special composting committee has been formed. The Texas Natural Resource Conservation Commission will be responsible for the recycling rate reporting. Rules were adopted to set up a record-keeping and reporting system to track the quantities of discarded materials being recycled in Texas. Regarding newsprint recycling, TNRCC established rules to set target goals (10% by the end of 1993; 20% by the end of 1997; and 30% by the end of 2000) for the use of recycled newsprint by Texas newspapers. The Texas Railroad Commission adopted new rules that establish a set of rate provisions for trucking "recyclable materials" in Texas, to assure that such trucking is competitive with interstate trucking of these materials.

d. Evaluation of Current System

Recycling activities which include composting are at an unprecedented level in the communities located near Houston. For smaller non-urban or rural communities, recycling activities are not nearly as strong. H-GAC estimates that its current overall recycling rate is approximately 10% with the Houston urbanized area having a higher rate than the outlying areas. For each type of recyclable materials no individual recycling rate estimates were made. The degree of recycling and the number of facilities will need to increase over the three planning horizons to meet the regional recycling goals of 20% by 1997, 40% by 2002, and 65% by 2012.

Existing implementation of composting and "Don't Bag It" programs is inadequate to meet the regional yard waste recycling goals of 20% by 1997, 50% by 2002, and 80% by 2012. Given the importance of waste reduction and recycling, composting programs will need to be strengthened to reflect this priority. Yard waste minimization or utilization programs, backyard or home composting programs, local and/or regional composting programs, and organic municipal solid waste material composting programs will be needed. Markets and alternative uses for compost will also need to be developed.

Markets

The development of recycling markets is impacted by economic principles, technical issues, and/or market factors. Economic barriers may include competition between recycling and different management options; imbalances between supply and demand; and cost factors, such as government subsidies to virgin materials. If a manufacturer must pay more for materials derived from recycling whether it is the result of higher transportation costs, subsidies to virgin materials, or higher processing and handling costs, recycling will suffer.

Economic forces that limit markets can include: the cost of raw materials, capital and labor; the costs of transportation; new business or capacity expansion decisions; and end-product prices. Examples of market barriers are government and commercial specifications; the requirements and specifications of bid policies; specifications and price preference of contract policies; facility siting concerns; and initial capital investment requirements. Basic cost factors can also influence recycling, as it competes with landfilling and incineration. In many cases, the choice between recycling and traditional disposal forms depends on the costs of the different management options. Traditionally, increased recycling is driven by high disposal costs.

Perceptions and attitudes of manufactures and consumers can also impact recycling. Some consumers are unwilling to buy recycled products because they perceive the product to be inferior, they prefer the visual appearance of a product that is made from virgin materials, or they are unaware that a recycled product is available. Manufacturers may be unwilling to used secondary materials because they are unaware of technical advances in the reprocessing or they are considered with the liability issue.

Markets for recycling can be driven by procurement policies and price preferences. Investments into the recycling business and its continued growth can be strongly influenced by access to dependable large-volume markets such as governmental contracts. Government purchases represent a large market, approximately 20% of the gross national product. Government purchase of recycled products can stimulate the market and increase the availability of recycled goods. Municipalities should develop procurement policies that actively promote the purchase of supplies, materials and equipment made with recycled or recyclable materials. Bidding procedures should clearly indicate a preference for such products. Contracts should be awarded to bidders offering such products when quality and performance are not compromised and cost differentials between such products and products made with raw materials are not excessive.

Many governmental agencies, as well as H-GAC, have voluntarily adopted resolutions encouraging the purchase of products made from recycled materials, as well as purchases of products that may be recycled when they have served their intended use. Additionally, Texas legislation provides for governmental entity preference for recycled products. As of September 1, 1991, governmental entities shall give preference in purchasing to products made of recycled materials if the products meet applicable specifications regarding quantity and quality.

Technical issues, such as material quality, may also serve as barriers. Material quality can limit the substitutability of secondary materials for virgin materials. The inability to remove certain contaminants also hinders recycling. For example, certain unremovable contaminants in some iron and steel scrap compromise the strength of the final steel product, thereby, limiting the amount of scrap that can be used and the types of products in which it can be used. Contaminant removal also negatively impacts some plastic recycling.

Collection and Processing

Recycling Collection Methods. Collection procedures will vary according to type of solid waste being recycled and to individual program's resources and needs. Basic methods of collection are: curbside collection or direct pickup, drop-off centers, and/or buy back centers. Curbside collection or direct pickup is typically the most convenient collection methods for the participant and has the highest level of participation and waste reduction. A 3-15% reduction of the waste stream can be expected.

Curbside programs consist of three methods of collection; curbside commingled, curbside separated, and curb-sort. Operational decisions that must be made include: commingled or separated; same day as regular trash pickup or a different day; one person crew or multi-person crews; and type of household containers. Commingled collection is a relatively efficient and easy collection process. However, a subsequent facility for sorting is required. Requiring recyclables to be separated, reduces labor costs, but may reduce public participation. Many participants feel extra sorting is inconvenient. Picking up of recyclables the same day as regular trash pickup has an advantage in that it is easier for residents to remember. A disadvantage might be that collection routes may have to be adjusted in order to have sufficient vehicle capacity. Having an one person crew is more cost effective, since labor is the highest cost in most recycling programs. The additional of a second or third crew member adds little to collection productivity.

Decisions regarding the type of household recycling containers to be used must be made. Types of containers include plastic bins, bags, and large roll-out carts. Several studies show that participant participation rates are higher when collection containers are provided. The presence of one uniform recycling container creates peer pressure among neighborhood residents. However, uniform recycling containers such as plastic bins or roll out carts significantly increase start up costs. A benefit of using bags as the collection containers is that labor is saved in collection because the driver doesn't have to return the container to the curb. Some contamination problems are associated with the use of bags and glass can not be collected in bags.

Drop-off centers consist of unattended containers, trailers (stationary or mobile), or sites where materials may be deposited. They can be sponsored by the local government or by non-profit organizations. These centers are inexpensive and beneficial to communities just beginning a recycling program, rural areas, and apartment complexes. Success of these centers depends on public participation, type of technology employed, and amount of revenue received from sale of collected materials. Drop-off centers require more effort by individual citizens. One to three percent reduction of the waste stream can be expected.

Buy-back centers, sometimes associated with drop-off centers, are facilities in which individuals are paid an amount based upon the current market price for materials. They

provide citizens with an added incentive to recycle by paying individuals or organizations for their recyclables. The expected waste stream reduction is 1-3%.

Higher costs are associated with the operation of buy-back centers since money must be paid for the materials recovered. In areas that are economically disadvantaged, buy-back centers may achieve the highest level of participation. To adequate evaluate the effectiveness of a buy-back center, the costs of operations must be compared to the avoided disposal costs.

Material Recovery Facilities (MRFs). MRFs can operate in conjunction with both drop-off and curbside programs and can process separated materials or commingled recyclables. The primary advantage of MRFs is that they allow recyclables materials from a municipality or subregion to be pooled and processed uniformly. However, not all communities need a MRF. The need for a MRF depends on local market demand, the type of collection method utilized, the number of different recyclables collected, and the quantities of materials.

A MRF may be attractive option to a community or subregion if the buyer of the materials requires extensive processing, if a large variety of recyclables are collected and they require intermediate separation, or if a vast amount of materials are handled. Since MRFs require significant capital and operating costs, a large amount of materials must be handled to justify the cost of the facility.

Composting. Numerous types of composting operations are in existence. Feedstock for compost operations can include yard waste, municipal solid waste, sludge, and agricultural/animal waste. Alternate composting systems, such as windrow and static pile or in-vessel are available. Windrow and static pile systems typically process material in an unconfined area, and the product is stored in piles to undergo further stabilization. In-vessel composting processes the material in enclosed structures.

Yard waste composting which includes such things as grass, leaves, garden debris, bark and pruning, has been the primarily focus of composting. The removal of yard waste and other organic materials also benefits incineration operations. Yard waste does not burn well due to high moisture content. Additionally, the burning of nitrogen rich grass cuttings can produce nitrogen oxide, which contributes to air pollution.

Municipal solid waste composting requires a large amount of pre-processing of the feed stock. Isolation of the compostable portion of the municipal solid waste stream (yard waste, food wastes, and organic fractions such as paper) must be separated from the waste stream. Equipment is required to separate the materials into compostable and noncompostable fractions, shred the material and provide adequate aeration. Contamination problems, such as the presence of heavy metals, may exist without proper pre-processing. Municipal solid waste composting can reduce a large portion of the waste stream, but typically at a high cost.

Waste reduction levels for municipal solid waste composting will vary depending on the facility capacity, level of material recovery included in the system design, waste stream composition, and material market requirements. Municipal solid waste composting can recover approximately 50-60% of the waste stream; however, this recovery rate can be increased by an additional 10-15% if a front-end recycling is employed.

Sludge composting involves the mixing of sludge with some type of bulking agent such as sawdust, wood chips, leaves, or recycled compost. Sludge composting facilities may be static piles, windrows, or in-vessel. For environmental and public health reasons, sludge piles are generally built on some type of pad and are enclosed. Compared to municipal solid waste compost facilities, sludge composting facilities are easier to site due to reduced area requirements and odor problems. The sludge compost product contains high nutrients, especially nitrogen, and is considered a valuable product when sufficient quality is assured.

Agricultural/animal waste composting involves the mixing of animal manure with bulking agents. This mixture is then composted in either windrows or static piles. The final product is a highly nutritive soil additive. This type of composting is generally performed by small, private entities such as farms or nurseries. Zoos may also compost their animal wastes.

e. Evaluation of Alternatives

Each community has its own special recycling requirements. Each community needs to assess their community resources; analyze their current management practices; and identify markets for recyclables.

A multi-jurisdictional approach to recycling may be needed for smaller, non-urban communities. Joint recycling systems can help improve market development by allowing collected materials to be pooled, therefore, creating a larger, more marketable supply for buyers. Additionally, such programs may increase the cost effectiveness of their recycling programs by pooling resources of several communities. Economies of scale can also influence the purchasing of collection vehicles and equipment, financing programs, and MRFs. Sub-regional programs can share processing equipment and key personnel. A single recycling coordinator could handle marketing, education, and promotion activities for a subregion. Peer information exchanges can exist within a subregion.

Proximity to markets and the associated transportation costs greatly affect recycling programs. Since prices are relatively low, high transportation costs can doom an otherwise successful operation. These costs may be reduced through the use of transfer stations, rail transportation, and/or cooperative transportation agreements. Actions to reduce transportation costs should be further explored.

Public awareness and education are the keys to success for any recycling program. Public officials, business leaders, and the general public need to be educated on the benefits of recycling and the importance of buying recycled products. Public officials and

community leaders have the need for increasing recycling information exchange and training opportunities to help communities build truly effective recycling programs. Education of public officials will assist them in evaluating recycling alternatives to choose the most cost-effective, appropriate type of recycling program for their community. For the commercial sector and general public, educational efforts are needed to get individuals to source separate and to buy recycled products. Publicity campaigns and education programs are needed to encourage recycling and achieve high participation rates.

Funding is crucial to the long-term survival of recycling programs. Given the present state of recycling within the H-GAC area, recycling programs are expensive to initiate and operate. Revenue from the sale of collected materials is not able to sufficient the programs. Creative financing options are needed. A possible financing option is the establishment of dedicated funding source. A dedicated fund for recycling programs would relieve local officials from the uncertainty of yearly allocations. Additionally, an added fee or tax would serve as an incentive to recycle.

Many materials can be recycled at least several times before their final disposal, therefore decreasing the use of virgin materials. Recycling materials several times may produce less pollution and use less energy than from both the manufacturing of a new product from virgin materials and landfilling or incineration. However, recycling does produce some pollutants, particularly heavy metals and dioxins. Iron and steel scrap can contain lead, cadmium, and chromium. These metals may be found in the sludges from the core-making processes and baghouse dusts. Problematic air emissions are also common, however, the occurrence may be reduced if electric arc furnaces are used. Heavy metals may exist in air emissions from aluminum recycling if the scrap aluminum was contaminated with painted labels, plastics, oil and grease. In paper recycling, heavy metals may be present in wastewater and de-inking sludge. Some printing inks contain pigments that have lead and cadmium. In addition, paper recycling may produce dioxins, a by product of pulp bleaching. Dioxins have also been found in the emissions of some scrap and metal smelting facilities.

Composting

Composting programs are designed to complement other management activities. The most obvious benefit of composting is the saving of landfill space. The level and type of composting needed can vary according to a variety of factors. In general, higher technology options are used in urban areas where the availability of space is limited and odor levels are more of a concern. For smaller, non-urban areas, low-level technology approaches may be more feasible due the lower costs. Factors that influence the type and level of composting needed are: distance from collection routes; available resources; quantity of compostables in the local waste stream; and, relevant regulations. Regarding the last factor, compost operations may generate odors which can violate nuisance and air quality laws. Composting facilities may also be limited by storm water an sediment control requirements.

When evaluating composting as an option, cost of collection, processing, and distributing must be considered. These costs should be weighed against the avoided disposal costs and the environmental benefits of the composting program.

Governments can stimulate the market for compost by using the compost themselves and by requiring their private contractors to use compost. Municipalities should be encouraged to use compost materials whenever possible and to compost their own organic waste. Municipalities could use the compost on public parks, playgrounds, and roadside and median strips. In general, governmental support is needed for the development of composting programs and/or other management techniques that beneficially use yard waste and other organic matters.

Quality standards and grades of compost should be developed by the composting industry. Compost from various feedstocks should be given different grades and recommended for highest and best use. Development of standards and grades will assist with market development.

While composting is a recommended management activity, there are several environmental effects. Odor generation is the most common of these effects. Odor can be minimized by frequent turning of compost piles and through proper temperature control. The use of in-vessel composting systems also reduces odor problems.

Composting can also result in water quality impacts. Water runoff from a yard waste composting operation often contains large concentrations of nutrients which can cause algae blooms in nearby surface waters. Municipal solid waste composting and sludge composting can present more serious water quality problems. These operations can introduce high levels of nitrates, phosphorus, volatile organics and metals to the water supply.

f. Conclusions

- The success of a recycling program depends on markets. No recycling effort should begin before markets have been identified and agreements have been signed. If there are no available markets, the collected materials will have to be landfilled. Not all material markets are not mature. An established market may quickly go out of business, thus requiring disposal of recovered materials. Additionally, markets fluctuate as prices rise and fall in relation to demand and supply changes.

- Market development is crucial to recycling. Local and state governments need to be actively involved in market development. Government entities need to evaluate their codes and ordinances to eliminate regulatory barriers. Government entities also need to implement recycled product procurement programs.

- Components of a recycling operation will vary from program to program. Each community will need to design recycling program based on their own resources and

needs. Curbside collection may not be feasible for every recycling program. Typically, curbside collection is best suited from urbanized areas. For less populated areas, drop-off facilities may be more cost effective and for economically depressed areas, buy-back centers may booster public participation by providing an economic incentive to participate.

- Typically, transportation costs exceed material revenue, thus making cost of operation high and economically unviable. To save on transportation costs, it is best to work with local markets, if possible. It is also more cost effective to transport full loads to markets. Ample room for storage of collected material is needed so a full load can be collected.

- Recycling goes beyond collection. Recycling is a resource recovery method involving the collection and processing of recovered products into raw materials for new products. The best way to sustain and strengthen recycling efforts is to manufacture products made with recycled materials.

- Multi-jurisdictional recycling programs can help make recycling efforts more cost effective by pooling resources and creating economies of scale. Multiple jurisdictions can share processing and collection equipment, marketing responsibilities and financing programs. Cooperative marketing with surrounding areas involved in recycling will produce higher volumes of collected materials. Higher volumes demand more competitive prices.

- Various technical and equipment options may be exercised. Required equipment and associated costs, depending on level of technology chosen, will vary with each recycling program. Specialized equipment or existing equipment with alterations or may be used. The more separation and processing done before shipping to market, the higher price paid by the buyer, but the operation costs will also be higher.

- Municipal solid waste recycling is a relatively new industry. Markets and technical expertise are still in the development stages. Cooperation is needed between the public and private sectors. Communities should consider partnerships with the private sector who typically has more experience in recycling.

- Funding is needed for research and market development. New recycling businesses need to be stimulated. If a particular market collapses and other recycling alternatives exists, the recovered material will not require disposal.

3. Collection and Disposal

a. Activities and Programs

The following section presents a description of municipal solid waste collection and disposal activities and programs in the H-GAC region.

Existing Programs

Collection Programs. There are four types of residential waste collection programs in the H-GAC region. Municipal governments operate curbside waste collection programs in 31% of the communities which responded to H-GAC's Solid Waste Management Survey. Private curbside collection programs serve 45% of the responding communities. An additional 16% of the collection programs are contracted by individual citizens, mainly in unincorporated rural areas and communities with under 1,000 population. These individuals must contract with private haulers or transport their waste to landfills themselves. The remaining 9% of the region is served by drop-off centers, where citizens take their refuse to a central location provided by the city or county. Appendix 3 provides a detailed list of collection and disposal services provided by communities in the H-GAC region.

Transfer Stations. There are currently twelve permitted transfer stations in the H-GAC region. Six of these, all in Harris County, are inactive at this time. The remaining active transfer stations are listed in Table 18.

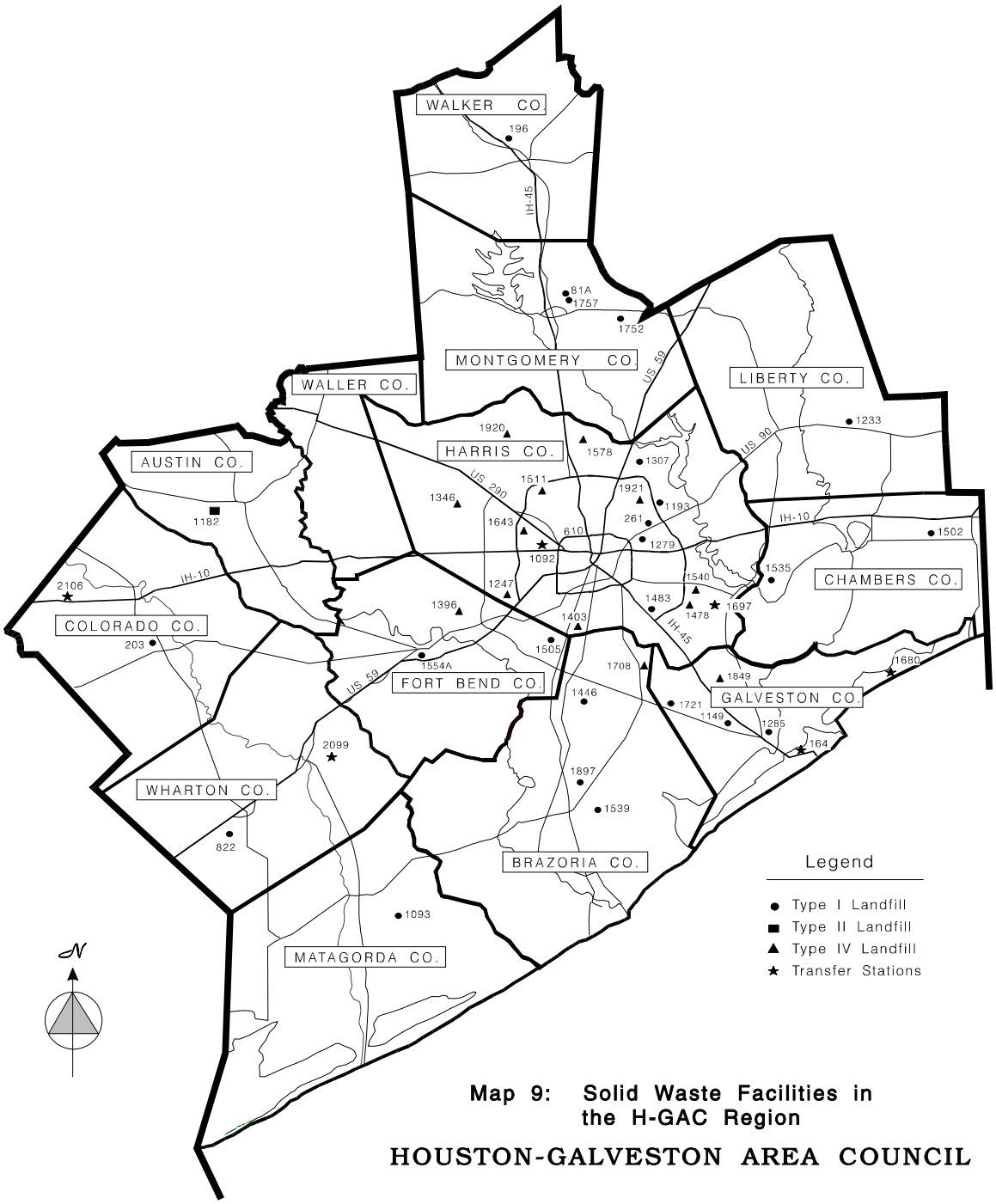
Under new TNRCC rules, transfer stations may be operated with a "registration-only" permit if the site is serving less than 5,000 people. A registration-only permit is completed by filling out Part A of the permit application and by completing a site operational plan. Matagorda County, the Town of Dayton in Liberty County, the Town of San Felipe in Austin County, and Wharton County are the only local governments currently utilizing the registration-only permit for the operation of a transfer station.

Table 18: Active Transfer Stations in the H-GAC Region

Permit #	County	Area Served
2106	Colorado	City of Weimar and Schulenburg area
164	Galveston	City of Galveston
1680	Galveston	Crystal Beach (Bolivar Peninsula)
1697	Harris	City of Deer Park
1092	Harris	City of Houston
2099	Wharton	City of Wharton

Landfills. Landfilling is the predominant solid waste management method in the H-GAC region. Throughout the 13-county H-GAC region there are 36 active landfills. As shown

in Table 19, 26 of the 36 active sites are private operations. Map 9 shows all active landfills and transfer stations in the H-GAC region.



Map 9: Solid Waste Facilities in the H-GAC Region

HOUSTON-GALVESTON AREA COUNCIL

Figure 13: Solid Waste Facilities: HGAC Region

Permit #	Operator	County	Type
81A	Western Waste/City of Conroe	Montgomery	I
164	City of Galveston/GCA	Galveston	V-TS
196	City of Huntsville	Walker	I
203	Tricil Environmental (Laidlaw)	Colorado	I
261	BFI/ McCarty Road	Harris	I
822A	City of El Campo	Wharton	I
1092	City of Houston	Harris	V-TS
1093	Matagorda County	Matagorda	I
1149	BFI/ Hitchcock	Galveston	I
1182	City of Bellville	Austin	II
1193	BFI/ Whispering Pines	Harris	I
1233	City of Liberty	Liberty	I
1247	Doty Sand Pit	Harris	IV
1279	WMNA/ Bluebonnet	Harris	I
1285	City of Texas City	Galveston	I
1307	WMNA/ Atascocita	Harris	I
1346	Gary O. Weiss	Harris	IV
1396	Fort Bend Co. Reclamation	Fort Bend	IV
1403	Casco Hauling and Excavation	Harris	IV
1446	City of Alvin	Brazoria	I
1478	Sanifill of Texas/Greenbelt	Harris	IV
1483	Urban Waste Technologies	Harris	I
1502	Chambers County	Chambers	I
1505	BFI/ Fort Bend	Fort Bend	I
1511	Sanifill of Texas/ Allweather	Harris	IV
1535	Hazelwood	Chambers	I
1539	Brazoria County Disposal	Brazoria	I
1540	Sanifill of Texas/Greenshadows	Harris	IV
1554A	Fort Bend County	Fort Bend	I
1578	Sanifill of Texas/ Hardy	Harris	IV
1643	Sanifill of Texas/West Belt	Harris	IV
1680	City of Crystal Beach	Galveston	V-TS
1697	City of Dear Park	Harris	V-TS
1708	Dixie Farm Rd L/F-Hill Sand Co.	Brazoria	IV
1721	E&D Waste Systems	Galveston	I
1752	Montgomery Contractors	Montgomery	I
1757	Western Waste	Montgomery	I
1849	North County	Galveston	IV
1897	Sanifill of Texas	Brazoria	I
1920	Robin Ray/ Clow Road L/F	Harris	IV
1921	Cougar Landfill	Harris	IV
2099	City of Wharton	Wharton	V-TS
2106	City of Weimar	Colorado	V-TS

Type I landfills serve more than 5,000 persons and require daily compaction and cover. The publicly-owned Type I landfills are generally spread throughout the H-GAC region. They may have a service area which is greater or less than the entire county in which they are located. As can be seen in Tables 19 and 20, Austin and Matagorda counties will have limited landfill capacity in the near future. All of the landfills in Waller County will be closed by the end of 1992.

The publicly-owned Type I facilities in Chambers, Fort Bend, Montgomery and Walker counties serve as regional facilities, providing disposal services for most of the host county and for some communities outside of the county. Most of the privately-owned Type I facilities are located in five of the seven Houston CMSA counties (Brazoria, Fort Bend, Galveston, Harris and Montgomery). They represent 46% of all Type I facilities and 75% of all available Type I disposal acreage. The private site in Chambers County serves portions of Chambers, Harris and Liberty counties, while the Colorado County site serves as many as six counties both in and outside of the H-GAC region.

Sixty-one percent of all Type I landfills, or 78% of the Type I landfill acreage, are owned and operated by private companies. Two of the landfills, Urban Waste Technologies and E&D Waste Systems, are currently baling waste before disposal. The lone remaining Type II facility in the region is operated by the City of Bellville.

Type IV facilities are for the disposal of brush, construction and demolition waste. All of the Type IV capacity in the region is privately operated. The Type IV facilities are all located in four counties of the Houston CMSA (Brazoria, Fort Bend, Galveston and Harris), where construction activities are prominent enough to support such a facility.

Table 19: Active Landfills in the H-GAC Region

	Type 1		Type 2		Type 4		
County	Public	Private	Public	Private	Public	Private	**Total**
Austin			1				1
Brazoria	1	2				1	4
Chambers	1	1					2
Colorado		1					1
Fort Bend	1	1				1	3
Galveston	1	2				1	4
Harris		5				9	14
Liberty	1						1
Matagorda	1						1
Montgomery	1	2					3
Walker	1						1
Waller							0
Wharton	1						1
Total	**9**	**14**	**1**	**0**	**0**	**12**	**36**

Source: Texas Department of Health self-reporting data (1989), with corrections made from local government and industry contacts.

Table 20: Acreage of Active Landfills in the H-GAC Region

County	Type 1 Public	Type 1 Private	Type 2 Public	Type 2 Private	Type 4 Public	Type 4 Private	**Total**
Austin			12				12
Brazoria	75	196				76	347
Chambers	76	41					117
Colorado		75					75
Fort Bend	80	339				70	489
Galveston	54	506				13	573
Harris		301				220	521
Liberty	16						16
Matagorda	10						10
Montgomery	25	254					279
Walker	30						30
Waller							0
Wharton	106						106
Total	**472**	**1,712**	**12**	**0**	**0**	**379**	**2,575**

Note: 219 acres of Type 1, Type 2 and Type 4 landfill space in Austin, Harris, Walker, and Waller counties is currently permitted, but the sites are listed as inactive by the Texas Department of Health. These acres are not shown in this Table. In Fort Bend County 339 acres of the private active landfill space is in the BFI-Fort Bend Project. The site is under construction and will be open by 1993.

Source: Texas Department of Health self-reporting data (1989), with corrections made from local government and industry contacts to 1990 acreage.

Appendix 7 includes a list of all solid waste management permits ever issued in the H-GAC region.

Incineration. Although there have previously been active facilities, there are currently no active municipal solid waste incinerators in the H-GAC region.

Planned Programs

Planned Transfer Station Expansions and New Facilities. Best Pack Disposal, Inc., has filed for a permit to operate a transfer station in northwest Houston. If permitted, the transfer station will serve 400,000 people and accept up to 1,000 tons of waste per day. This facility is currently in the public hearing process. Several other transfer station studies are underway in the region. Matagorda County officials are considering their transport options once the Matagorda County landfill closes. The focal point of the study now is the use of a centrally located transfer station to serve the counties residents. There are also several private companies studying the use of transfer stations to make their landfill more accessible as a regional landfill. It is not known how many permit registrations are being considered at this time.

Planned Landfill Expansions and New Facilities. Table 21 shows pending landfill permits in the H-GAC region. These proposed permits are for facilities which would add capacity to areas of the region where capacity is currently limited. These permit

applications have appeared in the *Texas Register* since November 1990. H-GAC cannot comment on these permit applications until they are released for agency review by TNRCC. Several other landfill studies are under way in the H-GAC region, as listed in Table 22. These studies are not permit applications as of yet, and they may never be proposed.

Table 21: Landfill Permit Applications and Amendments

Permit #	Type	Applicant	County	Acreage
1446	1	City of Alvin	Brazoria	70
1535-A	1	Hazelwood Enterprises, Inc.	Chambers	160
1721-A	1	E&D Waste Systems Inc.	Galveston	40
1307-A	1	Waste Management	Harris	157
150-A	4	Hughes Sand Pits, Inc.	Harris	24
1420-A	4	Dependable Trucking, Inc.	Harris	10
1441-A	4 to 1	Indian Paint Brush Development	Harris	aerial
1921	4	Cougar Landfill	Harris	119
2185	4	Sanifill of Texas, Inc. (Tanner Road)	Harris	85
1965	1	Greens Bayou Development, Inc.	Harris	44
2110	1	Madden Road Landfill Limited Partnership	Fort Bend	180
2202	1	Evergreen Development Corp.	Harris	174

From H-GAC Survey of Local Governments and *Texas Register*

BFI recently received a permit for a Type I facility in Jefferson County, which is just east of the H-GAC region, adjacent to Chambers County. This facility may impact future plans for regionalization in the Chambers and Liberty County area. Two other studies are under way to site and develop Texas Natural Resource Conservation Commission-approved Class 1 industrial non-hazardous waste disposal sites. These studies are being undertaken by private industry in Colorado County (Laidlaw Environmental) and Montgomery County (Western Waste).

Planned Incinerator Expansions and New Facilities. There are currently no planned incinerators other than the Eccor, Inc., permit application in Liberty County. The Eccor facility will accept medical waste, along with a small portion of municipal solid waste. The Lower Colorado River Authority is currently studying the feasibility of converting Unit 3 of the Fayette Power Project (in the Capital Area Planning Council Region) to a municipal waste incinerator.

Facility Siting

As part of the H-GAC Regional Solid Waste Management Survey, municipalities were asked if there are any ordinances, land use plans or local policies that would possibly restrict the siting and operation of any solid waste management facility -- public or private -- in their community. Twenty-three out of 120 municipalities responded that they do have some type of ordinance or policy that would restrict siting. Zoning is the

Table 22: Landfill Studies in the H-GAC Region

Applicant	County	Type of Study
City of Sealy	Austin	Expansion or closure of their current Type 2 landfill, or commercialization.
City of Bellville	Austin	Expansion or closure of their current Type 2 landfill, with possible expansion to a regional facility.
Chambers County	Chambers	Expansion of 1502 into a regional landfill.
Sanifill of Texas, Inc.	Chambers	Expansion of 1535 (Hazelwood Landfill)
Sanifill of Texas, Inc.	Harris	75 acre expansion to 1540 (Greenshadow)
Sanifill of Texas, Inc.	Harris	25 acre expansion to 1565 (Fairbanks)
City of Houston	Harris	Type 1 Facility
Matagorda County	Matagorda	Expansion or closure of their current landfill.
Western Waste	Montgomery	Type 1 permit adjacent to 81A and 1757.
City of El Campo	Wharton	Expansion of landfill to regional facility or privatization of operation.
Darrel D Dickey, Inc.	Walker	Expansion of Walker County Type 2 landfill, which was never constructed, to a Type 1 regional landfill.

From H-GAC Survey of Local Governments

ordinance most communities utilize to direct the development of solid waste management facilities.

b. Impact of Changes in Legislation and Regulations

Federal

The Resource Conservation and Recovery Act of 1992 (RCRA '92) has been introduced into Congress. Provisions in RCRA '92 would mandate state solid waste management plans and require capacity estimates, waste inventories, and source reduction and recycling goals. It would authorize states to impose higher fees on out-of-state municipal solid waste. The bill would link such authority to the EPA's approval of state solid waste management plans.

To allow state control of out-of-state waste imports, the draft includes provisions for each state to charge a higher disposal fee for waste generated out of state. The maximum fee could not be higher than ten times the highest total fees charged for disposal by the state where it is generated. If a state chose not to set differential fees, the state could set limits on the total amount of waste imported.

Besides RCRA '92, the issue of whether states should be allowed to regulate interstate transportation of municipal solid waste for disposal is being discussed at the federal level. Several bills have been introduced. Senator Coats (R-Indiana) introduced legislation that would enable a state to ban or limit solid waste imports once the state has developed a 2-year plan to manage waste within its borders. Representatives Mike Synar (D-Oklahoma) and Howard Wolpe (D-Michigan) have initiated legislation that would establish a system of permits, fees and international agreements to control the export of solid and hazardous wastes.

EPA's RCRA Subtitle D rules became effective on September 11, 1991. The rules mandate minimum federal standards for municipal solid waste landfills, including location restrictions, facility design and operating criteria, groundwater monitoring requirements, corrective actions requirements, financial assurance requirements, and closure and post-closure requirements. These rules were written in response to 1984 amendments to RCRA that mandated EPA to adopt minimum standards for municipal solid waste landfills.

The final Subtitle D rules were published in the *Federal Register* on October 9, 1991. The standards are considered minimum operating standards that each state must adopt. The states have 18 months to promulgate rules that meet or exceed the criteria and standards outlined in Subtitle D. However, landfill operators must still meet the minimum standards outlined by EPA by the following specified dates:

- **Immediate Impact:** If a landfill takes waste after the rules were published, the landfill will have to meet the new final cover requirements. This is the only effective date that has immediate impact on landfills.
- **24 Months:** This effective dates applies to location restrictions, which involves airports, floodplains, wetlands, fault areas, and unstable areas; design criteria, which applies to new facilities and expansions; operating criteria; groundwater monitoring; corrective actions on new landfills; closure; and post-closure care.
- **30 Months:** Financial assurance requirements.
- **36 Months:** Groundwater monitoring and corrective action for existing landfills located less that 1 mile from drinking water intake.
- **48 Months:** Groundwater monitoring and corrective action for existing landfills located less that 2 miles from drinking water intake.
- **60 Months:** Groundwater monitoring and corrective action for existing landfills located more than that 2 miles from drinking water intake.

The final rules include key dates and provisions that all landfill operators in the H-GAC region must adhere to since no part of the H-GAC region qualifies for small landfill exclusions based on annual rainfall and winter access scenarios. The new Subtitle D

requirements will greatly increase the costs of operating a landfill. Several publicly-owned, smaller landfills chose to cease operations prior to the final adoption of Subtitle D. Additionally, several other landfills have announced plans to close prior to October 1992 when the new location, design, and operating criteria; groundwater monitoring; closure and post-closure requirements become effective. Given the increased operating costs, only regional facilities will be economically feasible to operate.

Another federal measure to protect groundwater is a proposed bill entitled Groundwater Protection Policy (S 976). The purpose of this bill is to amend the Solid Waste Disposal Act to establish a national groundwater protection policy designed to protect the quality and quantity of the nation's groundwater resources. If passed, the bill has the potential to impact the siting of solid waste disposal facilities. Groundwater protection concerns related to facility siting would be addressed on a national level. State and local protection strategies could come into conflict with national policy.

State

Texas has 18 months to enact new rules and regulations to implement Subtitle D criteria and standards. The Texas Natural Resource Conservation Commission (TNRCC) will be the agency responsible for establishing the rules. The TNRCC proposes to develop draft rules by March 1992. Public information meetings for the proposed draft rules would be conducted from March to May 1992. TNRCC plans to release proposed final rules during June 1992, with public hearings scheduled for summer and early fall. The final rules would be promulgated by October 1992.

During the 72nd Texas Legislative Session, H.B. 426, which addresses notification procedures, was signed into law. This bill requires that state senators and representatives be notified of certain permit applications or the intent to file an application in their respective districts. The bill applies to permits "to construct, operate, or maintain a facility to store, process, or dispose of solid waste or hazardous waste" and "to (a) construction permit for a facility that may emit air contaminants." This notification requirement applies to permits issued by TNRCC, and the Texas Air Control Board (TACB). This new requirement should facilitate public participation and involvement.

TNRCC adopted new rules recently regarding the application review process which address the scheduling and preparation for a public hearing. *Subchapter E. Permit Procedures and Design Criteria - Application Review Process,* established changes concerning the number of persons required to be notified by mail of any scheduled public hearing on a permit application for a solid waste management facility. The new rules also affect the way such notifications are to be provided. Mailed notifications will be required regardless of the type of solid waste management facility permit being sought. Previously, the requirement for mailed notifications applied only to landfill sites. The rule also reduces from 3/4 mile to 1/2 mile the distance from the boundaries of a solid waste site or proposed site in which notification must be given. The distance determines which residents, businesses, and property owners must be provided mailed notices of hearings.

c. Evaluation of Current System

Collection and Transfer

Evaluation and Needs Assessment: Collection Programs. The current solid waste collection programs in place throughout the region provide an adequate level of service to the residential sector. Collection programs will have to be modified to take advantage of changing solid waste management options. Recycling goals and bans of certain materials from landfills are the two major catalysts behind current modifications in collection programs. Concerns about illegal disposal of solid waste expressed by local government officials are also a reflection upon the current collection programs. Illegal disposal of waste will continue to rise in areas where the government does not provide a convenient method of disposal for its citizens. The areas where this is most likely to occur are where citizens must contract with private haulers, transport waste to landfills themselves, or where white goods (bulky items) and items currently banned from landfills are not collected. The adequacy of collection programs will grow in importance as local landfills continue to close in favor of regional facilities, as recycling programs are initiated, and as certain items are banned from landfills.

Transfer Stations. The fifteen active, permitted or registered transfer stations in the H-GAC region have limited capacity for waste transfer. The capacities of the active transfer stations are listed in Table 23. If the landfills of the future, considering the current trend, will be large regional facilities, then there is a definite need for more transfer stations in the region. The growing knowledge and use of registration permits for transfer stations will be beneficial to smaller communities and rural portions of counties utilizing drop-off programs and serving small, dispersed populations.

Table 23: Capacity of Active Transfer Stations in the H-GAC Region

Permit #	County	Area Served	Population Served	Tons Per Day	Public/ Private
2106	Colorado	City of Weimar	10,000	25	Public
164	Galveston	City of Galveston	80,000	180	Public
1680	Galveston	Crystal Beach	800	2	Public
1697	Harris	City of Deer Park	35,000	70	Public
1092	Harris	City of Houston	300,000	650	Public
2099	Wharton	City of Wharton	11,000	21	Private
Regis.	Austin	Town of San Felipe	618	2	Public
Regis.	Liberty	City of Dayton	3619	6	Public
Regis.	Matagorda	Matagorda County	2,000	5	Public
Regis.	Wharton	Wharton County	4,000	6	Public

All larger communities in the region may soon face long hauls to regional facilities, so permitted transfer stations will become a necessity for economical solid waste

management programs. Siting problems will continue to force the regional facilities farther away from municipal waste sources. In addition, larger regional facilities will attract more traffic from more communities, so transfer with fewer trucks will reduce the incoming traffic to the landfill. Transfer stations can also be designed to collect and transport recycled goods, which will assist local governments in achieving their state-mandated recycling goals. If incineration is to become a viable option in some communities, then transfer stations will be necessary to transport the waste stream to the incineration plant. In all of the planning subregions there is a need for local government studies of the possible utilization of transfer stations, including those necessary for rail transport.

Disposal

Landfill Capacity. Table 24 shows the projected trend in the region's total landfill capacity throughout the long-range planning horizon. The estimated population is based on H-GAC's *Regional Forecast, 1990-2010*, with several modifications. The tons per year was calculated using TNRCC's 1989 waste generation rate of 6.2 pounds per person per day. The landfill acres per year was calculated using the average compaction density of 700 pounds per cubic yard and an H-GAC region average cell depth of 48.8 feet. The

Table 24: H-GAC Region Total Landfill Availability

Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	3,897,146	49,985	4,469,238	144	2,575
1991	3,976,702	52,925	4,562,645	147	2,428
1992	4,056,257	55,864	4,656,052	150	2,279
1993	4,135,813	32,321	4,719,473	152	2,127
1994	4,215,368	32,896	4,810,203	155	1,973
1995	4,294,924	33,471	4,900,933	157	1,815
1996	4,374,479	34,046	4,991,663	160	1,655
1997	4,454,035	34,621	5,082,393	163	1,491
1998	4,533,590	35,197	5,173,123	166	1,325
1999	4,613,146	35,772	5,263,853	169	1,156
2000	4,692,701	36,347	5,354,583	172	984
2001	4,788,497	37,037	5,463,832	176	808
2002	4,884,293	37,728	5,573,081	179	629
2003	4,980,089	38,419	5,682,330	183	447
2004	5,075,884	39,109	5,791,579	186	260
2005	5,171,680	39,800	5,900,828	190	71
2006	5,267,476	40,490	6,010,078	193	-122
2007	5,363,272	41,181	6,119,327	197	-319
2008	5,459,068	41,872	6,228,576	200	-519
2009	5,554,863	42,562	6,337,825	204	-723
2010	5,650,659	43,253	6,447,074	207	-930
2011	5,746,455	43,943	6,556,323	211	-1,141
2012	5,842,251	44,634	6,665,572	214	-1,355

From H-GAC Survey of Local Governments, TDH 1990 Landfill Database, and industry contacts

import/export population is taken from the H-GAC Survey of Local Governments, *Draft Report on Regional Solid Waste Management Characteristics and Practices* in the Golden Crescent Regional Planning Commission, and discussions with the Capital Area Planning Council, City of Weimar, Brazos Valley Development Council, and Deep East Texas Council of Governments. The projection is intended to show the total landfill capacity of the region and how long this capacity will last without an increase in waste reduction programs or new landfill permits.

The capacity numbers show that the region is currently not experiencing a landfill capacity crisis. A review of the landfill location map indicates that there is a landfill location crisis. In 1988 there were 3,496 acres of permitted active landfill space in the region. Since then the threat of Subtitle D and rising cost of operation have forced many landfills to close. The 1991 estimate for landfill space is approximately 2,300 acres. Table 25 reflects the changes throughout the region. All but one Type II landfill is closing or closed; the only Type III facility closed; 37% of the Type I facilities closed; and 32% of the Type IV facilities have closed. Future impacts of Subtitle D implementation by the Texas Natural Resource Conservation Commission may force the closure of the remaining Type II facility and the Type I facilities in Brazoria (1), Liberty, Matagorda and Colorado counties.

Table 25: Landfills, 1989-1991

	Type I		Type II		Type III		Type IV	
County	1989	1991	1989	1991	1989	1991	1989	1991
Austin			2	1				
Brazoria	4	3	2	0			1	1
Chambers	2	2					1	0
Colorado	1	1	1	0				
Fort Bend	4	2*	1	0			2	1
Galveston	3	3					1	1
Harris	9	5					14	9
Liberty	3	1	1	0	1	0		
Matagorda	1	1						
Montgomery	3	3	1					
Walker	1	1	2	0				
Waller	2	0	2	0				
Wharton	1	1						
Total	**34**	**23**	**12**	**1**	**1**	**0**	**19**	**12**

From H-GAC Survey of Local Governments, TDH 1990 Landfill Database, and industry contacts

Note: In Fort Bend County, one of the 1991 active landfills is the BFI-Fort Bend Project. The site is under construction and will be open by 1993.

Communities throughout the region are concerned about the tipping fees they are paying now and those they will be paying in the future. Communities in the H-GAC region have disposal contracts with various landfills throughout the region. Table 26 contains the contracted rates communities have with landfill operators in the region. The concern with these rates are that they are 1991 contracted rates. Subtitle D and other proposed rule

changes by the Texas Natural Resource Conservation Commission will have a significant impact on landfill tipping fees by 1994.

Import/Exportation

The H-GAC region currently has adequate disposal capacity to serve the region. The problem with the disposal capacity is its location and distribution. Several trends are noticeable in waste management practices affecting importation and exportation of municipal solid waste throughout the region. The first is that private solid waste disposal

Table 26: Contracted Landfill Tipping Fees

Permit #	Landfill	Type	County	Tipping Fee*
196	Huntsville	1	Walker	$2.50
203	Tricil Environmental (Laidlaw)	1	Colorado	$4.17
261	BFI/McCarty Road	1	Harris	$5.52
1247	Doty Sand Pit	4	Harris	$3.00
1285	Texas City	1	Galveston	$9.00
1307	WMNA/Atascocita	1	Harris	$6.66
1478	Sanifill of Texas/Greenbelt	4	Harris	$3.00
1483	Urban Waste Technologies	1	Harris	$6.50
1535	Hazelwood	1	Harris	$4.56
1539	Brazoria County Disposal	1	Brazoria	$4.50
1540	Sanifill of Texas/Greenshadows	4	Harris	$2.39
1554A	Fort Bend County	1	Fort Bend	$5.43
1721	WMNA/E&D	1	Galveston	$4.32

*The tipping fee is per ton, except for Huntsville which is for cubic yards.
From H-GAC Survey of Local Governments

facility operators are willing to operate landfills where they know they will get capacity to efficiently operate under new state and federal landfill criteria. The capacity is generated near large population bases, such as Houston, Harris County, Fort Bend County, Galveston County, and Montgomery County. Municipalities and other public landfills have realized the economies of scale involved in current landfill operations and have closed or are studying the possibility of becoming a regional facility. Therefore, waste migration is becoming more and more prevalent in the H-GAC region.

The second trend is that the region is a net importer of municipal solid waste. Large private landfills in Montgomery County and Colorado County serve as regional facilities, providing capacity for Grimes, Madison, San Jacinto, Fayette, Jackson, and Lavaca counties. Another trend is that virtually all municipal solid waste generated in the H-GAC region is being disposed of in the H-GAC region. The earliest estimate for exportation is 1992, when communities in Waller County may be exporting to a regional facility in Brazos County. The forth trend is that the waste being imported into the region

is from municipalities. The waste is from residential collection programs. The final trend is that most of the municipal solid waste generated in Harris County and the City of Houston is currently being disposed of in Harris County. Most of what is being exported from Harris County originates from utility districts or commercial waste haulers. However, this is expected to shift when BFI-Fort Bend opens in 1993 and as other facilities study the possibility of regionalization in Wharton, Colorado, Austin and Chambers counties.

Facility Siting

While the need for solid waste management facilities is increasing, it is becoming more difficult to site and operate these facilities. Community opposition, characterized by the "NIMBY" ("Not In My Backyard") syndrome, contributes to the difficulty. Government actions can also add to the difficulty. The goal of siting criteria is to ensure that solid waste management facilities are sited so as to prevent negative environmental or community impacts to the maximum extent practicable. Facility siting concerns can be focused on a number of different types of solid waste facilities, including transfer stations, processing facilities, MRF's, government or commercial composting operations, incinerators, and landfills.

The identification and mitigation of local concerns is essential to the successful siting of solid waste facilities. Local concerns may include: potential environmental contamination; changes in land use; burdens on existing municipal services and infrastructure; and perceived adverse economic impacts.

Community opposition can be addressed by including the public in the siting process. Successful siting depends on early substantive and continual public participation, positive intergovernmental relations, and sincere efforts to mitigate risks, such as additional controls, frequent monitoring and inspection, and rigorous enforcement. Public involvement plans must be developed early in the siting process. Active citizen involvement in the siting process and an effective public information campaign can enhance public acceptance of the facility. Siting should be a continual negotiation process, and it must take place with public support.

d. Evaluation of Alternatives

Collection and Transfer

Unit Pricing. Unit pricing has been found effective in both increasing overall participation in waste reduction and recycling programs and in making the consumer pay for the actual services provided. As with other utilities, unit pricing of waste services makes the public aware of the actual cost of providing the service, and they vary use based on price paid. Unit pricing systems are typically run in one of two ways: at a volume-based level or a weight-based level. In volume-based systems, the customer pays

for the number of cans produced or bags produced each period. Some systems are run so the consumer can subscribe to the amount or size of cans they set out weekly. Other volume-based systems are achieved using a paid bag or sticker program. In these the consumer either pays for all the "official" bags or for the stickers to be placed on bags. Weight-based programs are achieved using scales and bar codes to assign the weight to a residence. Weight-based systems are technically more sophisticated, but results achieved include a greater emphasis on waste reduction since every item discarded adds to the total.

Certain hybrid systems of unit pricing could be studied if a community is opposed to the program. One is a program where the customer receives a certain number of bags or stickers for free, and once the supply is used they must purchase additional bags or stickers from the operator. Another example is a recycling participation rate. In this type of program, customers are charged less for garbage services if they participate on a certain number of recycling days.

If a community intends to meet the waste reduction and recycling goals of the future, unit pricing will be a key to their success. Case studies show that unit-pricing programs reduce conventional waste collection amounts and increase participation in recycling and composting.

Curbside Programs. Curbside programs will continue to be the most-used method of residential solid waste collection in the region. Typical collection programs are operated twice weekly with special pick-up of white goods. As recycling and alternative waste management methods are initiated, modification of curbside collection programs will have to occur. Collection programs of the future will have to assume that waste has a value, and fees for collection must reflect this value. There is a value for goods collected to be recycled or composted, just as there is a value for goods to be landfilled. The value is the cost of handling and processing, the revenue from selling recyclables and compost, the avoided landfill cost, and the realized landfill cost. Modification must occur throughout the entire collection program.

Collection Vehicles. In an integrated solid waste management system, collection vehicles will have to meet many challenges. The traditional rear-loader predominantly used in curbside collection may have to be modified. Rear-loaders generally require a two- or three-man crew to collect waste for disposal. Recycling vehicles and side-loaders are two alternatives to the rear-loaders. Recycling vehicles are multi-bin collection trailers that can be added to the rear-loader as a trailer or can operate as stand-alone vehicles. Side-loaders are gaining popularity because they are designed for one-person operation. They are automated with a collection arm that the driver operates from the cab of the truck to pick up waste.

Pick-up Frequency. Collection frequency should be studied in the future. Standard curbside programs are twice-weekly pick-ups for disposal. In the future, twice-weekly may include one day for disposal and one for recyclables and/or items banned from

landfills. Waste decomposition and climate factors will have a major impact on pick-up of waste. Innovative programs -- such as twice-weekly pick-up in summer for disposal and for recyclables, and once weekly in the winter alternating between disposal and recyclables -- may be studied.

Units. To ease collection burdens, the implementation of unit pricing or the use of new vehicle designs and/or collection units (garbage cans, plastic bags or recycling bins) will have to be studied. Standardized collection cans will be needed if an automated system is initiated. Standardized plastic bags or cans are a key element in a unit-pricing collection program. And bins used to pick up recyclable materials may be needed for that type of program. Some cities already require residents to use plastic bags to reduce liability and improve the appearance of streets after pick-up.

Convenience Stations. Convenience stations (drop-off centers) have been used to collect waste in rural areas for many years. They are now being used in the collection of recyclables where curb-side collection is not feasible. They are operated using roll-off flatbeds or front-loader dumpsters. The continued use of convenience stations for the collection of recyclables will be a necessity if unit markets are created. The use of convenience stations for items banned from landfills will have to be studied. An issue in the continued use of convenience stations will be hours of operation and staff required to operate them. Unless the convenience station is attended, improper use could occur, such as illegal disposal and theft of recyclables. During operating hours, an attendant should be available to monitor use of the station. And once it is closed, access to the station should not be permitted.

Transfer Stations. The purpose of transfer stations is to collect waste from several smaller vehicles into one larger vehicle for hauling to a distant disposal site. Two distinctly different types of transfer stations will be considered in the future. The first will be needed in rural areas, where disposal capacity is dispersed. The second type will be used in metropolitan areas, where landfills are unavailable and collection areas large.

Rural transfer stations will be constructed as part of a network of facilities to serve all portions of the region. Rural transfer stations will be needed in the future to reduce travel distances of collection vehicles to disposal. Rural transfer stations provide small communities and rural portions of counties a convenient collection point for waste haulers. Once waste is transferred to a larger haul vehicle, a wider range of disposal options may exist. With one large vehicle making a trip to alternative regional landfills, smaller communities may have an option in landfill disposal. Rural transfer stations should be designed to collect recyclables as well. The central collection and transfer of recyclables will make recycling more feasible until better markets are developed.

A permit is not currently required for a municipal solid waste transfer station which serves less than 5,000 persons. A registration process with TNRCC is in place so that transfer stations can be utilized in rural portions of the state. The registration process

involves the completion of a five-page detailed explanation of the site and operational plan. A permit will be required if a site is intended to serve more than 5,000 persons.

Metropolitan transfer stations will be needed as the siting of regional landfills becomes less practicable near densely-populated areas. Transfer stations will make distant disposal sites more accessible to these areas. The use of transfer stations in metropolitan areas has proven to eliminate non-productive travel time to landfills, reduce the cost of collection programs, and make larger collection routes more feasible. Modern transfer stations have been operated to accommodate recycling programs as well, provided that they are designed with a collection area for recyclables.

Material Recovery Facilities (MRF's) are specially-designed transfer stations for recycling programs. MRF's are automated or manually-run facilities for the collection and separation of recyclables. MRF's will be needed in the H-GAC region as recycling programs are enhanced to meet new market demands. MRF's are discussed in more detail in the Recycling section of this plan.

Transportation Issues. Transportation issues will increase in collection and disposal programs as landfills close, regional landfills open, and the Clean-Air Act is implemented. The cost of transporting waste long distances will facilitate further transfer station studies. The Clean Air Act will affect the type of collection and transfer vehicles used in CMSA Counties and Liberty Counties (Clean Air Act non-attainment area). The type of vehicle fleets that conform to the Clean Air Act are not determined as of yet. However a short term issue of interest for haulers, collectors and communities in the region will be the implementation of alternative fuel vehicle programs in the region.

Disposal

Landfilling. There will always be a need for landfills in the operation of a municipal solid waste management system. Current TNRCC guidelines allow four types of landfills to be permitted. They are:

- Type I landfills, serving more than 5,000 persons, where waste is compacted and covered daily
- Type II, serving less than 5,000 persons, where under certain circumstances waste will be compacted and covered once a week
- Type III, serving less than 1,500 people, where compaction and coverage is negotiated, and
- Type IV, for the disposal of brush, construction and demolition waste, where coverage is required monthly

Future landfills, under new Subtitle D criteria, will all be built and operated beyond current Type I standards. The only exception is in the operation of Type IV facilities. Since Type IV facilities are free of mixed municipal solid waste, the Texas

implementation plan for Subtitle D may exclude Type IV facilities from many of the criteria. There is some indication from TNRCC that this is being considered. If so, plans for future landfills in the H-GAC region should be for either Type I facilities or Type IV facilities.

Landfills will provide the ultimate disposal of a majority of waste generated throughout the region until markets for recycled materials are developed and resource recovery and waste reduction programs can begin. Once started, all solid waste management processes have a residue waste that must be disposed of in a safe and efficient manner. In the future this residue waste will likely contain more contaminated materials that cannot be recycled or reused. Therefore, it is important that landfills be designed to appropriately handle these materials. The impact of state implementation of Subtitle D is not known at this time. However, H-GAC estimates that landfill cost will likely double in many areas. Even though the cost of development and operation of landfills will rise, it will remain relatively low compared to alternative solid waste management processes.

Landfills can be designed to incorporate two methods of operation -- shredding and baling of waste -- that reduce the volume of waste being disposed. Shredding of waste reduces the material to a small homogeneous size for landfilling. It allows for greater compaction and placement in landfills and reduces settlement of closed cells once in place. If the material is shredded at a transfer station, there may be markets for it as a fuel for incineration or for other uses. Baling is a process which compresses and binds waste into uniform bails. This process increases density of materials for landfilling and allows for uniform placement into landfills. A baling facility may be placed on-site at the landfill, or it can be undertaken at a transfer station prior to transport. This method of landfill operation will also reduce the amount of waste settling after it is placed in the landfill. There are currently two landfills in the H-GAC region utilizing bailing systems. They are the E&D landfill in Galveston County and Urban Waste Technologies landfill in Harris County.

Future landfills and those currently in operation can take other measures to provide greater disposal capacity. Three ways to take greater advantage of current landfill space are aerial expansion, greater compaction density, and operational criteria. Aerial expansion is the building up of landfills into airspace above the ground level. While there are no restrictions against height of aerial expansion, height is a factor in liner design and integrity. Aerial expansion should be studied to take advantage of the space being used for landfilling. The height of the technically-appropriate maximum aerial expansion should be determined for the site, and then actual landfill height can be negotiated down to an acceptable level that complements surrounding land uses.

The second measure is greater compaction density. This can be achieved by using shredding and baling or with improved compaction equipment. The average compaction density achieved in some landfills which dispose of waste compacted in trucks and then buried with roller wheels is near 1,200 pounds per cubic yard.

The third method is improved operational criteria, which includes greater use of synthetic liners, use of synthetic daily covers that can be reused each day, and improved inspection of waste loads to remove large bulky items. The use of synthetic reusable liners is in the experimental stages in several areas. It is not known how daily cover requirements will be handled in the state implementation of Subtitle D, but this option currently remains open. Increased inspection of waste loads to remove bulky items for recycling or compaction will allow for greater compaction density in the landfill.

Several landfills in the region have gas collection systems to control the methane gas produced at landfills. The Fort Bend County landfill collects gas and burns the product. The BFI/McCarty Road landfill collects methane gas and sells to a nearby industry. Future landfills will have to consider methane gas collection programs and a search for markets for the gas should be undertaken

Incineration. Incineration is a method of solid waste management that reduces volume 75% by weight and 95% by volume. It produces energy and provides for the recovery of recyclables both before and after incineration. The major reasons why incineration is not in wide use throughout the H-GAC region is that incineration costs more than any other solid waste management technique, in both capital and operational cost. It is a management technique that most small communities in the region cannot afford to complete alone. Incineration projects will have to be studied at a subregional level to be economically efficient and to provide a large enough waste stream after recycling and waste reduction.

Incineration units built in the 1980's have employed Best Available Control Technology (BACT) -- including dry scrubbers, baghouses and DeNox systems (to remove nitrous oxide) -- that make them far superior to old incineration units. The Clean Air Act of 1990 recognized the need for incineration in solid waste management practices and required BACT systems in their design and operation.

Two types of incineration technology which are proven as successful solid waste management practices are *mass burn* and *refuse-derived fuel*. Mass-burn facilities burn solid waste in its as-received state. Mass-burn facilities in operation in Florida require that waste be recycled prior to entering the system, and once the ash is cooled it passes under a magnet system to remove remaining metals. A mass-burn facility may either be a modular system, a smaller facility which is a whole unit shipped to a site with a capacity of 100-200 tons per day, or a field-erected system, a larger units built at the site with a capacity of 400-3,000 tons per day.

Refuse-derived fuel (RDF) is solid waste which has been processed for inclusion as a fuel in an incineration project. RDF is processed for use in one of two methods: dry processing and densified-fuel. Dry processing, the most common form of RDF, is a process where material are recovered for recycling then passed through a trommel which segregates the waste into different size categories. Small waste items, generally less than six inches in diameter, are then burned, and larger waste is processed before burning.

The RDF is burned with coal or other fossil fuels to produce energy. Densified-fuel is produced by pelletizing or briquetting machines that produce waste in small particle sizes to be included in RDF projects. Using principles developed in the food and fertilizer industry, pellets are formed by an extrusion process, while briquettes are formed in high-pressure molds. RDF has traditionally been used as a supplement to fossil fuels in coal-fire plants. However, some mass-burn incineration units have begun using RDF to reduce cost and the risk of breakdowns due to unwanted materials entering their units.

New technology in incineration units has made use of RDF in a fluidized bed. Fluidized beds burn waste on a suspended medium where the fuel is subject to high turbulence and heat during burning. While the technology is not proven, tests have provided the following results: high combustion efficiency (better burnout); more stable combustion of the heated mass without hot or cold spots; less NOx production; and natural scrubbing action that potentially removes SO_2.

Pyrolysis. Pyrolysis, a form of incineration, is the decomposition of waste through a process of adding heat in an oxygen-deficient atmosphere under pressure. The process is still considered an experimental technology. The end-product can be used as fuel in incineration projects (when an oil or gas) or as a building material (when solid). When pyrolysis was first considered as a method for utilizing solid waste, it was as a fuel source for incineration. Since that time the cost of incineration was expected to be compatible with landfilling. Adding the expense of pyrolysis as a refuse-derived fuel was not that great. Because incineration projects have not been widely developed, alternative uses of the materials produced through pyrolysis have been researched. Recent studies have focused on the use of pyrolysis materials in road construction and cinder blocks. As research and development progresses in these areas, the use of pyrolysis may become economically feasible.

Biological Conversion Systems. Biological conversion systems are two-fold: *landfill gas recovery*, and *anaerobic digestion to methane gas*. Landfill methane gas recovery is required under Subtitle D. The methane gas will be extracted for four potential uses. The first is to sell as a gas to nearby markets. The second is to use it in gas-driven turbines to generate electricity for sale. The third option is to burn it in a boiler to make steam and/or electricity. And the fourth is to flare it as a gas control measure until energy can be sold. Recent federal budgets have allowed a tax credit for installing methane gas collection systems, so this may still be a viable tax-saving option for private landfill operators in the future.

Anaerobic digestion (bioconversion) is a mechanical process which accelerates biological digestion to produce methane gas. It is a process still in the experimental stage that has proven slow and difficult to control. The economic justification of such a project remains questionable, even in areas paying over $100 per ton to dispose of solid waste.

Facility Siting

Recycling and reuse activities will minimize the quantity of solid waste to be disposed. However, there will continue to be a significant amount of solid waste generated that will require disposal, either through landfilling or incineration. The potential for surface water and/or ground water pollution, soil contamination, and/or air emissions from disposal facilities dictates that solid waste management facilities be sited and operated in a manner that provides a high level of environmental protection while still meeting economic criteria. Siting concerns typically fall into four general categories: exclusionary, environmental, economic, and public acceptance. Possible components of these categories are:

- exclusionary factors ("fatal flaws"), which may include airports, protected settings (historic landmarks and sites, areas of archeological or paleontological significance), wetlands, and floodplains
- environmental factors, which may include geology, bedrock, groundwater hydrology, topography, and surface water hydrology
- economic factors, which may include access/haul distances, optimum site/land availability, and engineered systems requirements, and
- public acceptance factors, which may include land use compatibility traffic impacts, isolation/natural screening, odor control, and real estate values/community compensation

Siting criteria should protect public health, public safety, the environment, and historical and cultural resources, and they should minimize development costs and impacts on land development, economic growth and aesthetics. Criteria are also established to ensure compliance with laws and regulations.

Siting criteria can be based on various standards which include performance standards, uniform standards and categorical standards. Performance standards are based on risk assessments, which typically lead to high variability in designs. Uniform standards are based on technical design considerations with some allowances for variations, which result is little variability in designs. Categorical standards are based on technical design considerations with designs for different categories of site-specific conditions, which would lead to an intermediate level of design variability.

Siting criteria vary by locality. Nationally, there are no standard site-selection criteria that are applicable to all solid waste management facilities except for the Federal Aviation Administration regulations concerning the distance between runways and landfills. This is likely to change with RCRA '92.

Siting criteria can take many forms, including the banning of facilities from specific areas, such as floodplains; placement of restrictions on the possible location of facilities; establishment of minimum setbacks and/or buffers; or the development of performance standards. Examples of minimum setback siting criteria from select government entities for different solid waste facilities are shown in Appendix 9.

e. Conclusions

- Collection programs should be modified to match an integrated solid waste management system. This includes the use of unit pricing, reviewing curbside programs, and evaluating vehicles used in collection.

- Changes in collection programs should be carefully studied before implementation. Illegal disposal will occur unless convenient collection programs are provided.

- Rural collection programs should be studied. If curbside collection is not feasible, convenience stations should be used to collect waste as well as recyclables and items banned from landfills.

- There is an inadequate distribution, number, or capacity associated with transfer stations, planned and active, throughout the H-GAC region to support communities in an integrated solid waste management system

- Communities in rural portions of the region should study the use of registration-only permits, and metropolitan areas should study the use of permitted transfer stations in conjunction with regionalization of landfills. All transfer station studies should include recycling and composting collection processes in design and operation.

- Two counties in the H-GAC region -- Austin and Waller -- currently have no Type I capacity. Four more counties, Colorado, Liberty, Matagorda, and Waller, may lose all of their capacity once Subtitle D is implemented.

- The H-GAC region does not have a short-term landfill capacity problem. There is a capacity location and distribution problem.

- There will always be a need for landfills in a municipal solid waste management program. Plans for future landfills in the H-GAC region should be for Type I or Type IV regional facilities.

- Landfills should be designed and operated to allow for maximum capacity in disposal. This includes shredding, baling, maximum aerial build-up, the use of high-density roller-wheel compacters, or possibly the use of synthetic reusable daily covers.

- State implementation plans for Subtitle D criteria should be a high-priority concern of communities in the H-GAC region. These communities should be actively involved in the review and comment portion of the implementation process.

- There are no active municipal solid waste incinerators in the H-GAC region. Currently incineration is not in the short range plans of communities in the region.

- Incineration using Best Available Control Technology (BACT) Clean Air Criteria should be under continued study throughout the H-GAC region. Mass burn and RDF have improved technology that make them environmentally-acceptable solid waste management options, especially considering the 75%-by-weight and 90%-by-volume reduction in waste. These studies should include the evaluation of experimental technology which may become more feasible in time.

- Facility siting should protect public health, safety and the environment. Currently, facility siting criteria are varied throughout the country.

- Cities can utilize comprehensive plans, zoning and other ordinances to provide for safe siting and operation of municipal solid waste management facilities.

4. Special Waste

The H-GAC Solid Waste Management Special Waste Issues Subcommittee identified 15 special waste categories that exist within the region. Examples of types of waste are listed for each category in Table 27. Each category was then rated either as "high", "medium", or "low", based on the volume of waste generated, its impact within the waste stream, and the relative management difficulty when using proper treatment and disposal methods. The ranking is shown in Table 28. Using this ranking system, the subcommittee recommended that the Solid Waste Management plan focus primarily on household hazardous waste, small quantity waste generators, tires, sludge, medical waste, and other miscellaneous waste, such as grease and grit trap, used oil and lead-acid batteries. Many of the special wastes identified by the subcommittee are included in the TNRCC definition of special waste; however, they are not identical.

Table 27: Special Waste Categories

Waste Category	Types of Waste
Household Hazardous	Lawn Chemicals, Home Chemicals, Pesticides, Paints, Antifreeze
Used Oil	Home, Farm, Commercial, Institutional
Construction/Debris	Asbestos, Paints (toxic), Asphalt, Lead, Batteries, Solvents
Grease and Grit Trap/Septage	Restaurants, Institutional, Rural/Septic, Portable Toilets
Small Quantity Commercial	Photo Labs, Print Shops, Garages, Dry Cleaners, Grit Traps
Medical	Bodies, Veterinary, Sharps, Medicines, Dressings/Other, Infectious and Radioactive, Laboratory Chemicals
Industrial	Bi-products (ashes, plant trash, chemicals, acids)
Sludge	Municipal (water & wastewater treatment), Oil Well, Industrial (scrubbers), Chemical Sludges
Food Processing	Seafood, Slaughterhouse
Incinerator Ash	Monofill Disposal
Wood	Treated Wood
Leachates	
White Goods	
Tires	
Capacitors/Asbestos	

Table 28: Volume, Impact, and Difficulty Rankings for Special Waste*

Waste	Volume	Impact	Difficulty
Household Hazardous Waste/Separated	LOW	MEDIUM	MEDIUM
Grease Traps/Septage	LOW-MED	HIGH	HIGH
Medical Waste	HIGH	HIGH	HIGH
Sludge (water treatment and wastewater treatment)	VERY HIGH	HIGH(MED)	(HIGH)MED* * if handled properly technology is available
Leachates	LOW	LOW	LOW
Wood	LOW	LOW	MEDIUM
Used Oil	MEDIUM	MEDIUM	MEDIUM(HIGH)
Construction/Debris (presently disposed in Type IV landfill)	MEDIUM	LOW	MEDIUM
Small Quantity Waste Generators	LOW	MEDIUM	HIGH
Industrial Materials	HIGH	HIGH	HIGH
Capacitors, Asbestos	MEDIUM	HIGH	MEDIUM(HIGH)
Food Processing	HIGH	MEDIUM* * odor, vermin	LOW
White Goods	LOW	(LOW)MEDIUM	MEDIUM
Incinerator Ash	MEDIUM	HIGH	HIGH
Tires	HIGH	HIGH	HIGH
Septage	MEDIUM	HIGH	MEDIUM

* Special wastes were ranked as to volume in waste stream, potential negative impact if improperly disposed, and the relative difficulty to properly treat and dispose.

a. Types of Waste

Household Hazardous Waste

Household hazardous waste (HHW) is depicted as any solid waste classified as hazardous which is generated in a household by a consumer. The definition of "household" includes single and multiple residences, hotels, motels, bunkhouses, crew quarters, ranger stations, campgrounds, picnic grounds and day-use recreational areas. Major categories of household hazardous materials are: household cleaners; paint products; pesticides and fertilizers; automotive products; and arts and crafts-related solvents and thinners. Based on national data from collection programs, a typical breakdown of HHW is 50% paints and solvents; 20% used motor oil; 20% solvents, pesticides and herbicides; and 10% batteries, unidentified materials and other miscellaneous items, such as, old chemistry sets, photographic materials, and fiberglass epoxy.

HHW represents roughly 1% of the total residential waste stream. The City of Houston estimates that its residents generated 23,000 tons of HHW in 1989. Using the per capita HHW generation rate suggested by this figure, the H-GAC region likely generates 55,000 tons of HHW annually. While HHW constitutes only a small percentage of the residential waste stream, the potential damage from improper disposal is significant. Improper disposal can be harmful to waste collectors and landfill workers, can damage sewers and septic tanks, and can pollute the air, water and soil.

Small Quantity Commercial Waste Generators

A national survey by the Environmental Protection Agency (EPA) identified 378,000 small quantity commercial waste generators. The City of Houston estimates that there are approximately 10,000 small quantity generators in Houston and numerous others throughout the region. It is expected that the number and types of small quantity generators located in the region are consistent with national estimates and characteristics. Typically, the generators are engaged in services and are more highly concentrated in urban areas. According to the EPA survey, small quantity generators can be divided into 22 industry categories. Seven of the 22 industries represent 89% of small quantity generators. These most significant industry categories are vehicle maintenance, metal manufacturing, printing and ceramics, other services, laundries, pesticide application services, and photography. Small quantity generators can be further broken down into two groups: those that produce between 100 and 1,000 kilograms of hazardous waste per month *(small quantity generators);* and, those that produce less than 100 kilograms of hazardous waste per month *(very small quantity generators).* Of the estimated 378,000 small quantity generators, 30% are classified as small quantity generators and are required to comply with federal regulations regarding hazardous waste disposal. The remaining 70% are very small quantity generators, which are not federally regulated.

Three types of hazardous waste -- used lead-acid batteries, spent solvents, and strong acids and alkalies -- generate the greatest volume. Together, they represent 84% of the waste generated annually. However, each generator produces diverse hazardous wastes. For example, a vehicle maintenance shop would generate used lead-acid batteries, spent solvents, strong acids and alkalies, ignitable wastes, ignitable paint wastes, and paint wastes containing heavy metals. By comparison, the waste from a pesticide service would be empty pesticides containers, pesticides solutions, and waste pesticides containing arsenic, carbonates, mercury and other toxic constituents.

Tires

National figures indicate that between 200 and 250 million waste tires are discarded yearly in the United States, translating to roughly one tire per person. In Texas, 17 million used tires are scrapped each year, or one per person per year. Using this per capita generation rate, it can be estimated that 3.9 million tires are annually discarded in the H-GAC region.

Problems arise when the scrap tires are improperly disposed. The U.S. Department of Energy estimates that 168 million tires disposed of each year are landfilled or placed in junk yards. It is what happens to the remaining tires that creates problems. Illegal tire dumps can cause serious health and environmental problems. Nationally, there are at least 34 illegal stockpiles of 100,000 or more tires that have been identified, and all are within 150 miles of major metropolitan areas.

The Texas Natural Resource Conservation Commission (TNRCC) has been surveying illegal tire dumps using site information provided by county commissioners and judges. As of April 30, 1991, eleven of the thirteen counties in the H-GAC region had responded to the TNRCC survey. Of those eleven counties, seven have reported a total of 170 illegal dump sites. Within the region, Austin, Chambers, Galveston, Harris, Montgomery, Walker, and Wharton Counties reported the existence of illegal tire dumps. Eighty percent of the illegal sites report stockpiles of less than 1,000 tires. Nineteen percent of the sites have between 1,000 and 50,000 tires discarded onsite. The remaining one percent of the sites each have more than 50,000 tires dumped on them.

Sludge

Types of sludge include: municipal sludge from water and wastewater treatment; oil well sludge; industrial sludge; and chemical sludges. Virtually every community, regardless of size, produces municipal sludge which must be managed. Based on EPA data for 1988, there are about 15,305 publicly-owned treatment facilities nationwide which produce 465,775 wet tons of sludge every day. Most domestic sludge contains 75-80% water. EPA estimates that 7.7 million dry metric tons of sludge is produced annually. This amount is expected to double by the end of the 1990s.

In the H-GAC region, the amount of sludge is estimated to account for 4.1 percent of the municipal solid waste stream. Based on EPA per capita generation figures, in 1989, 177,342 tons of sludge was generated. By 1997, the amount of sludge generated is estimated to be 205,894 tons. For the years 2002 and 2012, the amount of sludge generated is 228,284 tons and 282,996 tons, respectively.

Medical Wastes

TNRCC defines medical waste as waste generated by health care-related facilities which is associated with health care activities not including garbage or rubbish generated from offices, kitchens or other non-health care activities. Special wastes from health care-related facilities includes animal waste, bulk human blood and blood products, microbiological waste, pathological waste and sharps. Specific examples are bodies (both human and animal); veterinary waste; sharps; medicines; dressings and other; infectious and radioactive waste; and laboratory chemicals.

Each day, 26 tons of medical waste is generated by Houston's 86 hospitals and by thousands of doctors; dentists; veterinarians; dialysis centers; medical laboratories; medical schools; outpatient surgery centers; emergency clinics; and bio-medical research firms. It is estimated that there are 10,000 health care facilities in Houston alone.

Hospitals produce 95% of medical waste according to federal statistics. For each hospital bed, 22 pounds of medical waste is produced per day. Of this 22 pounds, four pounds is considered infectious waste.

In July 1989, EPA conducted a survey to determine hospital medical waste disposal practices. Survey results showed that 70% of responding hospitals own or share an incinerator; 49% use steam sterilization; 23% dispose of blood and blood products to sewer systems; 21% dispose of dialysis waste to a sewer system; 14% grind infectious wastes and discharge them to the sewer; and 11% dispose of infectious waste in a sanitary landfill without sterilization -- a practice which is illegal.

Grease and Grit Trap

It is difficult to measure the amount of grease and grit trap generated. Restaurants, motels/hotels, schools, laundries, and services stations are examples of generators of this type of special waste. The treatment and disposal of grease and grit trap depends on the generation source. Restaurant grease and fat rendering recycling is a well developed industry. Products made from recycled materials may include pet food, cosmetics, plastics, and farm animal feed. If grease is not recycled, disposal methods may include disposal in a Type I municipal solid waste site or a sludge-only landfill. Grit and grease from septic tanks has completely different management requirements. Various disposal methods may be utilized. Waste may be hauled along with septic waste to a wastewater treatment facility. Or waste may de disposed of at a Type I landfill, land applied, or composted.

Used Oil

Over 300 million gallons of used oil are generated each year by Do-It-Yourselfers (DIYs) who change their own motor oil, but only 10 percent is properly collected and sent off for recycling. The remaining oil is being improper disposed, typically it is dumped into the storm sewers or mixed with municipal solid waste or poured directly onto the ground to kill weeds. Mismanagement causes needless damage to streams, ground water, and lakes. All automotive oils can be recycled safely and productively, thus saving energy and avoiding environmental pollution.

b. Activities and Programs

Household Hazardous Waste

A privately sponsored HHW collection program operates in the eastern portion of the H-GAC region. The collection program is an annual event. The sponsors for collection day are the Deer Park Local Emergency Planning Committee (LEPC), the East Harris County Manufacturers Association, Rollins Environmental Services (TX), Inc., Bay Area/University of Houston at Clear Lake, GNI Group, Grief Brothers, BFI, Chemwaste Management and USPCI. The collection program had two sites- Deer Park and the University of Houston at Clear Lake. The program was offered to employees of the sponsoring companies and selected municipalities. Among the materials collected: automotive products, including used oil; gardening products, including pesticides; paint

products; and cleaning products. At the Deer Park sites, a total of 18,900 pounds was collected -- a significant increase from the 1990 weight of 1,920 pounds. The Clear Lake site collected roughly 70,000 pounds of HHW.

Collected HHW, except for motor oil was either landfilled or incinerated. Motor oil was recycled by Greif Brothers and USPCI. Materials requiring incineration were sent to the Rollins Environmental Services, Inc. for incineration disposal. Materials to be landfilled were sent the Chemical Waste Management, Inc. Lake Charles, LA facility.

Dow Chemical Company in Freeport sponsors a collection program for the cities of Brazoria, Freeport and Lake Jackson. Employees of Dow also participate in the program. The HHW which is collected is incinerated on-site at the Dow Chemical plant.

The City of Houston held a pilot HHW collection program Spring 1992. The program was limited to 30,000 households. The city worked with Chemical Waste Management, Inc. Chemical Waste Management donated $70,000 toward the disposal costs. It is estimated that six tons of HHW will be collected. Fifty-nine percent of this material will be recycled or detoxified, including approximately 2,800 pounds of automotive oil. The rest will be sent to secure hazardous waste landfills or incinerators for disposal.

The Private Sector Initiative recycled the household paint. Agricultural and pesticides materials were collected by the Texas A&M Agricultural Extension Service Center. Additionally, the City itself reused and/or recycled automotive/boat batteries and motor oil. Materials requiring landfilling were disposed at the Chemical Waste Management, Inc. facility in Lake Charles, LA. Materials requiring incineration were sent to the Rollins Environmental Services' Deer Park facility.

Future plans include a permanent HHW program consisting of a mobile unit to serve the entire city (starting in 1992-93) in conjunction with a complete educational program.

Tires

Tire disposal sites may include a permitted municipal solid waste landfill; a permitted tire disposal site, or monofill; and a permitted tire processing facility designed for tire disposal or resource recovery. TNRCC requires that scrap tires either be split, quartered or shredded prior to disposal. Whole tires may not be landfilled. The landfills within the H-GAC region which have shredders are: the Fort Bend County Landfill; the E & D Waste Systems, Inc., facility in Galveston County; the Tricil Environmental (Laidlaw) facility in Colorado County; a Sanifill of Texas, Inc., facility in Brazoria County; and the Hazelwood Enterprise, Inc., facility in Chambers County.

There is a tire recycling located within the H-GAC region. Waste Recovery, Inc., located in Baytown, produces wire-free tire derived fuel. This fuel source is sold directly to pulp and paper mills. The tipping fee is 60 cents per passenger tire and $3.00 per truck tire. The plant is capable of producing 3,000 tons of processed tire derived fuel. 1,500 tons of

tire derived fuel is the equivalent of 186,000 tires. The processing plant is computer operated. The tires are ground and chopped into a 2-inch configuration.

A tire disposal application recently published in the *Texas Register* calls for a facility which would process and dispose tires. Barnes Tire Company, Inc., has filed application 2192 with TNRCC to operate a tire disposal site in Harris County. The site would house a ten-acre tire disposal and processing facility.

Sludge

There are 65 sludge disposal registration beneficial use (Permit type VII-R) facilities and no sludge land disposal (Permit Type VII) in the H-GAC region, according to the TNRCC facility database. Additionally, there are two Type VII-R facility permits pending. Existing facilities are shown on Table 29. (A complete listing of sludge facilities appears in Appendix 7). TNRCC registration is required for land applications that put to beneficial use municipal solid waste sludge, septage and water supply treatment sludge.

There are operation and nuisance concerns associated with many of these sludge disposal/beneficial use facilities. Complaints regarding obnoxious odors and high heavy metal contents have been expressed.

Table 29: Sludge Facilities by County

County	No. of Permit Type VII-R	
Austin	4	
Brazoria	3	(1 pending)
Chambers	1	
Colorado	7	
Fort Bend	14	
Galveston	1	
Harris	8	
Liberty	1	(Part A of application received)
Matagorda	1	
Montgomery	2	
Walker	3	
Waller	20	
Wharton	1	

Source: TNRCC self-reporting data (1989).

Medical Waste

There is one off-site permitted medical waste incinerator in the H-GAC region. It is located in Brazoria County near Brookshire Village. National Medical Waste, Inc., operates the incinerator, which burns needles, syringes, scalpels, bandages, blood, caps, gowns, masks and various other waste which hospitals generate. It is estimated that less than 2% of the waste is body parts. The plant has a burning capacity of 20,000 pounds per day.

National Medical Waste, Inc., anticipates an expansion of its medical waste incinerator in Brazoria County. However, no formal application has been submitted. An increase in the burning capacity from 20,000 pounds per day to 100,000 pounds per day is planned. This increase would require three more incinerators.

Memorial City Medical Center in west Houston and the University of Texas M.D. Anderson Cancer Center in the Texas Medical Center have onsite incinerators. Onsite pathological incinerators used by a hospital, clinic, laboratory or similar facility, and facilities used only for incineration of onsite generated infectious or pathological waste, are only required to register with TNRCC as a Type V Separate Solid Waste Processing Site.

Table 30 lists the permit applications for medical waste incinerators and transfer stations that have been published in the *Texas Register* since November 1990. Most of these permit applications were filed during the summer of 1991. In February 1992 the Dunham Environmental Services permit was issued, construction of the facility has not commenced.

Table 30: Medical Waste Permit Applications and Amendments

Permit #	Type[1]	Applicant	County	Additional Capacity/Day
2168	5WI	Dunham Environmental Services	Colorado	25 tons
2150	5WI	S. Tex. Environmental Mgmt.	Fayette[2]	120 tons
2167	5WI	Eccor, Inc.	Liberty	72 tons
2193	5WI	Enviroguard Technologies, Inc.	Waller	25 tons
2161	5TS	Complete Compliance Corp.	Harris	2 tons
2166	5TS	Eccor, Inc.	Harris	45 tons

[1] WI denotes incinerators, and TS denotes transfer stations.

[2] Fayette County is in the Capital Area Planning Council Region, but the facility will serve portions of the H-GAC region.

Grease and grit trap

Within the H-GAC region, there is one active grease and grit trap waste processing/recycling facility, Groce Company, Inc., which is located in Harris County. Three additional applications, Sanvac, Inc., located in Montgomery County, Big Chief Environmental in Harris County, and Tideland Grease Trap Service in Galveston County, are currently in the permitting stage.

While it is recommended that grease and grit trap waste be processed at a special facility, it may also be disposed of at Type I landfills and sludge-only landfills that are permitted for the disposal of grease and grit trap wastes.

Used Oil

Several gasoline stations and automotive service stations accept used oil from the public. Exxon, Mobil Corporation, Chief Auto Supply, and most Sears service stations have

implemented collection programs aimed at Do-It-Yourselfers (DIYs). Participating stations serve as collection points. DIYs collection stations allow customers to dispose small quantities of used motor oil free of charge.

c. Impact of Changes in Legislation and Regulations

New and proposed state and federal regulations have been focused on special waste. Federal legislation has been drafted to address a variety of specials wastes. On the state level, S.B. 1340 directly impacts the management of lead-acid batteries, used oil, scrap tires, and household hazardous waste. The negative environmental impacts of improper disposal for these materials should be reduced as a result of the bill's provisions. Opportunities for recycling and reuse should also be increased.

Household Hazardous Waste

Household Hazardous Waste was addressed in H.B. 1581, S.B. 1340, and S.B. 818. Provisions in H.B. 1581 and S.B. 1340 required that regional and local solid waste management plans include an element which specifically address household hazardous waste collection and disposal programs. S.B. 818 applies to water quality which is effected by the improper disposal of household hazardous waste. This bill encourages local governments and river authorities to facilitate and promote programs for the collection and disposal of household hazardous waste. It further states that programs may include the establishment of a permanent collection site, mobile collection sites, and periodic collection events. The inclusion of household hazardous waste elements in solid waste planning should help to educate local government officials and the public as to the potential dangers associated with the improper disposal of household hazardous waste. It should be noted that no funds have been allocated to establish collection programs.

Tires

Tire recycling and rubberized asphalt are addressed in S.B. 1340. New TNRCC rules have been adopted to implement the requirments of S.B. 1340. As of January 1992, tire retailers are required to collect a fee of $2.00 per new tire sold. The fee is to be deposited in the state Waste Tire Recycling Fund. This fund is dedicated to the clean-up of illegal tire dumps and to the recycling or beneficial reuse of scrap tires. Tire processors who reduce the tires to a nine square inch particle size will be reimbursed $0.85 per tire, provided that at least 25 percent of the tires are from state-designated priority enforcement sites, and that the tire shreds are not landfilled. The shredded tires may be temporarily stockpiled, used in energy recovery, and/or recycled. The waste tire recycling funds only applies to shredded tires. A 15 % price preference for rubberized asphalt was also included in S.B. 1340.

The new rules should help alleviate the presence of illegal tire dumps, however, no incentives were included for market development. Market development must be addressed.

Nationally, tire recycling and rubberized asphalt are addressed in two major bills. It is expected that RCRA will address establish comprehensive federal and state programs for

the management of scrap tires. Possible provisions include: a price preference for rubberized asphalt; a mandate to include a percent of rubberized asphalt in federally assisted road construction; prohibition on the disposal of whole tires in landfills; requirement that all haulers and collectors to operate under state-issued permits; imposition of a federal tax of 50 cents per tire on the sale of new tires; requirement of states to collect an additional feed of at least 50 cents per tire on new tires, and use of this money to manage their program; and imposition of a $1 per tire tipping fee on vehicle owners when they give up their used tires.

In December 1991, the new Federal Surface Transportation Act was signed into law. This bill addresses the use of recycled paving materials. It requires demonstration program using rubberized asphalt, studies to determine the feasibility and performance standards for alternative types of recycled asphalt which include asphalt containing recycled rubber, reclaimed asphalt, recycled glass, and/or recycled plastics. The Department of Transportation will be required to establish a clearinghouse on the use of rubberized asphalt. In addition, depending on the studies, the new act mandates the use of at least 5% rubberized asphalt by the year 1994.

The impact of RCRA legislation, beside the new regulations of the Federal Surface Transportation Act, will likely have a minimum impact on Texas given that the state recently adopted its own scrap tire management plan.

Sludge

It is expected in early 1993, new comprehensive sludge regulations promulgated by the EPA will be adopted. The proposed regulations will address: the land application, distribution and marketing of any products derived from sludge; establish maximum allowable exposure limits for pathogens, heavy metal, PCBs, and organic toxins; and set standards for odor, pathogen, and vector reduction, application rates, and labeling requirements.

The proposed regulations also address preferred disposal methods. Disposal methods for sludge are gradually being shifted away from landfilling, as the primarily form of disposal, to alternative methods which include composting, land application and thermal options (incineration and heat drying). The proposed regulations will include extensive emission control standards for incineration.

Under the proposed sludge rules, states may implement their own sludge regulations if they are as stringent as the federal ones. It is also possible for states to allow EPA to regulate their sludge programs. The sludge regulations ultimately will be enforced through the National Pollutant Discharge Elimination System (NPDES) permit process.

There will be fiscal impacts associated with the rules, such as implementation costs to enact the new sludge permitting program and to hire personnel with technical expertise. Also, disposal costs will increase as landfilling is replaced with alternate methods which require more sophisticated equipment.

Medical Waste

In December 1991, TNRCC adopted new rules regarding the transportation of medical waste. The rules set forth less costly methods of providing financial responsibility for transporters of medical waste. The rules will enable small businesses to register as transporters and provide collection and transportation services in compliance with rules covering medical waste management. Transporters of untreated medical waste will be required to provide evidence of financial responsibility through a pollution liability insurance policy or an irrevocable letter of credit in an amount determined by the number and type of transport vehicles used. These rules should help reduce the costs of medical waste transportation, thus decreasing the likelihood of illegal medical waste dumping.

Used Oil

S.B. 1340 included a mandate to address recycling and illegal disposal of used automotive oil. New regulations have been adopted to implement the requirements of S.B. 1340. The TNRCC rules address the management of used oil. The new rules are primarily focused on DIYs. Businesses and governments that change automobile oil are encouraged to serve as public used oil collection centers. To encourage the establishment of these public collection sites, the associated liability of operating a facility has been reduced by statute. In addition to the collection stations, an used oil recycling fund is to be established. The State Controller's Office is responsible for collecting a per quart fee on oil. Furthermore, the state shall give preference to motor oil that contains at least 25 percent recycled oil.

Through the establishment of public collection programs and active public awareness campaigns, the potential for improperly disposed used oil contaminating the soil and surface and ground water should greatly be reduced.

On the national level, used oil recycling may be impacted by the EPA ruling as to whether used oil should be listed as a hazardous waste. If EPA lists used oil as a hazardous material, it is due to the presence of contaminants such as lead and benzene. The final EPA ruling is expected in mid-1992. The listing of used oil as a hazardous material would impact the collection of used oil by increasing the cost of collection. However, this ruling maybe offset if Congress includes used oil provisions in the reauthorization of RCRA.

Lead-acid Batteries

As part of the implementation of S.B. 1340, TNRCC adopted new rules regarding the management of lead-acid batteries. The new sections contain special requirements for persons who generate, handle, recycle, and/or dispose of lead-acid batteries. The rules states that no person may place a lead-acid battery in mixed municipal solid waste. Retailers and wholesalers of lead-acid batteries must accept trade-ins from customers. Proper disposal of the collected batteries include battery manufacturers, secondary lead smelters, and/or authorized collection or recycling facilities. Additionally, retailers and wholesalers are required to post signs regarding the sale and disposal of lead-acid

batteries. These rules should help reduce the potential pollution of ground water given that they ban the disposal of lead-acid batteries from landfills.

On the federal level, numerous bills have been introduced that would impact the management of lead-acid batteries. Proposed bills have included the following provisions: fees on the use of virgin lead in batteries; mandatory take-back of used batteries by retailers; and a required certain percentage of secondary lead in all new batteries.

Small Quantity Commercial Waste Generators
In 1991, S.B. 1099 was passed and new rules were subsequently enacted to implement the requirements of the bill. The new rules, proposed by the Texas Natural Resource Conservation Commission and the Texas Air Control Board, require facilities to develop source reduction and waste minimization plans and reports. Small quantity generators are affected by the new rules. Small quantity generators must file pollution prevention and waste minimization plans. The plans must include at the minimum, a description of their facility; a list of all hazardous wastes generated and the volume of each; a prioritized list of chemicals to be reduced; a statement of reduction goals; information on environmental and human health risks considered in determining reduction goals; implementation activities and related timetable. These new requirements should provide for better management and reduced amount and toxicity of wastes generated by small quantity generators. Problems associated with *Very Small Quantity Generators* will not be reduced.

d. Evaluation of Current System

Household Hazardous Waste
Few collection programs exist within the H-GAC region, and those in operation are concentrated to specific areas, Brazoria and east Harris Counties. Of the household hazardous waste (HHW) collection programs in existence, participation is limited to selected areas. HHW education are also generally lacking throughout the H-GAC region. Regional or community-based collection programs are needed. Private and public entities will need to work together to address the disposal and education needs. The existing program in the Deer Park area only serves a small portion of the metropolitan population. However, the program is effective and could serve as an example for other areas.

Public education on the health and environmental hazards of HHW will need to be the main priority in HHW management. Public education should focus on making the public aware of the presence of hazardous materials in the home and the consequences of improper use and disposal; identifying substitutes that are less hazardous; encouraging better home management practices such as buying only the amount of hazardous material that is needed at any one time; and identifying proper storage and disposal methods.

While the overall goal is to minimize the amount of HHW going to landfills, collection programs will need to be operated in tandem with reduction and reuse strategies.

Therefore, HHW collection programs must be developed and promoted. The goals of a household hazardous waste collection program should include the following:

- increase general public awareness of the hazardous materials found in most homes and how these materials may impact on human health and the environment
- educate residents as to the best methods of HHW disposal
- remove HHW from homes, thus reducing exposure and potential injury
- reduce danger to refuse collectors and other sanitation workers, and
- provide proper disposal for HHW

Participation in collection programs is usually less than 1 %, which makes the costs per person extremely high. The cost of a "collection day" program can range from $30 to $300 per participant. A program with high participation may cost $2 per pound of HHW collected, while a program with low participation may cost over $9 per pound. When evaluating the cost of a collection program, it is important to address intangible costs such as increased public awareness that will be raised during the publicity surrounding the collection event. Long-term disposal cost savings and avoided environmental damages need to be included in the cost analysis as well.

Sponsors of HHW programs must be concerned with hazardous waste regulations and liability. Organizers of HHW program need to minimize general liability and CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) liability. General liability includes: collection program personnel; the public participating in the program; property damage that might occur at the collection site; and damage, injuries, or other incidents that might occur while the waste is being transported from the collection site. CERCLA liability is related to potential future impacts caused by the ultimate disposal site.

Tires

The availability of tire recycling activities must be increased if the rubber and leather recycling goals of 5 % by 1997, 10 % by 2002, and 50 % by 2012 are to be achieved.

Presently, landfilling is the most common practice for tire disposal. Recycling and reuse applications are limited, using only a small portion of the available stock. The development of an economically feasible scrap tire management options should be a priority for the entire H-GAC region. Three major management options are available; shredding and/or splitting for disposal, recycling and reuse, and incineration for energy recovery. Tires can be used as fuel in cement kilns, pulp and paper mills, utility boilers, or dedicated to energy facilities. Obstacles to tire recycling and reuse include unstable markets for recycled goods, high capital investment costs for recyclers and energy recovery facilities, negative public perception of energy recovery facilities, and maintaining a constant reliable supply of tires as feed stock.

Sludge

In the H-GAC region, the most common forms of sludge disposal are landfilling and land application. Landfilling of sludge is the least preferred management method. Current usage of preferred alternatives, such as, composting, land application, and thermal options (incineration and heat drying) are limited. The land applications are primarily concentrated in several counties. Generally, the application areas are not within the general area of the generation source.

Impediments to sludge composting also exist. These impediments include liability concerns; operational requirements, siting concerns, high cost of required TNRCC testing and processing equipment, and the lack of available markets. If not properly processed and tested, cadmium, zinc, and heavy metals may be found in the compost.

Medical Waste

The TNRCC regulates medical waste generators, transporters, and disposal sites. Under TNRCC regulations, approved medical waste treatment methods include: chemical disinfection; incineration; encapsulation (only for sharps in containers); steam sterilization; and thermal inactivation. TNRCC rules prohibit the landfill disposal of untreated medical waste which has been identified as a special waste from health care-related facilities if those generators are located within 75 miles of a commercial, permitted, operational solid waste facility which treats medical waste. The generator may use any authorized treatment facility of choice but may not landfill untreated waste. Medical waste producers more than 75 miles from a medical waste treatment site may take their waste to a landfill until March 31, 1992. After that date, the landfill disposal of untreated waste will cease.

Within the H-GAC region, the primary form of disposal is incineration. There is only one permitted medical waste incinerator in the region. Some of the medical waste is being exported to a medical waste incinerator in Carthage, Texas (Panola County). As mentioned in Section 2, there are six pending applications, four for incinerators and two for transfer stations in the H-GAC region. The majority of the proposed and existing facilities are located near the Houston urbanized area. Outlying counties do not currently have adequate facilities for medical waste disposal.

While stringent medical waste management regulations are in existence, there are problems associated with medical waste disposal, such as, illegal disposal and lack of proper identification of medical waste. Many small quantity generators and the general public may not know the proper treatment procedures for medical waste.

Grease and grit trap

The existing collection systems for grease and grit trap is adequate. Much of the management of this type of waste is handled by the private sector. However, more processing facilities are needed, especially in the outlying areas.

Used oil

Used oil recycling is in the beginning stages. Several private initiatives have begun to encourage the recycling. The outlook for used oil recycling is positive given the recent establishment of the state used oil recycling program and fund, as described in Section 3.

Used oil recycling also is being promoted at the national level. The EPA encourages the recycling of used oil through their *Project ROSE* campaign. The program's goal are to increase awareness of the hazards of dumping used oil and to organize a convenient use oil recycling network for individual communities. *Project ROSE* serves as an information and resource center for both industry and DIYs. The newly adopted TNRCC used oil recycling program is similar to this EPA program.

e. Evaluation of Alternatives

Household Hazardous Waste

There are several possible methods for HHW collection. Stationary collection sites, rather than mobile sites, are the most common approach. The planning and operation of a stationary collection involves the setting of a date for collection, advertising the service to the public, and then conducting the program. The number of sites and length of program can vary. Currently, one-day collection events are more common than permanent collections sites. The one site/one time period approach is most applicable to small communities and is less expensive that having an ongoing permanent collection site.

Another collection variation involves having multiple sites either simultaneously or in sequence. Two or more collection sites may be operated on the same day, followed by sites opening in different locations. Multiple sites are advantageous in large cities and may encourage participation. However, multiple sites are expensive, especially if operated simultaneously, because multiple, trained crews must be employed.

Permanent collection sites increase the convenience of a collection program, by increasing participation. Permanent collection sites generally have high operation costs. Examples of good permanent collection sites are fire stations, landfills, and government-owned property. Programs involving permanent collection facilities allow citizens to drop off wastes at their own convenience. Permanent collection sites can be more effective for collecting HHW than one day collections. However, liability concerns have limited some efforts to establish permanent collection sites.

Mobile collection units can provide ongoing, year-round collection of HHW. Mobile units operate on a fixed, predictable schedule. It is estimated that mobile units are more cost effective and cost efficient than one day collection sites. Generally, mobile units need 5,000 square feet in which to operate.

Curbside collection of HHW may also be utilized. Curbside collection programs are generally targeted to specific items, such as used oil and household batteries. This type of collection is typically operated in conjunction with curbside recycling programs. While participation levels are high, curbside collection is costly and requires specially-trained

personnel to collect, pack and transport the collected materials. Also, specially designed trucks are required.

HHW collection programs may be sponsored either by local government, public interest groups or private firms. Financial support may be obtained from a variety of sources which can include: local or regional chemical manufacturers; corporations with local branches; civic groups; grants; user fees; and additional fees on utility bill. Typically, government sponsored programs are funded from allocations of general funds and monetary and service donations from the community. Funds for programs sponsored by public interest groups come from the groups themselves and are often supplemented with donations from individuals or other service organizations. Service that may be donated include the use of a collection site, the use of equipment, or the availability of chemical expertise to identify waste. Private firms, such as commercial hazardous waste management firms and chemical manufacturers, also sponsor collection efforts.

Tires

Tires present a special disposal and reuse challenge because of their size, shape, and physiochemical nature. The three major management options available for disposal, recycling, and conversion are landfilling, recycling and reuse, and incineration. Specific examples include: reuse as tires; recycling into other products, reuse of whole tires; recovery of the raw materials in tires; processing of tires into tire-derived fuel (TDF); shredding and disposal in monofills.

The disposal of shredded or split tires can either occur in municipal solid waste landfills or tire monofills. Basically, tire shredding and splitting requires relatively low capital costs. However, this is not a preferred management option because landfill space is limited and the value of the tire as a fuel or raw material is lost. However, if disposal is chosen, disposal in monofill is preferred as opposed to landfills. If in the future the tire chips become a valuable resource, the tires in the monofill can easily be recovered and used.

Tires as fuels can be used in cement kilns, pulp and paper mills, and in dedicated tire-to energy facilities. Overall, the advantages of burning tires are that their fuel value is recovered and there is no need to disposal of the tires in a landfill or elsewhere. Barriers and disadvantages associated with TDF include the fact that TDF is more costly than traditional fuel stocks, the reliability of the supply of tires is questionable, the poor perception in the marketplace of TDF as a fuel source; the potential for pollution; and the high capital investments required to adapt existing facilities to the use of TDF.

Recycling and reuse options are numerous; however, the markets for the byproducts are limited. Whole tires can be used in the construction of artificial reefs and breakwaters, earth stabilization and reinforcement applications, tire fences, and playground equipment. The disadvantages of whole tire applications are that applications are limited and only a small portion of the available tire supply is used. Recycling options that covert tires into other products can be done two ways: cutting scrap tires into suitable shapes and

assembling them into new products or by grinding the tires into crumb and using it in asphalt mix, or rubber/plastic compounds for a wide variety of molded or die cut products.

Market development lags behind processing technology and market development studies should be implemented. New markets, as well the expansion of existing markets, are needed. Currently, there are not enough markets and end products to digest the amount of material generated from tires. Government procurement policies and price preferences for products made from recycled tires can help stimulate market development.

Grant programs should be funded through the newly established TNRCC tire recycling fund which is generated from a surcharge placed on the sale of new tires. Also, funds generated from the existing landfill surcharge should be targeted for demonstration projects and research and development programs. Local governments and private industries should be eligible for various grant programs.

Sludge

The feasibility of alternative management methods needs to be investigated. Beneficial-use land application is not equally distributed throughout the region and much of the land application occurs away from the generation source usually suburban Municipal Utility Districts. Public perception of land application is poor in counties where land application is common. Cooperative efforts to establish alternative regional sludge disposal sites should be established. Cooperation is needed between the generation sources and beneficial users.

Sludge composting involves the mixing of sludge with some type of bulking agent such as sawdust, wood chips, leaves, or recycled compost. Sludge composting facilities may be static piles, windrows, or in-vessel. For environmental and public health reasons, sludge piles are generally built on some type of pad and are enclosed. The sludge compost product is high in nutrients, especially nitrogen, and is considered a valuable product when sufficient quality is assured. However, it is more difficult to market sludge compost than yard waste compost. Public perception of sludge composting is mixed.

Medical Waste

After March 1992, new TNRCC regulations that ban landfilling of untreated medical waste will be effect. With these regulations, new facilities will be needed, especially in rural areas, since, prior to March 1992, medical waste generators were allowed to dispose untreated medical waste in a landfill if they were located more than 75 miles away from a medical waste treatment site. Rural areas will need to investigate alternative disposal options. Given the high cost to operate a medical waste treatment facility, rural areas may choose to establish medical waste transfer stations or regional disposal facilities. Additionally, rural areas may not generate enough medical waste to sustain the operating capacity of a treatment site.

Alternative means of disposal should be encouraged. Incineration may not be feasible for all areas. Historically, public perception of incineration has been poor and it may be difficult to site a new facility. Also, as a result of Clean Air Act, the Texas Air Control Board and the EPA have adopted stricter emission standards which may increase operation and testing costs. If an incineration project is proposed, an intensive public awareness campaign is needed to educate the public on the advantages and disadvantages of medical waste incineration.

Beside providing adequate medical waste disposal, illegal disposal of medical waste needs to be addressed. The occurrence of illegal disposal may be decreased through increased enforcement activities, better monitoring of generators and transporters, and education. Grant funds and fines levied on violators should be dedicated to enforcement and clean-up. Public awareness campaigns focusing on identifying medical waste and outline proper treatment technique may need to be implemented.

Used Oil

As part of the newly established used oil recycling fund and collection program, the state is planning to establish various public education and technical assistance grant programs for the purpose of encouraging local governments to set up DIY used oil collection programs. Local governments and private businesses should be encouraged to participate in these programs. The success of used oil recycling is dependent on public participation. An expansive educational program is needed. The importance of used oil recycling should be communicated through the media, schools, special events, and civic and volunteer organizations. Educational materials, such as brochures, flyers, and information packets should be developed and distributed.

f. Conclusions

- The category special waste incorporates many types of wastes, with each one having its own special characteristics and unique management, handling, and disposal requirements. Currently, only certain major items in the special waste stream, such as tires, used oil and lead-acid batteries are being addressed by legislation and regulations. The management alternatives for other types of special waste should be studied.

- Existing recycling and reuse opportunities for special waste are limited. For example, the markets for products made from recovered tires are saturated. Alternative uses need to be found and markets for products made from recycled special wastes need to be stimulated.

- Throughout the region, large quantities of special wastes are illegally disposed. Improper waste disposal can seriously impact the environmental and public health. Proper collection and disposal options need to be identified, collection programs established and laws against illicit disposal strictly enforced.

- Proper collection and disposal of special wastes is costly. Financing for special waste management programs is needed. Grant and loan programs focusing on research and pilot demonstration programs should be encouraged. Government, research institutions, and private industries need to assume active roles.

- Special waste education is needed. Alternative, non-toxic products for hazardous special wastes are available, and programs to promote awareness of these products should be developed. Additionally, education programs on what constitutes a special waste and its special handling requirements are needed.

5. Institutional Options

The institutional options section outlines the benefits and barriers to continued involvement by local governments in solid waste management. It is also intended to assist local governments in making sound planning and management decisions to implement an integrated solid waste management system.

a. Evaluation of Current System

Chapter 363 of the Health and Safety Code states:

> Each county with a population of more than 30,000 and each municipality shall review the provision of solid waste management services in its jurisdiction and shall assure that those services are provided to all persons in its jurisdiction by a public agency or private sector.

The manner in which local governments offer that service in the H-GAC region is wide and varied. As mentioned earlier, the manner in which most H-GAC local governments provide this service fall into one of the following five categories.

1. Local government provides collection and owns and operates landfill.
2. Local government contracts with the private sector for collection and/or disposal.
3. Local government bills residents on behalf of a private service which operates on the basis of contracts with individuals.
4. Combination of these within the same local government jurisdiction.
5. Private disposal without local government involvement.

According to a 1991 survey, more than half of the local governments in the H-GAC region (61%) use variations of private sector service. And more than 90% of all waste generated in the H-GAC region is currently landfilled. Privatization is the trend in solid waste collection and landfilling. For, in recent months ten public (municipal or county owned) landfills in the region have closed or ceased operation, and the responsible community has turned to a privately owned landfill for their disposal service. While many local governments have turned to the private sector for some aspect of their operation, many others want to maintain some control over their operation, be it collection, disposal or both. Appendix 3 shows current levels of service provided by municipalities in the H-GAC region.

b. Evaluation of Alternatives

Institutional Options

Institutional options for solid waste management include local responsibility, inter-local agreements, solid waste authorities, public-private partnerships, and privatization. In the H-GAC region there are examples of most of these options in place already. Regional-

ization of solid waste management services to handle higher landfill construction and operational cost, higher collection cost, and to meet recycling market demands is quickly becoming the best management solution for many local governments. All but one of the institutional options, local responsibility, discussed in this section is a form of regionalization.

Local responsibility. Local responsibility is the scenario where a local government is solely responsible for all solid waste collection, recovery and disposal programs. Many communities in the H-GAC region have traditionally provided solid waste services as part of their public works program. This option requires the local government to finance facilities and equipment for handling their solid waste, as well as pay for the actual collection, handling and other operational expenses of a program. Local governments facing tighter budgets and operational criteria have been turning away from this option and to the private sector or regionalization as a more cost-effective form of municipal solid waste management.

PROS of Local Responsibility

1. Community with population and economic base can afford to stand alone, retaining full control over its solid waste management services.
2. Community that retains full control over its solid waste management services will not be dependent on other communities for financing or on a private service provider that may not always be in existence (bankruptcy or closure).
3. Community that retains full control over its solid waste management collection and disposal will not be reliant on the private collection or disposal market, which may be a monopoly in their area.

CONS of Local Responsibility

1. Community will have to have an estimated 50,000 population base and 20 years in capacity to economically afford to comply with Subtitle D regulations for landfill design, operation, closure and post-closure maintenance and finance.
2. Community may not be as efficient in cost and effectiveness in providing services as the private sector.
3. Regionalization offers advantages over local responsibility in cost distribution of collection, transfer, and disposal.
4. Markets for recycled materials may be developed if a larger amount of goods are collected and pooled for pick-up rather than an individual community hauling the goods to market.

Interlocal agreements. Interlocal agreements are contracts between governmental entities for services and facilities that will benefit all entities by providing the same or a higher level of services at a lower cost. Interlocal agreements (or contracts) are being used throughout Texas for virtually all services that a community can provide, including solid waste management. Interlocal agreements offer local governments the option of

providing regional solid waste services to solve their local solid waste management problems. Local governments who want to retain a greater control over their solid waste services will utilize interlocal contracts over other forms of regionalization. Interlocal agreements allow participating governmental units to negotiate and manage their solid waste program jointly. One governmental unit will usually take the lead in an interlocal agreement by providing a facility or operation and then contracts capacity to other governments. Appendix 6 includes a more detailed discussion of interlocal agreements and has several solid waste contracts from throughout the state.

PROS of Interlocal Agreements

1. Specific authority granted in Health and Safety Code to allow interlocal agreements that will permit regionalization without the state legislature creating an Authority.
2. Local governments retain control over their portion of the regionalization effort without an outside governing body making the decisions. They will also retain a greater control over the ongoing operation of the programs.
3. Regional solutions and economies of scale to solve local solid waste management issues.
4. Cities that already provide solid waste management services have some level of expertise and equipment to operate a solid waste program.
5. Cities and counties will have long-term presence to accept the liability associated with solid waste management, especially post closure care of landfills.
6. The potential for host community benefits can be written into the interlocal agreement.

CONS of Interlocal Agreements

1. There may not be one decision making government body in charge of the operation.
2. Interlocal contracts often have termination clauses, that could end the agreement and may leave a community without essential services.
3. Term or duration of contract may not be efficient to respond to changes in the program.
4. Interlocal agreements may not include the counties involved, leaving un-incorporated areas with inadequate service.

Solid waste authorities. Solid waste authorities are special districts created to handle solid waste collection and disposal options for a specified area. A solid waste authority can fill the role of many governmental units as one governmental entity, with a distinct governing body drawn from the communities involved in the authority. An authority may also remove local governments from many of the liability issues associated with solid waste management practices. There are currently three types of authorities or districts that can be utilized for solid waste management. They are general law districts, existing regional special districts, and new special law districts.

General law districts include existing water control and improvement districts and municipal utility districts. They have the authority to provide solid waste services, tax residents, issues bonds, and finance projects. Regional special law districts include river authorities and, in the H-GAC region, the Gulf Coast Authority (GCA). River authorities may have the power to provide solid waste services written into their enabling legislation. However, most river authorities have no taxing authority and their governmental board is appointed by the governor and not the affected communities. The GCA currently is studying its role in future municipal solid waste management projects. Another type of authority can be newly-created solid waste disposal districts. The GCA is an example that other communities can follow. The Legislature has the authority to create a special purpose district to conserve the state's natural resources if the communities within a specified region are willing to support such a district.

PROS of Solid Waste Authorities

1. One governing body to control the operation.
2. Geographic boundaries of authorities can be created to best meet the solid waste management needs of the area.
3. Regional solutions and economies of scale to solve local solid waste management issues.
4. If created by the Legislature, they will have the long term presence required to accept the liability associated with solid waste management, especially the post closure care of landfills.
5. Newly-created authorities will be focused only on solid waste management issues.

CONS of Solid Waste Authorities

1. River authorities may have little taxing and revenue gathering capability to finance solid waste projects, and will be governed by a Board appointed by the Governor.
2. Authorities may not have the same powers as cities and counties (condemnation, zoning, police power).
3. Local governments may fear the loss of control over solid waste management.
4. Newly-created authorities may not have the expertise to adequately handle solid waste disposal issues.
5. State control over the creation and decimation of authorities may be an issue to resolve.

Public-private partnerships. Public-private partnerships are utilized to take advantage of the strengths of both private industry and public agencies. A publicly-owned or financed facility can be operated by a private company. This will allow a public entity control over a landfill, transfer station or materials recovery facility (MRF) while not having to deal with the day-to-day operations. Private ownership and public operation works in much the same way. A public entity can lease a facility from the private sector who has the capital to finance the construction and development of the operation. In

either scenario, the local government obtains the expertise and programs developed by the private sector.

PROS of Public-Private Partnerships

1. Allows the community some control over its solid waste management projects, will still allowing for regionalization of services provided by the private sector.
2. Cities that already provide solid waste management services can continue to draw on their expertise, while also utilizing the efficiency of the private sector.
3. Private organizations will be focused on solid waste management issues, allowing communities to reduce their level of involvement.
4. Private firms and the host community can assist each other in the siting of solid waste management facilities.

CONS of Public-Private Partnerships

1. The governmental agencies may not have an adequate number of private operations in their area to choose from, creating a monopoly situation.
2. Private organizations are profit-oriented, while public agencies are service-oriented and must often respond to political changes.
3. Long-term contracts may limit the control communities have over the contracting firm and responding to changes in solid waste management practices.
4. Private firms do not have the permanence of governmental agencies.

Privatization. Privatization has been occurring in solid waste management for a number of years. Many local governments have utilized privatization for essential municipal services to increase efficiency and effectiveness of the operation. Numerous studies have concluded that privatization has the potential to reduce the cost of operating a solid waste management system. Private organizations often serve areas larger than the geographic boundaries of a community and have an economy of scale over individual community collection and disposal programs. The barriers to privatization can be just as damaging to local governments. The fact that the private organization is a business means that it can close and leave the community without solid waste services. Local governments also may have less control over their programs, and long-term contracts often reduce the competition for the services in the area.

There are three basic forms of privatization in practice in the H-GAC region. The first is a contract for service in which qualified contractors are selected through a competitive bidding process and provide the service on behalf of the government. The second is the award of a franchise, where private companies bill and collect payment directly from households or businesses through negotiated rates with the community. The third is private subscription, where each household or business individually hires a firm to handle their solid waste.

PROS of Privatization

1. Private organizations will be focused only on the business of solid waste management.
2. Private firms will have to handle the siting of solid waste management facilities.
3. Regionalization of services occurs because private firms usually serve more than one community. The regionalization will result in greater economic efficiency.
4. In general, private haulers use smaller, more efficient pickup crews.
5. Private firms will be responsible for post-closure care of landfills and liability of their solid waste management operation.
6. Private firms are generally more effective in the operation of recycling programs.

CONS of Privatization

1. The governmental agencies may not have an adequate number of private operations in their area to choose from, creating a monopoly situation.
2. Private organizations are profit-oriented, and may not want to contract for unprofitable elements of the solid waste management program.
3. Long-term contracts may limit the control communities have over the contracting service provider to effect changes in solid waste management practices.
4. Private firms may not be as permanent as governmental agencies, creating liability concerns for closed landfill maintenance.
5. Private firms are removed from the political process once contracts are signed, and they will not have to be as responsive to political changes and public pressure as public operations.
6. Private landfill operators may ask for a guaranteed amount of waste which local governments have to provide in order to receive lower disposal rates, a guaranteed waste stream. When markets are developed for recycling and waste reduction programs begin the local government may have to pay a higher rate.

c. Conclusions

- Municipalities in the H-GAC region have been moving toward privatization in their solid waste management programs. The area where most cities have been utilizing the private sector is in landfill operation. The vast majority of the region's waste is privately landfilled and most of the capacity is privately owned

- Regionalization of municipal solid waste management services is more economical than sole municipal responsibility. This point is illustrated in recycling market development, recycling curbside pick-up, and landfill operation, all of which require certain economies of scale.

- Privatization of municipal solid waste management services, a form of regionalization, is increasing throughout the region. Before privatization is considered in rural areas the private markets must be studied. A concern in these areas should be the creation of a monopoly in services by one vendor.

- Private landfill contract negotiation should include the following considerations: wet weather operation, fees by ton (to compensate for half loads or light loads), and if they have waste generation guarantees for lower tipping fees, these guarantees reflect the impact recycling and waste reduction will have on generation.

- Interlocal agreements can be written for almost any aspect of a solid waste management program. Innovative use of interlocal agreements should be studied in future solid waste management programs. The use of agreements for host-community benefits, joint market development, or smaller communities utilizing a larger city's price negotiation and contracts with private firms should be considered.

6. Public Education Programs

Local governments in the H-GAC region have many mandates to follow and goals to reach in solid waste management. Many will be starting a recycling program for the first time, most will be initiating waste reduction efforts, all are facing higher collection and disposal costs, and some will be reexamining at the entire organization surrounding their solid waste management operations. Public education programs in an integrated solid waste management system are the key factor to success of the system. Public education may focus on public awareness of solid waste management issues, or the implementation of a specific program, or even the education of decision makers about the "tough choices" they face in solid waste management. In all of these situations the target audience must receive reliable information that will assist them in making the best decision or help increase their participation in the program.

a. Evaluation of Current System

In the H-GAC region, the predominate form of public education concerning solid waste management issues is taking place through local Keep Texas Beautiful affiliates. Several of these programs are Keep America Beautiful (KAB) recognized programs as well. KAB recognized programs must follow KAB guidelines in order to retain affiliation. Cities in the region where there are KAB recognized affiliates include Baytown, Galveston, three in Houston, Kingwood, Lake Jackson, Pearland, and Sealy. KTB affiliates have traditionally focused on litter abatement and education programs. They provide public education programs such as flyers, public service announcements, youth education modules, and organize programs such as community clean-up days. In recent years, KTB affiliates have branched out into recycling and other waste reduction programs. Some provide education materials and programs concerning recycling, such as the Clean Houston affiliate. Others actually provide the recycling service, examples include Clean Pearland and Make Sealy Sparkle. The Texas headquarters of Keep Texas Beautiful, Inc provides public education modules on litter abatement, youth education concerning recycling and waste reduction.

Local governments in the region have different types of education programs. While some sponsor their KTB affiliates and utilize KTB programs, others create education campaigns to implement specific projects. Every city that has a recycling program has utilized some type of public education to implement the program. For example, to implement their pilot recycling program, the City of Houston organized block captains to be the trained experts and to continue to disseminate information in their area. City staff held public meeting to discuss the program, delivered recycling bins to all the participants doors, and distributed door hangers as reminders and updates to the participating homes. The City hosted a press conference to officially 'kick off' the program. And finally, the city continues to host block captain meetings to ensure that the program is running efficiently. While the Houston recycling program was not the first in the region, its size and media outreach created an interest in recycling. The media coverage, both television and print reached many residents in the region not living in Houston and raised public awareness of recycling issues.

Many governments are involved in another type of public education program, their council or commission meetings. Whenever governmental officials debate, hear reports, or ask for public comments concerning solid waste management issues they are involved in a public education campaign. Many councils hear information items concerning the budget or possibilities of beginning new solid waste programs. The local media often covers these proceedings and continues the public education process. In these cases it is up to the staff to provide reliable information to assist in the decision making process.

At the state level, the Texas Natural Resource Conservation Commission, (TNRCC), Municipal Solid Waste Division has initiated a public awareness campaign concerning solid waste management issues. The programs through TNRCC have focused on the Division's new direction and programs in recent years, especially since the passage of S. B. 1519 and other recent legislation which modified section 363 of the Health and Safety Code. Topics include: the coding of plastics; a quarterly newsletter outlining the Bureau's activities; a 1-800 number to obtain information from a newly created library; an 'enviro-holiday' flyer; a media library; updates of old or out of date materials; and signs and posters to help citizens implement the new waste oil recycling program. The Division has also released a grant for the development of a youth education program. KTB, the recipient of the grant, is in the process of developing a statewide model public education program.

The Environmental Protection Agency (EPA) has taken an active role in the creation of public education programs as well. In 1991, the EPA initiated a grant program for the development of model waste reduction and public education programs. The City of Pearland was one of the recipients of the grant. Pearland will develop the program and provide a report to the EPA about its implementation. This information will be disseminated throughout the EPA's Region VI for all local governments. The EPA , along with KTB, also host a teachers roundtable, an informal that meets to discuss youth education programs.

Business and industry have developed their own education programs as well. Many of these programs are directed at the consumer to advertise measures these companies are taking to recycle and reduce waste, and they are effective communication techniques for recycling and waste reduction. Wal-Mart, just by sponsoring a recycling bin at their stores, is raising public awareness about recycling. The discontinuation of any materials collected at the store also lets the public know that the markets are saturated. Many other stores provide sacks and bags with environmental messages on them, some will even recycle the bag if brought back or give rebates to the consumer if they are reused. McDonald's created an education program to let the public know of their recent changes, and received quit a bit of national media attention for their efforts.

Solid waste management companies also provide public information programs. BFI utilized a public education program to implement its blue bag recycling program in a portion of Houston. BFI landfill operators offer tours and information concerning the

operation of their landfill. Waste Management provides information concerning their landfill in much the same manner. They are also in the process of creating a solid waste education center in north Harris County.

Local governments in the H-GAC region have expressed a need for more public education programs. The individual topic may be facility siting, illegal disposal, recycling, household hazardous waste, medical waste disposal or general solid waste management issues. These programs may be started by the state, by H-GAC, through Keep Texas Beautiful or by the local governments themselves. A coordinated effort by the state is needed to provide useful general information concerning solid waste management issues and changes in state laws and programs. However the implementation of local programs such as recycling and waste reduction will require some community specific information. Keep Texas Beautiful affiliates will have good information to begin with, however specific education programs will still have to be developed.

b. Evaluation of Alternatives

Implementing new solid waste management programs requires that elected officials, community leaders and the public be educated as to the necessity for the change and how they can be participate. Public education programs should be utilized so that each target audience understands what its role in solid waste management programs will be. Elected officials must be provided accurate information concerning program alternatives, legislative mandates, and cost of implementing solid waste programs. Community and business leaders should be provided the same type of information in addition to specific programs that they may utilize in waste reduction and recycling programs.

As landfill regulations tighten and alternative waste handling programs increase, the general public will be facing higher disposal cost and new techniques to dispose of its waste. Education programs will be necessary to explain the higher cost and how they can work to reduce those cost from rising in the future. Education programs will have to be utilized to explain new recycling and waste reduction programs, many people have simply put waste on their curb twice a week, or illegally dumped it, and it has disappeared. They must now realize that these habits must be changed to meet increased demands on landfill space, tightened regulations and recycling goals.

The most important lesson that industry and community leaders have learned in the past several years is that what the public believes to be true, no matter how accurate, is as effective as the truth itself. This lesson can be no more clearly exemplified than in the case of landfill siting and operation. Public education programs must be developed that effectively explain the "truth" in solid waste management practices.

The types of public education programs available to help implement solid waste management plans, start new programs, or site new facilities in a community or region are numerous. The following section will highlight many of these alternatives.

Programs

Programs are the actions communities can take to effectively provide public education information. Each of the programs listed can be used as a stand-alone program or as part of integrated education program, as each can cover a specific area in solid waste management or an integrated solid waste management approach.

Civic sponsorship. Civic sponsorship programs are those which have the funding or support of civic or other special interest groups within the community. Examples include the League of Women Voters or Chamber of Commerce funding a special event or guide book for the community, or an environmental group underwriting the expenses of the development of a mailer or brochure.

Conference booth sponsorship. Many companies and organizations sponsor conference booths at trade shows, conferences, or special events. Providing a conference booth concerning the solid waste management practices of the community could bring just as much publicity to the communities solid waste programs.

Corporate sponsorship. Corporate sponsorship of public education programs can take many forms. The type of programs found throughout the H-GAC region include the sponsorship of recycling bins by placing the company logo on the side, the sponsorship of a hot-line number for citizens to call, or the placement of community recycling rules on grocery bags.

Information items. Information items are often included on agendas of city council or county commissioners meetings. Information items can be utilized by staff to inform elected officials of recent legislation, program choices, participation rates and many other elements of a solid waste management program. If interest is shown by elected officials concerning the item. the local media will often pick-up on it in their reports. If information items raise awareness and spark debate further information items, a retreat, or special sessions may be called for.

Education modules. Creating or purchasing an established education program that can be used at schools or other civic events can be a useful investment. School programs that are in the form of a module that can be inserted in an academic curriculum will often gain support from school districts. Other education programs that a trained volunteer can pick-up and use at a civic club or other event, could be used to supplement staff time that would be otherwise spent giving presentations.

Keep America/Texas Beautiful affiliation. Keep America Beautiful and Keep Texas Beautiful affiliation will mean the community can tie into the many established public education programs that these agencies have established. The programs range from youth education to litter abatement to recycling.

Public meetings. Holding public meeting to involve the public in the planning process for a solid waste management plan or the detailed planning of specific project will open up the process to many private citizens who have an interest or concern in solid waste management. Public meeting offer both the community and individual an opportunity for feedback and discussion concerning the topic of solid waste management.

Public information officer. A public information officer in a community can provide media and interest citizens with an immediate response to their inquiries concerning solid waste management. The public information officer can also coordinate public service announcements, new releases, and organize special "kick-off" events.

Resource library. A resource library can be used by citizens, community leaders and elected officials to obtain both technical references and public education materials.

Site visits/tours. An established site visit and tour schedule at solid waste management facilities can be utilized both to educate the public about facility operations and to let concerned citizens visit the site to monitor day-to-day operations.

Speakers bureau. Establishing a speakers bureau to visit civic groups, schools and special events to address the agencies programs will often benefit a community. An established volunteer speaker bureau will grow in use as issues arise such as a the implementation of a community-wide recycling or waste reduction program.

Special event promotions. Special events to "kick-off" a program or celebrate a special day (such as Earth Day) will raise public awareness in the public as to what a community is doing. In the H-GAC region there have been Earth Day celebrations, environmental expos, and recycling program "kick-offs".

Training programs. Training programs to implement recycling efforts have been highly successful in the H-GAC region. Providing training to community leaders, block captains, and public servants gives programs coordinators an opportunity to answer questions and concerns often associated with new programs.

Materials

The materials often used for public education takes many forms, based on budgeting and resource availability. Many of the materials discussed in this section can be used in one or all of the public education programs listed above.

Brochures. Brochures usually contain one to two pages of useful information or rules to follow in the implementation of special programs, and are the most used public education method in the H-GAC region.

Conference booths. A permanent conference booth on the subject of integrated solid waste management, recycling or waste reduction could be developed by communities.

The booth could be used to advertise the solid waste management practices of the community and distribute information concerning them.

Door hangers. Door hangers are used as a quick alert for all homeowners or residents of community. Door hangers have been used to notify resident of collection days for pick-up of trash or recyclables, or to remind residents of yard waste composting programs.

Guidebooks. Guidebooks are generally much more detailed explanations of solid waste management programs to be used by elected officials and community leaders. An example of this is Clean Houston's *A Community Leader's Guide to Recycling.*

Mailers. Mailers are the inserts used in utility bills to notify citizens of programs the community is undertaking. Examples of this include the "Don't Bag It" mailers used by the City of Houston to kick-off their program.

Merchandising materials. Merchandising materials are the bumper stickers, key chains and pencils used to handout to citizens. They serve as a constant reminder of the programs a community is undertaking in solid waste management.

Newsletters. Newsletters concerning solid waste management programs and planning efforts are utilized to keep the community leaders and concerned citizens informed about the progress of programs. Newsletters can also be used to promote a program or to alert readers of changes in the programs.

Outdoor advertising. Some communities may wish to utilize billboards, banners, and street signs to promote recycling, special events, or some other aspect of their solid waste program.

Paid advertising. In some markets the only time public service announcements are played is in off-peak hours. If the community wishes to utilize prime radio or television hours, or a prime location in the newspaper, paid advertising may be the best method to reach these markets.

Press releases. Press releases announcing new programs or policies of a community will often receive some attention from the local media.

Public service announcements. Public service announcements will often receive play time from local radio and television markets. The announcements that are the most successful often feature a prominent figure from the community.

Slide shows/videos. Slide shows and videos can be prepared that will liven otherwise technical or long subjects. Slide show and videos can be prepared to be part of a standard presentation or in a stand alone format that will need no other explanation, other than a question and answer period following the presentation.

Speakers bureau manual. A speakers bureau is a pool of experts from throughout the community that have training and involvement in a communities solid waste management program. The speakers bureau manual can be utilized to train speakers and provide them with needed information.

It is important to note that education programs and materials have different target audiences and different results. The approach a community could take will depend on its size, its resources and its objectives. To assist local governments in initiating public education efforts, H-GAC has compiled a bibliography of different public education programs being used throughout the state and nation. This information is found in a separate document.

c. Conclusions

- Public Education programs are a key element in the success of implementing new solid waste management programs. Waste reduction and recycling will not be successful programs in any community unless the public is adequately trained to actively participate.

- Public education includes general solid waste management information for the public, as well as site or project specific information to be used in implementing new projects and making policy choices.

- The Municipal Solid Waste Division must coordinate public awareness campaigns concerning general solid waste management issues and programs being implemented by the Division. The Division should also continue its role as a clearinghouse and disseminator of useful publications from other states and programs.

- Keep Texas Beautiful and Keep America Beautiful affiliation is highly recommended for communities in the H-GAC region. The public education modules and youth education programs will be useful in the implementation of solid waste management policy.

- School districts and private education institutions must be included in the future development of youth education programs.

PART IV
Appendices

Appendix 1

Subcommittees of the Solid Waste Management Task Force

WASTE REDUCTION SUBCOMMITTEE

of the H-GAC Solid Waste Management Task Force

Ulysses G. Ford, Chairman
City of Houston.

Bruce Aitchison
Mc Donalds's Corporation

Bob Carlquist
Houston Chronicle

Susan Grissom
Citizens In Action

Dale Gurley
Western Waste Industries

Bill Lampe
Coca-Cola Foods

Ed Machacek
Houston Post

Charles Miller
Houston Chronicle

Ben Pfeffer
Sierra Club

Ken Piercy
Printing Industry

Sandra Putz
Whole Food Markets

Eric Russell
Frito-Lay

Richard Somerville
US Environmental Solutions

RECYCLING SUBCOMMITTEE

of the H-GAC Solid Waste Management Task Force

Dennis Caputo, Chairman
Proler International, Inc.

Cathy Bell
Sierra Club

Jerry Burns
City of West University Place

Glenn Carraux
Carraux Enterprise International, Inc

Ed Chen
City of Houston

Garry M. Gallo
Steel Can Recycling Institute

Ed Glass
Champion International

Cindy Kellgren
City of Huntsville

David F. Martinez, P.E.
Southwestern Laboratories

Trent Mitchell
Waste Management of NA

Mark Muhich
Galveston Recycling Task Force

Richard Somerville
US Environmental Solutions

Michael Sullivan
Champion International

Shari Walker
ASK Recyclers

Christina West
The Woodland Corporation

PROJECT REVIEW/SITING CRITERIA SUBCOMMITTEE

of the H-GAC Solid Waste Management Task Force

Barbara Bain, Co-Chair
League of Women Voters

Mary Ellen Whitworth, Co-Chair
Citizens Advisory Committee on Solid Waste Disposal Options

Paul Davis
Solid Waste Consultant

Jeff Decoteau
BFI

Harold Graham
Global Advantage

Steve Hupp
Harris Co. Pollution Control

Vance Kemler
Gulf Coast Disposal Authority

Bill Klett
CH2M Hill

Patricia Maddox
West Houston Association

Glenn Masterson
Solid Waste Consultant

Maureen Mulrooney
Citizen Representative for Harris Co. Precinct 4

Paul Pabor
McBride-Ratcliff and Associates

Bill Petty
City of Houston

Commissioner Michael Pruett
Matagorda County

Barry Van Sandt
Van Sandt and Associates

Brent Watts
TNRCC

Gail Williford
Houston Homeowners Association

SPECIAL WASTE ISSUES SUBCOMMITTEE

of the H-GAC Solid Waste Management Task Force

Ron Drachenberg, Chairman
Fort Bend County

Theresa Battenfield
City of Houston

Glenn Carraux
Carraux Enterprise International

Gary W. Davis
Audubon Society

George Elrod
BFI

Tom Eng
City of Houston

Bill Manning
Manning Engineering Corp.

Jerry Neel
Rollins Environmental Services

Dr. Leo O'Gorman
Brazoria County Health Officer

Richard Somerville
US Environmental Solutions

Ann Stone
City of Houston

Joe Teller
Gulf Coast Disposal Authority

INTERLOCAL AGREEMENTS SUBCOMMITTEE

of the H-GAC Solid Waste Management Task Force

Sandra Pickett, Chair
City of Liberty

Don Brandon
Chambers County

Dale Brown
City of Huntsville

Fran Coppinger
Brazoria County

Dan Guitierrez
City of Houston

Leonard Lamar
City of Palacios

Paul Lott
Chambers County

Jim McAlister
Gulf Coast Authority

John Olson
Olson and Olson

Frank Parks
City of Weimar

Richard Stolleis
City of Sugar Land

Thomas G. Wendorf
City of Missouri City

PUBLIC EDUCATION SUBCOMMITTEE

of the H-GAC Solid Waste Management Task Force

Robert Chase, Chairman
Clean Houston

Robin Blut
Clean Houston

Vesta Brandt
KNUZ/KQUE

Bob Carlquist
Houston Chronicle

Glenn Carraux
Carraux Enterprise, Inc.

Fran Coppinger
Brazoria County

Dee Hruska
Youth Education Committee

Barbara Link
Texas Environmental Center

Ben Pfeffer
Sierra Club

Sandra Putz
Whole Foods Markets

Richard Somerville
U.S. Environmental Solutions

Appendix 2

Planning Subregion Work Groups

Subregion 1: Montgomery and Walker Counties Work Group

Bill Storey
City Administrator
City of Conroe

Hon. John Martin
County Commissioner
Montgomery County

Julane Tolbert
County Commission Precinct 1
Montgomery County

Dean Towery
Public Works Director
City of Conroe

Johnny Poteete
Public Works Director
City of Huntsville

Cindy Kellgren
Sanitation Superintendent
City of Huntsville

Dale Brown
Director of Planning
City of Huntsville

Christina West
Solid Waste Coordinator
Woodlands Community Association

Glen Isbell
City Engineer
City of Huntsville

Del Gurley
Composting Manager
Western Waste Industries

Subregion 2: Chambers and Liberty Counties Work Group

Sandra Pickett
Councilwoman
City of Liberty

Joe Edd Stifflemire
Solid Waste Director
City of Liberty

Hon. Paul Lott
County Commissioner
Chambers County

Don Brandon
County Engineer
Chambers County

Hon. Bobby Payne
County Commissioner
Liberty County

Jim Mitchum
Emergency Management Coordinator
Liberty County

Bob Greene
Texas Rural Leadership Program
City of Liberty

Theodore Ricks
Alderman
City of Anahuac

Rusty Senac
Councilman
City of Beach City

Diane West
Mayor
City of Dayton

Glen Pearce
Public Works Department
City of Cleveland

William Heathcock
Public Works Department
City of Mont Belvieu

Vance Kemler
Director of Muncipal Services
Gulf Coast Authority

Georganna Myers
Lower Trinity SWCD

Bill Fitzsimmons
Public Works Department
City of La Porte

Subregion 3: Galveston County Work Group

Mike Fitzgerald
County Engineer
Galveston County

Thomas Manison
Director
Waters Davis SWCD

Mary Jane Valentine
Manager Landfill Permitting
Browning-Ferris, Inc.

James Haven
Public Works Department
City of Galveston

Jess Hagermeir
Public Works Director
City of League City

Jim McAlister
Director of Solid Waste Services
Gulf Coast Waste Authority

Joe Vickery
Environmental & Consumer Health
City of LaMarque

Bob Drenth
President
Best Waste Systems, Inc.

Mark Muhich
Galveston Recyling Task Force

Ron Cox
City Manager
City of Friendswood

George Stapleton
Public Works Director
City of Texas City

Subregion 4: Brazoria County Work Group

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Public Works Director
City of Lake Jackson

Hon. Billy Joe Plaster
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Brazoria County

Paul Davis
Solid Waste Consultant

Joe Almaraz
Sanitation Superintendent
City of Pearland

Faye DeAngelo
Sanitation Superintendent
City of Alvin

Dr. Leo O'Gorman
Health Officer
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Hon. Micky Brooks
County Commissioner
Brazoria County

Hon. Jim Phillips
County Judge
Brazoria County

Fran Coppinger
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Toni Hurt
Brazoria County Solid Waste Management Task Force

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Brazoria County Solid Waste Management Task Force

A.A. MacLean
Brazoria County Solid Waste Management Task Force

Bill Pennington
Brazoria County Solid Waste Management Task Force

Charles Moss
Agricultural Extension Agent
Brazoria County

Subregion 5: Colorado, Matagorda and Wharton Counties Work Group

Milton Wavr
Public Works Director
City of Columbus

Frank Parks
City Manager
City of Weimar

Hon. I. J. Irvin
County Judge
Wharton County

Jon Absheir
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City of Bay City

Hon. E. R. Vacek
County Commissioner
Matagorda County

Hon. Chris King
County Commissioner
Wharton County

Terry Roberts
City Manager
City of El Campo

Hon. H. O. Strunk
County Judge
Colorado County

Robert Boone
Public Works Director
City of El Campo

Hon. Leonard Lamar
Mayor
City of Palacios

Hon. Michael J. Pruett
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Matagorda County

Robert A. Miller
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Don Chovanec
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Subregion 6: Austin and Waller Work Group

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County Judge
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Warren Klump
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City of Bellville

John Mumme
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Joycelene Odum
Waller County Representative
Solid Waste Management Task Force

Hon. Delmar Barry
County Commissioner
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James Vines
City Administrator
City of Hempstead

Don K. Williams
Physical Plant
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Jonathan MacBride
Director of Special Education
Austin County Education Coop

Frank Kluna, Jr.
Department of Public Works
City of Hempstead

Hon. James R. Duke
County Commissioner
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Hon. Curtis Hemphill
County Commissioner
Austin County

Hebert L. Johnson
Mayor
City of Hempstead

Elroy Stevenson
Councilman
City of Prairie View

Subregion 7: Fort Bend County Work Group

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Public Works Director
City of Sugar Land

Mark Sgabay
Public Works Director
City of Richmond

Ron Drachenberg
County Engineer
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Tom Wendorf
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City of Missouri City

Mary Jane Valentine
Manager Landfill Permitting
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City of Sugar Land

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City of Meadows

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City of Rosenberg

Paul L. Schelstrate
Project Manager
Houston Landfill District
Browing-Ferris Industries

Subregion 8: Harris County Work Group

Herb Thomas
Public Works Director
City of Baytown

Dick Larson
Public Works Director
City of Bellaire

Ray Jones
Public Works Director
City of Deer Park

John Horton
Public Works Department
City of Jersey Village

Orlin Hyde
Sanitation Supervisor
City of Pasadena

Jerry Burns
Public Works Department
City of West University Place

George Bridges
Public Works Department
City of Hunters Creek Village

Ernest McGowen Sr.
Councilman
City of Houston

Jeff Decoteau
Environmental Engineer
Browning-Ferris Industries

Bill Petty
Department of Public Works
City of Houston

Gail Williford
President
Houston Homeowners Asssociation

Patricia Maddox
Executive Director
West Houston Association

Rodney Smith
General Manager of Houston Landfills
Waste Management of N.A.

Hon. Jerry Eversole
County Commissioner
Harris County

Bob Johnson
Public Works Director
City of Tomball

Glen Masterson
Landfill Consultant
Harris County, Precinct 4

Jim Price
Public Works Department
City of Tomball

Maureen Mulrooney
Citzen Representative
Harris County, Precinct 4

Genie Barnes
Alderwoman
Taylor Lake Village

Gordon Leeks
Public Works Asst. Director
City of Baytown

Appendix 3

Local Government Solid Waste Management Services and Budget

Appendix 4

Population by Census Tract

COUNTY	CENSUS TRACT 1980	POP 1980	POP 1990	POP Diff	Pecent Change
Subregion 1 Montgomery	901.O1	4451	6599	2148	48%
	901.02	7056	7550	494	7%
	901.03	3811	4986	1175	31%
	902.01	3828	4138	310	8%
	902.02	3472	3670	198	6%
	902.03	7300	8012	712	10%
	902.04	4605	7087	2482	54%
	902.05	3772	4297	525	14%
	902.06	3541	5155	1614	46%
	902.07	4434	21080	16646	375%
	903.01	6100	7724	1624	27%
	903.02	6117	9449	3332	54%
	904.00	1814	2622	808	45%
	905.00	4025	6272	2247	56%
	906.01	4967	7118	2151	43%
	906.02	4413	5150	737	17%
	906.03	5454	6495	1041	19%
	907.01	4768	6803	2035	43%
	907.02	3690	4180	49 0	13%
	907.03	5522	4110	-1412	-26%
	908.01	3584	4426	842	23%
	908.02	2169	2677	508	23%
	908.03	7223	9089	1866	26%
	909.00	3562	4800	1238	35%
	910.00	8135	10616	2481	30%
	911.01	3186	5885	2699	85%
	911.02	5105	7212	2107	41%
	912.01	1021	1327	306	30%
	912.02	1362	3672	2310	170%
Subregion 1 Walker	1901.00	6921	11371	4450	64%
	1902.00	4535	5827	1292	28%
	1904.00	6301	6267	-34	-1%
	1905.00	5666	6074	408	7%
	1906.00	4483	4632	149	3%
	1907.00	5059	5463	404	8%
Subregion 2 Chambers	1101.01	3649	4306	657	18%
	1101.02	4051	5167	1116	28%
	1102.00	2866	2904	38	1%
	1103.00	4933	4619	-314	-6%
	1104.00	3039	3092	53	2%
	1201.01	3627	3470	-157	-4%
Subregion 2 Liberty	1001.00	3065	2875	-190	-6%
	1002.01	2470	3295	825	33%
	1002.02	5244	6135	891	17%
	1003.00	3534	4189	655	19%
	1004.00	1755	2000	245	14%
	1005.00	2173	2386	213	10%
	1006.00	1729	1908	179	10%
	1007.00	3616	3449	-167	-5%

	1008.00	627	507	-120	-19%
	1009.00	6001	5719	-282	-5%
	1010.00	6205	6221	16	0%
	1011.00	4704	6964	2260	48%
	1012.00	5965	7078	1113	19%
Subregion 3 Galveston	1201.02	4022	3438	-584	-15%
	1202.00	-4415	8166	3751	85%
	1203.00	6182	13196	7014	113%
	1204.00	3238	3424	186	6%
	1205.00	3715	4138	423	11%
	1206.00	2367	3393	1026	43%
	1207.00	1413	9221	7808	553%
	1208.00	4796	5582	786	16%
	1209.00	1743	1711	-32	-2%
	1210.00	4036	4787	751	19%
	1211.00	2012	3126	1114	55%
	1212.01	3569	3522	-47	-1%
	1212.02	4988	5344	356	7%
	1213.00	2110	1977	-133	-6%
	1214.00	4014	5363	1349	34%
	1215.00	2889	3518	629	22%
	1216.00	2710	4108	1398	52%
	1217.00	6703	7336	633	9%
	1218.00	2188	2407	219	10%
	1219.01	8088	7619	-469	-6%
	1219.02	1815	2054	239	13%
	1220.00	7668	7208	-460	-6%
	1221.00	7138	6599	-539	-8%
	1222.00	4265	3862	-403	-9%
	1223.00	6589	7467	878	13%
	1224.00	2336	2473	137	6%
	1225.00	1404	1158	-246	-18%
	1226.00	2277	1789	-488	-21%
	1227.00	4411	3913	-498	-11%
	1228.01	2725	2396	-329	-12%
	1228.02	3006	2803	-203	-7%
	1229.01	2957	2730	-227	-8%
	1229.02	2802	3444	642	23%
	1230.00	2657	1796	-861	-32%
	1231.00	3419	3426	7	0%
	1232.00	5983	4958	-1025	-17%
	1233.00	5373	4387	-986	-18%
	1234.00	1761	1772	1.1	1%
	1235.00	2517	2080	-437	-17%
	1236.00	3449	2476	-973	-28%
	1237.00	822	971	149	18%
	1238.00	756	351	-405	-54%
	1240.00	4861	3837	-1024	-21%
	1241.00	2729	2337	-392	-14%
	1242.00	2366	2132	-234	-10%
	1243.00	2722	2500	-222	-8%
	1244.00	1528	1410	-118	-8%
	1245.00	2010	1926	-84	-4%
	1246.00	2465	2231	-234	-9%

	1247.00	2348	2369	21	1%
	1248.00	2161	2087	-74	-3%
	1249.00	2053	1724	-329	-16%
	1250.01	710	1662	952	134%
	1250.02	5870	7111	1241	21%
	1251.00	4531	4998	467	10%
	1252.00	1135	1582	447	39%
	1253.00	826	1727	901	109%
	1254.00	2670	2807	137	5%
Subregion 4 Brazoria	601.00	10160	13236	3076	30%
	602.01	3348	8256	4908	147%
	602.02	12250	14869	2619	21%
	603.00	5314	6211	897	17%
	604.00	13785	15103	1318	10%
	605.00	8987	10522	1535	17%
	606.00	2025	1832	-193	-10%
	607.00	1707	8239	6532	383%
	608.00	6689	8111	1422	21%
	609.00	7203	5015	-2188	-30%
	610.00	4993	4863	-130	-3%
	611.00	3294	3683	389	12%
	612.00	4523	4781	258	6%
	613.00	1471	1820	349	24%
	614.00	3769	4248	479	13%
	615.00	342	497	155	45%
	616.00	1089	869	-220	-20%
	617.00	3653	4494	841	23%
	618.00	2596	2189	-407	-16%
	619.00	6035	6314	279	5 %
	620.01	3627	3563	-64	-2%
	620.02	8801	8682	-119	-1%
	621.00	1893	1838	-55	-3%
	622.00	2136	1939	-197	-9%
	623.00	979	1010	31	3%
	624.00	1711	1305	-406	-24%
	625.01	7055	9366	2311	33%
	625.02	5962	6028	66	1%
	625.03	6083	6936	853	14%
	626.01	2546	2717	171	7%
	626.02	6178	6350	172	3%
	627.00	4158	4023	-135	-3%
	628.00	6093	4339	-1754	-29%
	629.00	7740	6896	-844	-11%
	630.00	642	681	39	6%
	631.00	684	802	118	17%
	632.00	66	80	14	21%
Subregion 5 Colorado	1501.00	5211	4759	-452	-9%
	1502.00	2379	2231	-148	-6%
	1503.00	3875	3854	-21	-I%
	1504.00	3645	4039	394	11%
	1505.00	3713	3500	-213	-6%
Subregion 5 Matagorda	1301.00	2845	2698	-147	-5%
	1303.00	8122	4517	-3605	-44%
	1304.00	4097	3092	-1005	-25%

	1305.00	3292	3112	-180	-5%
	1306.00	5796	5607	-189	-3%
	1307.00	4697	4056	-641	-14%
Subregion 5 Wharton	1401.00	5897	5632	-265	-4%
	1402.00	1669	1689	20	1%
	1403.00	2299	1963	-336	-15%
	1404.00	5873	6012	139	2%
	1405.00	2348	2662	314	1.3%
	1406.00	4013	3459	-554	-1.4%
	1407.00	1992	1823	-169	-8%
	1408.00	3204	3279	75	2%
	1409.00	6226	6792	566	9%
	1410.00	4440	4213	-227	-5%
	1411.00	2281	2431	150	7%
Subregion 6 Austin	1601.00	1894	1917	23	1%
	1602.00	3813	4066	253	7%
	1603.00	3718	4594	876	24%
	1604.00	2467	2484	17	1%
	1605.00	5834	6771	937	16%
Subregion 6 Waller	801.00	911	1302	391	43%
	802.00	3883	5120	1237	32%
	803.00	9565	11194	1629	17%
	804.00	5439	5681	242	4%
Subregion 7 Fort Bend	701.01	1561	1779	218	14%
	701.02	7547	11910	4363	58%
	701.03	9094	16519	7425	82%
	701.04	7188	9843	2655	37%
	701.05	9202	22118	12916	140%
	701.06	14194	5225	-8969	-63%
	701.07	1130	1460	330	29%
	702.01	2018	2994	976	48%
	702.02	5890	14966	9076	154%
	702.03	2335	19609	17274	740%
	702.04	2212	1770	-442	-20%
	703.01	5120	30117	24997	488%
	703.02	9355	17480	8125	87%
	703.03	5603	9935	4332	77%
	704.00	1423	2338	915	64%
	705.00	1475	2669	1194	81%
	706.00	2370	3009	639	27%
	707.01	9807	11093	1286	13%
	707.02	2681	2569	-112	-4%
	707.03	1188	4014	2826	238%
	708.00	349	279	-70	-20%
	709.01	3047	2841	-206	-7%
	709.02	7864	9649	1785	23%
	709.03	1378	2023	645	47%
	710.01	5543	5506	-37	-1%
	710.02	2285	2997	712	31%
	711.00	1566	1546	-20	-1%
	712.00	1417	1326	-91	-6%
	713.00	3928	4741	813	21%
	714.00	2076	3096	1020	49%

Subregion 8 Harris	121.00	2145	7005	4860	227%
	201.01	3385	2359	-1026	-30%
	201.02	5137	3837	-1300	-25%
	202.00	8228	7012	-1216	-15%
	203.01	3779	3050	-729	-19%
	203.02	5853	5560	-293	-5%
	203.03	2463	2477	14	1%
	204.00	3111	1871	-1240	-40%
	205.01	4020	2661	-1359	-34%
	205.02	5757	3934	-1823	-32%
	205.03	2431	1378	-1053	-43%
	206.01	3512	2395	-1117	-32%
	206.02	3524	2641	-883	-25%
	207.01	2689	1967	-722	-27%
	207.02	2753	1871	-882	-32%
	207.03	2622	2063	-559	-21%
	207.04	988	615	-373	-38%
	208.01	1880	1213	-667	-35%
	208.02	4822	3425	-1397	-29%
	208.03	5719	4680	-1039	-18%
	209.00	751	752	1	0%
	210.01	5473	4396	-1077	-20%
	210.02	3222	2633	-589	-18%
	211.00	9903	10044	141	1%
	212.00	8953	9343	390	4%
	213.01	2951	2810	-141	-5%
	213.02	9136	11538	2402	26%
	214.01	374	246	-128	-34%
	214.02	2849	3087	238	8%
	215.01	4411	3156	-1255	-28%
	215.02	5946	4580	-1366	-23%
	215.03	6519	4798	-1721	-26%
	216.01	3808	2949	-859	-23%
	216.02	2115	1538	-577	-27%
	217.01	6840	4086	-2754	-40%
	217.02	3504	2442	-1062	-30%
	218.01	2380	1978	-402	-17%
	218.02	2579	2361	-218	-8%
	218.03	2074	1572	-502	-24%
	218.04	5481	2699	-2782	-51%
	219.00	6212	4571	-1641	-26%
	220.01	2844	2886	42	1%
	220.02	3786	4078	292	8%
	221.00	2139	2001	-138	-6%
	222.01	2264	2595	331	15%
	222.02	4092	4046	-46	-1%
	223.01	3708	3480	-228	-6%
	223.02	3310	3181	-129	-4%
	223.03	4964	4894	-70	-1%
	224.01	3670	3271	-399	-11%
	224.02	3034	2482	-552	-18%
	224.03	8449	7074	-1375	-16%
	224.04	3573	2868	-705	-20%
	225.01	4464	3353	-1111	-25%

225.02	3897	3306	-591	-15%
225.03	3282	2972	-310	-9%
225.04	4190	2797	-1393	-33%
226.01	3949	3829	-120	-3%
226.02	5214	4836	-378	-7%
227.00	5257	4520	-737	-14%
228.01	8555	12040	3485	41%
228.02	2351	9485	7134	303%
229.00	2319	2026	-293	-13%
230.01	7932	8901	969	12%
230.02	5082	10440	5358	105%
230.03	7165	6449	-716	-10%
230.04	9705	9946	241	2%
231.00	5889	5426	-463	-8%
232.00	5585	4217	-1368	-24%
233.00	1859	1253	-606	-33%
234.00	2913	2696	-217	-7%
235.00	5779	5659	-120	-2%
236.00	6122	6374	252	4%
237.00	1191	2546	1355	114%
238.00	3789	3251	-538	-14%
239.00	6950	6712	-238	-3%
240.01	1980	1417	-563	-28%
240.02	13625	13447	78	-1%
240.03	3157	2778	-379	-12%
241.01	267	191	-76	-28%
241.02	2365	3977	1612	68%
241.03	2039	1895	-144	-7%
242.00	1279	3143	1864	146%
243.00	1941	2748	807	42%
244.01	2804	6-2-48	3444	123%
244.02	3415	6269	2854	84%
245.01	0	4485	4485	0%
245.02	6477	10293	3816	59%
246.00	1158	1913	755	65%
247.00	5627	11646	6019	107%
248.00	5575	10530	4955	89%
249.01	4961	-5678	717	14%
249.02	8449	29136	20687	245%
249.03	6928	6585	-343	-5%
250.00	1193	2531	1338	112%
251.00	4980	4836	-144	-3%
252.00	1047	1331	284	27%
253.00	4992	8550	3558	71%
254.00	1398	1692	294	21%
255.00	2085	2576	491	24%
256.00	582	665	83	14%
257.00	1068	1327	259	24%
258.00	4180	3738	-442	-11%
259.01	6599	6727	128	2%
259.02	3264	3456	192	6%
260.00	189	1757	1568	830%
261.00	4220	4939	719	17%
262.00	1190	1392	202	17%

263.00	4431	3496	-935	-21%
264.00	3535	3000	-535	-15%
265.00	2217	2447	230	10%
266.00	4840	4590	-250	-5%
267.01	4618	6378	1760	38%
267.02	2930	3850	920	31%
267.03	3913	5739	1826	47%
268.00	5209	5569	360	7%
269.01	4018	4259	241	6%
269.02	4507	3680	-827	-18%
270.00	4430	4351	-79	-2%
271.00	2860	2872	12	0%
272.00	3883	3692	-191	-5%
273.00	4392	4550	158	4%
274.00	1300	1632	332	26%
275.00	101	179	78	77%
300.22	3962	2600	-1362	-34%
300.23	1472	1409	-63	-4%
300.24	3242	2152	-1090	-34%
301.01	4972	4859	-113	-2%
301.02	6154	5730	-424	-7%
302.00	6654	5796	-858	-13%
303.00	21 27	1176	-951	-45%
304.01	4642	2489	-2153	-46%
304.02	5206	2880	-2326	-45%
305.01	4250	2559	-1691	-40%
305.02	4251	2354	-1897	-45%
306.00	5119	3577	-1542	-30%
307.01	5780	3524	-2256	-39%
307.02	4900	3425	-1475	-30%
308.00	7431	67 61	-670	-9%
309.01	6049	6183	134	2%
309.02	3086	4097	1011	33%
309.03	3110	4398	1288	41%
310.00	7131	6214	-917	-13%
311.00	10079	8776	-1303	-13%
312.00	7825	6725	-1100	-14%
313.01	5359	5219	-140	-3%
313.02	5432	5038	-394	-7%
314.01	4320	3347	-973	-23%
314.02	3664	4164	500	14%
315.00	6102	4243	-1859	-30%
316.01	3221	2434	-787	-24%
316.02	1493	1722	229	15%
317.01	1719	1215	-504	-29%
317.02	389	267	-122	-31%
317.03	3633	2826	-807	-22%
317.04	6189	4826	-1363	-22%
318.01	3726	2330	-1396	-37%
318.02	6273	4812	-1461	-23%
318.03	3567	2810	-757	-21%
318.04	3912	2489	-1423	-36%
319.01	3768	3682	-86	-2%
319.02	3253	3766	513	16%

320.01	4497	4753	256	6%
320.02	2379	2624	245	10%
320.03	5231	5140	-91	-2%
320.04	2652	2825	173	7%
321.01	8954	12529	3575	40%
321.02	2170	1962	-208	-10%
321.03	2294	1933	-361	-16%
322.01	23	16	-7	-30%
322.02	4220	4066	-154	-4%
322.03	3215	3295	80	2%
322.04	2704	2554	-150	-6%
323.01	5109	5469	360	7%
323.02	3993	3339	-654	-16%
324.01	331.4	3571	257	8%
324.02	91.70	9164	-6	0%
324.03	53	59	6	11%
324.04	4666	4961	295	6%
325.01	2306	2448	142	6%
325.02	6245	5656	-589	-9%
326.00	6637	5996	-641	-10%
327.01	6123	4852	-1271	-21%
327.02	4126	3244	-882	-21%
328.01	7271	5909	-1362	-19%
328.02	4918	3691	-1227	-25%
328.03	3840	2977	-863	-22%
329.01	3	0	-3	-100%
329.02	4945	3484	-1461	-30%
329.03	4388	2771	-1617	-37%
330.01	20	1738	1718	8590%
330.02	3987	3549	-438	-11%
331.00	5594	13296	7702	138%
332.00	9009	10141	1132	13%
333.00	3496	2736	-760	-22%
334.00	6499	6570	71	1%
335.01	4499	5996	1497	33%
335.02	6095	3646	-2449	-40%
335.03	3907	3690	-217	-6%
336.00	4681	4332	-349	-7%
337.00	372	256	-116	-31%
338.00	3137	2238	-899	-29%
339.01	0	4	4	#DIV/0!
339.02	6325	5213	-1112	-18%
339.03	2073	2308	235	11%
340.00	8100	6569	-1531	-19%
341.00	419	521	102	24%
342.00	891	1005	114	13%
343.01	5861	4518	-1343	-23%
343.02	12343	8354	-3989	-32%
344.00	2011	2110	99	5%
345.01	5656	5864	208	4%
345.02	2659	4179	1520	57%
346.00	4047	5288	1241	31%
347.01	5684	6480	796	14%
347.02	4761	4953	192	4%

347.03	2170	1904	-266	-12%
347.04	6455	6004	-451	-7%
348.01	4354	4665	311	7%
348.02	8939	9553	614	7%
349.01	4050	3592	-458	-11%
349.02	5746	4916	-830	-14%
350.01	1208	1003	-205	-17%
350.02	1809	1736	-73	-4%
350.03	3666	4452	786	21%
350.04	5087	4800	-287	-6%
351.00	4087	4265	178	4%
352.00	534	0	-534	-100%
353.01	4421	3908	-513	-12%
353.02	6360	6029	-331	-5%
354.00	0	22	22	#DIV/0!
355.01	6654	6744	90	1%
355.02	8180	7658	-522	-6%
356.01	3887	5276	1389	36%
356.02	2738	2626	-112	-4%
356.03	5073	4754	-319	-6%
356.04	3177	3089	-88	-3%
357.01	6291	5999	-292	-5%
357.02	8259	7238	-1021	-12%
357.03	3920	4871	951	24%
358.01	3341	3201	-140	-4%
358.02	4779	4572	-207	-4%
359.01	12579	19553	6974	55%
359.02	5261	6903	1642	31%
360.01	4587	6440	1853	40%
360.02	8343	8931	588	7%
360.03	5221	6345	1124	22%
360.04	4692	6020	1328	28%
361.00	94	6	-88	-94%
362.00	37	19	-18	-49%
363.00	3843	6930	3087	80%
364.00	635	514	-121	-19%
365.01	1585	1287	-298	-19%
365.02	3418	3079	-339	-10%
365.03	1920	1791	-129	-7%
366.01	9258	13479	4221	46%
366.02	3426	3406	-20	-1%
367.00	669	927	258	39%
368.01	4406	6471	2065	47%
368.02	3210	3118	-92	-3%
369.00	4601	4531	-70	-2%
370.00	7356	17123	9767	133%
371.01	24209	28970	4761	20%
371.02	7971	10147	2176	27%
372.00	4063	8528	4465	110%
373.01	7349	16193	8844	120%
373.02	9444	10984	1540	16%
373.03	4012	5931	1919	48%
373.04	1398	2126	728	52%
374.00	5790	6929	1139	20%

375.00	6235	8028	1793	29%
400.25	1150	2255	1105	96%
400.26	6874	770	-6104	-89%
401.01	2324	2164	-160	-7%
401.02	3472	2759	-713	-21%
402.01	5829	5459	-370	-6%
402.02	4076	3835	-241	-6%
403.00	6757	6212	-545	-8%
404.01	2699	2643	-56	-2%
404.02	3675	3608	-67	-2%
405.01	4141	3040	-1101	-27%
405.02	4024	4121	97	2%
406.00	5674	5743	69	1%
407.01	4723	4929	206	4%
407.02	3223	3499	276	9%
408.00	2817	2928	1ll	4%
409.00	3497	3850	353	10%
410.00	5696	6142	446	8%
411.00	1366	1392	26	2%
412.01	4716	4768	52	1%
412.02	4651	4693	42	1%
413.01	4283	3693	-590	-14%
413.02	2846	2495	-351	-12%
413.03	2826	2814	-12	0%
414.01	5930	5733	-197	-3%
414.02	4595	2403	-2192	-48%
415.01	2650	2560	-90	-3%
415.02	2586	2306	-280	-11%
415.03	4119	3569	-550	-13%
415.04	2879	2635	-244	-8%
416.01	4616	6515	1899	41%
416.02	4688	4472	-216	-5%
416.03	5484	5013	-471	-9%
416.04	2802	2549	-253	-9%
416.05	506	485	-21	-4%
417.01	5589	5285	-304	-5%
417.02	4119	3872	-247	-6%
418.01	2417	2213	-204	-8%
418.02	2825	2474	-351	-12%
419.01	1034	1892	858	83%
419.02	2299	2090	-209	-9%
419.03	694	829	135	19%
419.04	4740	6849	2109	44%
419.05	5719	5973	254	4%
419.06	11780	12561	781	7%
420.01	3240	3556	316	10%
420.02	5465	4911	-554	-10%
420.03	5337	4667	-670	-13%
421.00	4194	3872	-322	-8%
422.01	2744	3010	266	10%
422.02	5723	5092	-631	-11%
422.03	10076	10460	384	4%
422.04	5115	5044	-71	-1%
423.01	6251	8055	1804	29%

423.02	3903	4205	302	8%
423.03	3685	3014	-671	-18%
423.04	6585	6035	-550	-8%
423.05	6326	7267	941	15%
423.06	1997	1779	-218	-11%
423.07	3379	4957	1578	47%
424.01	8052	9332	1280	16%
424.02	4858	8121	3263	67%
424.03	5161	6738	1577	31%
424.04	5424	4815	-609	-11%
425.01	3393	3671	278	8%
425.02	3686	3999	313	8%
425.03	7454	6843	-611	-8%
425.04	3504	5397	1893	54%
426.01	3848	4171	323	8%
426.02	6048	6551	503	8%
427.01	6610	5100	-1510	-23%
427.02	8864	8710	-154	-2%
428.01	3381	2911	-470	-14%
428.02	3053	2677	-376	-12%
429.00	3621	3356	-265	-7%
430.01	2592	24431	-149	-6%
430.02	3989	3948	-41	-1%
431.00	5478	5022	-456	-8%
432.00	4791	11534	6743	141%
433.00	14931	21266	6335	42%
434.01	9172	11687	2515	27%
434.02	5090	4730	-360	-7%
435.01	10019	10880	861	9%
435.02	9282	10897	1615	17%
436.01	11712	13879	2167	19%
436.02	7808	12746	4938	63%
436.03	17255	31081	13826	80%
437.01	5604	18236	12632	225%
437.02	10398	26083	15685	151%
438.01	7011	15969	8958	128%
438.02	17785	22779	4994	28%
438.03	11428	8921	-2507	-22%
438.04	1199	6637	5438	454%
438.05	9168	14384	5216	57%
438.06	1855	15003	13148	709%
439.01	6129	5591	-538	-9%
439.02	5046	4638	-408	-8%
440.01	1433	1483	50	3%
440.02	4215	3954	-261	-6%
440.03	2958	3197	239	8%
440.04	3750	3391	-359	-10%
440.05	2990	2449	-541	-18%
440.06	2506	2633	127	5%
441.01	3353	3392	39	1%
441.02	621	665	44	7%
442.01	3061	2365	-696	-23%
442.02	1613	1578	-35	-2%
442.03	5182	3938	-1244	-24%

442.04	4918	5263	345	7%
443.01	10352	11047	695	7%
443.02	3247	1359	-1888	-58%
443.03	4702	4656	-46	-1%
443.04	5518	4267	-1251	-23%
443.05	3416	4188	772	23%
443.06	3920	4359	439	11%
444.01	3824	4086	262	7%
444.02	6819	6419	-400	-6%
444.03	10583	9366	-1217	-11%
444.04	6905	8696	1791	26%
445.01	5981	5572	-409	-7%
445.02	5800	6471	671	12%
446.01	8476	6762	-1714	-20%
446.02	12859	11711	-1148	-9%
446.03	6839	6481	-358	-5%
447.01	6937	7740	803	12%
447.02	9557	9307	-250	-3%
447.03	4419	4592	173	4%
448.00	170	113	-57	-34%
449.00	14853	29747	14894	100%
450.00	2261	6540	4279	189%
451.01	612	6718	6106	998%
451.02	8973	20939	11966	133%
452.01	4561	14554	9993	219%
452.02	3445	12500	9055	263%
501.00	27	24	-3	-11%
502.00	2074	1113	-961	-46%
503.01	7046	5766	-1280	-18%
503.02	6509	5577	-932	-14%
504.00	3230	2324	-906	-28%
505.01	1337	1114	-223	-17%
505.02	4219	2157	-2062	-49%
506.01	3588	2881	-707	-20%
506.02	5943	6118	175	3%
507.01	4201	3554	-647	-15%
507.02	5187	4752	-435	-8%
508.00	5539	5668	129	2%
509.01	3118	3099	-19	-1%
509.02	3155	2574	-581	-18%
509.03	6079	5572	-507	-8%
510.00	4776	3206	-1570	-33%
511.00	6810	5917	-893	-13%
512.00	7581	7141	-440	-6%
513.00	3402	2478	-924	-27%
514.01	3776	3149	-627	-17%
514.02	2192	1377	-815	-37%
515.01	4913	4500	-413	-8%
515.02	2785	2424	-361	-13%
516.01	4589	4427	-162	-4%
516.02	2745	2288	-457-	-17%
517.01	1376	1099	-277	-20%
517.02	4348	4316	-32	-1%
517.03	5548	5404	-144	-3%

517.04	6540	6459	-81	-1%
517.05	571	249	-322	-56%
518.01	4153	3851	-302	-7%
518.02	2729	2681	-48	-2%
518.03	3721	3262	-459	-12%
519.01	4958	4214	-744	-15%
519.02	4212	3022	-1190	-28%
519.03	3882	3497	-385	-10%
520.01	7028	4620	-2408	-34%
520.02	3832	4038	206	5%
520.03	3784	2655	-1129	-30%
521.01	2799	2787	-12	0%
521.02	3780	4141	361	10%
521.03	3870	3869	- 1	0%
522.01	4314	4633	319	7%
522.02	6220	6862	642	10%
523.01	5193	4600	-593	-11%
523.02	5251	4793	-458	-9%
523.03	4910	5022	112	2%
524.00	1890	1499	-391	-21%
525.01	2783	6862	4079	147%
525.02	4436	3723	-713	-16%
525.03	2775	2161	-614	-22%
525.04	3850	2643	-1207	-31%
526.01	3310	2730	-580	-18%
526.02	3405	3154	-251	-7%
526.03	3390	3208	-182	-5%
526.04	3929	3751	-l78	-5%
527.01	5226	4903	-323	-6%
527.02	3223	2963	-260	-8%
527.03	2769	2346	-423	-15%
528.00	2106	2189	83	4%
529.01	3710	4725	1015	27%
529.02	10005	11457	1452	15%
530.01	1564	2061	497	2%
530.02	8070	10116	2046	25%
530.03	9245	15757	651	-70%
531.01	7840	7522	-318	-4%
531.02	4526	3835	-691	-15%
531.03	7612	6066	-1546	20%
532.01	8076	6808	-1268	-16%
532.02	5047	4924	-123	-2%
533.01	1766	-6901	-2135	5%
533.02	11164	11496	332	3%
533.03	7804	8812	-992	-13%
534.01	6074	9696	3622	60%
534.02	1730	3272	542	89%
535.00	3754	11575	7821	208%
536.01	11522	15841	4319	37%
536.02	2367	6213	846	162%
537.01	5731	7670	1939	34%
537.02	5048	28120	23072	457%
538.01	9724	15417	5693	59%
538.02	11517	20404	8887	77%

539.00	9617	16458	6841	71%
540.01	7962	9807	1845	23%
540.02	11213	14874	3661	3%
541.00	13194	32736	19542	48%
542.01	5162	18407	13245	57%
542.02	3234	5497	2263	0%
543.00	3223	9310	6087	89%
544.00	612	19195	18583	3036%
545.01	3181	4383	1202	38%
545.02	14912	22545	7633	51%
546.00	558	2318	1760	315%
547.00	389	661	272	70%
548.00	396	700	304	77%
549.00	1352	2566	1214	90%
550.00	966	2290	1324	137%
551.01	1876	7090	5214	278%
551.02	10395	1924	850	85%
552.00	2790	4732	1942	70%
553.00	3996	6576	258	65%
554.00	881	983	102	12%
555.01	785	1718	933	119%
555.02	10514	21390	10876	103%
556.01	4299	5797	1498	35%
556.02	8365	15884	7519	90%
557.00	1065	2326	161	118%
558.01	4202	10860	6658	158%
558.02	11206	14506	3300	29%
559.01	7113	79771	864	12%
559.02	15080	25145	10065	67%

Appendix 5

Planning Subregion Organization and Methodology

PLANNING SUBREGION ORGANIZATION

The overall geographic scope of the solid waste management plan is the 13-county Gulf Coast Planning Region. However, in order to provide effective, workable recommendations addressing local solid waste management issues and concerns, the Gulf Coast Planning Region will need to be divided into planning subregions. The Texas Natural Resource Conservation Commission (TNRCC) requires that all regional solid waste management plans approach their planning process from four geographic scopes. The first geographic area is small geographic areas, such as census tracts and city boundaries. The second is subregional planning areas to be used for the assessment of problems and the evaluation of alternatives. The third is county boundaries for the summation and presentation of key information. The final geographic area is the entire region as a whole.

The 1985 H-GAC *Action Guide for Solid Waste Management* included 25 planning subregions. Early in the discussion of the current planning process it was recommended by H-GAC's Solid Waste Management Task Force that the planning subregions being revisited by staff in the preparation of this plan. The 25 planning subregions were considered too small to meet future solid waste management planning needs.

H-GAC staff has used the small geographic area information and county summaries to develop the boundaries for the planning subregions. The planning subregion scenario presented in this report was created to address common solid waste management problems and in some cases to reflect interjurisdictional efforts already underway. In order to meet more restrictive environmental regulations concerning landfill siting and operation and their associated cost, and the establishment of recycling programs to meet market demands, interjurisdictional cooperation will be a key element of future solid waste management efforts. Interjurisdictional cooperation will also make recycling and other waste reduction programs more effective.

Census tract boundaries, city and county responses to the solid waste management practices survey, and county wide landfill availability information provided by the TNRCC were used to determine the proposed planning subregions. The criteria used to create the subregions includes, but was not limited to:

1. Geographic area covered;
2. Existing governmental & institutional arrangements;

3. Groupings of cities;
4. Transportation networks;
5. Homogeneous character and problems facing the areas;
6. Suitability of area for solid waste management facility development;
7. Local government officials response to proposed planning areas; and
8. Availability of public and private solid waste management resources[1].

Methodology for Population Projections

The revised population projections contained in this report are based on *Houston-Galveston Area Council's Regional Forecasts, 1990-2000,* prepared in 1986, with several modifications.

Assumptions on which the original forecasts were based were developed by an expert panel of local bankers, economists, real estate analysts, and other persons knowledgeable about the economy of the H-GAC region. This report examined looked at population growth in the eight "Urban" counties[2] in the thirteen-county solid-waste management area. The projections this panel developed were computed by averaging the members' mid-range forecasts.

This report's revised study uses the mean of the council's estimated growth rates for the eight-county area over the decades 1990-2000 and 2000-2010, applied to 1990 second-release census population figures for the entire thirteen-county area to determine 2000 and 2010 projections. The revised projections use the same distribution pattern assumptions the panel projected. For the regional population projection, the revised study uses a growth rate of 1.875% compounded yearly, or 20.4% over the course of a decade. An individual county's population projection was derived from the proportion of regional population growth projected by the distribution pattern assumptions for the county. The projections for the remaining five counties[3] are based on a less rigorous study of distribution patterns which was agreed to internally (to H-GAC) by consensus. The five individual counties' populations were determined by applying these distribution

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[1] The total number of landfill acres available reflects 1989 available acreage and any additional space permitted up to June, 1991. It does not include acreage currently in the permitting process or anticipated landfill development.

[2] Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties are considered "Urban."

[3] Austin, Colorado, Matagorda, Walker, and Wharton counties are the "Non-urban" counties.

assumptions to the overall population growth projections for the thirteen counties. The relative proportions of people in the urban and non-urban counties out of the whole thirteen county region is assumed to be constant in the projections. The forecast calculation table used in this plan is shown on the following page.

Population projections for the years between 1990 and 2000, between 2000 and 2010, and to 2012 were estimated using linear interpolation.

Waste-Generation Rates

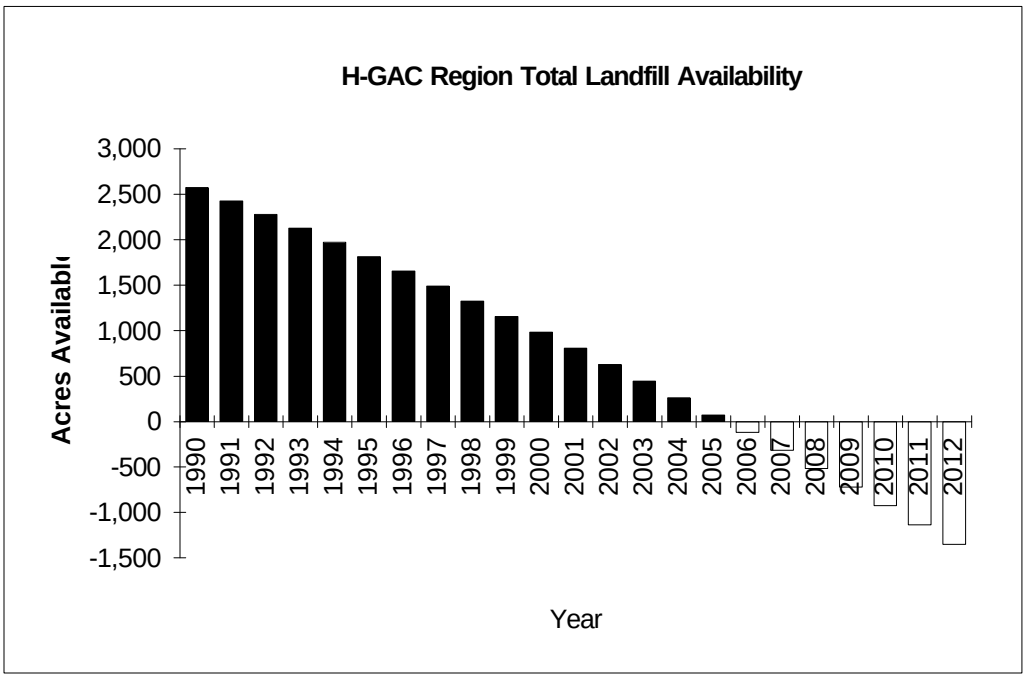
Waste generation rates were calculated using the TNRCC per capita waste generation rate of 6.2 pounds/person/day (lbs/p/d). This number was generated by TNRCC from 1989 landfill self-reporting numbers. The waste generation figure includes all waste entering municipal landfills. This includes waste from households, offices, construction projects, and special waste. Landfill acreage available was taken from the 1989 capacity numbers with corrections made from government and industry contacts.

From 1979 to 1989, the per capita waste generation number has risen from 5.2 lbs/p/d to the present 6.2 lbs/p/d. In the ten year period, Texas has experienced approximately a 20% rise in waste generation. However, for the purpose of this report, H-GAC is using the 6.2 lbs/p/d rate as a constant throughout the planning horizon. The waste generation rate is used as an assumption to reflect the planning subregions, and to show the anticipated volume of waste to be handled by each planning area. In the solid waste management plan, waste reduction techniques will be proposed that have the potential to level or actually lower the rise in the waste generation rate. Senate Bill 1340, passed during the 72 Legislative Session, sets a 40% recycling goal for Texas by 1994. This 40% goal, still somewhat undefined, will deal with waste generated and entering the waste stream H-GAC has calculated.

On the following page, landfill capacity for the entire H-GAC region is calculated. The chart shows how the total capacity of the region would be affected if all waste generated within the region were landfilled in existing facilities.

H-GAC Region Total Landfill Availability

Year	Est. popul.	Imp/exp pop	Tons/Yr.	Acres/Yr.	Acres avail.
1990	3,897,146	49,985	4,469,238	144	2,575
1991	3,976,702	52,925	4,562,645	147	2,428
1992	4,056,257	55,864	4,656,052	150	2,279
1993	4,135,813	32,321	4,719,473	152	2,127
1994	4,215,368	32,896	4,810,203	155	1,973
1995	4,294,924	33,471	4,900,933	157	1,815
1996	4,374,479	34,046	4,991,663	160	1,655
1997	4,454,035	34,621	5,082,393	163	1,491
1998	4,533,590	35,197	5,173,123	166	1,325
1999	4,613,146	35,772	5,263,853	169	1,156
2000	4,692,701	36,347	5,354,583	172	984
2001	4,788,497	37,037	5,463,832	176	808
2002	4,884,293	37,728	5,573,081	179	629
2003	4,980,089	38,419	5,682,330	183	447
2004	5,075,884	39,109	5,791,579	186	260
2005	5,171,680	39,800	5,900,828	190	71
2006	5,267,476	40,490	6,010,078	193	-122
2007	5,363,272	41,181	6,119,327	197	-319
2008	5,459,068	41,872	6,228,576	200	-519
2009	5,554,863	42,562	6,337,825	204	-723
2010	5,650,659	43,253	6,447,074	207	-930
2011	5,746,455	43,943	6,556,323	211	-1,141
2012	5,842,251	44,634	6,665,572	214	-1,355



Appendix 6
Interlocal Agreements
A Report by John Olson
and the Interlocal Agreements Subcommittee

I. Introduction

As part of its effort to develop a statewide solid waste management plan, the Texas Legislature has provided for the development of regional and local solid waste management plans by regional planning commissions and local governments. Because each local government is required to develop a local plan which complies with the regional plan of which it is a part, implementation of most local plans will require some degree of cooperation and association with other local governments within its region. The purpose of this report it to assist local governments in formulating agreements to implement and effectuate the local regional plans.

II. Legislative Authority

The basic authority for local governments to contract with one another for the provision of governmental services may be found in the Interlocal Cooperation Act, Tex. Rev. Civ. Stat. Ann. art 4413(32c), as amended. The stated purpose of the Act is "to improve the efficiency and effectiveness of local governments by authorizing the fullest possible range of intergovernmental contracting authority at the local level...between and among counties, cities, school districts, and other political subdivisions of the state, and agencies of the state." (Sec. 1). Under Section 4 of the Act, local governments may contract with one or more other local governments to perform governmental functions. The definition of governmental functions found in Section 2 includes "waste disposal."

The Texas Legislature mandated a regional approach to solid waste management with the adoption of Section 363.061, et seq, Tex. Health & Safety Code. Under Section 363.064 of such Code, regional and local plans are to encourage cooperative efforts between local governments in the siting of landfills, and consideration is to be given to the local need to transport waste between municipalities or counties if suitable sites for landfills do not exist. In other words, not only does law exist which authorizes local

governments to contract with each other to provide solid waste management services, it encourages it.

Specific authority for various aspects of interlocal contracting for solid waste matters is located in Sections 361, 363, and 364 of the Health and Safety Code.

A. Sec. 361.163 - authorizes counties to enter into cooperative agreements with local governments and other governmental entities to jointly operate solid waste management activities and to charge reasonable fees for the services.

B. Sec. 363.116 - authorizes cities, counties, and certain conservation and reclamation districts to contract to furnish or receive solid waste management services.

C. Sec. 363.117 - provides specific grants of authority to cities, counties, and certain conservation and reclamation districts to contract for the acquisition, ownership, management, sale, operation, and furnishing of solid waste management services, including services for the collection, transportation, processing, and disposing of such wastes.

D. Sec. 364.002 - authorizes counties to contract with cities, conservation and reclamation districts, or any other political subdivision or agency of the state which possesses authority to own and operate solid waste collection, transportation, or disposal facilities or systems, to provide or receive such services from each other.

III. Role of Interlocal Agreements in Waste Management

In view of the legislative mandate to manage solid waste on a regional basis, local governments will, in many cases, be forced to interrelate with other local governments in the collection, transportation, and disposal of solid wastes. It is anticipated that such interrelations will result in regional solutions to local solid waste management problems.

Whether by mandate or choice, agreements between local governmental entities regarding solid waste management services will occur. It is the reduction to writing of these agreements in accordance with the Act which formalizes the understandings and entitles one party to rely on the representations of the other.

VI. Developing Interlocal Agreements

It is not possible to describe any standard "process" to develop an interlocal agreement. How agreements are developed is as varied as the subject matter they contain. The only serious advice to be given here is that the person or persons charged with negotiating contract provisions make frequent and thorough disclosures to those possessing the authority to approve the agreement, thus perhaps saving considerable time and trouble if the negotiations are heading down the wrong path, and that the entity's legal counsel be closely consulted or allowed to occupy a position on the negotiating team.

Prior to entering face-to-face negotiations, it is prudent to have the objective in focus--what is it, specifically, that is being sought? Are we to jointly construct or purchase a transfer station or landfill? How much is it worth? Have properties been appraised and architects' or engineers' estimates been reviewed? What are the financial, political, and legal ramifications? Who is to issue bonds to finance construction or acquisition? Who will hold permits, be responsible for violations? What are the limits of the parties? As governmental entities, are either lacking in authority to perform or bind as contemplated? Know the rights, authority, and limitations of all parties. The answers to these questions should be known prior to the commencement of face-to-face negotiations. If the negotiator is aware of the limits of the other parties, he can more aptly identify those areas subject to negotiation.

Once a proposal has been reduced to writing by the negotiating teams, the governing bodies should consider the following before authorizing execution:

A. Does the contract satisfy the need and accomplish the objective sought when the entity decided to proceed?

B. Can the entity afford to enter into the contract? What financial obligations and risks are created? Does the current budget provide sufficient funding? Will the entity be required to raise capital through the issuance of bonds or certificates of obligation and, if so, have financial advisors and bond counsel been consulted? Will additional insurance be required? What impact will payment of the financial obligations, whether operating or debt service, have on the tax rate and financial condition of the entity?

C. Is management of contract services adequately provided for? What rights or obligations exist in the event of mismanagement, faulty financial forecasting, or unforeseen costs? What remedies are available? Which remedies are excluded? If management of the contract services is vested in a body other than ours, have we adequately reserved our right to review, inspect, and question?

D. Is the agreement compatible with the state's objectives? Have the local and regional solid waste management plans been complied with?

E. Are geographical limits established for waste resources, and are responsibilities and obligations established for hazardous or other contaminated wastes?

F. Have all the issues been addressed? If so, is the language specific in its terms? Are there any questions regarding obligations, duties, or rights of any party?

G. Is the term of the agreement longer than necessary?

H. Is the agreement flexible? Does it provide means for adjustments for future needs?

A last word regarding negotiations. Local governments all exist for the same purpose--to serve. When entering into negotiations for the development of an interlocal agreement, do so in the proper spirit of cooperation. As between governmental entities, there is no profit motive. the objectives for all parties should be the same. How can we best serve? While each local government has an obligation to protect the interests of its citizens, it is not required to do so at the expense of another. Remember, be cooperative. Why else would we call these contracts interlocal cooperation agreements?

V. Salient Elements of an Interlocal Cooperation Agreement

The Interlocal Cooperation Act requires that the agreement "state the purpose, term, rights, objectives, duties, and responsibilities of the contracting parties." It also provides that the agreement must "specify that the party or parties paying for the performance of governmental functions or services shall make payments therefore from current revenues available to the paying party." (Sec. 4[b]). The Act also provides that the parties to the agreement "shall have full authority to create an administrative agency or designate an existing political subdivision for the supervision of performance..." of the agreement. (Sec. 4[d]).

A laundry list of possible contract provisions might include the following:

- Identification of the parties;
- Purpose clause;
- Findings;
- Definitions;
- Term or duration, including rights of renewal and termination;
- Rights of the parties;
- Duties and responsibilities of the parties;
- Detailed description of services to be provided;
- Specific financing obligations;

- Management of services to be provided;
- Procedures for fiscal management such as budgeting input, payment schedules, and budget approval processes;
- Transfer of title to or interest in property, real and personal;
- Insurance;
- Dispute resolution, such as arbitration or contract alternative dispute resolution;
- Termination procedures;
- Boiler plate provisions:

    Severability

    Force majeure

    Assignment

    Nondiscrimination

    Notice

    Captions

VI. Summary

The use of interlocal cooperation agreements between local governments is an effective, useful, and necessary tool to implement regional solid waste management. There is sufficient and varied authority in law for local governments to contract with each other to provide solid waste management functions, from planning to resource recovery.

Attached for review are sample interlocal contracts dealing with various aspects of solid waste management. The attachments are intended for illustration only, and the reader is advised to engage the services of an attorney for the preparation of any such agreement.

The preceding report included three interlocal agreements that the Subcommittee analyzed and found to have salient elements worth review by local governments. H-GAC has these agreements on file for review upon request. The interlocal agreements are:

1. An interlocal agreement between an existing authority and a city to provide municipal solid waste transfer, processing and disposal.
2. An interlocal agreement to provide a multi-jurisdictional sludge composting facility.
3. An interlocal agreement for several communities to contract solid waste management disposal to a district that will operate a regional landfill.

If you would like to receive a copy of any of these arrangements please send a written request to:

Community and Environmental Planning
Houston-Galveston Area Council
P.O. Box 22777
Houston, Texas 77227-2777

Appendix 7
Solid Waste Facilities in the H-GAC Region

SOLID WASTE FACILITIES IN THE H-GAC REGION

The following list is a description of all the permitted solid waste management facilities in the H-GAC region. This includes known open, closed, and inactive facilities. The open facilities have estimated acreage and closing date data included as well. These estimates are from the Texas Natural Resource Conservation Commission annual report data presented to H-GAC in 1990 and 1991, with corrections made from local government and industry contacts. This information is included as a requirement of the solid waste management planning process, *however H-GAC strongly recommends that before using this data for any purpose, interested parties contact the Texas Natural Resource Conservation Commission concerning current information on each site. The information included in this report is updated annually by the Texas Natural Resource Conservation Commission.*

Codes utilized in the facilities list are:

Permit #:

00001-09999 Non-hazardous municipal solid waste management facility
10000-19999 Registration for beneficial land use of sludge and similar waste

Facility:

1 Sanitary Landfill, daily cover required (population equivalent served exceeds 5,000 people).
2 Sanitary Landfill, weekly cover required (population equivalent served in from 1,500 to 5,000 people).
3 Sanitary Landfill, monthly cover required (population equivalent served is less than 1,500 people).
4 Sanitary Landfill for brush and/or construction-demolition material, monthly cover required.
5 Miscellaneous solid waste processing facility.
5GG Grease and Grit Trap Waste Processing Facility.
5RE Resource Recovery/Waste-to-Energy Facility, incineration with energy recovery.
5RR Resource Recovery/Recycling Facility.
5TB Trench Burner Facility (now illegal in Texas).
5WI Solid Waste Incineration Facility, without energy recovery.
7 Sludge Land Disposal Facility.
7R Sludge Disposal Registration Beneficial Use.
9GR Methane gas recovery from inactive landfill or portion of landfill.

Permit #	County	Facility	Status	Owner	Acres	Closing
846	Austin	3	Closed	Austin County	x	x
847	Austin	3	Closed	Austin County	x	x
848	Austin	3	Closed	Austin County	x	x
849	Austin	3	Closed	Austin County	x	x
1182	Austin	2	Active	City of Bellville	11	1999
1538	Austin	5RE	Closed	Sealy Power Limited	x	x
1903	Austin	2	Closing	City of Sealy	x	x
10021	Austin	7R	Cancelled	West Memorial MUD	x	x
10024	Austin	7R	Cancelled	Sprint Waste Disposal	x	x
10091	Austin	7R	Registered	Carl Miller/Bachmeyer	262	-
10094	Austin	7R	Registered	Carl Miller/Reznicek	2197	-
10109	Austin	7R	Cancelled	Carl Miller/Wied	x	x
10102	Austin	7R	Cancelled	Texas Agent Inc/Wolchik	x	x
10103	Austin	7R	Registered	Dan Hord	692	-
10110	Austin	7R	Cancelled	Texas Agent Inc.Sorrel	x	x
10116	Austin	7R	Cancelled	Carl Miller/Underwood	x	x
10118	Austin	7R	Cancelled	Texas Agent Inc/Kaechele	x	x
10120	Austin	7R	Cancelled	Carl Miller/Lange	x	x
10122	Austin	7R	Cancelled	Carl Mill/Kloss	x	x
10303	Austin	7R	Registered	Gro-Mor Inc.	98	-
126	Brazoria	1	Closed	City of Pearland	x	x
355	Brazoria	1	Closed	City of Alvin	x	x
367	Brazoria	1	Closed	City of Angleton	x	x
516	Brazoria	1	Closed	City of Lake Jackson	x	x
887	Brazoria	1	Closed	TDCJ/Ramsey Unit 2	x	x
903	Brazoria	2	Closed	City of Sweeny	x	x
1065	Brazoria	4	Denied	Jack Shelton	x	x
1337	Brazoria	2	Closed		x	x
1386	Brazoria	5WS	Unknown	ISO-TEX	4	-
1446	Brazoria	1	Active	City of Alvin	75	2009
1539	Brazoria	1	Active	Brazoria County Disposal	146	2050
1708	Brazoria	4	Active	Dixie Farm Rd L/F-Hill Sand Co.	76	2110
1714	Brazoria	5RE	Revoked	Energy Advancement, Inc.	x	x
1783	Brazoria	2	Inactive	Brazoria County	27	1995
1897	Brazoria	1	Active	Sanifill of Texas	50	2025
1919	Brazoria	5WI	Inactive	Nation Medical Waste of Texas	-	-
1930	Brazoria	5RE	Closed	TDCJ/Ramsey	x	x
2121	Brazoria	5TB	Closed	Acme Systems	x	x
10005	Brazoria	1	Closed	Cities of Brazoria & W. Columbia	x	x
10126	Brazoria	7R	Cancelled	Jamie Blackwell	x	x
10225	Brazoria	7R	Registered	J. H. Caldwell	2	-
10240	Brazoria	7R	Registered	Houston Ind. Mgmt./Winkelm	825	-
10299	Brazoria	7R	Unknown	City of Pearland	14	-
10335	Brazoria	7R	Registered	Jamie Blackwell	1	-
1012	Chambers	4	Closed	Chambers County	x	x
1013	Chambers	1	Closed	Chambers County	x	x
1502	Chambers	1	Active	Chambers County	76	2000
1535	Chambers	1	Active	Hazelwood	41	1997
10233	Chambers	7R	Registered	Houston-Turf, Inc.	786	-
203	Colorado	1	Active	Tricil Environmental Response	37	2000

Permit #	County	Facility	Status	Owner	Acres	Closing
789	Colorado	3	Closed	Colorado County	x	x
844	Colorado	2	Closed	Colorado County	x	x
850	Colorado	2	Closed	City of Weimar	x	x
2106	Colorado	5TS	Active	City of Weimar	-	-
10003	Colorado	7R	Cancelled	Sprint Waste Disposal Co.	x	x
10004	Colorado	7R	Cancelled	Sprint Waste Disposal Co.	x	x
10006	Colorado	7R	Registered	Sprint Waste Disposal Co.	220	-
10007	Colorado	7R	Registered	Sprint Waste Disposal Co.	105	-
10008	Colorado	7R	Registered	Sprint Waste Disposal Co.	160	-
10009	Colorado	7R	Cancelled	Sprint Waste Disposal Co.	x	x
10012	Colorado	7R	Cancelled	Sprint Waste Disposal Co.	x	x
10016	Colorado	7R	Cancelled	Sprint Waste Disposal Co.	x	x
10022	Colorado	7R	Registered	Sprint Waste Disposal Co.	unknown	-
10030	Colorado	7R	Registered	Sprint Industries Inc.	770	-
10031	Colorado	7R	Registered	Sprint Industries Inc.	200	-
10127	Colorado	7R	Cancelled	Texas Agent Inc./Milligan	x	x
10148	Colorado	7R	Cancelled	Texas Agent Inc./Sorrel	x	x
10323	Colorado	7R	Registered	Sprint Industries Inc.	unknown	-
71	Fort Bend	1	Closed	Fort Bend County	x	x
191	Fort Bend	2	Closed	Frank R. Beinek	x	x
608	Fort Bend	1	Closed	City of Richmond	x	x
624	Fort Bend	1	Closed	City of Rosenberg	x	x
920	Fort Bend	4	Closed	Tony Scarpinato	x	x
922	Fort Bend	2	Denied	Fort Bend County	x	x
923	Fort Bend	3	Denied	Fort Bend County	x	x
972	Fort Bend	4	Closed	Texas A&J Corp.	x	x
979	Fort Bend	2	Closed	Fort Bend County	x	x
1048	Fort Bend	1	Closed	Fort Bend County	x	x
1177	Fort Bend	4	Denied	Circle C Land Corp.	x	x
1396	Fort Bend	4	Active	Fort Bend Co. Reclamation	31	1995
1505	Fort Bend	1	Active	BFI/ Fort Bend	339	2008
1554	Fort Bend	1	Active	Fort Bend County	80	1999
1561	Fort Bend	5TB	Closed	Tree and Wood Disposal	x	x
1683	Fort Bend	4	Closed	Sprint Waste Disposal	x	x
1797	Fort Bend	4	Closed	Fort Bend Co. Reclamation	x	x
10011	Fort Bend	7R	Cancelled	Sprint Waste Disposal, Inc.	x	x
10027	Fort Bend	7R	Revoked	Arnold & Winston Services	x	x
10037	Fort Bend	7R	Registered	Bond Brothers	unknown	-
10061	Fort Bend	7R	Revoked	Houston Ind. Mgmt/Stanpac	x	x
10119	Fort Bend	7R	Registered	Gro-Mor, Inc.	541	-
10130	Fort Bend	7R	Registered	Houston Ind. Mgmt/Yelderm	2310	-
10131	Fort Bend	7R	Registered	CDR Inc/Brisco & Wright	168	-
10132	Fort Bend	7R	Registered	CDR Inc/Brisco	33	-
10140	Fort Bend	7R	Registered	CDR Inc/Brisco	242	-
10141	Fort Bend	7R	Registered	CDR Inc/Brisco & Wright	48	-
10150	Fort Bend	7R	Registered	City of Richmond	40	-
10159	Fort Bend	7R	Registered	CDR Inc/Mahlman Estate	110	-
10160	Fort Bend	7R	Registered	CDR Inc/Mahlman Estate	55	-
10161	Fort Bend	7R	Registered	CDR Inc/Mahlman Estate	unknown	-
10247	Fort Bend	7R	Denied	CDR Inc/Marek	x	x

Permit #	County	Facility	Status	Owner	Acres	Closing
10248	Fort Bend	7R	Denied	CDR Inc/Gerke	x	x
10341	Fort Bend	7R	Registered	CDR Industries Inc.	241	-
10355	Fort Bend	7R	Registered	CDR Environmental, Inc.	100	-
164	Galveston	5TS	Active	City of Galveston/ GCWDA	-	-
239	Galveston	1	Closed	City of Texas City	x	x
1002	Galveston	4	Closed	City of League City	x	x
1149	Galveston	1	Active	BFI/ Hitchcock	235	2009
1212	Galveston	2	Closed	A. D. Suderman, Jr.	x	x
1285	Galveston	1	Active	City of Texas City	54	1999
1365	Galveston	5WS	Closed	Todd Shipyards Corp./R & T	x	x
1680	Galveston	5TS	Active	City of Crystal Beach	-	-
1721	Galveston	1	Active	E&D Waste Systems / WMNA	271	2026
1788	Galveston	5GG	Permitting	Tideland Grease Trap Service	2	-
1849	Galveston	4	Active	North County	13	1993
10182	Galveston	7R	Registered	E & D Waste Systems, Inc.	unknown	-
38	Harris	1	Closed	BFI/Holmes Road	x	x
80	Harris	1	Closed	E. L. Cockerham	x	x
109	Harris	1	Closed	City of Pasadena	x	x
149	Harris	4	Closed	Casco Haul Excavating	x	x
150	Harris	4	Closed		x	x
261	Harris	1	Active	BFI/ McCarty Road	45	2000
283	Harris	4	Closed	Carter Swint Company	x	x
337	Harris	5TS	Closed	City of South Houston	x	x
377	Harris	1	Closed	BFI/Homes Road	x	x
543	Harris	6	Closed	Inst. of Storm Research	x	x
591	Harris	1	Closed	City of Pasadena	x	x
659	Harris	5WI	Closed		x	x
763	Harris	4	Closed	Lawrence Petitt	x	x
798	Harris	1	Closed	City of Jacinto City	x	x
925	Harris	4	Closed	City of Webster	x	x
1074	Harris	5TS	Inactive	City of Houston	-	-
1091	Harris	5TS	Closed		x	x
1092	Harris	5TS	Active	City of Houston	-	-
1105	Harris	1	Closed	Harris County	x	x
1107	Harris	1	Closed	City of Galena Park	x	x
1117	Harris	5GG	Active	The Groce Company	unknown	-
1135	Harris	4	Closed	WGI, Incorperated	x	x
1140	Harris	1	Closed	City of Tomball	x	x
1160	Harris	1	Denied	Conservation Management	x	x
1174	Harris	4	Closed	W. H. Grisbee Estate	x	x
1188	Harris	4	Closed	Kickerillo Company	x	x
1193	Harris	1	Active	BFI/ Whispering Pines	104	1999
1224	Harris	1	Denied	BFI	x	x
1226	Harris	4	Closed	B & J Dirt & Ditch Services	x	x
1229	Harris	4	Revoked	B & L Landfill, L. Griffen	x	x
1238	Harris	1	Closed	City of Bellaire	x	x
1247	Harris	4	Active	Doty Sand Pit	5	1995
1250	Harris	1	Closed	City of West University	x	x
1259	Harris	4	Closed	Doty Sand Pit, Inc.	x	x
1279	Harris	1	Active	WMNA/ Bluebonnet	30	1997

Permit #	County	Facility	Status	Owner	Acres	Closing
1301	Harris	4	Closed	Addicks-Fairbanks R/S Co.	x	x
1307	Harris	1	Active	WMNA/ Atascocita	52	1997
1323	Harris	4	Closed	Community Maintenance	x	x
1346	Harris	4	Active	Gary O. Weiss	5	1993
1355	Harris	5TS	Inactive	City of Bellarie, GCWDA	-	-
1389	Harris	4	Closed	Pit Operations, Inc.	x	x
1403	Harris	4	Active	Casco Hauling and Excavation	80	2020
1420	Harris	4	Inactive	Dependable Trucking, Inc.	-	-
1441	Harris	1	Closed	Indian Paintbrush Development	x	x
1448	Harris	4	Closed	BSI-WII/BSI/Brittmore	x	x
1471	Haris	5TS	Inactive	Sprint Waste Disposal	-	-
1477	Harris	7	Closed	University of Houston	x	x
1478	Harris	4	Active	Sanifill of Texas/Greenbelt	16	1999
1483	Harris	1	Active	Urban Waste Technologies	50	1999
1493	Harris	4	Closed	BSI-WII/San Jac/East Belt	x	x
1497	Harris	5TB	Closed	City of Baytown	x	x
1504	Harris	5RE	Unknown	UT System Cancer Center	-	-
1511	Harris	4	Active	Sanifill of Texas/ Allweather	52	1999
1540	Harris	4	Active	Sanifill of Texas/Greenshadows	22	1995
1557	Harris	5TS	Inactive	Western Refuse of Texas, Inc.	-	-
1565	Harris	4	Closed		x	x
1574	Harris	5TB	Closed	Jack R. Wade	x	x
1578	Harris	4	Active	Sanifill of Texas/ Hardy	18	1999
1586	Harris	4	Closed	Ronald B. Dokell	x	x
1599	Harris	4	Closed	G. O. Weiss, Inc.	x	x
1602	Harris	5TB	Closed	J. K. King	x	x
1610	Harris	4	Closed	Lakeside Landfill	x	x
1612	Harris	5TB	Closed	Leas-it, Inc.	x	x
1643	Harris	4	Active	Sanifill of Texas/West Belt	12	1993
1648	Harris	5TB	Closed	Magnolia Development, Inc.	x	x
1654	Harris	5TB	Closed	Leon E. Stephens	x	x
1660	Harris	1	Closed	Evergreen Development	x	x
1672	Harris	5	Inactive	Goodyear Tire/Big Chief	-	-
1697	Harris	5TS	Active	City of Dear Park	-	-
1712	Harris	5TB	Closed	Best Refuse Recycling	x	x
1765	Harris	1	Inactive	FMC Corp. / City of La Porte	65	2020
1766	Harris	6	Active	Heritage Services, Inc.	27	-
1777	Harris	9GR	Active	Getty Synthetic Fuels, Inc.	4	-
1785	Harris	5RE	Inactive	Georgia Gulf Corporation	-	-
1910	Harris	5WI	Denied	Bio Waste Management Co.	x	x
1920	Harris	4	Active	Robin Ray/ Clow Road L/F	10	1994
1921	Harris	4	Active	Cougar Landfill	117	2020
1925	Harris	5TB/RR	Repermitting	City of Houston	x	x
1960	Harris	5WI	Closed	Med-Safe, Inc.	x	x
2065	Harris	5TB	Closed	Ove Foster	x	x
2117	Harris	5TS	Inactive	Best-Pak REM, Inc.	-	-
2166	Harris	5TS	Active	Eccor, Inc.	-	-
10002	Harris	7R	Cancelled	Sprint Waste Disposal, Inc.	x	x
10013	Harris	7R	Cancelled	City of Nassau Bay	x	x
10014	Harris	7R	Registered	Harris County MUD #5	unknown	-

Permit #	County	Facility	Status	Owner	Acres	Closing
10018	Harris	7R	Registered	Martens Cattle Co.	unknown	-
10029	Harris	7R	Cancelled	CDR Ind. Inc./Nine Bar Ranch	x	x
10043	Harris	7R	Registered	CDR Ind. Inc./Dincans	-	-
10047	Harris	7R	Revoked	Jolly Utility Service	x	x
10079	Harris	7R	Denied	CDR Ind. Inc./Chudleigh	x	x
10080	Harris	7R	Registered	CDR Ind. Inc./Lowery	78	-
10133	Harris	7R	Cancelled	CDR Ind. Inc./Caulking	x	x
10134	Harris	7R	Cancelled	CDR Ind. Inc./Oshman	x	x
10135	Harris	7R	Cancelled	CDR Ind. Inc./Kleb	x	x
10139	Harris	7R	Registered	City of Clear Lake City	unknown	-
10222	Harris	7R	Cancelled	Texas Agent Inc./Fay	x	x
10270	Harris	7R	Registered	Bio-Star Inc./Martini	unknown	-
10279	Harris	7R	Cancelled	CDR Industries	x	x
10282	Harris	7R	Registered	Bio-Star Inc.	unknown	-
10358	Harris	7R	Registered	CDR Environmental, Inc.	101	-
415	Liberty	1	Closed	City of Cleveland	x	x
528	Liberty	1	Closed	City of Liberty	x	x
835	Liberty	1	Closed	City of Dayton	x	x
861	Liberty	2	Closed	Liberty County	x	x
1016	Liberty	3	Closed	Liberty County	x	x
1047	Liberty	1	Closed	City of Dayton	x	x
1121	Liberty	3	Closed	Liberty County	x	x
1233	Liberty	1	Closing	City of Liberty	16	1993
1347	Liberty	1	Closed		x	x
10348	Liberty	7R	Permitting	City of Dayton	unknown	-
49	Matagorda	1	Denied	J. W. Massey	x	x
248	Matagorda	3	Closed	Matagorda County	x	x
371	Matagorda	1	Closed	City of Bay City	x	x
588	Matagorda	2	Closed	City of Palacios	x	x
1023	Matagorda	3	Closed	Matagorda County	x	x
1035	Matagorda	3	Closed	Matagorda County	x	x
1043	Matagorda	1	Closed	Matagorda County	x	x
1093	Matagorda	1	Active	Matagorda County	10	1993
1435	Matagorda	1	Closed	City of Palacious	x	x
1713	Matagorda	5TB	Closed	City of Bay City	x	x
2086	Matagorda	5RE	Inactive	Process Design, Inc.	-	-
10076	Matagorda	7R	Registered	J. W. Massey	x	x
81	Montgomery	1	Active	Western Waste/City of Conroe	25	1998
706	Montgomery	2	Closed	City of Willis	x	x
766	Montgomery	4	Closed	Roy Fulcher	x	x
781	Montgomery	1	Closed	Montgomery County	x	x
902	Montgomery	4	Closed	L. D. Neeley	x	x
1090	Montgomery	3	Closed	Dana Richardson Properties	x	x
1163	Montgomery	4	Closed	James D. Harrell	x	x
1217	Montgomery	3	Closed	T.J. Jackson	x	x
1235	Montgomery	3	Closed	John Taylor, Jr.	x	x
1487	Montgomery	5TB	Closed	William A. White	x	x
1653	Montgomery	2	Denied	City of Willis	x	x
1710	Montgomery	5TB	Closed	River Sand, Inc.	x	x
1752	Montgomery	1	Active	Montgomery Contractors	173	2007

Permit #	County	Facility	Status	Owner	Acres	Closing
1757	Montgomery	1	Active	Western Waste	81	2025
1901	Montgomery	2	Closed	City of Willis	x	x
2134	Montgomery	5GG	Permitting	Sanvac, Inc.	2	-
10019	Montgomery	7R	Registered	Runnels Septic Service	180	-
10297	Montgomery	7R	Denied	Ed Wakefield	x	x
10318	Montgomery	7R	Registered	Philip Whitley	unknown	-
196	Walker	1	Active	City of Huntsville	20	2002
916	Walker	3	Closed	William Lucher	x	x
966	Walker	3	Closed	V. C. Plunkett	x	x
1367	Walker	3	Closed	Grady Chandler	x	x
1492	Walker	3	Permitting	Grady Chandler Co.	-	-
1566	Walker	2	Closed	TDCJ/Ellis Unit	x	x
1647	Walker	2	Inactive	Champion International	-	-
1665	Walker	5RE	Closed	TDCJ/Ellis Unit II	x	x
1824	Walker	2	Closed	TDCJ/Ellis Unit	x	x
10015	Walker	7R	Cancelled	Edward O. Harvey	x	x
10023	Walker	7R	Cancelled	Sprint Waste Disposal Co.	x	x
10048	Walker	7R	Cancelled	Davis & Brown Contruction	x	x
10066	Walker	7R	Registered	Davis & Brown Contruction	89	-
10117	Walker	7R	Registered	Terry W. Fulgham	unknown	-
10242	Walker	7R	Registered	Norman E. Adams	685	-
10295	Walker	7R	Denied	Tommy Lynch	x	x
114	Waller	2	Closed	City of Hempstead	x	x
507	Waller	1	Closed	City of Katy	x	x
600	Waller	2	Closed	Prairie View A&M University	x	x
814	Waller	3	Closed	City of Waller	x	x
1289	Waller	3	Closed	J. C. Branceh	x	x
1310	Waller	1	Closed	Prairie View A&M University	x	x
1445	Waller	2	Closed	Best Pak Disposal Inc.	x	x
1613	Waller	5RE	Permitting	Energy Advancement, Inc.	-	-
1776	Waller	5	Closed	Briscoe Maphis/Genstar	x	x
10035	Waller	7R	Cancelled	Brisco Maphis/Genstar	x	x
10036	Waller	7R	Cancelled	CDR Ind. Inc./Elliott	x	x
10038	Waller	7R	Registered	CDR Ind. Inc./Page	375	-
10039	Waller	7R	Registered	CDR Ind. Inc./Gosler	96	-
10040	Waller	7R	Cancelled	CDR Ind. Inc./Cook	x	x
10051	Waller	7R	Denied	City of Katy	x	x
10057	Waller	7R	Registered	Carl Miller/Miller	2	-
10058	Waller	7R	Registered	Carl Miller/Liang	101	-
10059	Waller	7R	Registered	Carl Miller/Pattison	111	-
10064	Waller	7R	Registered	Carl Miller/Tropical	260	-
10065	Waller	7R	Cancelled	Texas Env. Con. Inc./Stout	x	x
10067	Waller	7R	Cancelled	Carl Miller/Beckendorf	x	x
10072	Waller	7R	Cancelled	Main Waste Tech./Morgan	x	x
10073	Waller	7R	Registered	Carl Miller/Pederson	704	-
10074	Waller	7R	Cancelled	Main Waste Tech./Davis	x	x
10075	Waller	7R	Cancelled	Main Waste Tech./Davis	x	x
10077	Waller	7R	Registered	Bio-Star, Inc.	218	-
10081	Waller	7R	Registered	CDR Ind. Inc./Cantrell	386	-
10084	Waller	7R	Registered	Carl Miller/White	480	-

Permit #	County	Facility	Status	Owner	Acres	Closing
10086	Waller	7R	Registered	Carl Miller/Buller	100	-
10087	Waller	7R	Cancelled	Carl Miller/Buller	x	x
10088	Waller	7R	Registered	Carl Miller/Paben	158	-
10089	Waller	7R	Registered	Carl Miller/Paben	150	-
10090	Waller	7R	Cancelled	Carl Miller/Pfeffer	x	x
10095	Waller	7R	Cancelled	Carl Miller/Wawarofsky	x	x
10096	Waller	7R	Cancelled	Carl Miller/Wawarofsky	x	x
10097	Waller	7R	Registered	Carl Miller/Stasney	100	-
10100	Waller	7R	Cancelled	Carl Miller/Herbert	x	x
10101	Waller	7R	Cancelled	Carl Miller/Buller	x	x
10104	Waller	7R	Cancelled	Carl Miller/Pattison	x	x
10105	Waller	7R	Registered	Carl Miller/Timmerman	432	-
10107	Waller	7R	Registered	Carl Miller/Elkins	432	-
10108	Waller	7R	Cancelled	Texas Ag. Ent. Inc./Roark	x	x
10115	Waller	7R	Cancelled	Texas Ag. Ent. Inc./David	x	x
10121	Waller	7R	Cancelled	Carl Miller/Henson	x	x
10123	Waller	7R	Registered	Carl Miller/Pattison	110	-
10125	Waller	7R	Cancelled	Texas Ag. Ent. Inc./David	x	x
10149	Waller	7R	Cancelled	Texas Ag. Ent. Inc./Dawson	x	x
10151	Waller	7R	Cancelled	Texas Ag. Ent. Inc./Broussard	x	x
10221	Waller	7R	Registered	Carl Miller/Wilson	unknown	-
10223	Waller	7R	Registered	Carl Miller	unknown	-
10224	Waller	7R	Registered	Carl Miller/ K-Brook	410	-
10267	Waller	7R	Denied	Steve N. Kent	x	x
222	Wharton	3	Closed	Texas Gulf, Inc.	x	x
819	Wharton	2	Closed	Anton Kelner, Jr.	x	x
822	Wharton	1	Active	City of El Campo	106	2050
840	Wharton	3	Closed	Wharton County	x	x
855	Wharton	1	Closed	City of Wharton	x	x
2099	Wharton	5TS	Active	City of Wharton / WMNA	-	-
10106	Wharton	7R	Cancelled	Texas Ag. Ent. Inc./Sklar	x	x
10226	Wharton	7R	Cancelled	Texas Ag. Ent. Inc./Duncan	x	x
10234	Wharton	7R	Registered	Bob Berry/Goudeau	unknown	-
10237	Wharton	7R	Cancelled	J. W. Cagle	x	x
10238	Wharton	7R	Cancelled	J. W. Cagle	x	x

Appendix 8

Employment by Sector

Retail

	1985		1997		2002		2010		2012	
Austin	Information not available									
Brazoria	18,074	28.6%	22,115	28.3%	23,799	28.1%	26,493	28.0%	27,167	28.0%
Chambers	1,463	20.5%	1,912	20.7%	2,099	20.7%	2,398	20.8%	2,473	20.8%
Colorado	Information not available									
Fort Bend	13,423	33.1%	22,010	32.7%	25,588	32.7%	31,312	32.6%	32,743	32.6%
Galveston	23,490	31.7%	25,943	31.5%	26,965	31.4%	28,600	31.3%	29,009	31.2%
Harris	323,685	21.6%	395,557	22.1%	425,503	22.2%	473,418	22.4%	485,397	22.4%
Liberty	4,933	38.6%	6,845	37.9%	7,642	37.8%	8,917	37.5%	9,236	37.5%
Matagorda	Information not available									
Montgomery	15,140	39.9%	23,923	38.3%	27,583	37.9%	33,438	37.5%	34,902	37.5%
Walker	Information not available									
Waller	1,829	28.3%	2,538	27.9%	2,834	27.8%	3,307	27.7%	3,425	27.7%
Wharton	Information not available									

Office

	1985		1997		2002		2010		2012	
Austin	Information not available									
Brazoria	6,182	9.8%	7,664	9.8%	8,281	9.8%	9,269	9.8%	9,516	9.8%
Chambers	233	3.3%	305	3.3%	334	3.3%	382	3.3%	394	3.3%
Colorado	Information not available									
Fort Bend	4,766	11.7%	7,962	11.8%	9,293	11.9%	11,424	11.9%	11,957	11.9%
Galveston	7,464	10.1%	8,390	10.2%	8,776	10.2%	9,394	10.3%	9,548	10.3%
Harris	553,809	37.0%	678,260	37.8%	730,115	38.1%	813,082	38.5%	833,824	38.5%
Liberty	677	5.3%	963	5.3%	1,082	5.3%	1,273	5.4%	1,321	5.4%
Matagorda	Information not available									
Montgomery	4,469	11.8%	7,832	12.5%	9,233	12.7%	11,475	12.9%	12,035	12.9%
Walker	Information not available									
Waller	207	3.2%	291	3.2%	326	3.2%	382	3.2%	396	3.2%
Wharton	Information not available									

Medical

	1985		1997		2002		2010		2012	
Austin	Information not available									
Brazoria	1,953	3.1%	2,361	3.0%	2,532	3.0%	2,804	3.0%	2,872	3.0%
Chambers	334	4.7%	428	4.6%	467	4.6%	529	4.6%	545	4.6%
Colorado	Information not available									
Fort Bend	1,193	2.9%	1,927	2.9%	2,233	2.8%	2,722	2.8%	2,844	2.8%
Galveston	8,775	11.9%	9,588	11.6%	9,926	11.6%	10,468	11.4%	10,603	11.4%
Harris	83,510	5.6%	92,798	5.2%	96,667	5.0%	102,859	4.9%	104,407	4.8%
Liberty	784	6.1%	1,049	5.8%	1,159	5.7%	1,336	5.6%	1,380	5.6%
Matagorda	Information not available									
Montgomery	2,061	5.4%	3,012	4.8%	3,409	4.7%	4,043	4.5%	4,202	4.5%
Walker	Information not available									
Waller	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Wharton	Information not available									

Government

	1985		1997		2002		2010		2012	
Austin	Information not available									
Brazoria	4,083	6.5%	5,107	6.5%	5,534	6.5%	6,217	6.6%	6,388	6.6%
Chambers	341	4.8%	441	4.8%	482	4.8%	549	4.8%	566	4.8%
Colorado	Information not available									
Fort Bend	3,442	8.5%	5,711	8.5%	6,657	8.5%	8,170	8.5%	8,548	8.5%
Galveston	3,104	4.2%	3,470	4.2%	3,622	4.2%	3,866	4.2%	3,927	4.2%
Harris	43,493	2.9%	49,589	2.8%	52,128	2.7%	56,192	2.7%	57,208	2.6%
Liberty	541	4.2%	765	4.2%	859	4.2%	1,008	4.2%	1,045	4.2%
Matagorda	Information not available									
Montgomery	1,299	3.4%	2,281	3.6%	2,690	3.7%	3,344	3.8%	3,508	3.8%
Walker	Information not available									
Waller	218	3.4%	314	3.4%	353	3.5%	417	3.5%	433	3.5%
Wharton	Information not available									

Industrial

	1985		1997		2002		2010		2012	
Austin	Information not available									
Brazoria	26,642	42.1%	33,375	42.6%	36,181	42.8%	40,670	43.0%	41,792	43.0%
Chambers	4,079	57.2%	5,290	57.2%	5,794	57.2%	6,601	57.2%	6,803	57.2%
Colorado	Information not available									
Fort Bend	13,260	32.7%	22,334	33.2%	26,115	33.3%	32,165	33.5%	33,677	33.5%
Galveston	19,690	26.6%	22,413	27.2%	23,547	27.4%	25,362	27.7%	25,816	27.8%
Harris	385,793	25.8%	451,196	25.2%	478,447	25.0%	522,049	24.7%	532,949	24.6%
Liberty	4,227	33.1%	6,253	34.7%	7,097	35.1%	8,447	35.6%	8,785	35.7%
Matagorda	Information not available									
Montgomery	9,650	25.4%	17,283	27.6%	20,463	28.1%	25,552	28.7%	26,824	28.8%
Walker	Information not available									
Waller	1,633	25.2%	2,638	29.0%	3,057	30.0%	3,727	31.2%	3,895	31.5%
Wharton	Information not available									

Education

	1985		1997		2002		2010		2012	
Austin	Information not available									
Brazoria	6,295	10.0%	7,651	9.8%	8,217	9.7%	9,121	9.6%	9,347	9.6%
Chambers	684	9.6%	877	9.5%	957	9.4%	1,086	9.4%	1,118	9.4%
Colorado	Information not available									
Fort Bend	4,502	11.1%	7,293	10.8%	8,456	10.8%	10,317	10.7%	10,782	10.7%
Galveston	11,510	15.5%	12,608	15.3%	13,066	15.2%	13,798	15.1%	13,981	15.1%
Harris	105,287	7.0%	124,810	7.0%	132,945	6.9%	145,960	6.9%	149,214	6.9%
Liberty	1,611	12.6%	2,167	12.0%	2,399	11.9%	2,770	11.7%	2,863	11.6%
Matagorda	Information not available									
Montgomery	5,353	14.1%	8,177	13.1%	9,353	12.9%	11,236	12.6%	11,707	12.6%
Walker	Information not available									
Waller	2,582	39.9%	3,316	36.5%	3,622	35.5%	4,112	34.4%	4,234	34.2%
Wharton	Information not available									

Total

	1985		1997		2002		2010		2012	
Austin	Information not available									
Brazoria	63,229	100.0%	78,275	100.0%	84,544	100.0%	94,574	100.0%	97,082	100.0%
Chambers	7,134	100.0%	9,251	100.0%	10,133	100.0%	11,545	100.0%	11,898	100.0%
Colorado	Information not available									
Fort Bend	40,586	100.0%	67,238	100.0%	78,342	100.0%	96,110	100.0%	100,552	100.0%
Galveston	74,033	100.0%	82,411	100.0%	85,902	100.0%	91,488	100.0%	92,884	100.0%
Harris	1,495,577	100.0%	1,792,209	100.0%	1,915,805	100.0%	2,113,560	100.0%	2,162,999	100.0%
Liberty	12,773	100.0%	18,042	100.0%	20,238	100.0%	23,751	100.0%	24,629	100.0%
Matagorda	Information not available									
Montgomery	37,972	100.0%	62,508	100.0%	72,731	100.0%	89,088	100.0%	93,177	100.0%
Walker	Information not available									
Waller	6,469	100.0%	9,097	100.0%	10,193	100.0%	11,945	100.0%	12,383	100.0%
Wharton	Information not available									

Appendix 9
Siting Criteria from other Jurisdictions

Solid Waste Management Facilities Land Use Location Standards and Restrictions

POLITICAL SUBDIVISION	DISTANCE FROM Residence	DISTANCE FROM Other Land Uses	DISTANCE FROM Parkland	DISTANCE FROM Property Lines	DISTANCE FROM Public Roads
LANDFILLS					
STATES					
Florida					1,000
Indiana	600			100	
Michigan	300 if residence is in existing prior to approval			100	100
Minnesota	1,000			200	
Nebraska					1,000
New York				100	
Ohio	1,000		1,000 state nature preserve refuge or national wildlife refuge or forest	300	
Virginia	200	200 school, hospital, nursing home	200 recreational park area		50
Washington	250	100 zoned non-residential	1,000	100	
Wisconsin			1,000 (exemption available)	100	1,000
COUNTIES					
Montgomery Cty., MD	1,000				
CITIES					
City of Tampa, FL		permitted in Industrial- Heavy zone, Commercial- Intensive, & Industrial- General either by right or special use			
City of Austin, TX		permitted in P (public) zone			

POLITICAL SUBDIVISION	DISTANCE FROM Residence	DISTANCE FROM Other Land Uses	DISTANCE FROM Parkland	DISTANCE FROM Property Lines	DISTANCE FROM Public Roads
LANDFILLS					
COUNCIL OF GOVERNMENTS					
Metropolitan Council	1,300 screening	***institutional***	500 screening		25 active fill
St. Paul, MN	300 active fill	1,300 screening	100 active fill		25 landfill activities
	200 landfill activities	300 active fill	100 landfill activities		
		200 landfill activities			
		commercial			
		500 screening			
		100 active fill			
		100 landfill activities			
		industrial,			
		mining, agricultural			
		50 active fill			
		50 landfill activities			
Metropolitan Service District	200 residential zone	100 commercial zone	60 significant natural area		
Portland, OR		200 open space zone			
(all types of facilities)					
COMPOSTING					
Virginia	300	300			
		health care facility, school, or			
		similar type of public institution			
TRANSFER STATIONS					
Virginia	200	200		50	
		school or recreational facility			
Cook County, Illinois	800-1,000	500			
		(recommended)			
		schools, hospitals			
MRF/ RECYCLING CENTER					
Virginia	200	200	200	50	
		school			
City of Austin, TX	100				
	of any adjoining property				
	zoned or used for SF-5				
	or more restrictive purposes				

POLITICAL SUBDIVISION	DISTANCE FROM Residence	DISTANCE FROM Other Land Uses	DISTANCE FROM Parkland	DISTANCE FROM Property Lines	DISTANCE FROM Public Roads
ENERGY RECOVERY & INCINERATION FACILITY					
Virginia	200	200 hospital, nursing home, school	200 recreational park area	50	
Florida	---------- 300 ---------- for air curtain incinerators- from any pre-existing occupied building located off site	1,000 active portion of any landfill unless that air curtain incinerator is separated from the active of the landfill by a controlled gate or check-in station			
	----------1,000 - 3,000 ---------- depending on type of air curtain incinerator				
ENERGY RECOVERY & INCINERATION FACILITY					
City of Dallas, TX (based on proposal by The Waste Incinerator Policy Committee)	**Pathological** 1,000 **Medical/Infectious (<225 lbs or >225 lbs/hr)** 1,000 **Municipal** 1,500	*Schools, Churches* **Pathological** 1,000 **Medical/Infectious (<225 lbs or >225 lbs/hr)** 1,000 **Municipal** 1,500	**Pathological** 1,000 **Medical/Infectious (<225 lbs or >225 lbs/hr)** 1,000 **Municipal** 1,500	**Pathological** 100 **Medical/Infectious (<225 lbs or >225 lbs/hr)** 100 or 200 **Municipal** 200	
	Pathological or Medical/Infectious Inc. **Pathological** 1/4 mile **Medical/Infectious (<225 lbs or >225 lbs/hr)** 1/4 or 1 mile **Municipal 1 mile**				
	Municipal **Pathological 1 mile** **Medical/Infectious (<225 lbs or >225 lbs/hr)** 1 mile **Municipal 2 miles**				

POLITICAL SUBDIVISION	*Excluded Areas and/or Restrictions*	DISTANCE FROM Geologic Features	DISTANCE FROM Ground Water	DISTANCE FROM Water Supply Wells	DISTANCE FROM Surface Waters
LANDFILLS					
STATES					
California	floodplains; Holocene fault lines; areas of rapid geologic change; minimum of 5 ft above the highest anticipated elevation of underlying groundwater and waste; compliance w/city or county land use controls; justification of need	depends on site	depends on site		
Florida	open sink holes (depending on geologic formation); limestone or gravel pits; de-watered pits; flooding areas (unless drainage provision); areas open to public view from any major thoroughfare without proper screening; in any natural or artificial body of water including groundwater; conform with zoning; sites must have adequate quantity of earth cover which is easily workable and compactable; must provide easy access by collection and transfer vehicles			500 unless landfill was first	200 or 3,000 exempt if proper leachate collection 3,000 if Class I surface water
Indiana	prohibited from waters of the US located within the state of that would be in violation of section 301 of the Clean Air Act, as amended; the habitat of any endangered, threatened, or rare species of plant, invertebrate, or vertebrate as identified by 50 CFR 17 and 310 IAC 3-3-6; the location of candidate nature preserves included in the Indiana Dept. of Natural Resources; floodways of drainage areas greater than 1 sq. mile (w/out approval); within areas of karst topography (w/out provisions); over mines (exceptions available); within the floodplain unless the waste is protected from floodwater inundation by a dike w/ a top evaluation not less than 3 feet above the base flood elevation			600 or 1,200 potable or public	100
Michigan	focus on odor management- greater isolation distances may be required if (1) geologic conditions require it; (2) the site is adjacent to a special quiet zone, as designated by local or state government				100 lakes, perennial streams
Minnesota	floodplains; shoreline mgmt. areas; wetlands; all emission control areas; areas w/ visible karst features which may impair leachate monitoring; locations w/unstable soil or bedrock; must comply w/ local government location standards; within 1 mile areas of concern include public parks, occupied dwellings, special studies may be required				1,000

POLITICAL SUBDIVISION	*Excluded Areas and/or Restrictions*	DISTANCE FROM Geologic Features	DISTANCE FROM Ground Water	DISTANCE FROM Water Supply Wells	DISTANCE FROM Surface Waters
LANDFILLS					
STATES					
Nebraska	sites subject to flooding; conformity to applicable ambient air quality and source control regulations; areas having high groundwater tables may be restricted to landfills operations which will maintain a safe vertical distance between deposited refuse and the maximum water table elevation; sites shall be located in conformance with applicable state and county or municipal zoning laws and ordinances	----------depends on site analysis----------			
New York	primary water supply & principal aquifers; floodplains; unstable areas; regulatory wetlands; agricultural lands; unmonitorable or unremediable areas; endangered species habitats	----------depends on site analysis----------			100
Ohio	floodways; sand or gravel pits (where deposits haven't been completely removed); limestone or sandstone quarries; governmentally-owned parkland; within area of potential subsidence due to an underground mine; above sole source and/or an unconsolidated aquifers; regulatory floodplains; surface and subsurface areas surrounding a public water supply well (depending on anticipated contaminants movement (5 years))	200 Holocene fault	1,500 depth to non-sole source aquifer 1,000	1,000 developed spring	1,000 national scenic rivers, stream segments designed by Ohio EPA as either state resource water; coldwater or exceptional warmwater habitats
Virginia	sites subject to flooding, geological unstable areas; prohibited where groundwater monitoring cannot be conducted; excessive slopes (> 33%); lack of readily available cover materials on site or lack of a firm commitment for material; springs, seeps, or other groundwater intrusion into the site; the presence of gas, water, sewage, or electrical or other transmission lines under the site; the prior existence on the site of an open dump, unpermitted landfill, lagoon, or similar facility	5 between solid waste & the max. seasonal water table or bedrock	500 drinking water	500	100
Washington	over Holocene fault, in a subsidence area, or adjacent to any geologic feature which would impair the structural integrity; 100 yr. floodplains; sites outside the political boundaries of the siting agency; sites lacking adequate soils for liner & cover materials; sites w/irreplaceable archaeological or historical resources			1,000 downgradient 1,200 community supply	200 measured horizontally
Wisconsin	floodplains; critical habitat areas; wetlands; need to complete local approval process; documentation of need is required			1,200	1,000 (lakes, ponds, flowage) 300 (streams, rivers)

POLITICAL SUBDIVISION	*Excluded Areas and/or Restrictions*	DISTANCE FROM Geologic Features	DISTANCE FROM Ground Water	DISTANCE FROM Water Supply Wells	DISTANCE FROM Surface Waters
LANDFILLS					
COUNTIES					
Montgomery Cty., MD	floodplains; wetlands; intentional contamination or ground or surface water sites where leachate cannot be separated from ground or surface water; landfill exclusion areas (3 miles of the two existing county landfills)				
CITIES					
City of Tampa, FL	within flood zone A, as established by the Federal Emergency Management Agency; all federal, state and local regulations must be met; a conceptual site plan must be submitted showing compliance w/ local development regulations				
City of Austin, TX	no private companies allowed to open a waste facility (landfill, transfer station, incinerator, service yard, etc.) inside the city limits; for city to open a waste facility property must be zoned or rezoned P (public); city must provide proper notice to property owners within 300 ft of site, in addition to holding a public hearing				
COUNCIL OF GOVERNMENTS					
Metropolitan Council St. Paul, MN	focus on aesthetic and nuisance impacts; certification of need; establishes standards for various land uses (construction of barriers, plantings of vegetation, and/or compensation to property owners may be substituted for the protection level required) ***Noise (100 feet)*** Residential & Institutional - L(50) of 60 dBA Commercial & Recreational - L(50) of 65 dBA Industrial, Mining, & Agricultural - L(50) of 75 dBA				
Metropolitan Service District Portland, OR (all types of facilities)	based on draft ordinance that addresses siting, comprehensive planning, & zoning; vibrations not to exceed 0.002g peak at a property line; glare or lighting may not shine off-site in excess of 0.5 footcandles onto non-industrial zoned land; at least 20% of site is to be landscaped; facility shall not adversely affect historic resources; comply w/ the applicable floodplain zone regulations, local slope hazard regulations, local geological/soil hazard regulations; noise level studies must be done as to show that facility will not adversely impact noise sensitive uses (residence, hospital, or school); must monitor ground and surface water impacts and methane gas impacts		60 wetland		

POLITICAL SUBDIVISION	*Excluded Areas and/or Restrictions*	DISTANCE FROM Geologic Features	DISTANCE FROM Ground Water	DISTANCE FROM Water Supply Wells	DISTANCE FROM Surface Waters
LANDFILLS					
COUNCIL OF GOVERNMENTS					
Southeast Michigan Council of Governments	focus on landfill air quality (gas & odor generation & composition); prohibit reintroduction of untreated leachate by surface application;	SLIDING SCALE SETBACK REQUIREMENTS BASED ON GENERIC MODELING STUDY			
Detroit, MI	require remote tipping of highly odorous waste such as sewage sludge; require active gas collection systems with treatment as required based on an assessment of odor and air toxics impacts; if adjacent properties are relatively undeveloped, consider prioritizing development of tipping face areas. By tipping in areas adjacent to future residences first, then in areas to commercial and industrial zones, complaints of odors associated w/ tipping face operations will be reduced; require remote operations of composting facilities.				
COMPOSTING					
Ohio	floodways				
Virginia	areas subject to base floods, geological unstable areas or where the site topography is heavily dissected. Acceptable sites must have sufficient area and terrain to allow for proper management of leachate (varies if non-cofined composting)		prohibited if the seasonal high water table lies within 5 ft of the ground surface		
TRANSFER STATIONS					
Virginia	sites shall be adjacent to or have direct access to roads which are paved or surfaced and capable of withstanding anticipated load limits; shall allow for sufficient room to minimize traffic congestion and allow for safe operations				50
Cook County, Illinois	avoid siting in floodplains, wetlands, or near surface water; select soils suitable for road and building construction; prohibited from the habitat of threatened and endangered species; excluded from irreplaceable historical, archeological, paleontogical sites; demonstration of need; must comply w/local zoning if in unicorporated Cook Co.; local siting approval required if in municipality; must comply w/municipal, township, or County road limits; 4 to 10 acres desirable, depending on plant capacity and expected expansions; located near centroid of waste shed				
MRF/ RECYCLING CENTER					
Virginia	areas subject to base floods; sites shall be adjacent to or have direct access to roads which are paved or surfaced and capable of withstanding anticipated load limits; shall allow for sufficient room to minimize traffic congestion and allow for safe operations				50

POLITICAL SUBDIVISION	*Excluded Areas and/or Restrictions*	DISTANCE FROM Geologic Features	DISTANCE FROM Ground Water	DISTANCE FROM Water Supply Wells	DISTANCE FROM Surface Waters
MRF/ RECYCLING CENTER					
City of Austin, TX	permitted in MI and LI districts; must have no less than 150 feet of frontage on a public street				
RECYCLING COLLECTION CENTER					
City of Austin, TX	require specific zoning - GR, P (Public) subject to restrictions, and is permitted in CS, CS-1, CH, LI and MI; must comply with all applicable compatibility standards				
ENERGY RECOVERY & INCINERATION FACILITY I					
Virginia	areas subject to base floods; sites shall be adjacent to or have direct access to roads which are paved or surfaced and capable of withstanding anticipated load limits; shall allow for sufficient room to minimize traffic congestion and allow for safe operations				50
City of Dallas, TX (based on proposal by The Waste Incinerator Policy Committee)	proposed siting regulations and policies for operating and monitoring various types of waste incinerators; notification boundary requirement vary depending on type of incinerator (200-500 ft for pathological waste, 500' for medical/infectious waste, 750' for municipal waste); minimum distance on for main use incinerators				

Appendix 10
Acronyms

ACRONYMS

BCTF	Brazoria County Solid Waste Management Task Force
BFI	Browning-Ferris Industries (private enterprise)
CAC	City of Houston Citizens Advisory Committee
CERCLA	Comprehensive Environmental Response Compensation and Liability Act (Federal Superfund Act)
CMSA	Consolidated Metropolitan Statistical Area
COG	Council of Governments
HDPE	High Density Polyethylene (milk and detergent bottles)
EPA	Environmental Protection Agency
GCA	Gulf Coast Waste Disposal Authority
GLO	General Land Office
H.B.	House Bill
LDPE	Low Density Polyethylene (plastic garbage bags and wrappers)
H-GAC	Houston-Galveston Area Council
HHW	Household Hazardous Waste
LCRA	Lower Colorado River Authority
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
MUD	Municipal Utility District
NARC	National Association of Regional Councils
NIMBY	"Not in my Backyard"
NRAC	Houston-Galveston Area Council Natural Resources Advisory Committee
PET	Poly-Ethylene Terphthlate (soft drink containers)
PVC	Vinyl/Polyvinyl Chloride (cooking oil containers)
RCRA	U.S. Resource Conservation and Recovery Act
S.B.	Senate Bill
SWANA	Solid Waste Association on North America
TACB	Texas Air Control Board
TARC	Texas Association of Regional Councils
TBI	Texas Board of Irrigators
TDF	Tire Derived Fuel
TDH	Texas Department of Health
TNRCC	Texas Natural Resource Conservation Commission
TWC	Texas Water Commission
TWWDB	Texas Water Well Drillers Board
WMNA	Waste Management of North America (private enterprise)
WCWMC	Waller County Waste Management Committee

Appendix 11
Glossary and Definitions

GLOSSARY AND DEFINITIONS

Aquifer: A natural underground geologic formation that stores rainfall and streamflow that peculates through the land surface. Springs and wells tap into water stored in aquifers.

Agricultural Waste: Waste normally associated with the production and processing of food and fiber on farms, feedlots, ranches, and forests which may include animal manure, crop residues, and dead animals.

Bio-degradable: Waste which is capable of being broken down by microorganism into simple, stable compounds, such as carbon dioxide and water. Most organic wastes, such as foods and paper waste, are biodegradable.

Brush: The cutting or trimming from trees, shrubs, or lawns and similar materials.

Buffer Zone: Neutral area acting as a protective barrier between two non-compatible land uses. A buffer zone can act to minimize the environmental impacts including those relating to odor and visual character.

Buy-back Center: A facility where individuals bring recyclables in exchange for payment.

Class I Industrial Non-Hazardous Waste Disposal Site: Any industrial solid waste designated as a Class I by the Executive Director of the Texas Natural Resource Conservation Commission that has not been identified or listed as a hazardous waste site by the administrator of the U.S. Environmental Protection Agency under the federal Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976.

Compost: Disinfected and stabilized product of the decomposition process that is used or sold for use as soil amendment, artificial top soil, growing medium amendment, or similar uses.

Composting: The controlled biological decomposition of organic materials through microbial activity. Depending on the specific application, composting cans serve as both a volume reduction and a waste treatment measure. A beneficial organic composting activity is an appropriate waste management solution for diverting compatible materials from the solid waste stream that cannot be recycled and converted into an useful product and that can serve as a soil amendment of mulch.

Cullet: Clean, color-sorted, crushed glass that is used in glass making to speed up the melting of silica sand. The use of cullet reduces the energy required for glass manufacturing and therefore the cost.

Curbside Commingled: Collection programs where a mixture of recyclable materials are collected from a single container at the curb.

Curbside Separated: Collection programs where recyclable materials are separated into separate containers by the resident prior to pick-up at the curb.

Curb-sort: Collection programs where recyclables are separated at the curb at the time of pick-up.

De-Inking Facility: A facility in which inks and other contaminants are removed from paper products as part of the paper recycling process.

Dioxin: Dioxins are a family of 75 chemicals. They are a natural by-products of the combustion process and are not a substance intentionally manufactured. Dioxins are considered to be one of the most harmful toxins produced.

Disposal: The discharging, depositing, injection, dumping, spilling, leaking, or placing of solid waste or hazardous waste, whether containerized or uncontainerized into or on land or water so that the solid waste or hazardous waste or any other constituent thereof may be emitted into the air, discharged into the surface water or groundwater, or introduced into the environment in any other matter.

Drop-off Centers: Collection program where recyclable or compostable material are dropped off by individuals at a designated location.

End Markets: The combination of manufacturing interests which buy recyclable materials and process them for reuse. The demand for goods made of recyclable materials determines the feasibility of recycling and resource recovery.

Ferrous Metals: Metallic materials that contain iron. Ferrous metals can be separated from other materials with magnet.

Food Wastes: The organic residues generated by the handling, storage, sale, preparation, cooking, and serving of foods, commonly called garbage.

Garbage: Solid waste that is putrescible animal and vegetable waste materials from the handling, preparation, cooking, or consumption of food including waste materials from markets, storage facilities, and the handling and sale of produce and other food products.

Generator: Any person, by site or location, whose act or process produces solid waste.

Grease and Grit Trap Waste: Grease traps are often located in the sewer systems of hotels, restaurants, and similar food preparation establishments. Grit traps are located in the drainage and sewer systems at maintenance and repair shops, automobile

service stations, car washes, laundries, and other similar establishments. Waste collected from both grease and grit traps is classified as special waste by the State of Texas and thus has specific disposal requirements.

"Green Code": Refers to an unified code which could be put on products to inform consumers about a product's relative toxicity, recyclablity, and recycled material content.

Groundwater: Water present in the saturated zone of an aquifer. Groundwater can be free, that is, not bound or confined to a particular area, and is often a source of surface water. Fifty percent of the nation's drinking water comes from groundwater.

Heavy Metals: Metals of high atomic weight and density such as cadmium, mercury, and lead. These metals are found in batteries, lighting fixtures, colorants, and inks and thus are part of the municipal waste stream.

Household Hazardous Waste (HHW): Any solid waste classified as hazardous which is generated in a household by a consumer, such as paints, batteries, and cleaning solvents.

Houston Consolidated Metropolitan Statistical Area: Consolidated Metropolitan Statistical Areas (CMSAs) are large Metropolitan Areas (MAs) of more than 1,000,000 persons in which two or more Primary Metropolitan Statistical Areas (PMSAs) have been designated. PMSAs consist of a large urbanized county or cluster of counties that demonstrates very strong internal economic and social links, in addition to close economic and social links with other portions of the larger Metropolitan Area. The Houston CMSA includes the following seven counties: Brazoria; Fort Bend; Galveston; Harris; Liberty; Montgomery; and Waller.

Humus: Organic materials resulting from decay of plant or animal matter. Also referred to as compost.

Hydrology: Science dealing with the properties, distribution, and flow of water on or in the earth.

Incineration: Burning of waste to reduce the volume to be disposed.

Inorganic Waste: Waste composed of matter other than plant or animal (i.e., contains no carbon).

Integrated Solid Waste Management: A practice of using several alternative waste management techniques to manage and dispose of specific components of the municipal solid waste stream. These alternatives may include source reduction, recycling, composting, energy recovery, and landfilling.

Interlocal Agreements: Contracts between governmental entities for services and facilities that will benefit all entities by providing the same or higher level or services at a lower cost.

Leachate: Liquid that has percolated through solid waste or another medium and has extracted materials by dissolving them or carrying them is suspension.

Material Markets: See End-Markets.

Material Recovery Facility: A facility designed to separate recyclables from a mixed waste or commingled material supply.

Medical Waste: Waste generated by health care facilities or which is associated with health care activities. Includes animal waste, bulk human blood and blood products, microbiological waste, pathological waste and sharps. Trash generated from offices, kitchens, or other non-health care related activities with health care facilities is not classified as medical waste.

Monofill: A landfill or landfill trench into which only one type of waste is placed.

Mulch: Ground or mixed yard waste used to nourish the soil and to protect plants from evaporation and freezing temperatures.

Municipal Sludge: Sludge produced from a municipal waste water treatment facility.

Municipal Solid Waste (MSW): Solid waste resulting from or incidental to municipal, community, commercial, institutional, and recreational activities, including garbage, rubbish ashes, street cleanings, dead animals, abandoned automobiles, and all other solid waste other than industrial solid waste.

Municipal Utility District: A taxing governmental body formed by a developer under the Texas Water Code to finance water, sewer, and drainage improvements in a development. The money borrowed through the sale of low-interest MUD bonds is re-paid by property owners though taxes and fees within the district.

Natural Resources Advisory Committee (NRAC): The Board appointed standing Houston-Galveston Area Council advisory committee on environmental issues.

Non-Point Source: Pollutants that are associated with general sources, such as urban runoff, rather than specific sources. Compared to a point source of water pollution, such as discharge from a wastewater treatment plant, nonpoint source pollution is not readily to a particular source.

Odor: The property or quality of a thing that simulates or is perceived by the sense of smell.

Organic Waste: Waste material containing carbon. The organic fraction of municipal solid waste includes paper, wood, food waste, and yard wastes.

Particulates: Tiny pieces of matter resulting from the combustion process that can have harmful effects on those who breath them.

Pathogens: An organism capable of causing a disease.

Postconsumer Waste: Material or product that has served its intended use and has been discarded after passing through the hands of a final users.

Pre-Cycling: Consumer purchasing decisions that will reduce waste such as avoiding disposable products such as paper cups, purchasing bulk items with less packing, and choosing longer-wearing products.

Recharge Zone: Land surface through which rainfall, runoff and streamflow peculates into an aquifer, thereby replenishing the water stored in the aquifer.

Recycled Material: Materials, goods, or products that consist of recyclable material or materials derived from postconsumer waste, industrial waste, or hazardous waste which may be used in place of raw or virgin materials in manufacturing a new product.

Putrescible Waste: Solid Waste materials which are capable of being decomposed by microorganisms, causing odors and gases and attracting vectors.

Recyclable Material: Material that has been recovered or diverted from the solid waste stream for purposes of reuse, recycling, or reclamation, a substantial portion of which is consistently used in the manufacture of products which may otherwise be produced using raw or virgin materials. Recyclable material is not solid waste. However, recyclable material may become solid waste at such time, if any, as it is abandoned or disposed of rather than recycled.

Recycling: A process by which materials that have served their intended use or are scrapped, discarded, used surplus, or obsolete are collected, separated, or processed and returned to use in the form of raw materials in the production of new products. Except for mixed municipal solid waste composting, that is, composting of the typical mixed solid waste stream generated by residential, commercial, and/or institutional sources, recycling includes the composting process if the compost material is put to beneficial reuse.

Resource Conservation and Recovery Act (RCRA): The primary federal enabling legislation for solid waste management. The objectives of this Act are to protect the public health and the environment while preserving materials and energy resources.

Resource Recovery: The recovery of useful materials or energy from solid waste. Includes energy recovery, recycling, and reuse.

Reuse: The use of a product more than once in its same form for the same purpose (i.e., reusable beverage containers).

Sanitary Landfill: A controlled area of land on which solid waste is disposed of in accordance with standards, rules, or orders established by the Texas Natural Resource Conservation Commission.

Setback: The distance that a building must be placed back from a designated boundary, such as a street, alley or property line.

Sludge: Any solid, semisolid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility, or any other such waste having similar characteristics and effects, exclusive of the treated effluent from a wastewater treatment plant.

Solid Waste Management Task Force: Task force established by the Houston-Galveston Area Council's Natural Resource Advisory Committee. Includes local government officials, solid waste management professionals, and representatives for citizen organizations.

Source Reduction: A minimization of waste achieved through product design, manufacturing procedures, consumption patterns, or reuse.

Special Wastes: Any solid waste or combination of solid waste that because of its quantity, concentration, physical or chemical characteristics or biological properties require special handling and disposal to protect the human health or the environment. Includes medical wastes, household hazardous wastes, waste oil, sludge, grease and grit trap wastes, slaughterhouse and other animal waste, asbestos containing materials, and used tires.

Tipping Fee: Price charged for delivering solid waste to a landfill, incinerator, or recycling facility; usually expressed in dollars per ton.

Tire Derived Fuel (TDR): Fuel derived from processing scrap tires that can be used in cement kilns, pulp and paper mills, and in dedicated tire-to-energy facilities.

Transfer Stations: A fixed facility used for transferring solid waste from collection vehicles to long-haul vehicles. It is not a storage facility such as one where individual residents can dispose of their waste in bulk storage containers.

Variable Waste Disposal Fee: A disposal fee system where the cost of disposal increases as the volume of waste increases.

Vector: An agent, such as an insect, snake, rodent, or animal capable of mechanically or biological transferring a pathogen form one organism to another.

V.T.C.S.: Vernon's Texas Civil Statutes.

Waste Minimization: A practice that reduces the volume or the environmental or health hazards associated with waste, pollutants, or contaminants. Example may include source reduction, reuse, recycling, neutralization, and detoxification.

Waste Reduction: A minimization or reduced toxicity of waste through product design, manufacturing procedures, consumption patterns, or reuse.

Waste-to-Energy Facility: A solid waste incinerator which is designed to generate electricity from the energy produced by the combustion of waste.

White Goods: Large metal household appliances (e.g., stoves, dryers, refrigerators, ...).

Yard Waste: Leaves, grass clipping, yard and garden debris, and brush, including clean woody vegetative material. This term does not include stumps, roots, or shrubs with intact root balls.