Exhibit XIII

Countywide Comprehensive Plan For Pinellas County

Solid Waste and Resource Recovery Element

Adopted on December 20, 1988 by the Pinellas County Board of County Commissioners as the Countywide Planning Authority and Recommended by the Pinellas Planning Council.

This document was a plan element of the PPC under previous legislation. Although the introduction and title page have been modified, references may remain concerning that previous legislation. It should be noted in such cases that Chapter 88–464 of the State Statues now applies to this document by the adoption of the Countywide Planning Authority.

Table of Contents

Table of Contents (Cont.)

List of Figures

Figure Number

List of Figures (Cont.)

Figure Number

Introduction

Residents and public officials of Pinellas County are well aware that urbanization in Florida is proceeding at a very rapid pace and that growth can create a multitude of problems when not properly managed. Capacities of natural and man-made systems are being pushed to their maximum limits daily. The proper disposal of solid wastes generated by Pinellas County residents and business is an example of a public service whish must be planned for in advance prior to reaching capacity limitations. This document presents a plan to properly manage and dispose of solid waste generated by current and future residents, while recovering reusable resources to the greatest extent possible.

Due to the problems created by uncontrolled urbanization and a sincere concern for Florida's total environment, urban, rural, and undeveloped areas, the Florida State Legislature has begun efforts in recent years, to solve these problems.

This document is designed to address all solid waste planning requirements applicable to Pinellas County and incorporate the Resource Recovery and Management Program for Pinellas County into the framework of the countywide comprehensive plan format.

Plan Definitions

Goals, objectives, and policies must be viewed as an integrated, interdependent whole. The definitions of these terms must be made clear for the proper structuring and understanding of each plan element as well as the coordination of the plan elements with each other (e.g., *Conservation and Coastal Zone Management Element*). The definitions for these terms are given below; the same definitions are use throughout the plan.

Goals: Long-range community aspirations which represent significant positive gains which should be achieved by local governments and serve to establish the directions which the community will take. The "goal" describes the end condition that is sought; it is not an action nor a procedure, nor a process (i.e., good planning).

Objectives: Attainable targets which are action-oriented and designed to address outstanding community problems. An "objective" is a measurable component of a goal. Objectives are achieved in part through the implementation of planning policies. An

objective is subordinate to goals and is organized such that each relates to specific goals.

Policies: Guidelines for action which direct the achievement of objectives and enable local governments to respond to a wide range of problems as they arise. A "policy" is one of several possible procedures; it is a predetermined mode of behavior of a predisposition toward certain courses of action (guidelines).

Recommendations: Course of action designed to achieve objectives within policy guidelines which address themselves to a set of specific problems. Recommendations are suggested courses of action that may be employed to solve existing problems and avoid their reoccurrence in the future. These may include performance criteria, specific strategies, changes in administrative procedures or suggestions for further study. Recommendations do not constitute an "end state" rather, they offer potential solutions that should be considered.

Plan Objectives

- To meet the legal requirements of state law, which requires a general solid waste element that describes the solid waste problems of Pinellas County, and the general facilities that are required to solve these problems.
- To meet the requirements of state law, which requires Pinellas County to develop a Resource Recovery and Management Program.

Scope of Plan

1. To establish for Pinellas County a program for the receiving in bulk, storage, separation, processing, recovery, recycling, and/or disposal of residential, commercial, industrial, and demolition solid waste. The program will maximize economic benefits and minimize negative environmental, sociological, and political impacts. The planning area encompasses all of Pinellas County including the incorporated municipalities.
2. To formulate available countywide solid waste data and studies into a general countywide plan which is a coordinated element of the *Pinellas County Countywide Comprehensive Plan.*
3. To provide goals, objectives, and implementation policies by which locally prepared plans can be reviewed.

4. To provide a countywide solid waste planning guide for those jurisdictions that prefer to prepare a separate detailed solid waste element to meet their comprehensive planning requirements.

Planning Coordination

The state law requires the coordination of the several elements of the local comprehensive plan. The *Solid Waste and Resource Recovery Element* is being coordinated with other elements of the *Countywide Comprehensive Plan* in terms of land use, population projections, environmental constraints, and financial resources. This element has been closely coordinated with countywide water-resources related elements: wastewater, drainage, and water supply.

This element has also been coordinated with other agencies involved in solid waste resource recovery planning in Pinellas County. These are: local planning departments in the county and solid waste Technical Management Committee (TMC) composed of solid waste technical managers within the county; the Pinellas County Solid Waste Management Department which has primary responsibility for development of the Pinellas County Resource Recovery and Management Program; and the county's solid waste engineering consultant Henningson, Durham and Richardson (HDR).

Solid Waste Policy Coordination

The state law requires coordination of the local comprehensive plans of adjacent municipalities, counties, the region, and the [*Florida*] *State Comprehensive Plan*.

To further the intent of the required coordination of the solid waste and resource recovery policies, proposals in the recommendations of this plan element have been reviewed in relation to the policies in the following documents:

- *The Florida State Comprehensive Plan*, the Florida Department of Administration – Division of State Planning, 1978.
- *Solid Waste Management and Resource Recovery Technical Assistance Handbook*, Department of Environmental Regulation, 1976.
- *Future of the Region*, Tampa Bay Regional Planning Council (TBRPC), 1977.
- *Preliminary Goals, Policies and Economic Assumptions, Pinellas County General Plan*, PCPC, 1977.

The program and policy recommendations of this element have been found to be in conformance and agreement with the solid waste and resource recovery policies of the above documents. The relevant policies of these documents are included in Appendix A of this report.

Summary of Findings and Recommendations

Summary of Findings

Listed below are the major findings of the county's *Solid Waste and Resource Recovery Element* which have been extracted from the plan's analysis sections. These findings have served as the foundation for the program and policy recommendations contained in Chapter V of the plan.

1. By the year 2000, Pinellas County is expected to be generating approximately 16,000 tons of solid waste per week. This will be an increase of nearly 4,800 tons per week or 39 percent greater waste generation than in 1975. Implementation of the Pinellas County Resource Recovery and Solid Waste Disposal Program will insure the most feasible recovery of the energy and material from solid waste, while simultaneously solving the critical problem of finding an acceptable method of refuse disposal.
2. The greatest percentile waste generation increase is projected to occur in the northern sectors of the county, which are presently only partially developed. The planning sector which includes St. Petersburg will have the greatest absolute total increase of the 12 planning sectors, with a projected increase of 969 tons per week between 1975 and the year 2000.
3. The 25 governments of Pinellas County have three types of collection arrangements: 11 cities have their own collection systems, 13 cities have franchise contracts with private collectors, and the unincorporated areas operate under private enterprise systems of collection which do not have franchise contracts with the BCC.
4. Typical Pinellas County solid waste contains 5.4 percent ferrous metals and approximately one percent aluminum. Its combustible portion has an average value of 5,935 BTU/lb.
5. Several of the county's major roads are hampered with high traffic volumes: however, solid waste transport adds proportionately very little to the overall traffic volume.

6. It has been determined that railroads and barge routes are available for Pinellas County if a regional approach of solid waste management is developed at a later date.
7. Sanitary landfills are currently the mode of solid waste disposal in Pinellas County. The four existing sites have limited future life expectancy. The largest facility, called Toytown, will be fully utilized by 1983. The County Bridgeway Acres site will be utilized for residue disposal and emergency raw refuse disposal during periods of plant shutdown once the planned resource recovery facility becomes operational.
8. Sanitary landfilling is not considered to be a viable future solid waste disposal method in Pinellas County, due to the lack of centrally located available large acreage that is not environmentally sensitive.
9. Based on future solid waste projections and a limited amount of land suitable for raw landfilling, Pinellas County must find an alternate method of waste disposal.
10. A countywide approach to resource recovery and solid waste disposal is believed to be the best approach available to Pinellas County for the foreseeable future.
11. All alternative resource recovery systems evaluated by the county would use considerably less land for landfilling than present sanitary landfill disposal techniques.
12. All alternative resource recovery systems considered would minimize or eliminate negative environmental impacts associated with sanitary landfilling. Examples include vermin and bird attraction, objectionable odor of putrescible matter, and leachate pollution of groundwater.
13. Studies have confirmed that resource recovery, in the form of electricity and secondary materials in the form of ferrous metal and aluminum, is available for the Pinellas County solid waste/resource recovery system.
14. There are existing energy and materials markets available to Pinellas County for projected recoverable energy and materials from a Pinellas County resource recovery system.
15. Possible existing energy markets for a Pinellas County resource recovery system are: Solid refuse derived fuel (RDF) at TECO's Big Bend Plant, solid RDF at FPC Crystal River Plant, pyrolysis gas at FPC Bartow Plant, and electricity at the FPC distribution grid system.
16. Confirmed energy markets for a Pinellas County resource recovery system are pyrolysis at FPC Bartow Plant and electricity at FPC's distribution grid system.

Summary Recommendations

The summary of recommendations includes program recommendations for the Pinellas County Resource Recovery and Solid Waste Disposal Program. The summary also includes policy recommendations which have been developed as an outgrowth of the interrelation of solid waste and other major elements of the *Pinellas County Comprehensive Plan.* The recommendations are listed under these two headings.

Program Recommendations

1. Pinellas County received solid waste/resource recovery systems proposals from six major companies representing "state-of-the-art" offerings. Four different resource recovery technologies have been proposed addressing tow existing energy market options and one alternate market. These are:
   - *Mass Burning* – FPC Electrical Market – Grumman, Universal Oil Products, Inc., (UOP), and Wheelabrator Frye, Inc. (WFI).
   - *Prepared Fuel in Conventional Boiler* – FPC Electrical Market - Combustion Engineering (CE).
   - *Pyrolysis* – FPC gas market – Union Carbide (UCC).
   - *Dry Powder Fuel* – alternate markets – Combustion Equipment Associates (CEA)
2. There have been two financing options proposed. Public financing was offered by all proposers but CEA. Private financing was offered by CEA, UCC, UOP, and WFI.
3. The capacity of the facilities proposed range from 12,000 tons per week to 18,000 tons per week. Also, the level of redundancy offered varied somewhat between systems.
4. The Pinellas County Resource Recovery Facility is proposed to be located on a 240-acre site adjacent to the existing 118th Avenue county landfill.
5. It has been proposed that Pinellas County proceed with negotiations to have UOP design, construct, and operate the Pinellas County Resource Recovery System for 20 years. Financing will be arranged by Pinellas County, with the most likely financing technique consisting of the sale of long-term revenue bonds.
6. The proposed facility will have the capability to process 14,000 tons of solid waste per week and be designed to allow for further expansion. The county will guarantee the delivery of at least 36,000 tons per month of solid waste to the plant. The facility will process solid waste to generate steam from which electric power will

be produced for sale to FPC. The combustion residue will be processed to recover ferrous metals, aluminum, heavy non-ferrous metals and aggregate. UOP will manage and operate the entire facility. In return, it will receive 20 percent of the generated electricity and recovered materials revenues and $6.06 per ton as an operator's fee. The residue of the process, after the energy and materials recovery, will be landfilled by the county at its landfill location adjacent to the site. It is estimated the resource recovery process will reduce the solid waste 95 percent by weight so that the amount of residue requiring landfilling will weigh only five percent of the tonnage of raw waste entering the facility.

7. The capacity of the resource recovery facility should be expanded by the year 1990 to meet the projected increase in solid waste generation. The capacity should be expanded to at least 16,000 tons per week to handle the year 2000 waste generation.
8. Pinellas County should investigate the feasibility of establishing solid waste transfer stations at appropriate locations within the county to equalize transportation cost for waste collectors from various parts of the county to the resource recovery facility.
9. Pinellas County should maintain an effective solid waste resource recovery public relations and education program so that the general public and the affected parties associated with solid waste management are made aware of the facts of the program, including the expected increase in overall solid waste collection an disposal costs.
10. Pinellas County should establish administrative rules delineating its powers and responsibilities under Florida Statue, Chapter 75-487, Pinellas County Solid Waste Disposal and Resource Recovery Act.
11. The Pinellas County Solid Waste Management Department should have administrative control of all solid waste disposal in Pinellas County.
12. The Pinellas County Board of County Commissioners should expand the licensing of all private solid waste collectors operating in the unincorporated portions of Pinellas County to coordinate service areas and types of service in order to ensure the proper coordination of collection in relation to the delivery of waste to the resource recovery and disposal facility.
13. If enacted, regulations covering the licensing of private waste collectors should be based on documentation confirming that private collectors have adequate financial capability and management experience to provide the waste collection services.

Policy Recommendations

1. The responsibility of the Solid Waste Technical Management Committee (TMC) for Pinellas County should be expanded to include the evaluation of problems associated with solid waste collection and transport as well as its present responsibilities concerning resource recovery and disposal.
2. The collection and transport of solid waste should remain the responsibility of local jurisdictions whether the system be municipal collection, franchised private collection or licensed private collection.
3. It should be required that all individuals, organizations, and governments within Pinellas County use the services of the Pinellas County Resource Recovery and Solid Waste Disposal System.
4. All processible solid waste within Pinellas County should be delivered to and processed at the Pinellas County Resource Recovery and Disposal Facility.
5. The existing sanitary landfill operations within the county should be phased out when the Pinellas County Resource Recovery and Solid Waste Disposable Facility becomes operational, except as authorized by the BCC.
6. Studies should be conducted by local governments in Pinellas County to improve the efficiency of solid waste management practices.
7. Results of solid waste management studies should be presented to the TMC for solid waste and the Pinellas County Planning Council to enable the jurisdictions of Pinellas County to have access to more cost-efficient methods for solid waste collection.
8. New technology in solid waste management practices should be disseminated to all waste collectors through the TMC for solid waste.

Analysis of Existing Conditions

Background Data

Planning Area Jurisdiction

Pinellas County is located on the west coast of central Florida. It is bound on the north by Pasco County and on the east by Hillsborough County. Two-thirds of the county is peninsular with the Gulf of Mexico to the west and Tampa Bay to the east. Its location in central Florida is shown in Figure 1.

Pinellas County contains 24 municipalities, each with its own interests, responsibilities, and powers. The county's total area is 280 square miles. These municipalities vary in size from less than one-tenth of a square mile to over 55 square miles. In addition to the 24 municipalities, unincorporated areas cover about 140 square miles within which some 223 thousand persons reside. The BCC exercises power in the unincorporated areas that are similar to the powers exercised within cities by councils or commissions. The locations of the cities and unincorporated areas in Pinellas County are shown in Figure 2.

Prior to 1975, each governmental jurisdiction in Pinellas County had independent responsibility for its solid waste management including both collection and disposal problems. As Pinellas County became more urbanized in the 1950s and 1960s and as landfill regulations were established in Florida, many of the cities began closing their dumping facilities because they did not have acceptable locations available for dumps or landfills. The closing of many city dumps put an additional load on the two largest landfills in the county, Toytown operated by St. Petersburg, and the county's Bridgeway Acres landfill. By the early 1970s, it became apparent in Pinellas County that a countywide approach to solid waste management was necessary and an integral requirement of this approach would be to find a suitable alternative to disposal by landfilling.

[Figure 1, Planning Area Locations]

[Figure 2, Pinellas County Governmental Jurisdictions]

The planning authority for solid waste management and resource recovery in Pinellas County is obtained through several legal mandates and administrative codes. Pinellas County has been designated as a county required to develop a Resource Recovery and Management Program in accordance with Chapter 17-7, Part B, administrative rules of the Department of Environmental Regulation and Florida Statutes, [Section] 403.701.

The BCC for Pinellas County, in accordance with Florida Statutes 75-487, *Pinellas County Solid Waste Disposal and Resource Recovery Act*, is given the responsibility to plan for a solid waste disposal and resource recovery system in conjunction with its development and operation. Under this act, the BCC for Pinellas County was given the power to develop a solid waste disposal and resource recovery system for the county, to prohibit the operation of solid waste disposal systems by other entities in the county, to finance, operate or contract to operate the systems and require all persons and municipalities to use the services of the resource recovery facility. The PCPC, through its special legislation, has as one of its responsibilities the development of a countywide comprehensive plan and overall development policy document. The PCPC

is currently developing and adopting a *Countywide Comprehensive Plan* which is countywide in scope. It includes all elements required by the LGCPA of 1975, one of which is a solid waste element. By Resolution 79-2, the PCPC will incorporate into its solid waste plan element the Pinellas County Solid Waste Disposable and Resource Recovery System selected by the BCC.

Physical Conditions

The Physical Conditions section briefly describes the major environmental features of Pinellas County which must be considered in a comprehensive planning process. The major reference document has been the *Conservation of Natural Resources and Coastal Zone Management Element of Countywide Comprehensive Plan for Pinellas County.* This element provides natural resource based information for all the general plan elements and is recommended as a resource document for more detailed natural resource information on Pinellas County.

Geology[1]

The subterranean geology of Pinellas County consists of stratified layers created primarily by marine mechanisms. The surface is underlain by several solution riddled limestone formations that dip southward through the county. Two formations reach the surface in Pinellas County: the Hawthorne and Tampa formations, while a third the Suwannee, is beneath the surface throughout the county. See Figure 3 for a geological cross-section of Pinellas County. These formations in conjunction with older formations in inland Florida form the Floridan Aquifer, which is the principle source of all fresh water used in central Florida for municipal, industrial, and agricultural needs.

[Figure 3, North South Geological Cross Section Pinellas County, Florida]

The Suwannee is the oldest formation of significance to the county. It is found at depths of 100 feet in the north and dips to over 250 feet deep in the southern part of the county. The formation consists of porous limestone formed during ancient (Oligocene) times.

The Tampa Formation also underlies the entire county. It reaches from the surface north of the unincorporated Palm Harbor area, and it dips to a depth of over 100 feet in the south county with two high areas: the "Coachman High" and the "St. Petersburg Plateau." The formation consists of hard limestone intermixed with granules of sand and phosphate. It varies in thickness from only 20 feet in the north to 150 feet in the

south. The Tampa Formation limestone also has many solution channels which store vast quantities of water.

The Hawthorne Formation, which is the upper geological stratum, is composed of layers of sandy clays. The formation defines the subsurface shape of the Pinellas Ridge, the highest topographic area of the county which extends from north of Dunedin, south to the Seminole area and east to St. Petersburg. The Hawthorne Formation is only about 10 feet thick in the north but over 100 feet thick in St. Petersburg.

Surface sands are found on top of the Hawthorne and Tampa formations which formed over time by erosion and sedimentation when sea levels were at stable elevations. This formed marine terraces of level deposits consisting primarily of sands and shells with occasional deposits of clays and decayed organic matter.

Soils

The upper geological formations in Pinellas County are covered with sand ranging from several feet to more than 50 feet in thickness.[2] These sandy soils are usually not influenced by the underlying geological formations. The sandy soils were formed by marine sedimentation deposited by Gulf currents in four terraces associated with different sea levels. Each terrace is covered by a mantle of quartz sand. Where sands have supported vegetation during marine fluctuation, organic deposits are found. The depth to water table has affected the formation of these organic soils. The soils tend to be sandy, acidic, having low natural fertility and often containing poorly defined low permeability hardpan clay layers.

In 1968, the soils of Pinellas County were studied and mapped by the Soil Conservation Service of the U.S. Department of Agriculture. The general soil associations from this study are shown in Figure 4. The properties and drainage of a soil determine its limitations for residential, industrial, transportation, recreation and other types of land use.

[Figure 4, General Soil Associations and Drainage Characteristics Pinellas County, Florida]

Climate

Pinellas County has pleasant temperature conditions. The annual average temperature is 73.9 degrees Fahrenheit (F). The average for January, the coolest month, is 62.2 degrees F and the average for July is 84 degrees F. Normally, temperatures range from

70 degrees to 90 degrees F in the summer and 32 degrees to 75 degrees F in the winter.[3] Available statistics indicate Pinellas County has a very sunny climate. On average, there are 223 sunny days a year in the area. Prevailing winds across the county are usually from the east at an average of approximately nine miles per hour. Daily rainstorms often occur in the summer. The amount of rainfall during the four summer months amounts to over 60 percent of the yearly rainfall average of 54 inches. The spring months usually exhibit below average rainfall to the extent that drought often occurs. The county's humidity ranges from 30 to 90 percent. Winter levels are usually low, and summer humidity levels are almost always fairly high. The Tampa Bay area is considered the nation's lightning capital, having an average of 90 days with thunderstorms a year. Tropical storms are one of the most important storms affecting Pinellas County. Records from 1900 to 1964 indicate that hurricanes come within a 50-mile radius of the county once every 6.5 years.

Drainage Basins[4]

Pinellas County's drainage basin boundaries are somewhat difficult to define due to the county's high surface water table, its low relief topography, and drainage changes from extensive urbanization. The PCPC developed a countywide *Master Drainage Plan* which identifies 52 drainage basins in the county, as illustrated in Figure 6. Generally speaking, in the southern section of the county, the streams draining from the Pinellas Ridge and uplands of St. Petersburg empty into the Gulf of Mexico, Lake Seminole, and inter-coastal bays. The low lying areas of south county drain east into Cross Bayou and Tampa Bay. In the north county, the basins drain from the ridge flowing west into the Gulf and east into upper Old Tampa Bay and Lake Tarpon. The East Lake Tarpon area drains westward into the lake and southward into the Safety Harbor/Oldsmar area.

[Figure 5, Surface Water Collectors]

[Figure 6, Master Drainage Plan Basins]

Flood Prone Areas

Flooding potential is a major problem in Pinellas County due to its low coastal topography, its location on the Gulf of Mexico, and the area's tendency for tropical storms which often cause riverine and tidal flooding. The flood hazard in Pinellas County has been stratified in a flood hazard hierarchy.[5] The hierarchy is described in Figure 7. The flood hazard areas are designated into two general categories. The first is preservation areas where no urban activity is recommended such as wetlands, bays, waterways and shorelines, and areas seaward of the Coastal Construction Control

Line. The secondary flood hazard category, conservation areas, consists of lands in the hurricane velocity zone, below the five-foot contour and lands within the FIA 100-year floodplain. Other conservation areas designated with lesser flooding hazard are those subject to infrequent flooding and lands with high water table. Figure 8 shows the major flood prone areas in Pinellas County, included within the 100-year floodplain, as designated by the federal Flood Insurance Administration.

Existing Conditions

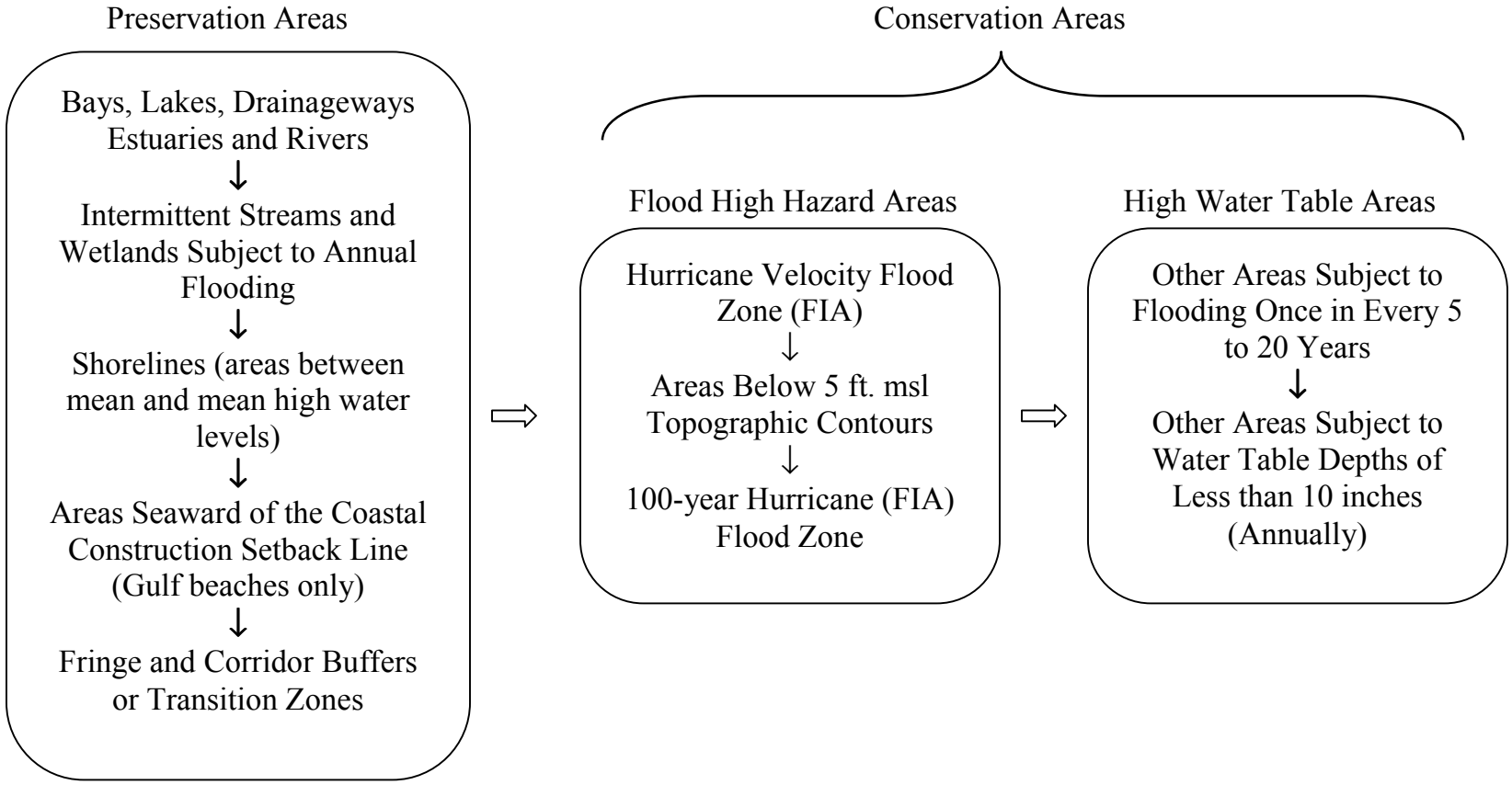
Population

Pinellas County is a highly urbanized county with an estimated total resident population of 818,548 as of April 1, 1979. Pinellas County has the third largest population in the State of Florida, but is the second smallest county in area. These characteristics combine to make Pinellas the most densely populated county in Florida.

The population is distributed amongst 24 municipalities as well as the unincorporated county. As of 1979, 594,728 persons reside in municipalities while 223,820 persons reside in portions of unincorporated Pinellas County. The municipalities vary greatly in population from St. Petersburg with 264,790 persons to Belleair Shore with 128 residents. A summary of resident population for the 25 political jurisdictions in Pinellas County is given in Figure 9.

The recreation/retirement orientation of the area has attracted a large number of retired persons into the county. The resulting age structure shows much higher proportions in the older age groups and much lower in the younger age groups than the national average. In 1975, persons 65 and older accounted for 33.7 percent of the population compared with 10.7 percent of the national population.[6]

Figure 7
Flood Hazard Hierarchy



Source: Pinellas County Department of Planning, 1979

[Figure 8, Flood Prone Areas]

Figure 9
Summary of Resident Population♠ Estimates
Pinellas County, Florida, April 1, 1979

Belleair	4,360
Belleair Beach	2,200
Belleair Bluffs	3,550
Belleair Shores	128
Clearwater	92,180
Dunedin	34,020
Gulfport	13,410
Indian Rocks Beach	4,360
Indian Shores	2,110
Kenneth City	4,780
Largo	63,090
Madeira Beach	5,490
North Redington Beach	1,550
Oldsmar	2,790
Pinellas Park	37,690
Redington Beach	1,990
Redington Shores	2,940
Safety Harbor	6,670
St. Petersburg	264,790
St. Petersburg Beach	12,210
Seminole	5,940
South Pasadena	5,090
Tarpon Springs	14,570
Treasure Island	8,820
Total Incorporated	594,728
Unincorporated	223,820
Total County	818,548

♠ Resident population is the sum of permanent and seasonal populations. Permanent population is the number of persons living within the county who consider it their usual place of residence. Seasonal population is the number of persons, other than permanent residents, living in year-round housing units at the time of the estimates.

Source: PCPC, *Population Estimates, Pinellas County*, 1979

Solid Waste Quantities and Types

Solid Waste Quantities

The base year of measured solid waste generation in Pinellas County was 1975. The total tonnages of solid waste disposal at the Pinellas County and St. Petersburg landfills were weighed before disposal. The total tonnage at the Largo and Tarpon Springs landfills were estimated from load records. Figure 10 indicates the total tonnages of solid waste disposed at the four sanitary landfills in Pinellas County for the year 1975.

Figure 10
Total Waste Tonnages for Pinellas County – 1975

Source	Total Tonnage
Pinellas County (Wells Brothers)	179,294
Toytown (City of St. Petersburg)	193,646
Largo	44,000
Tarpon Springs	11,000
Total:	527,940

Source: Henningson, Durham and Richardson, *Solid Waste Energy and Resource Recovery,* 1976

The solid waste generations were determined for individual cities in Pinellas County having municipal collection systems and disposal at the two major landfills. These figures were determined from landfill records for the year 1975. Figure 11 indicates solid waste generation by municipality.

The records of the City of St. Petersburg were used to establish the residential, commercial and debris proportions of the total generated solid waste flow. It is assumed the City of St. Petersburg is a representative area for the county. The City has approximately 35 percent of the countywide population and generates 36 percent of the solid waste. Figure 12 shows the tonnage breakdown of residential, commercial, and debris solid waste in St. Petersburg for the year 1975.

Figure 11
Solid Waste Generation by Municipality

City	Total 1975 Tonnage
St. Petersburg	188,780
Clearwater	61,321
Dunedin	17,404
Belleair	1,782
Madeira Beach	3,917
Safety Harbor	2,614
Treasure Island	5,286
St. Petersburg Beach	9,591
Gulfport	5,688

Source: Henningson, Durham and Richardson, *Solid Waste and Energy Resource Recovery,* 1976

Figure 12
Solid Waste Quantities – City of St. Petersburg

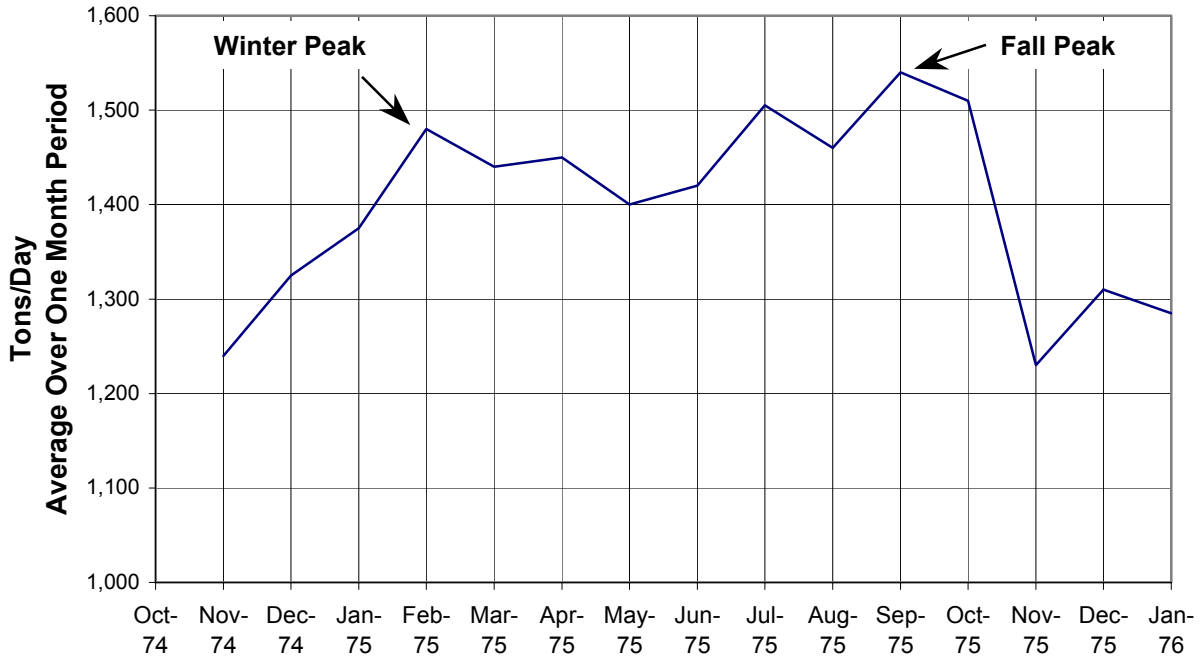
	Tonnage	Percent Distribution
Residential	97,060	51%
Commercial	63,907	34%
Debris	28,483	15%
Total	189,450	100%

Source: Henningson, Durham and Richardson, *Solid Waste Energy and Resource Recovery,* 1976

Seasonal Variations

Figure 13 illustrates the seasonal variation that occurs in solid waste generation in Pinellas County. The graph indicates that two peaks occur during the yearly cycle. One peak occurs during the winter (January) and the other at the beginning of fall (September). The winter peak of solid waste generation is attributable to the winter tourist season in Pinellas County and the fall peak is due to increased yard debris from summer vegetation growth.

Figure 13
Solid Waste Seasonal Variation - Pinellas County, 1975



Source: HDR, Solid Waste Energy & Resource Recovery, 1976.

Solid Waste Composition

During 1975, the City of St. Petersburg Sanitation Department determined the composition and fuel value of solid waste in conjunction with the countywide solid waste management and resource recovery program.[7] Samples were collected and sent to the Bureau of Mines Laboratory in Washington, D.C. where its composition was determined and its combustible fraction was separated and analyzed for heat value, moisture, sulfur, chloride and ash content. The composition of the solid waste is given in Figure 14; Figure 15 also indicates its combustible fraction analysis. The heat value in combination with the moisture and ash content determines the suitability of the solid waste as a fuel. The sulfur, chloride and ash content impact on the extent that exhaust pollution control devices would be required in a resource recovery system. Sulfur and chlorides also have a corrosive effect on boiler systems. The fine combustibles listed in Figure 15 are mostly grass clippings which are seasonal components of the solid waste stream. The Pinellas County solid waste consultant estimates the fuel value of the combustible fraction would range from approximately 5,830 to 6,040 BTU/lb. or an average of 5,935 BTU/lb.[8]

Figure 14
St. Petersburg Solid Waste Composition (Percent by Weight)

Solid Waste Materials	Percent of Total
Combustible Materials	(84.98)
Paper	31.41
Plastic	1.33
Wood	1.92
Textile	2.85
Rubber	-
Yard Waste	46.68
Food Waste	.79
Non-Combustible Materials	(15.02)
Glass	5.73
Ferrous	5.43
Aluminum	1.02
Other Metal	-
Miscellaneous	2.84
Inorganic	-
Totals	100.0

Source: Henningson, Durham and Richardson, *Solid Waste Energy and Resource Recovery,* 1976

Storage, Collection and Management Practices

The 25 governmental jurisdictions in Pinellas County have three types of collection arrangements. Eleven of the cities have their own municipal collection systems. Thirteen of the cities have franchise agreements with private solid waste collectors. The unincorporated sections of Pinellas County operate under a private enterprise system of solid waste collection in which licensed private collectors establish their own collection fees, service areas, collection schedules, and storage container requirements. Figure 16 shows the type of collection system, the service area and the collection operator for the 25 jurisdictions in Pinellas County. This data was obtained from the TBRPC study, *Solid Waste Resource Recovery*, June 1975. This study includes detailed solid waste collection inventory data for the 24 cities and the unincorporated area of Pinellas County.[9]

Figure 15
Bureau of Mines Analysis – St. Petersburg Solid Waste Combustibles

	BTU/lb.	H_2O (%)	Ash (%)	S (%)♠	Cl (%)♦
Cyclone No. 1 Screened and Reshredded Through 2 inch	7,010	16.8	7.4	0.1	0.4
Cyclone No. 2 Screened and Reshredded Through 2 inch	6,240	19.8	9.7	0.1	0.2
Cyclone No. 3 (minus 2 inch)	7,200	14.6	6.6	0.2	0.4
Three-State Aspirator Heavy Non-Conductors	4,970	41.9	3.6	0.2	0.3
Jig Overflow (Putrescibles and Yard Wastes)	3,480	50.0	11.5	0.1	0.2
Fine Combustibles	4,860	26.4	20.3	0.1	0.3
Composite Total Combustibles	5,830	25.2	10.3	0.2	0.3
Composite Total Combustibles (without yard waste)	6,040	24.9	8.3	0.2	0.3

Source: Henningson, Durham and Richardson, *Solid Waste Energy and Resource Recovery*, 1976

Transportation Routes Available for Use

Pinellas County being a highly urbanized county, has a well-developed public roads network for the collection and transportation of solid waste to disposal sites. There are over 3,000 miles of roads in the county consisting of approximately 600 miles of major and minor facilities, and 2,400 miles of local streets. Figure 17 indicates the major highway network of Pinellas County. Several of the major roads are hampered with high traffic volumes; however, proportionately solid waste transport adds very little to the overall traffic volume in the county.

The Metropolitan Planning Organization (MPO), the transportation planning agency for Pinellas County, has developed the county's long-range transportation plans as well as its five-year implementation programs. The county's long-range transportation plan is designed to resolve some of the traffic congestion problems on the major roadways.

The Tampa Bay Regional Planning Council has in its regional study, *Solid Waste Resource Recovery*, determined potential railroad and barge routes available if solid waste transportation was to be done on a regional basis.[10] These railroad and barge routes are depicted in Figure 18.

Figure 16
Pinellas County Collection Systems

Jurisdiction	System[1]	Service Area	Operator
Pinellas County	P	Unincorp. Area	N/A
Belleair	M	City Limits	City of Belleair
Belleair Beach	F	City Limits	Wells Brothers, Inc.
Belleair Bluffs	F	City Limits	Vita Signorile
Belleair Shores	F	City Limits	Wells Brothers, Inc.
Clearwater	M	City Limits	City of Clearwater
Dunedin	M	City Limits	City of Dunedin
Gulfport	M	City Limits	City of Gulfport
Indian Rocks Beach	F	City Limits	Environmental Services
Indian Shores	F	City Limits	Wells Brothers, Inc.
Kenneth City	F	City Limits	Wells Brothers, Inc.
Largo	M	City Limits	City of Largo
Madeira Beach	M	City Limits	City of Madeira Beach
North Redington Beach	F	City Limits	Wells Brothers, Inc.
Oldsmar	F	City Limits	Environmental Services
Pinellas Park	F	City Limits	Wells Brothers, Inc.
Redington Beach	F	City Limits	Wells Brothers, Inc.
Redington Shores	F	City Limits	Wells Brothers, Inc.
Safety Harbor	M	City Limits	City of Safety Harbor
St. Petersburg	M	City Limits	City of St. Petersburg
St. Petersburg Beach	M	City Limits	City of St. Petersburg Beach
Seminole	F	City Limits	Wells Brothers, Inc.
South Pasadena	F	City Limits	Imperial Carting
Tarpon Springs	M	City Limits	City of Tarpon Springs
Treasure Island	M	City Limits	City of Treasure Island

[1] P = Private Firms in Competition; F = Franchise; M = Municipal

Source: Pinellas County Solid Waste Management Department, 1979

[Figure 17, Pinellas County Major Highway Network]

Disposal Facilities

There are four sanitary landfills and six debris fills currently in operation in Pinellas County. Several of these fills are operating with temporary permits from the Department of Environmental Regulations. Figure 19 lists the names of the debris fills and sanitary landfills in Pinellas County as well as the site locations.

The Pinellas County solid waste consultants assessed the solid waste disposal sites throughout the county as of 1976. This study contained the following evaluations:

- Tarpon Springs currently owns and operates a sanitary landfill (4S) on a 70-acre site located in the southeast corner of the city. The landfill is near capacity and has a high water table. There are very few improvements in existence at the site.… There are no scales at the Tarpon Springs sanitary landfill, however, estimated tonnage for this facility is 11,000 tons of solid waste per year.

[Figure 18, Potential Rail Haul & Barge Operations in the Tampa Bay Region]

[Figure 19, Locations of Existing Disposal Sites]

- The City of Largo currently operates a sanitary landfill (3S) on a 60-acre site located south of East Bay Road at Highland Road extended.… Although there are no scales at this site, tonnages for this facility are estimated to be 44,000 tons of solid waste per year.
- The City of St. Petersburg operates the Toytown landfill (1S) which is the largest sanitary landfill operation within the county. The land is leased from the county by the City of St. Petersburg and serves the Cities of Clearwater and St. Petersburg as well as private users in the county. The Toytown sanitary landfill was designed to operate in two phases. Phase one was completed in the fall of 1978. Phase two is designed to last through 1983. A shortage of cover material may restrain Phase II operations. The cover areas are being contoured for eventual use as a golf course and recreational area.… Over the scale tonnages were approximately 290,000 tons in 1975.
- The Toytown sanitary landfill has complete leachate control facilities, monitoring wells and scales as well as sludge holding ponds. Approximately 215,000 gallons of sludge are brought to the site daily for disposal. Sludge is pumped from the holding ponds at Toytown across I-75 to the city sod farm where it is utilized as fertilizer. Phasing out of part of the sludge-sod farm operation is anticipated due to other needs for lagooning sludge.

- The Pinellas County Bridgeway Acres sanitary landfill (2S) is on county land and is operated on a contract basis by Wells Brothers, Inc., a private firm. This site is referred to as the Wells Brothers site and is used by the remainder of the county's municipalities as well as most of the private haulers. During January 1976, a total of 18 private haulers and governmental units disposed their solid waste at the 118th Avenue site. The current landfill site consists of 230 acres. Operations have been underway at the present site since July 1977, although the county has maintained a landfill in the immediate vicinity for the past 10 years.… The scaled tonnage for 1975 was approximately 180,000 tons of solid waste.
- Sanitary landfills are currently the mode of solid waste disposal for Pinellas County. The four existing sites have limited future usefulness. The largest facility which is Toytown, will be completed in 1983. The county site will be utilized until the proposed resource recovery plant is built in 1983. The critical future parameter, however, is land availability. The other two landfills are expected to be completed prior to 1983.[11]

Land Use and Zoning

The PCPC has been emerging as a significant countywide planning agency since 1965. Further, the countywide CLUP, together with the *Countywide Comprehensive Plan* elements adopted by the Council, have the force and effect of law countywide. With the increased emphasis in planning resulting from a combination of state mandated comprehensive planning by local governments (LGCPA) and the PCPC's planning responsibilities, more orderly growth and improved existing neighborhoods can be anticipated for the future.

The 25 governments within the county have zoning powers within their respective jurisdictions. The zoning regulations of the jurisdictions must conform to the Pinellas County countywide CLUP.

Pinellas County's land use development trend has been similar to the other coastal areas of Florida. Three high growth periods have occurred for land development in Pinellas County. These have been the 1921-1925 boom period, the post World War II growth period, and the 1971-1973 period. The post war period which lasted until 1971, developed the predominant land use patterns in Pinellas County, which are single-family residential subdivision development, retail commercial along the major roadways and tourist-oriented land use on the Gulf beaches. The last boom occurred between 1971-1973 and resulted in a considerable increase in multifamily structures including condominiums and apartments.

Although Pinellas County is the most urbanized county in the state, as of 1975, approximately 47 percent of its land was vacant. However, approximately 35 percent of the vacant land is environmentally sensitive and is expected to be preserved in a somewhat natural state. Residential development takes up to 48 percent of the developed land in Pinellas County. Commercial land use comprises almost six percent of the developed lands which is a considerably higher percentage than commercial development for urban areas nationwide. Industrial land use comprises only 2.2 percent of developed land in Pinellas County. This is a much lower percentage than industrial land use nationwide which is on the average almost 20 percent of developed land.

The Pinellas County land use and zoning acreage distributions are shown in Figures 20 and 21. The data in Figure 20 indicates the existing land use distribution by planning sector and total county for the year 1975. Figure 21 indicated the generalized zoning category distribution for the year 1977 by the same area breakdown. (See Figure 23 for planning sector boundaries.) A generalized comparison of the two sets of data indicates that considerable undeveloped lands in Pinellas County have residential, commercial, industrial and agricultural zoning designations while the percentage of public/semi-public zoning is comparable to the percentage of the various existing "public" land uses.

Solid Waste Management Financial Systems

The solid waste management financial systems used in Pinellas County are dependent upon the type of collection system in use, and also whether the municipality has its own landfill. The 11 municipalities that have their own collection systems meet their collection, transportation, tipping fee or landfill maintenance expenditures by means of collection fees or by revenue from the general fund or combination of the two. In the unincorporated area of Pinellas County where solid waste collection is conducted by private haulers, the entire revenue fund is determined by the fee rate established and collected by the hauler. The third collection system used by 13 cities involves franchise contracts with private haulers. The contracted revenue to the hauler must be estimated to meet his collection, transport and disposal tipping fee expenditures. The cities contract expenditures are met by revenues from collection fees or from their general revenue funds or combinations of the two.

Figure 20
Generalized 1975 Pinellas County Existing Land Use
(Inclusive of Right of Ways)

Planning Sector	Single-Family	Multifamily	Mobile Home	Commercial	Public/Semi-Public	Utilities/ Transportation	Designated Open Space	Agriculture	Industrial	Vacant	Total
1	751	220	178	293	177	18	425	366	159	4,573	7,160
2	279	133	0	9	0	667	505	5,944	26	15,096	22,659
3	747	177	190	77	126	44	786	3,498	45	5,828	11,518
4	1,980	273	386	175	295	0	1498	395	54	2,487	7,543
5	1,003	57	87	166	123	233	291	1,111	88	4,192	7,351
6	7,260	1,294	639	1,619	798	311	1492	782	362	6,197	20,754
7	5,448	1,224	1,408	816	460	115	891	433	346	4,874	16,015
8	350	165	156	219	381	968	546	108	556	5,875	9,324
9	5,380	706	441	508	640	71	1,361	727	251	6,404	16,489
10	3,581	319	1,990	788	466	295	562	339	397	6,952	15,689
11	21,631	2,019	559	1,899	1,619	1,539	3,063	64	340	7,768	40,501
12	971	270	2	284	284	22	1,370	0	5	1,089	4,297
Total	49,381	6,857	6,036	6,853	5,369	4,283	12,790	13,767	2,629	71,335	179,300
Percentage	27.5%	3.8%	3.4%	3.8%	3.0%	2.4%	7.1%	7.7%	1.5%	39.8%	100.0%

Source: PPC, *Land Use Element - Pinellas County General Plan*,1979.

Figure 21
Generalized 1977 County Zoning (in acres)

Planning Sector	Total Acreage	Low♦ Density	Mobile Home	Medium♦ Density	High♦ Density	Commercial	Industrial	Public/Semi-Public	Agricultural
1	7,160	2,202	257	528	727	827	512	1,081	1,026
2	22,659	13,801	0	234	0	119	582	0	7,923
3	11,518	5,148	352	1,285	0	1,245	75	0	3,413
4	7,543	3,050	240	492	134	368	40	1,815	1,404
5	7,351	4,978	90	247	86	274	215	190	1,271
6	20,754	9,723	585	1,687	680	3,877	610	1,755	1,837
7	16,015	5,380	1,365	3,174	738	2,184	840	876	1,458
8	9,324	391	193	1,292	29	1,456	3,429	960	1,574
9	16,489	8,787	532	2,518	349	1,767	590	477	1,469
10	15,689	6,847	1,291	2,305	0	2,641	1,102	270	1,233
11	40,501	15,171	268	3,351	0	2,793	1,354	17,564♠	0
12	4,297	1,582	0	164	690	764	0	1,097	0
Total	179,300	77,060	5,173	17,277	3,433	18,315	9,349	26,085	22,608
Percent Distribution	100.0%	43.0%	2.9%	9.6%	1.9%	10.2%	5.2%	14.6%	12.6%

♠ In Sector 11 this category includes right-of-way (9,183 acres), open space (6,367) and other public/semi-public zoning uses; in many other sectors these uses have been aggregated into other zoning districts.

♦ Zoning densities within these categories correspond to the density ranges in the present *Comprehensive Land Use Plan*.

Source: PPC, *Land Use Element - Pinellas County General Plan,*1979.

Hazardous Waste Programs

The Pinellas County Board of County Commissioners (BBC) does not permit hazardous waste disposal at the existing sanitary landfills in Pinellas County. Hazardous waste will not be accepted for processing at the Pinellas County Resource Recovery Facility when it is in operation. At present, hazardous waste disposal in Florida is administered by the Department of Environmental Regulation (DER) whereby hazardous waste generators must contact DER to obtain a permit to dispose of the waste.

In 1976, the U.S. Congress passed the *Resource Conservation and Recovery Act* (RCRA) which requires the Environmental Protection Agency (EPA) to establish a regulatory program to control hazardous waste. A major feature of this legislation is to require states [to] develop and carry out their own hazardous waste programs subject EPA's authorization. The new regulations use the "pathways" approach by which hazard[ous] waste is to be controlled at all stages of its cycle. The State of Florida is presently preparing enabling legislation so that it has the legal authority to administer the hazardous waste regulations developed by EPA.

Pinellas County Area Disaster Plan

Pinellas County has a Natural Disaster Plan which is a coordinated part of the *Pinellas County, Florida Civil Defense Emergency Operating Plan.* Natural disaster refers to any storm, hurricane, flood, fire or other catastrophe resulting in damage, hardship or suffering. The term does not refer to any enemy attach or acts of sabotage. Federal, state, county or municipal authorities would participate depending on the severity of the natural disaster. The County Director of Civil Defense is the county coordinator of natural disaster operations. The major problems impacting on solid waste management during a natural disaster is the responsibility of the disaster support operations of the Pinellas County Public Works, Engineering and Solid Waste Management Department. These functions which are covered in the County Natural Disaster Plan are the removal of blockading refuse from streets and major roads of the county. The roads are to be opened as quickly as possible to aid transportation and recovery. This clearing work is done under the supervision of the Public Works Department and coordinated with municipal public works departments. The collection and disposal of regular garbage and trash must be made along with the debris from the natural disaster. Some prioritization of the two may be recommended by the County Health Department and instructions issued to countywide solid waste collectors.

The Pinellas County Solid Waste Management Department, in cooperation with the Health Department, should determine temporary emergency disposal sites for natural disaster debris in the event the Pinellas County Resource Recovery and Disposal System cannot process the debris as it is collected during the cleanup operations.

The natural disaster related plans for the Pinellas County Resource Recovery and Solid Waste Disposal Facility is being coordinated with the *Emergency Preparedness Element* of the *Countywide Comprehensive Plan for Pinellas County*.

Solid Waste Generation Projections

Population Projections, 1975–2000

The primary population projections used for the solid waste generation projections are those prepared by the PCPD and used throughout the *Countywide Comprehensive Plan* for population related projections.[12] These population projections are given in Figure 22.

Figure 22
Countywide Population Projections♠

1975	1980	1985	1990	1995	2000
744,870	811,900	872,850	926,650	999,140	1,063,560

♠ Permanent and seasonal residents: does not include tourists.

Source: Demographic Study, Pinellas County, Florida. 1978

The county has been divided into 12 planning analysis sectors (PAS). These sectors are shown on the map in Figure 23. The population has been projected in five-year increments for the years 1975–2000 in these planning sectors. This is given in the table of Figure 24. The population distribution for the years 1975 and 2000 is shown in Figure 25.

[Figure 23, Planning Analysis Sectors]

Figure 24
Population Estimates

Planning Sector	1975	1980	1985	1990	1995	2000
1	13,440	15,128	17,266	19,522	24,982	29,878
2	2,696	11,235	14,781	21,017	31,472	39,327
3	13,733	22,467	26,151	30,293	37,545	43,479
4	33,549	35,770	38,297	40,936	43,823	46,623
5	11,406	12,897	14,198	16,391	20,005	23,528
6	110,837	113,178	123,826	132,232	141,801	150,441
7	89,169	102,060	114,510	119,507	123,425	126,285
8	7,463	8,915	9,809	11,370	14,045	16,613
9	85,140	88,038	93,404	98,915	105,928	112,365
10	78,701	79,990	85,723	90,991	97,304	103,252
11	278,014	299,477	308,750	317,352	329,906	342,369
12	20,722	22,745	26,135	28,124	28,899	29,415
Total	744,870	811,900	872,850	926,650	999,135	1,063,560

Source: Demographic Study, Pinellas County, Florida, 1978.

[Figure 25, Population Distribution]

Solid Waste Generation Criteria

The Pinellas County solid waste consultants have investigated solid waste generation in Pinellas County, and have established solid waste generation criteria for waste generation projections.[13] The waste generation rates were determined for individual cities in Pinellas County from landfill records and population estimates. Figure 26 gives the waste generation rates for the cities in Pinellas County for which landfill records were available.

From the waste generation rates investigation, the consultant established the following solid waste generation criteria for countywide projection purposes. The following generation criteria, shown in Figure 27, were developed for use on a countywide basis. These values include all solid waste except junk autos, tires, sewage sludge, hazardous waste, and construction and demolition waste. It was assumed that the waste generation rates would remain constant through the year 2000.

Figure 26
Waste Generation Rates by City

City	Generation Rate lbs/Capita/Day
St. Petersburg	3.94
Clearwater	4.26
Dunedin	3.28
Belleair	2.42
Madeira Beach	4.24
Safety Harbor	3.20
Treasure Island	3.50
St. Petersburg Beach	4.68
Gulfport	2.35

Source: Henningson, Durham and Richardson, *Solid Waste Energy and Resource Recovery*, 1976

Figure 27
Pinellas County Solid Waste Generation Criteria

Residential	2.00 lbs/capita/day
Commercial	1.90 lbs/capita/day
Yard Waste	0.40 lbs/capita/day
Total	4.30 lbs/capita/day

Source: Henningson, Durham and Richardson, *Solid Waste Energy and Resource Recovery,* 1976

Projected Solid Waste Generation

The table in Figure 28 indicates the projected solid waste generation for Pinellas County between 1975 and 2000. The waste generation is shown as total tons generated per week. The criteria used is 4.3 pounds per capita per day. The solid waste generation projections have been made for the entire county and for the 12 planning analysis sectors. Each projection figure is calculated by multiplying the respective population by the generation criteria, 4.3 pounds per capita per day, to obtain the projected waste for the area in question. The projection data was converted to tons per week which is the most common waste generation time frame in use.

Figure 28
Projected Solid Waste Generation For Pinellas County
1975–2000 in Tons per Week♠

Planning Sector	1975	1980	1985	1990	1995	2000
1	202.3	227.7	259.8	293.8	376.0	449.7
2	40.6	169.1	222.4	316.4	473.6	591.9
3	206.7	338.1	393.6	455.9	565.0	654.4
4	504.9	538.8	576.4	616.1	659.5	701.7
5	171.7	194.1	213.7	246.7	301.1	354.1
6	1,668.1	1,703.3	1,863.6	1,990.1	2,134.1	2,264.1
7	1,342.0	1,536.0	1,723.4	1,798.6	1,857.5	1,900.6
8	112.3	134.2	147.6	171.1	211.4	250.0
9	1,281.4	1,325.0	1,405.7	1,488.7	1,594.2	1,691.1
10	1,184.4	1,203.8	1,290.1	1,369.4	1,464.4	1,553.9
11	4,184.1	4,507.1	4,646.7	4,776.1	4,965.1	5,152.6
12	311.9	342.3	393.3	423.3	434.9	442.7
Total County	**11,210.3**	**12,219.1**	**13,136.4**	**13,946.1**	**15,037.1**	**16,006.6**

♠ Based upon waste generation criteria of 4.3 pounds per capita per day.

Source: Pinellas County Planning Department, 1979

Summary of Solid Waste Generation Projections

The areas of significant projected solid waste generation are those areas of projected large population increases. Between 1975 and the year 2000, the greatest percentile [of] waste generation increase will occur in the northern undeveloped sectors of the county. These include planning sectors 1, 2, 3 and 5, with waste generation increases from 100 percent to 1,500 percent. The total county projected waste generation shows an increase of 39 percent.

Planning Sector 11 (St. Petersburg) indicates the greatest absolute increase of waste generation between 1975 and 2000 which is an increase of 969 tons per week. The projected waste generation increase is roughly proportional to the city size within each planning sector with the exception of Sector 9 which includes Seminole. Sectors 3, 9

and 2 indicate large waste generation increases due to the large amounts of undeveloped land and projected population growth rates in these sectors.

Countywide, the projected increases in solid waste generation is considerable with approximately 4,800 tons per week increase in generation by the year 2000 to a total of approximately 16,000 tons per week. This indicates that by the year 2000, the waste generation will increase by almost one-half over what it was in 1975. The projected solid waste generation and waste increase between 1975 and 2000 is graphically depicted in Figures 29, 30, and 31.

[Figure 29, Projected Waste Generation by Planning Analysis Sectors, 1975]

[Figure 30, Projected Waste Generation by Planning Analysis Sectors, 2000]

[Figure 31, Increase in Waste Generation by Planning Analysis Sectors 1975–2000]

Plan Formulation & Implementation

Countywide Resource Recovery and Solid Waste Disposal Plan

Introduction

The *Pinellas County Resource Recovery and Solid Waste Disposal Plan* has been developed over a period of three years. In 1975, the Pinellas County BCC began a search for a solution to the county's serious solid waste disposal problems. A study by Henningson, Durham and Richardson (HDR), the county's solid waste consultant, investigated the feasibility of a resource recovery system for the county. During the same year, the county selected a site adjacent to its landfill as the location for its future resource recovery and solid waste disposal system. In 1977, resource recovery design requirements were established and request of proposals were issued to firms offering proven resource recovery technology. By early 1978, six proposals were received and evaluated with the UOP system recommended for selection. In February 1978, The BCC selected UOP as the contractor to design, construct, and manage the Pinellas County Resource Recovery System and authorized contract negotiations to begin.

The *Countywide Resource Recovery and Solid Waste Disposal Plan* is presented in this chapter under sections. These sections are as follows:

Technology Options – This contains a description of the technology available to Pinellas County for resource recovery.

Market Evaluation and Selection – This is a summary of the energy and materials market analysis conducted as part of the Pinellas County resource recovery feasibility study.

Evaluation and Selection of Resource Recovery System – This selection summarizes the major findings and recommendations of the evaluation of the system proposals submitted to Pinellas County.

Pinellas County Resource Recovery and Disposal System – This section contains a written and graphical description of the resource recovery system proposal by UOP, Inc.

Technology Options

A preliminary step in the development of the Pinellas County Resource Recovery and Solid Waste Disposal Program was to review and assess the state-of-the-art resource recovery technologies that are available. This review was made in considerable detail in the TBRPC study, *Solid Waste Resource Recovery* and the HDR study, *Solid Waste and Energy Resource Recovery for Pinellas County, Florida*. The following summary review has used these two reports as major references.

Resource recovery systems can be grouped into the two major resources found in solid waste. These are combustible wastes, which are potential energy resources and metals and glass, which are considered material resources. Figure 14, St. Petersburg Solid Waste Composition, indicates the percentile make up of typical Pinellas County solid waste.

Energy Recovery Systems

There are four different systems that were considered for resource recovery facilities. Three of these are variations of direct combustion systems by which the solid waste is burned to generate steam for use as an energy source. The fourth system is pyrolysis which is a high temperature distillation process which chemically breaks down combustible solid waste to a usable oil or gas product.

Direct Combustion Methods of Energy Recovery

1. *Mass Burning* – This method consists of the incineration of unprocessed solid waste at about 1,500 degrees F on a grate system in a waterwall furnace. Boilers recover the heat of combustion to generate steam energy which can be used in the operation of the resource recovery facility or sold to industrial customers as a heat or power source. The steam can also be used to generate electricity by providing the power to drive turbine electric generators.

   The use of mass burning waterwall furnace incineration for steam generation has been used successfully in Europe for over 50 years, and has been used successfully in the U.S. since 1970. The large capacity mass burning technology is the most proven of energy recovery systems. The large capacity plants are most suitable for highly urbanized areas where there is a high volume, steady waste generation and where the plant can more likely be located close to steam customers because the steam cannot be transported more than one to two miles.

2. *Dry Shredded Fuel Systems* – The principal of this method is to process the solid waste by shredding and separating it into combustible and non-combustible fractions. The shredded combustible solid waste is used as a refuse derived fuel in a standard utility or industrial steam boiler. The combustible fraction is usually approximately 80 percent of the solid waste, the remaining 20 percent can be processed for materials recovery with landfill disposal of the non-recovered fraction. The shredded refuse derived fuel can be used in conjunction with coal fired boilers. It can represent 10 to 20 percent of the total fuel consumption. The burning of shredded refuse derived fuel with fossil fuels has been successfully practiced in Europe. However, in the U.S., the design of oil-fired boilers does not lend itself to burning refuse fuel as part of the boiler fuel.

3. *Wet Pulped Fuel Systems* – The concept of this system is different from dry shredding only in the preparation of the solid waste derived fuel. This is done by a wet grinding and dewatering process commonly used in the paper industry. This process mixes the solid waste with water into a slurry. Non-pulpable items such as metals, glass and stone are removed and the waste is then pulped. The pulp is dewatered and dried after which it can be used as dry shredded fuel, a supplemental fuel in coal-fired boilers.

   The wet process refuse derived fuel is a good product in regard to its fine particle size and the separation of non-combustibles. However, it has several disadvantages. The process requires a separate processing facility for the non-combustible items and the fuel has a high (50%) moisture content which causes it to have a relatively low heat value of approximately 3,500 BTU/lb. Figure 32 lists several direct combustion systems that have been developed in this country in the last decade.

Pyrolysis Systems

The pyrolysis process for energy recovery from solid waste is basically different than direct combustion techniques. Pyrolysis of solid waste chemically decomposes the organic fraction of the waste to usable liquid or gaseous fuels. This is done by heating the solid waste at very high temperatures (up to 3,000 degrees F) in an air free atmosphere. This process requires considerable heat energy to maintain the high temperatures required for decomposition of the solid waste. Pyrolysis requires front-end shredding to separate the organic fraction from the inorganic fraction, and to reduce the organic material to small particle size for efficient decomposition.

Figure 32
Direct Combustion Systems

Location	Fuel Preparation	Contractor	Capacity♠	Products	Start Up Date
Nashville, Tenn.	Mass Burning	Nashville Thermal I.C. Thomasson Co.	720 TPD (2 units)	Steam	1974
Saugus, Mass	Mass Burning	RESCO Wheelaborator-Frye	1,200TPD (2 units)	Steam Ferrous Metals	1975
Harrisburg, Pa.	Mass Burning	Harrisburg Incinerator Authority	720 TPD	Steam	1973
Ames, Iowa	Processed fuel burning (Supplemental Fuel)	City of Ames, Gibbs, Hill, Durham and Richards	200 TPD	Electricity Ferrous Metal; Aluminum	1975
Chicago, Ill. NW Incinerator	Mass Burning	City of Chicago Joseff Martin	1,600TPD (4 units)	Steam	1972
East Hamilton Ontario, Canada	Processed fuel burning		600 TPD	Steam	1974
Chicago, Ill.	Processed fuel burning (Supplemental Fuel)	City of Chicago Ralph M. Parsons Co & Consoer, Townsend	1,000 TPD	Electricity Ferrous Metal	1976
Milwaukee, Wis.	Processed fuel burning (Supplemental Fuel)	City of Milwaukee American Can Co.	1,600 TPD (Max.)	Electricity Ferrous Metal	N/A
Norfolk, Va.	(Steam)	U.S. Navy	N/A	Steam	1972

♠ Tons Per Day

Source: HDR, *Solid Waste Energy and Resource Recovery,* 1976

Gaseous and liquid fuels obtained from pyrolysis of solid waste can be used as substitutes for fossil fuels at locations separate from the resource recovery facility. While oil fuels are readily transportable, gaseous fuels require a pipeline from the pyrolysis facility to the consumer. Fuels produced from pyrolysis of solid waste are clean fuels, being nearly free of sulfur and nitrogen oxides. Pyrolytic gases have heat

values approximately 30 percent that of natural gas while pyrolytic oils have heat values approximately 64 percent that of fuel oil. The pyrolysis method has certain advantages compared to the direct combustion technique for energy recovery. The residue of pyrolysis is only six percent of the solid waste input volume compared to 10 percent for direct combustion techniques. Pyrolysis does not need extensive air emissions control devices as do direct combustion systems. The energy product is gaseous or liquid fuel which has better transportation potential than the steam energy of direct combustion systems. However, pyrolysis has the disadvantage that it remains to be a proven system for a large scale facility. There are no large-scale continuously operating pyrolysis systems in the U.S. at this time. Figure 33 lists several large-scale pyrolytic systems that have been under development during the 1970s in this country.

Figure 33
Large Scale Pyrolysis Systems

Location	System	Capacity*	Cost $Million	Status	Comment
Baltimore Maryland	Monsanto Landgard	1,000 TPD	16.2	Shakedown Air Emission Problems	EPA Sponsored Project - $6.4 million req'd for Esp. Equip
South Charleston, West Va.	Union Carbide	200	Unknown Private	Demonstration Plant since April, 1974	Private Development
San Diego, California	Occidental Petroleum	200	14.4	Under Construction	EPA Sponsored Project
Erie County New York	"Torrax"	75	Unknown	Demonstration Plant – Closed	EPA Sponsored Project – Sold Three Systems
* Tons per day					

Source: Henningson, Durham and Richardson, *Solid Waste Energy and Resource Recovery,* 1976

Electricity Generation

All the energy recovery systems that produce high pressure steam have the potential for electricity generation. There are several prototype energy recovery systems in this country, however, none of the large scale direct combustion systems that are operating also generate electricity. Several of the large-scale European resource recovery facilities are co-generation systems which produce steam for an industrial power source and also to drive turbo generators for electricity generation. These facilities have been in operation since the early 1970s. The generation of electricity is feasible for a large-scale urban resource recovery system that has a large continuous waste flow containing fairly high heat value solid waste. The planning of a resource recovery system with electrical generation is more complex in that several added arrangements must be made. Agreements must be made with the local power utility to interface the

generated electricity with the utility's grid system. The facility must be located reasonably close to the utility's distribution system, and an agreement to purchase the generated electricity should be made as part of the resource recovery program development.

Materials Recovery Systems

Materials recovery systems consist of electro-mechanical sorting devices that sort out the major materials in solid waste that usually have marketable value. These are, in descending order of value per ton of raw solid waste, ferrous material mainly in the form of tin cans, aluminum also in can form and glassy aggregate, the latter often having marginal market potential.

Materials recovery systems can be front-end systems which separate and recover marketable, non-combustible materials before energy recovery, or back-end systems that separate and recover marketable materials after the energy recovery process. The ferrous metal recovery systems are the only proven technologies which have been in use for considerable time. Aluminum recovery systems have only been partially successful in pilot plant situations. Brief descriptions of basic materials recovery subsystems are give in Figure 34.

Market Evaluation and Selection

The potential markets for recoverable energy and materials were identified and evaluated for the Tampa Bay area of Florida.[14] Pinellas County's solid waste consultants verified the market evaluations and selected specific markets for recoverable energy and materials as a component of the resource recovery study for Pinellas County.[15]

An important step in the determination of the Pinellas County resource recovery system is the evaluation of the energy and materials markets in the county and within the greater Tampa Bay area. General resource recovery revenue studies indicate that the sale of recovered energy and materials cannot completely subsidize the costs associated with a resource recovery facility. A major goal, however, is to maximize resource revenues so that solid waste disposed costs are maintained at an acceptable level.

Markets for recoverable materials usually fluctuate considerably depending on the supply and demand of the items with which the recoverable materials are competing. The general trend of the materials market has been upward in demand and price. The future recoverable energy market is very optimistic because the price of fossil fuels has been increasing at a rate considerably greater than the general inflation rage.

Current Recycling Activities

Several of the municipalities in Pinellas County have recently had material recycling programs.[16] These have, in most part, been pilot programs. They have all been source separation programs in which residents separate paper, glass, aluminum and steel. Clearwater, Largo, and St. Petersburg have had similar source separation recycling programs. These programs have generated considerable public interest but were not financially successful.

Energy Markets

A general conclusion of Pinellas County's solid waste consultants market survey is that the only single users having energy needs compatible to the projected energy production from a Pinellas County resource recovery facility are the local power plant operations. The three main energy markets identified and verified by the consultants market survey are the power plant facilities outlined below and shown in Figure 35.

Tampa Electric Company (TECO) – Big Bend Plant

The survey indicates this plant to be a possible energy market for refuse derived fuel (RDF) prepared at a Pinellas County resource recovery plant having a dry shredded fuel processing facility. The TECO plant is located in Hillsborough County. It has three boiler turbine coal fired units with a total generation capacity of 400 mega watts (MW). The boilers would require retrofitting to accept RDF, however, it appears this adaptation could be made. The yearly coal consumption at the Big Bend facility is approximately 3,000,000 tons. If the total estimated production of RDF from Pinellas County were used as supplemental fuel, it would amount to six and one-half percent of the Big Bend fuel by the year 1990. This is considerably below the design proportion of 10 percent for refuse derived supplementary fuel.

Figure 34
Materials Recovery Subsystems

Type of System or Subsystem	Preprocessing Required	Potential Recovery	Capital Cost ($/ton of daily rated capacity)	Operating Cost ($/ton)	Revenue ($/ton)	Product Quality	Status of Technology
Fiber Recovery System	Wet pulping, screening, magnetic separation, air classification drying, optical sorting.	% of input Materials Recovered: Paper 50% Glass 50% Ferrous Metals 30%	$20,000	$17.35	$6.00 - $13.00	Low-grade paper suitable for roofing shingles or insulation color sorted glass + mixed cullet mixed ferrous scrap	Fiber recovery has been successfully demonstrated at 150 tons per day in Franklin, Ohio
Composting Systems	Shredding and magnetic separation. Air classification is required in some systems.	Organic Matter – 70% of input waste	$7,500 - $26,000	$16.00 $24.30	N/A	High Quality soil conditioners	Large scale plants have been separated at many locations; limited markets, however, have hampered its applicability. Currently, there are no large plants n the U.S. operating on a daily basis.
Ferrous Metal Recovery Subsystem	Shredding and magnetic separation, are sometimes required	More than 90% of the ferrous content in municipal solid waste can be recovered.	For total subsystem $800-$1,200/daily ton. Cost of separation alone $3,000 - $5,000	N/A	$12 - $20	Mixed scrap and scrap equivalent to No. 2 and No.3 bundles	Proven performance. Magnetic separators are employed in numerous waste processing facilities.
Aluminum Recovery Subsystem	Shredding and magnetic separation, air classification screening	Approx. 50% of the aluminum in municipal refuse can be recovered	N/A	N/A	$200 - $300	High quality aluminum can stock.	Pilot plant operation only thus far. Full-scale non-ferrous metal recovery systems were scheduled to be operational in Ames, Iowa and Franklin, Ohio in late 1975.
Glass Recovery Subsystem	Shredding and magnetic separation, air classification screening	70% of the glass is recoverable by froth flotation	Total cost of subsystem $452,000	$5.54	$12 - $20	Mixed cullet of use in paving and construction. Color sorted glass used in manufacture of containers	Technology is proven. Further refinements should increase recovery yield.

Source: HDR, *Solid Waste Energy and Resource Recovery*, 1976

Florida Power Corporation (FPC) – Crystal River Plant

This plant is located in Citrus County, 72 miles north of central Pinellas County. It has two boiler-turbine units with a generating capacity of 900 MW. These units are oil fired but have been ordered to be retrofitted to coal burning. As a coal burning system, the Crystal River facility could be an acceptable market for RDF produced in Pinellas County up to the year 2000.

[Figure 35, Energy Market Locations]

Florida Power Corporation – P.L. Bartow Plant

The FPC Bartow plant, which is located on Weedon Island in Pinellas County is identified as a market for pyrolysis gas and possibly steam energy. This plant has three boiler – turbine units having a generating capacity of 615 MW. The boilers are oil and gas fired and because of this are not suitable for RDF use. The energy that would be available from a Pinellas County pyrolysis or steam generating resource recovery facility could produce 13 percent of the heat requirements for the plant in the year 1980. This plant could be retrofitted to use pyrolysis gas fuel or possibly retrofitted for the use of high pressure steam from a steam generation facility.

Electricity Market

Additional resource recovery market evaluation indicates there is an electricity market for a Pinellas County resource recovery facility. A basic requirement for a resource recovery electricity market in Pinellas County would be to establish an agreement with FPC to interface the generated electricity to its electrical distribution system. Another requirement would be an agreement to purchase the electricity by FPC or by another electric utility that is on the regional electrical transmission grid system. It has been estimated that an energy recovery system with steam power electric generation could produce approximately .8 percent of the electricity demand of Pinellas County using all the combustible solid waste generated within the county, by the year 2000.

Secondary Materials Market

The secondary materials markets that were evaluated in depth for Pinellas County are those for ferrous metals and aluminum. Paper, cardboard, and glass markets were not studied in depth because the findings were that these markets do not economically justify the separation and recovery of these materials. Specifications for the secondary materials markets evaluated have been documented by the solid waste consultants.[17]

Ferrous Metals

Marketability studies by the Pinellas County solid waste consultant indicate there are adequate markets in the Tampa Bay area to make ferrous metal recovery a feasible subsystem of a Pinellas County resource recovery facility.[18]

Approximately seven percent of solid waste is ferrous metal scrap. Of this, approximately 70 percent is steel cans. There are several types of can composition which include small amounts of tin and lead as metal impurities in the ferrous can scrap. Two major markets for scrap steel cans are the de-tinning and steel mills markets. Other ferrous metal scrap such as white goods, small appliances, and junk autos are heavier and therefore, better suited than cans for remelting into new steel.

The Florida Steel Corporation has indicated its willingness to participate as a market in a ferrous metal recovery program. It has a steel mill in Tampa which manufactures steel reinforcement rods. The plant could accept ferrous metals recovered from a solid waste processing plant or de-tinned steel can materials.

The David J. Joseph Company operates a car shredder adjacent to the Florida Steel Corporation mill in Tampa. This facility is a market for large ferrous items as well as a market for junk autos. There are also more than a dozen scrap metal dealers in Pinellas and Hillsborough counties who could accept recoverable metals.

M and T Chemicals, Inc. which has a de-tinning plant in Tampa, has indicated a willingness to participate in a resource recovery program. De-tinning of steel cans provides the only domestic source of tin. There are approximately six pounds of tin that can be recovered from each ton of tin-plated steel cans.

Aluminum

Aluminum is the largest amount of non-ferrous metal found in solid waste. It usually consists of beverage cans and foil products. The Tampa Bay area has a higher percentage of aluminum can scrap in its solid waste due probably to the tourist orientation of the area. Aluminum cans and scrap can be remelted and used in the production of new cans. Aluminum companies encourage recycling of their products and would serve as markets for recovered aluminum. Reynolds Aluminum operates and aluminum collection center in Tampa and has indicated the desire to purchase the aluminum recovered from a Pinellas County resource recovery facility.

Other Secondary Materials

There are established markets for paper, cardboard, and glass in the Tampa Bay area, however, due to the varying nature of these markets and the technical problems with recovering these materials, they are not considered as viable markets in the development of a Pinellas County resource recovery system.[19]

Evaluation of Alternative Resource Recovery and Disposal Systems

Introduction[20]

Early in 1976, the Pinellas County BCC began a search for a resource recovery solution to the county's solid waste disposal needs. A feasibility study was prepared and submitted in May of 1976. From this point, a search has been underway for a resource recovery program which has the foundation of being:

- Technically sound
- Economically acceptable
- Environmentally acceptable

On March 1, 1977, a Request for Qualifications (RFQ) was issued. Advertising in local and national publications preceded the issuance of this document, and an excellent cross-section of interest was shown on a national level. A total of 22 firms submitted their qualifications to be considered for receipt of the Request for Proposals (RFP).

After the evaluations were finalized, the BCC took action upon recommendations by the county's solid waste consultant, HDR, and the Pinellas County TMC to yield a field of seven firms to whom a preliminary RFP was issued. These seven firms were:

Combustion Engineering (CE)
Combustion Equipment Associates (CEA)
Grumman Ecosystems
Union Carbide Corporation (UCC)
Universal Oil Products (UOP)
Wheelabrator – Frye, Inc. (WFI)
Widmer and Ernst

By going through this initial prequalification step, it was assured that only firms offering proven technology would be submitting a proposal for a resource recovery system for Pinellas County.

Interviews were held with all seven firms to review the preliminary RFP in order that:

- All firms clearly understood the overall guidelines of the RFP.
- The RFP was structured, if possible, to permit all potential proposers to submit their best proposals.
- The best possible offer could be obtained by Pinellas County in a competitive atmosphere.
- Capital costs were fixed according to January 1, 1978 dollars.
- Operating fee (the cost of operating the facility to be paid by the county to the contractor—not to be confused with the tipping charge to customers which is a function of all costs as well as revenues received from recovered resources).
- Description of facilities offered.
- Financing options (which would be considered by the proposer).
- Unit product guarantees for energy as well as recovered secondary materials.
- Implementation timetable (including design, construction and startup).

The technical guidelines provided were that the facility should have a design capability of 12,000 tons per week, and that a minimum of 450,000 tons per year of processible solid waste would be guaranteed to the contractor by Pinellas County.

Following the receipt of the proposal on November 15, 1977, a trip was made by the evaluation team to the headquarters of each of the six firms submitting proposals. The purpose of this trip was to listen to presentations of each proposer and to facilitate a direct interface with each proposer and the evaluation team whereby questions could be asked regarding each proposal. It was imperative that the evaluation team clearly understood all facets of each proposal and these interviews provided an opportunity to ask any necessary questions to aid in this understanding. The county's solid waste consultant (HDR) has been in constant contact with each firm throughout the evaluation process to confirm various items in each proposal.

Major Design Requirements

The document *Request for Proposals – Solid Waste Resource Recovery Program for Pinellas County, Florida*, contains the detailed design requirements developed by the Pinellas County Solid Waste Management Department for the county's resource recovery program.[21] Major design requirements are summarized in Appendix B.

Site Evaluation and Selection

Prior to the establishment of its resource recovery design requirements, Pinellas County selected and purchased a 240-acre area to be used as its future resource recovery and solid waste disposal site.[22] This county-owned land is available for all functions of the resource recovery program. The general location of this property in relation to the entire county is shown in Figure 36. A detailed site location map is provided on Figure 37 which delineates the complex of land and indicates the proposed use of this land. The proposed site of the resource recovery facility is a 22-acre plot shown in this figure. All landfilling operations will take place on the additional 200 acres which surround this proposed facility site.

[Figure 36, General Site Location]

[Figure 37, Resource Recovery Site Location]

The county's Department of Public Works and Utilities and the Department of Planning reviewed various suggested sites for solid waste resource recovery and disposal. The selected site is located adjacent to the present landfill bounded by 34th Street on the west, 114th Avenue on the north, 28th Street on the east, and 102nd Avenue on the south. The selected site was chosen over the other sites under consideration for the following reasons:

1. The proposed site can be linked with the existing county-owned property which is presently being operated as a solid waste facility, and in which the county has a sizable investment.
2. The proposed location is reasonably central in the county and is in proximity to major thoroughfares for good accessibility.
3. The proposed location is farther from existing residential uses, thereby minimizing potential adverse impact to residents in the vicinity.
4. Historically, this entire area has been generally one of extensive excavation and landfill operations.

5. The proposed location has good expansion capabilities.
6. The proposed location is industrially zoned and recognized on the land use plan for industrial activities.

Pinellas County Resource Recovery System Proposals

Seven firms were requested by Pinellas County to present proposals for a county resource recovery program based on the county's design requirements and located at the selected resource recovery and solid waste disposal site. Six firms prepared proposals for the county. Summaries of the proposal which are given in the solid waste consultant's proposal evaluation report are given in Appendix C.[23]

A total of six companies submitted 10 proposals, which were received by Pinellas County on November 14, 1977, in response to the Pinellas County RFP formally issued July 15, 1977. Of the 10 proposals, four individual processes were proposed. Two existing markets were addressed (gas and electricity both of which FPC has expressed an interest in buying), and one firm offered a RDF proposal but did not have a firm market for the fuel. Both public and private financing options were proposed by some firms with one firm only offering private financing and three firms only offering public financing. Reviews and evaluations of each proposal were made from the economic, technological, and environmental standpoints.

From an economic standpoint, numerous adjustments were necessary to each proposal in order to make an evaluation on a comparable basis. Featured in Figure 38 is a summary table showing the capital costs as proposed and the resulting sizes of bond issues required to finance the systems where public financing was offered. As can be seen, the least capital cost is associated with the UOP proposal while the highest capital cost is that of UCC. In order to establish the net disposal charge, all costs were tabulated along with the revenue streams and the net disposal charge calculated for each of the seven public financing proposals. Shown in the summary table are the net disposal charges for 1981 and 2001 calculated at a waste flow of 450,000 tons per year. The three private financing offerings were adjusted only by the inclusion of property tax since a privately financed and operated system could be subject to such taxes. Shown on the table are tabulations of the net disposal charge for the three private financing proposals covering the years 1981 and 2001. Figure 38 shows the following ranking of net disposal charges for 1981 at 450,000 tons per year:

1. UOP – two units – public financing - $10.27/ton
2. UOP – three units – public financing - $12.20/ton
3. UCC – private financing - $13.37/ton
4. CEA – private financing - $14.43/ton

5. Grumman – public financing - $19.33/ton
6. CE – base proposal – public financing - $19.33/ton
7. WFI – public financing - $21.22/ton
8. WFI – private financing - $21.99/ton
9. CE – alternate proposal - public financing - $24.41/ton
10. UCC – public financing - $34.68/ton

In addition to the above economic considerations, experience, technology, capability, and environmental criteria were evaluated for each proposer. Brief summaries of the conclusions resulting from the evaluation of each firm based upon these parameters are outlined in Appendix C.[24]

The county's solid waste consultant recommended that the county proceed with negotiations with Universal Oil Products. It appears that this proposal best satisfies the overall goals of the Pinellas County Resource Recovery Program. It is economically most attractive, the technology is sound, and environmentally the system appears to be adequate.

Should negotiations break down between UOP and Pinellas County, it was also recommended that negotiations be initiated with Union Carbide (UUC) and Combustion Engineering (CE) in that order. The UCC private financing proposal is the next most economically attractive to the UOP proposal and the corporate resources of UCC appear to be large enough to insure the system's adequate functioning during the 20-year operating period. The CE proposal is in the mid-range economically; however, the firm's extensive expertise and experience in the area of combustion, the conservation recovery guarantees and the flexibility of the proposed system make this proposal an attractive alternate.

Pinellas County Resource Recovery and Disposal System

After conducting a thorough review of alternative resource recovery solid waste disposal system proposals, the Pinellas County BCC selected the UOP proposal for the Pinellas County Resource Recovery System. UOP will design, construct and operate the resource recovery facility on the county's site. The facility will have the capability to process 14,000 tons of unprocessed solid waste per week. The county will guarantee delivery of 530,000 tons per year which averages 10,192 tons per week.

Figure 38
Resource Recovery Proposals Summary Data

Proposer	Type of System	Plant Capacity tons/week	Energy Production kWh/ton	Type Financing	Capital Cost	County Bound Issue	Operating Cost Per Ton	Disposal Charges Per Ton		Implementation Time in Months
								1981	2001	
Combustion Engineering Basic: 1 Boiler Unit	Electrical Production	12,025	513	Public	$70,300,000	$101,110,000	$7.51	$19.33	$35.86	30 mo.
Alternate: 2 Boiler Units	"	18,038	520	Public	$88,927,000	$124,449,000	$7.78	$24.41	$41.50	30
Combustion Engineering	Solid Fuel	14,000	8,310,000 BTU/ton	Private	N.A.		$12.90	$14.43	$22.37	24
Grumman	Electrical Production	15,750	395	Public	$79,900,000	$104,717,000	$6.40	$19.14	$31.56	42
Union Carbide Basic: Public Financing	Medium BTU Gas	13,650	7,000,000 BTU/ton	Public	$106,074,700	$139,070,000	$23.22	$34.68	$73.71	38
Alternate: Private Financing	"	"	"	Private	N.A.		$11.06	$13.37	$40.52	"
Universal Oil Products Basic: 2 Boiler Units	Electrical Production	12,000	495	Public	$44,880,000	$67,576,000	$7.14	$10.27	$20.27	30
Alternate: 3 Boiler Units	"	"	"	"	$48,395,000	$73,028,000	$7.89	$12.20	$24.50	32
Wheelabrator-Frye Basic: Public Financing	Electrical Production	12,000	565	Public	$70,912,000	$98,399,000	$7.89	$12.20	$24.50	32
Alternate: Private Financing	"	"	"	Private	N.A.		$11.5	$21.99	$43.10	"

Source: HDR, Pinellas Co. Resource Recovery Proposal Evaluation, May 1978.

The solid waste will be used as boiler fuel to produce superheated steam to generate electric power for sale to FPC. The combustion residue will be processed to recover ferrous metals, aluminum, heavy non-ferrous metals and aggregated for sale. The design includes provisions for flexibility and future expansion. The facility will meet all current applicable environmental requirements and will be designed so as to have an aesthetically pleasing appearance.

The two-boiler unit UOP facility has the following features:

- The configuration contains two nominal 1,025-ton per day UOP/Martin steam-generating units for burning ordinary, unsegregated solid waste and reduced volume oversized bulky waste.
- Heavy duty fragmentizer equipment for reducing the volume for oversize bulky waste.
- Fully enclosed tipping floor and storage pit for receiving the solid waste, and cranes for charging combustion units.
- Materials recovery and loading equipment.
- One 50 MW turbine generator, auxiliaries and switchgear.
- Water-cooled steam condensing system including a bypass desuperheating and pressure-reducing station to permit solid waste disposal operation during the infrequent periods when the turbine generator is not available.
- Access roads, ramps, and mobile equipment.
- Buildings of modern architectural design and meeting all current building codes and requirements.
- Air pollution control equipment meeting all current applicable regulations.

The Plant Site

The facility will occupy about 22 acres on the site selected by the county for the countywide resource recovery facility. The proposed site layout is shown in Figure 39. Its location will be at 110th Avenue and 28th Street. An artist rendition of the plant is shown in Figure 40. The buildings will be steel framed structures with prefabricated modular siding providing a pleasing visual effect.

[Figure 39, Plant Site Layout]

Commercial collection and transfer vehicles will enter the facility site along the northern boundary of the property. Private citizens wishing to use the facility will enter the site along a parallel road which will be separated from the roadway used by the larger collection and transfer vehicles. There will be a public dumping area provided (see Figure 39) where any private citizen can dump refuse into transfer trailers which, in turn, will be hauled over the scales and into the tipping area by plant personnel. This will eliminate potential hazards resulting from having private automobiles maneuvering in the same area with the larger vehicles using the facility.

Two 60-ton capacity electronic truck scales, each having a 10-foot by 60-foot platform, will be provided by the county to weigh incoming waste trucks. A prepunched card for each truck will be stored in the scale house. The card will have a truck number, district or other source, tare weight, and other pertinent information.

Upon arrival at the scale, one of two scalesmen will remove the truck's card from a rack, insert it into the scale mechanism, and press the weigh button. In just a few seconds, the truck will be weighed and a ticket will be printed showing the truck number, source, time, gross tare, and net weight, date and time. This ticket will be given to the driver. Simultaneously, the same information will be printed on a ledger in the office. The equipment will be suitable for producing punched tape, punched cards, or other hard copy data processing material.

[Figure 40, Pinellas County Resource Recovery Plant]

The scale operators will direct the incoming load of material to the resource recovery facility (or to the county landfill operation in the case where non-processibles are delivered).

The Combustion Process

Figure 41 is a section view of a UOP two-boiler combustion system essentially the same as that proposed for Pinellas County. The process steps are number coded to indicate the location of the steps within the facility. The trucks are directed to the dumping area (1) where they discharge the refuse at one of 12 tipping bays into the refuse storage pit (2). The capacity of the storage pit is approximately 7,700 tons of solid waste. This is adequate space to store three to four days of incoming refuse. Two overhead cranes (3) lift the material from the storage pit to the charge hopper of the boiler (4). The crane operator can mix solid waste to provide the best possible fuel mixture in the boiler. Non-processible material that inadvertently is delivered to the pit will be removed by the crane operator for alternate disposal. The feed hopper opens into a feed chute (5) which maintains a uniform refuse feed rate in direct

proportion to steam generation requirements. The refuse is automatically fed into the stoker grates (6). The grates operate with reverse reciprocating action. The grate area is inclined at a 26-degree angle producing a downward movement of the refuse during combustion. At the same time, the grates are moving upward providing a tumbling action which results in a uniform burnout of better than 95 percent of all combustible matter. A diagram of the Martin Reverse Reciprocating Stoker is shown in Figure 42. Undergrate compartments (7) provide controlled distribution of high pressure combustion air up through the grates providing through burnout of the refuse. An ash discharge is located at the end of and below the stoker grate area (8). As the residue is hydraulically discharged on a conveyer belt (9) where it is transported to the materials separation and recovery area.

[Figure 41, UOP Combustion System (Section View)]

The combustion chamber temperature is about 1,600 degrees F. The hot gases rise and travel through the waterwall boilers (10). The furnace boilers are constructed of tubular walls filled with water which forms steam when heated by the combustion gases. The water walls are covered with refractory material to prevent corrosion of the boiler tubular walls.

The steam generated is collected (11) and used to drive the turbine generator for energy recovery. Portions of the steam could be used to provide in-plant power requirements. The combustion gases, after passing through the boiler, are cooled to approximately 450 degrees F, the gas then passes into the electrostatic precipitators (12) where 97 percent of the particulate matter contained in the gases is removed. The cleaned gases are then discharged through the stack (13). The particulate matter (fly ash) collected in the electrostatic precipitators is removed and transferred back to the ash discharger.

[Figure 42, Martin Reverse Reciprocation Stoker]

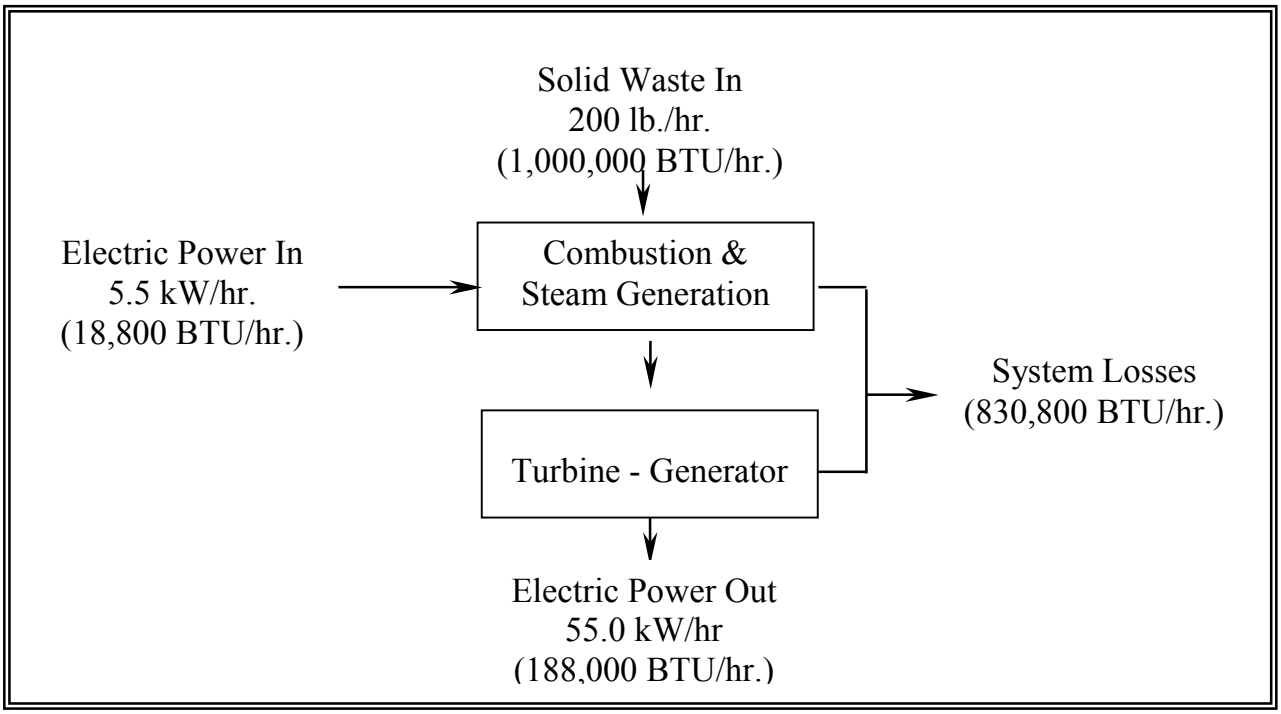
Energy Recovery

The energy recovery will be the most significant resource recovery of the Pinellas County Resource Recovery System. The steam, which will be produced at 600 psig and 750 degrees F, will drive the turbine generator which will generate electricity to be sold to FPC. Figure 43 is an energy in/energy out diagram that depicts the basic energy flows for the Pinellas County system. The fuel input to the combustion and steam generation system is shown, for convenience, as 200 pounds of refuse per hour which has heat of combustion of 1,000,000 BTU/hour. The additional power input is the auxiliary power required to run the electrical and mechanical equipment of the

system. The system losses occur during the combustion, steam, gas, and electrical generation steps. The output electrical power is that which is recoverable and can be sold as electricity to FPC.

It has been estimated that the electrical power generation by the Pinellas County Resource Recovery System will be equal to approximately .8 percent of the county's total electrical power consumption by the year 2000.

Figure 43
Energy In – Energy out Balance Diagram



Source: UOP, Proposal for Solid Waste Resources Recovery for Pinellas County, Fla., Nov., 1977

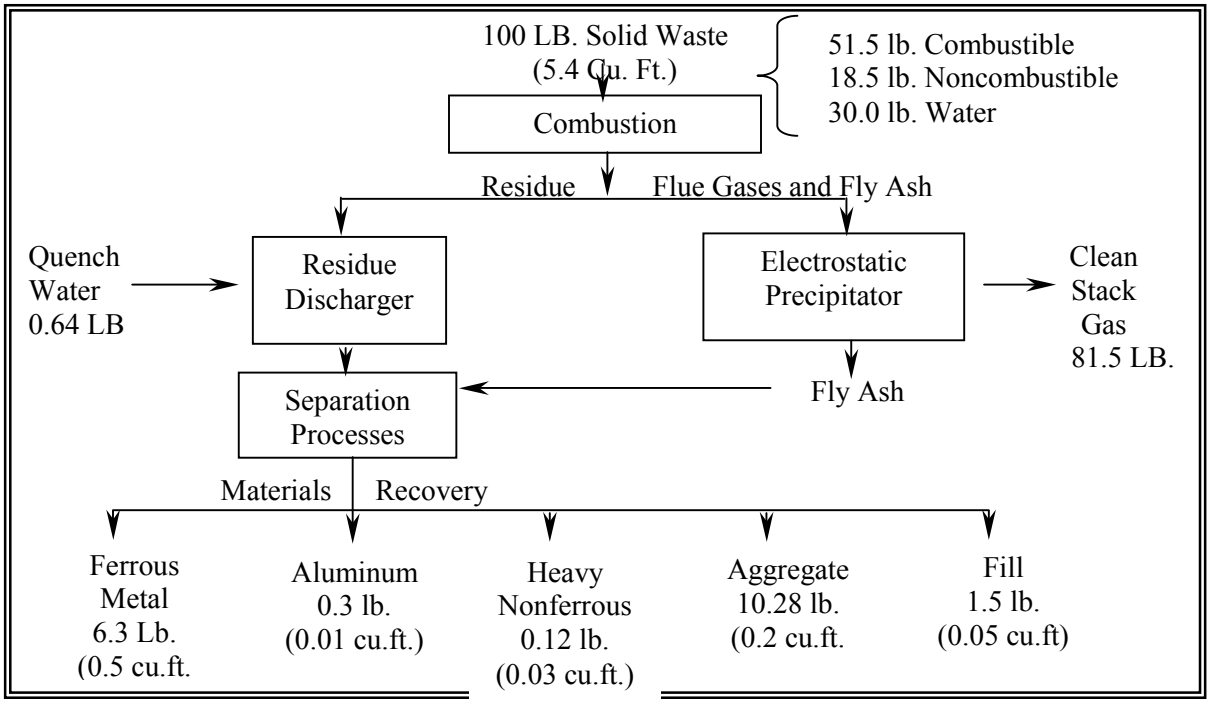
Materials Recovery

The materials that will be recovered in the Pinellas County System consist of ferrous metals, aluminum, heavy non-ferrous metals, aggregate material, white goods and combustion residue. Materials recovery occurs after rather than before energy recovery and is therefore, a more efficient operation since all the combustible materials have been reduced to ash and the recoverable materials are not contaminated with garbage, plastic, paper, paint and associated combustibles.

The UOP materials recovery system is based on technology adapted from the mineral sciences industries as pioneered by the Bureau of Mines, Department of Interior, College Park Maryland. A description and materials recovery schematic is presented in greater detail in Appendix D, as outlined in the UOP resource recovery proposal.[25]

In the Pinellas County facility proposed by UOP, materials will be recovered in proportions shown in the material balance diagram, Figure 44. For every 100 pounds of solid waste entering the resource recovery system, 81.5 lbs. of clean gas will be discharged through the stack. From the combustion residue which is processed through materials recovery, there will be 10.28 lbs. of aggregate, 6.3 lbs. of ferrous metal, 1.5 lbs. of fill, 0.3 lbs. of aluminum and 0.12 lbs. of non-ferrous metal.

Figure 44
Material Balance Diagram



Source: UOP, Proposal for Solid Waste Resource Recovery For Pinellas County, Fla., 1977

Operation Management

The Pinellas County Resource Recovery Facility, including materials recovery and power generation functions will be operated, maintained and managed under the direction of the UOP Solid Waste System. The following are excerpts depicting the major operations management factors from the UOP proposal:

1. The resource recovery facility, including materials recovery and power generation functions, will be operated, maintained and managed under the direction of UOP Solid Waste Systems. The facility will be operated 24 hours a day, seven days a week. The tipping area will be open to receive solid waste from 7:00 a.m. to 7:00 p.m., local time, Monday through Saturday, holidays included. Upon notification in advance, UOP will accept deliveries at other times.
2. Trucks entering the resource recovery facility will first pass through the county's weigh station where all weighing and record keeping will be accomplished to provide a basis for billing.
3. At the time of weighing, the weighmaster will determine the type of waste carried by each truck, and direct the truck to the proper location. Depending on the type of refuse, trucks will be directed to:
    a. Landfill
    b. Resource recovery facility
    c. Public disposal and recycle area
4. All trucks containing residential and commercial wastes will dump directly into the pit. Trucks containing special collections of oversized bulky waste will be directed to unload in the bulky waste area. Bulk liquid wastes, sewage sludge, hazardous or toxic wastes, junk automobiles or general construction and demolition debris will not be accepted at the proposed facility.
5. To avoid any counter current flow of traffic, all refuse delivery trucks will enter the tipping floor area through roll-up type doors at one end of the building and will leave through the opposite end.
6. The facility operation is highly automated. Only the operation of the refuse cranes and part of the materials recovery system are left totally to human discretion. The crane operator has four important functions: (1) charging the furnaces, (2) clearing the tipping area of the pit, (3) charging the bulky waste fragmentizer, and (4) mixing wastes with extreme variations in compositions.
7. Once refuse is fed into a refuse hopper by the overhead crane, the automatic system provided will control disposal of the refuse, steam generation, electricity generation, and residue recovery.
8. Plant personnel will primarily monitor the operation and take action as necessary to ensure smooth operation. The operation of the units is monitored and controlled from a modern control room. In the control room, an operator will monitor temperature, pressure and flow instruments which continually control and record performance of the boiler and combustion air system. There, the operator can adjust the firing conditions to result in changes in refuse disposal rate and

steaming rate. He can monitor and adjust the electrostatic precipitator operation of each unit, as well as steam delivery and condensate return. In like manner, he can also adjust the hydraulic oil systems required to drive the stoker, feeder rams, ash discharger, etc.

9. From logsheets of refuse deliveries, residue production, and combustion operating conditions, an operating summary which will describe refuse throughput, steam generation and refuse composition is prepared.

10. The electrostatic precipitator is controlled automatically by an electrical circuit. The rapping system and the fly ash handling system are the only moving parts in the electrostatic precipitator, and these will be monitored to assure continued operation. Experience indicates that the electrostatic precipitator and fly ash removal equipment requires little maintenance beyond routine inspection and cleaning. This can normally be accomplished periodically as needed during the low refuse delivery months and during the scheduled annual turnaround.

11. Each employee will be alerted to potential environmental and safety problems and actions to be taken to eliminate them. The plant engineer will be responsible for training employees to operate and maintain the resource recovery facility at a high level of environmental and safety performance.

12. The personnel requirements for the two-unit facility are:

Administration	8
Operations	34
Maintenance	12
Total	54

13. Proper maintenance of all systems is given high priority. The facility is designed to allow for normal preventive maintenance as needed and emergency maintenance as required. Twice each year, each combustion unit is scheduled for major inspection and servicing. The annual turnaround will occur during November or December, which is the period of minimum average refuse delivery. Another inspection period is scheduled for May or June, months during which deliveries are at moderate levels.

14. If it is desired by the county, the primary responsibility for the marketing and sales of recovered materials can rest with UOP solid waste systems. The manager of the facility will arrange for the delivery of materials to customers by means of their own or common carrier vehicles. He will be supported by UOP solid waste systems and the broad UOP research and development capabilities in metals and minerals, process technology, chemical analysis and environmental sciences.[26]

Economic Implications of Plan

Background Research and Planning

Considerable research and planning have occurred between 1976 and 1979 during development of the Pinellas County Resource Recovery and Solid Waste Disposal Program. This document references all the research and planning studies that went into this program effort.

The major research and planning effort for the program has been conducted by the Pinellas County solid waste consultant, Henningson, Durham and Richardson. The estimated cost for their research and planning effort for the Pinellas County Resource Recovery System has been $500,000.

Operation and Management

The Pinellas County Resource Recovery Facility, including materials recovery and power generation functions will be operated, maintained and managed by UOP Solid Waste Systems. The contractor's operation fee is based on factors which are part of the agreement with Pinellas County. The operation fee is based on the following two factors:

- $6.06 per ton of processed solid waste; and
- 20 percent of revenue derived from sale of electricity and recovered materials.

Operations costs and revenue estimates were established during the systems evaluation process for the 20-year contract period with UOP. Figure 45, Life Cycle Operating Costs, lists these estimated operating costs and revenues of the UOP operated system. The table lists estimated annual costs and revenues for five key years during the 20-year period. The major operating costs are the contractor fee, utilities, landfill operation and debt service. The major operating revenues are from the electricity and materials sales and financial investment interest. The two paramount cost figures are included in the table. These are:

- Net cost to county, which is the difference between total revenue and total cost; and,
- Tipping fee per ton, which is the required charge per ton of solid waste for the entire financial situation to balance for the county.

Figure 45
Life Cycle Operation Costs♠

Constants					
Waste Received (TPY) 450,000					
Energy Production (MM kWh) 223					
Annual Operations Costs ($1,000)	**1981**	**1986**	**1991**	**1996**	**2001**
Contractor Operating Fee	3,525	4,717	6,312	8,447	11,304
Utilities	326	410	524	680	893
Insurance	173	264	469	870	1,670
Miscellaneous Items	191	191	191	191	191
Landfill, Scale & Administration	429	574	770	1,032	1,383
Total Annual Operations Cost	4,642	6,156	8,266	11,218	15,439
Repair and Replacement Fund	139	185	248	337	463
Annual Debt Service	6,133	6,133	6,133	6,133	6,133
Total Costs	10,914	12,474	14,647	17,688	22,035
Annual Revenues ($1,000)					
Energy	4,878	6,215	6,994	7,707	9,801
Recovered Materials	885	1,116	1,412	1,789	2,271
Investment Interests	532	579	641	726	841
Total Revenues	6,294	7,910	9,048	10,222	12,912
Net Cost to County	4,620	4,564	5,600	7,466	9,123
Tipping Fee (per ton)	$10.27	$10.14	$12.44	$16.59	$20.27

♠ Figures are based on original design of 12,000 tons per week. Figures for final design of 14,000 tons per week are pending.

Source: Pinellas County Solid Waste Management Department, 1979.

Land Acquisition

In 1976, Pinellas County purchased 240 acres of land adjacent to its present landfill for the future resource recovery and solid waste disposal site. The purchase price of this property was $1,500,000.

Resource Recovery and Disposal System

Universal Oil Products, Inc. (UOP) has established cost estimates for the proposed two-unit resource recovery system selected by Pinellas County.[27] The cost estimates are based on the options in the RFP that the contractor operates the entire system, that

the county would arrange the financing, and the system would be owned by the county. The estimated costs assume that system requirements for 450,000 tons of processible solid waste will be delivered to the facility per year with a minimum rate of 36,000 tons per month and a heat value of 5,000 BTU/lb. with 30 percent water content. Finance costs, electric power costs, and utility costs are additive to the cost estimates. The costs are subject to escalation from January 1, 1978.

During the systems evaluation process, Pinellas County estimated the total capital costs that would be associated with the development of the entire system. Beside the contractor's (UOP) costs, this includes estimated permits and fees; county costs associated with building scales and required utility lines, as well as non-contractor site development; and, tax exempt revenue bond issue financing costs. All of these capital costs are listed in Figure 46. The total estimated capital costs for the Pinellas County Resource Recovery and Solid Waste Disposal System is $54,762,000 which requires a total revenue bond issue of $67,576,000.

Plan Implementation

Universal Oil Products, Inc. (UOP) has developed implementation steps for the design, construction and operation of the Pinellas County Resource Recovery System.[28] Figure 47 shows the organizations proposed to carry out the program. The overall direction and management of the program will be the responsibility of UOP Solid Waste Systems of Des Plaines, Illinois. The engineering, procurement and construction of the resource recovery facility will be the responsibility of Procon, Inc., a subsidiary of UOP. The Martin Company, which has granted UOP an exclusive license for its technology, will participate in all stages of project design, development, start-up and testing. UOP Environmental Services will manage, operate and maintain the entire facility including the marketing of the recovered materials. A large number of service organizations, subcontractors, and suppliers will carry out the design and construction under the direction of Procon, Inc.

Figure 46
Total Capital Costs for Pinellas County Resource Recovery & Disposal System♠

Contractors Costs ($1,000)	
Site Work	100
Buildings	3,505
Plant Facilities	2,645
Process Equipment	3,720
Combustion Train	21,910
Mobile Equipment	180
Auxiliary Equipment	included
Power Plant Equipment	9,520
Ash Handling	included
Receiving Area	included
Air Pollution Control	3,100
Wastewater Treatment	included
Engineering	included
Legal & Administrative	included
Start-Up Cost	included
Contingency	included
Performance	200
Subtotal – Capital Cost	44,880
Escalated Capital Cost	50,109
Sales Tax	1,002
Subtotal – Contractor Costs	**51,111**

Permits and Fees ($1,000)	
EIS	300
Power Plant Siting Submittal	75
Sewer Connection Fee	180
Water Connection Fee	included
Building Permits	50
Workman's Compensation	861
Owners Protection	6
Independent Contractors	26
Fire & Extended Coverage	150
Subtotal – Permits and Fees	**1,648**

County Costs ($1,000)	
Scales	120
Public Dumping Area	160
Parking and Rest Rooms	100
34th Street Extension	500
Water Line Extension	90
Sewer Line Extension	80
Additional Landscaping	20
County Capital Cost	**1,070**
Engineering	501
Legal & Administrative	251
Contingency	182
Subtotal – County Costs	**2,004**

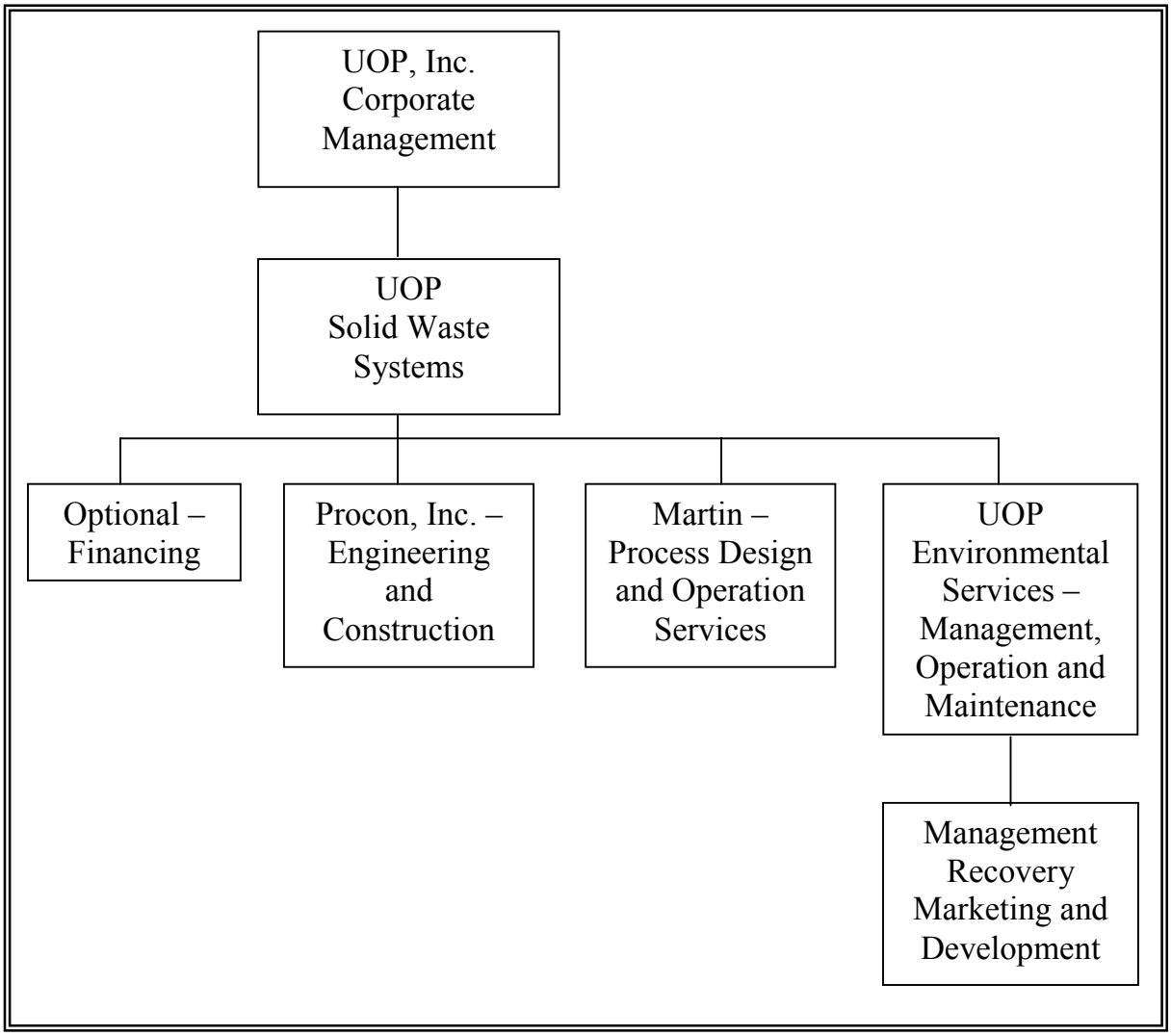
Summation ($1,000)	
Contractor Costs	51,111
Permits and Fees	1,648
County Costs	2,004
Total Capital Costs	**54,762**

Bond Issue ($1,000)	
Bond Financing Cost	12,814
Total Bond Issue	**67,576**

♠ Figures are based on original design of 12,000 tons per week. Figures for final design of 14,000 tons per week are pending.

Source: Pinellas County Solid Waste Management Department, 1979

Figure 47
Functional Organization Chart for
Design, Financing, Construction and Operation



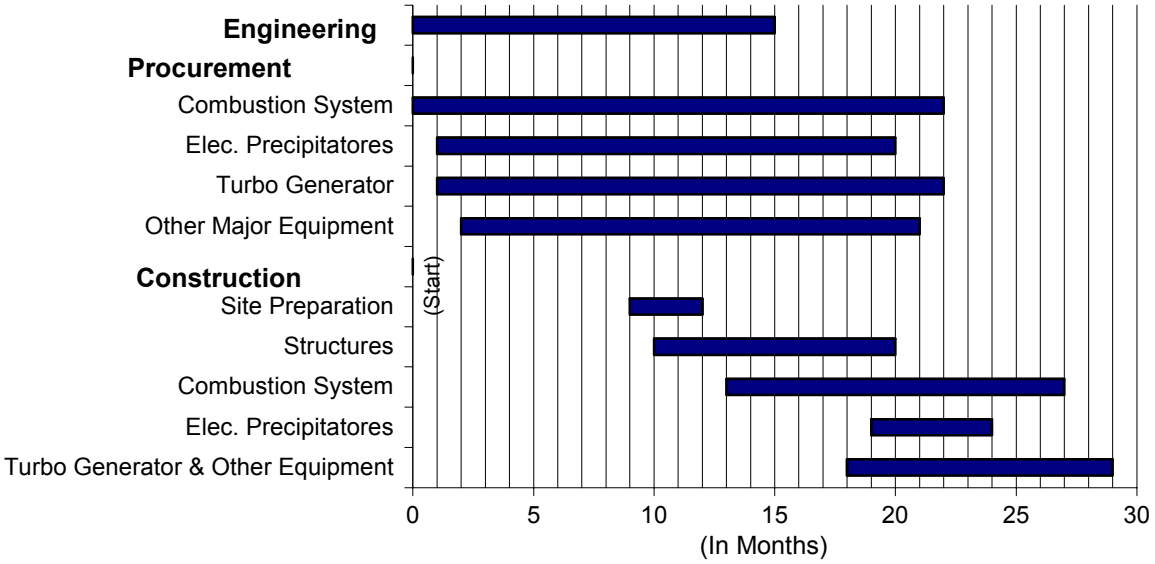
Source: UOP. Proposal for Solid Waste Recovery Program for Pinellas County, Fla., 1979

A construction and start-up schedule has been developed by UOP for the Pinellas County Resource Recovery System. The major scheduling steps of the project are shown in Figure 48. The schedule indicates that after the construction contract start date it would take UOP 30 months to conduct the engineering, procure the components, construct the plant, and achieve operational status for the plant.

As mentioned previously, solid waste collection practices currently in effect, i.e., municipal, private franchise and private non-franchise, will continue into the future for the purpose of delivering solid waste to the resource recovery facility. However, in

order to insure equity in assessing delivery costs, the County's Solid Waste Management Department has retained a consultant to conduct a solid waste delivery and transfer station feasibility study. This study and other operational decisions will be made on a continuing basis to insure sound management of solid waste delivery and processing and resource recovery activities.

Figure 48
Pinellas County Resource Recovery System UOP, Inc. Project Schedule



Source: UOP. Proposal for Solid Waste Recovery Program for Pinellas County, Fla., 1979

There will also be expanded solid waste management needs in the future as indicated by the waste generation projections for 1975-2000. The waste generation increases in all planning sectors throughout the county will require expanded solid waste collection and transportation facilities. Waste collection expansion is very incremental in nature and can best be handled through project (CIP) and budgetary planning on a yearly basis at the local level of government. Therefore, it is recommended that the aspects of solid waste management concerning collection and transport remain under the administration of local governments in Pinellas County as it is presently practiced. However, additional coordination should be incorporated into the countywide solid waste management at the city level as well as for the Pinellas County Resource Recovery and Solid Waste Disposal System.

It is recommended that results of solid waste management studies be presented to the Technical Management Committee (TMC) for solid waste and the Pinellas County Planning Council (PCPC) to enable the jurisdictions of Pinellas County to have access to

more cost-efficient methods for solid waste management. For example, presently, Clearwater and St. Petersburg have pilot programs investigating the effectiveness of the one-man waste collection system, whereby one operator drives the vehicle and loads the waste using specialized loading equipment and storage containers. The technical and administrative results of these pilot programs should be presented to the TMC and the PCPC for the possible use by all 25 jurisdictions within Pinellas County in the interest of improved solid waste management efficiency.

Program and Policy Recommendations

In addition to the implementation proposals noted above, this section of the plan includes program and policy recommendations that are proposed as guidelines to solve countywide solid waste management problems that were identified during the development of this element. Program recommendations are those which are related to the Pinellas County Resource Recovery and Solid Waste Disposal Program. Policy recommendations are related to the PCPC's role in countywide solid waste planning. There are several recommendations that could be considered related to both resource recovery and countywide solid waste planning; these are listed as policy recommendations.

Program Recommendations

1. The capacity of the resource recovery facility should be expanded by the year 1990 to meet the projected increase in solid waste generation. The capacity should be expanded to at least 16,000 tons per week to handle the year 2000 waste generation.
2. Pinellas County should investigate the feasibility of establishing solid waste transfer stations at appropriate locations within the county to equalize transportation costs for waste collectors from various parts of the county to the resource recovery facility.
3. Pinellas County should maintain an effective solid waste and resource recovery public relations and education program so that the general public and the effected parties associated with solid waste management are made aware of the facts of the program, including the expected increase in overall solid waste collection and disposal costs.
4. Pinellas County should establish administrative rules delineating its powers and responsibilities under Florida Statute, Chapter 75-487, *Pinellas County Solid Waste Disposal and Resource Recovery Act*.
5. The Pinellas County Solid Waste Management Department should have administrative control of all solid waste disposal in Pinellas County.

6. The Pinellas County Board of County Commissioners should expand the licensing of all private solid waste collectors operating in the unincorporated portions of Pinellas County to coordinate service areas and type of service in order to ensure the proper coordination of collection in relation to the delivery of waste to the resource recovery and disposal facility.
7. If enacted, regulations covering the licensing of private waste collectors should be based on documentation confirming that private collectors have adequate financial capability and management experience to provide the waste collection service.

Policy Recommendations

1. The responsibilities of the Solid Waste Technical Management Committee (TMC) for Pinellas County should be expanded to include the evaluation of problems associated with solid waste collection and transport as well as its present responsibilities concerning resource recovery and disposal.
2. The collection and transport of solid waste should remain the responsibility of local jurisdictions whether the system be municipal collection, franchised private collection or licensed private collection.
3. It should be required that all individuals, organizations, and governments within Pinellas County use the services of the Pinellas County Resource Recovery and Solid Waste Disposal System.
4. All processible solid waste within Pinellas County should be delivered to and processed at the Pinellas County Resource Recovery and Disposal Facility.
5. The existing sanitary landfill operations within the county should be phased out when the Pinellas County Resource Recovery and Solid Waste Disposal Facility becomes operational, except as authorized by the BCC.
6. Studies should be conducted by local governments in Pinellas County to improve the efficiency of solid waste management practices.
7. Results of solid waste management studies should be presented to the TMC for solid waste and the Pinellas County Planning Council to enable the jurisdictions of Pinellas County to have access to more cost efficient methods for solid waste collection.
8. New technology in solid waste management practices should be disseminated to all waste collectors through the TMC for solid waste.

Appendices

Appendix A

Solid Waste and Resource Recovery Policies

The following are not adopted policies of the Pinellas County Planning Council but are included in this document for coordination purposes only.

State of Florida Solid Waste Management Policies*

- Assist local governments in developing comprehensive plans and programs as required pursuant to Chapter 403.701-713, Florida Statute, that provide for the collection, storage, transportation, separation, processing, recovery, recycling and disposal of solid waste.
- Increase technical assistance for solid waste planning to local governments from regional health systems agencies, regional planning councils, and appropriate state agencies.
- Encourage and assist adjacent municipalities and counties to solve disposal problems by means of interlocal agreements.
- Seek alternatives to conventional methods of solid waste incineration which use resources inefficiently and create air pollution.
- Require the adoption, implementation, and periodic updating of a statewide solid waste recovery and management plan.
- Prepare, adopt, implement and periodically update regional and local solid waste recovery and management plans, in ways that are consistent with the state plan.
- Coordinate solid waste recovery and management plans with comprehensive plans for each area to insure consistency of development and management objectives.
- Ensure that hazardous waste disposal practices are effective in minimizing present or potential threats to human health and the environment.

* Division of State Planning, *The Florida State Comprehensive Plan*, Tallahassee, Florida, 1978. p. 72, 108, 168.

- Encourage proper siting, operating and reclamation procedures for solid waste disposal facilities.
- Encourage energy recovery from solid waste, where feasible.
- Encourage the identification and development of alternative uses and markets for materials recovered from solid waste.
- Encourage research and demonstration projects that test the feasibility of alternative solid waste recovery and management technologies.
- Encourage the investigation and, where feasible, the implementation of programs designed to reduce the volume of solid waste generated.
- Encourage solid waste public education programs.
- Encourage the development of personnel training programs designed to meet the needs of solid waste recovery and management systems.

The Florida Solid Waste Management and Resource Recovery Plan – Principles and Objectives[*]

Principle: Solid waste management programs will be planned to provide for adequate sanitary, safe and environmentally sound solid waste storage, collection, processing, disposal facilities and services to meet the residential, institutional, commercial, industrial and agricultural needs of the State of Florida.

Objectives

- Insure that counties and municipalities, either solely or in cooperation with other counties and municipalities or appropriate regional agencies, plan adequate solid waste storage, collection, processing, resource recovery or disposal facilities and services.
- Monitor solid waste management plans to insure implementation according to a schedule developed by the local governmental jurisdiction.
- Encourage citizen participation in development of solid waste management programs and plans, and help citizen understanding of solid waste management problems and solutions.
- Assure that solid waste management problems are approached on a scale sufficiently large to provide optimum economy and efficiency.

[*] DER *Solid Waste Management and Resource Recovery Technical Assistance Handbook*, Tallahassee, Florida, 1976, p. 1.

Principle: County, municipal or regional solid waste management programs should complement each other and comply with all applicable state standards.

Objectives

- Assure that all proposed new solid waste facilities are consistent with county, municipal or regional solid waste management plans and are in conformance with requirements established by the Department of Environmental Regulations.
- Where the private sector is utilized for solid waste management, the licensing of such services by local agencies should be based on assurance of the financial capability and the management experience of private firms to satisfactorily provide these services.
- Encourage practical safety standards for protection of all personnel involved in solid waste collection, processing, disposal and resource recovery programs.
- Encourage use of improved or new technology to achieve optimum management consistent with sound use of financial resources.
- Provide technical assistance to government and private industry in disseminating the latest solid waste management technology and practices which promote conformance with state solid waste management policy, requirements, and programs.
- Encourage land use zoning which will protect solid waste management facilities and disposal sites from encroachment by non-compatible land uses.

Principle: Waste generation should be reduced to promote and enhance conservation of energy, natural resources, and resources.

Objectives

- Encourage private industries, state and local governments, and the public to implement source reduction practices to reduce waste generation.
- Encourage federal action toward practical and economic approaches to national policies that provide for reduction in generation of waste materials.
- Promote modification of products by industry t reduce the quantity of materials used or to facilitate materials recovery.

Principle: Recovery of materials and energy from solid waste should be encouraged to conserve energy, land and natural resources.

Objectives

- Insure that designated resource recovery area plans have a resource recovery element. Plans should include an evaluation of the feasibility of resource recovery, working towards recovery of energy and materials.
- Encourage investment of private capital along with local governments in the development of resource recovery systems.
- Provide information relative to resource recovery markets and technology.
- Encourage procurement and use of products containing secondary materials that meet standards and to work for elimination of discriminatory policies toward recovery, storage, transportation and use of secondary materials.

Principle: Hazardous and toxic wastes should be collected, transported, treated and disposed in a manner that will provide maximum protection of the public and environment.

Objectives

- Determine hazardous waste sources, types, quantities and current method of treatment and disposal, and information about private collectors and transporters operating in the state.
- Define hazardous waste for other agencies, local governments and other interested persons, pointing out what hazardous wastes are and the present status of hazardous waste management in Florida.
- Designate or develop special hazardous waste facility locations based on generation-concentration, hydrologic considerations, economic and environmental criteria, and on the type of waste. Facilities operated by the private sector will be encouraged.
- Develop proposed legislation for proper control, treatment and disposal of hazardous waste in Florida.

Regional Solid Waste Policies[*]

Solid waste is recognized as a potential resource. The recycling and reuse of solid waste materials are encouraged. Toward this end:

[*] TBRPC, *Future of the Region – A Growth Policy for Tampa Bay Region*, St. Petersburg, 1977, p. 23.

- The research and investigation of solid waste as a source of energy and raw material and its reuse are supported.
- Research, development and implementation of methods of resource recovery from solid waste are encouraged.
- Incentives for research and development should be offered in order to encourage the implementation of resource recovery and the reuse of recovered materials.
- Methods for encouraging source reduction of solid waste are encouraged through resource recovery and solid waste plans.
- Methods of maximizing energy conservation through solid waste management are encouraged.
- Resource recovery energy systems should be incorporated as a measure to meet future energy demands.

Pinellas County Solid Waste Goals and Policies[♦]

- Plans for solid waste disposal should be directed toward resource recovery.
- Sanitary landfills which will be required even with full resource recovery should be designated to prevent water and air pollution, health problems, loss of aesthetics, depressed real estate values, and interference with aviation patterns.
- Planning for landfills should consider suitable reuses for the land when filling has been completed.
- Coordinate the various solid waste collection systems to eliminate duplication of coverage and reduce the cost per ton mile of collection and disposal.
- Plan for expanded solid waste collection service to newly developing areas of the county.
- Energy resource recovery systems should be incorporated in development planning, where feasible.

♦ PCPC, *Preliminary Goals, Policies and Economic Assumptions Pinellas County General Plan for the year 2000*, 1977, p. 6.

Appendix B

Major Design Requirements for Pinellas County Resource Recovery Program

Arrival of Refuse

Solid waste will arrive at the facility between the hours of 7:00 a.m. and 7:00 p.m. on Monday through Saturday, including holidays.

Traffic and Vehicle Control

The solid waste will arrive in a great variety of vehicles. The county will be responsible for separating domestic vehicles arriving with refuse from the regular sanitation vehicles. There shall be no intermingling of traffic (domestic vehicles and sanitation vehicles). All traffic facilities will be sized to accommodate a peak traffic volume of 120 vehicles per hour. All routine traffic shall be directed utilizing one-way roads.

Weighing and Payment Record Keeping

All weighing and record keeping will be the responsibility of the county. Vehicles will be routed by county personnel to one of three locations:

1. county operated landfill
2. contractors storage area, and
3. county operated vehicles disposal and recycle area.

Tipping and Storage Requirements

There shall be adequate tipping locations at all times and adequate storage to allow for uninterrupted delivery of raw refuse and for recovered materials prior to transport to market. Safety measures shall be provided in the tipping area and the design shall insure five to eight-minute turn-around time.

Resource Recovery Facility Design

The primary purpose of the facility shall be the recovery of energy for sale. Any further resource recovery is favored by the county, and proposals will be evaluated favorably which address additional resource recovery which is economically feasible.

Materials to be accepted by the contractor at the facility will consist of municipal, commercial, and industrial solid waste including refrigerators, household furniture, white goods, yard debris and selected demolition materials. General construction and demolition debris will be diverted directly to the county operated landfill, as required. Materials not acceptable to the contractor shall be explicitly defined in the proposal. All rejected wastes not processible by the contractor as well as residue of the facility, will be diverted to or delivered by the contractor to the county operated landfill as necessary for final disposal, or disposal of in an approved manner.

Processing Equipment

The contractor shall supply, maintain, and operate all necessary process equipment. The design should include provisions for redundancy and future expansion. The facility shall have the capability of processing 12,000 tons per week.

Building Design

All solid waste handling operations shall be totally enclosed. The architecture of the proposed layout shall be a consideration of the county.

Availability of Utilities

It is the responsibility of the contractor to supply the county with quantities of all utilities required by the facility. It shall be the responsibility of the county to provide water, sanitary sewer, and storm sewer systems from the property lines of the site.

Landfill Usage

The contractor shall state the items which will not be processed through the system. Construction and clearing debris will be diverted to the county maintained landfill. Land is a limited resource, therefore, every effort will be made to minimize future landfill requirements in Pinellas County.

Existing Energy Market

The energy market hat has been established by the county is the Florida Power Corporation. Specifications have been developed for both electricity and medium BTU gas which FPC has agreed to purchase. Also included are the anticipated unit rates to be paid for the energy. These rates will be used in all calculations regarding revenues from the facility. Unless otherwise specifically stated in the proposal, it is assumed that proposed energy byproducts will meet the specifications as stated.

Other Energy Markets

No attempt was made to exclude any participant in the RFQ phase of this endeavor for proposing systems which address energy markets other than those established. However, the potential contractor was required to establish contracts of agreement with the markets.

Expansion Capability

Consideration should be given for future expansion of the facilities.

Financing

It is the intent of the county to obtain the most favorable economic position relative to the financing of the facilities.

Operating Fee

The operating fee shall be the final negotiated fee established in the terms of the operating contract and will be adjusted in accordance with the fee adjustment factor.

Landfill Fee

A landfill presently operated by the county or its agent is located directly adjacent to the proposed facility site. It will be the responsibility of the contractor to deliver process residues to this site for landfilling.

Waste Composition

The following assumptions should be made concerning waste stream composition:

1. contains a heat value of 5,000 BTU/lb,
2. contains 7 percent by weight ferrous material,
3. contains .5 percent by weight aluminum, and
4. contains 30 percent by weight water.

Gross Processible Portion of the Solid Waste Stream

This is the portion of the total waste stream that remains after the non-processible portion is removed. It will most likely contain some items which cannot be processed by the facility. The county will supply gross processible solid waste at the following guaranteed minimum rates:

450, 000 tons/year

36,000 tons/month.

Appendix C

Summaries of Proposals and Evaluation Conclusions

Summaries of Resource Recovery Proposals

Combustion Engineering (CE)

Combustion Engineering submitted two proposals. The basic proposal involved a two-line front-end processing system with a single boiler which will burn either solid waste or coal. Heat of combustion would produce steam and generate 47.5 MW of electricity through the use of a single turbine generator. The system also provides for recovery of ferrous metals by magnetic methods during front-end processing. The one boiler guarantees a net energy production of 513 kWh per ton of processed refuse and a ferrous metal recovery efficiency of 95 percent. The price of the facility is $70,300,000. The proposed operating cost is $7.51 per gross ton. Combustion Engineering submitted an alternate proposal offering a two-boiler, single turbine generator system with a 50 percent increase in capacity.

Combustion Equipment Associates (CEA)

Combustion Equipment Associates submitted a proposal for a facility to convert solid waste into a proprietary dry fuel called ECO-FUEL^{R} – 11. The system proposed would be basically the same as a facility presently under construction in Bridgeport, Connecticut. The system has a capacity of 14,000 tons/week. Proposed markets for the fuel are Florida Power Corporation (FPC), Tampa Electric Company (TECO), and Hooker Chemical Company. No confirmation of these markets, however, was submitted with the proposal. The CEA offer included a maximum processing fee of $12.90/ton. The county's only involvement in this proposal would be to supply the guaranteed solid waste quantities and pay the processing fee. All energy and materials would be the property of CEA, and the marketing of these resources would be the responsibility of CEA. CEA's preferred method of financing involves a combination of an equity position by CEA and mortgage financing.

Universal Oil Products (UOP)

Universal Oil Products submitted two proposals incorporating two and three-boiler system configurations. Both systems proposed involved the mass burning (no

preprocessing) of solid waste in boilers (Martin-European Technology) with the recovered heat used to generate electricity to be sold to FPC at the rate of 495 kWh/ton of gross processible solid waste. Both systems have the same nominal capacity of 12,000 tons/week of gross processible solid waste. In addition to the recovery of energy, both proposals guarantee the post-processing recovery of ferrous metals, aluminum, and heavy non-ferrous. The energy recovery guarantee as stated for both proposals is 550 kWh/ton gross or 495 kWh/ton net (with in-plant used satisfied by electricity generated), with ferrous, aluminum and heavy non-ferrous recovery efficiencies guaranteed at 90 percent, 60 percent, and 40 percent, respectively. Both proposals were submitted on the basis of public financing. The capital cost of the two-boiler proposal was $44,880,000 and the operating cost was $7.14 per net ton. The capital cost of the three-boiler proposal was $48,395,000 and the operating cost was $7.89 per net ton.

Wheelabrator-Frye, Inc.

Wheelabrator-Frye, Inc. submitted two proposals utilizing the same system configuration with alternate financial and ownership options. The system proposed involves the mass burning (no preprocessing) of up to 12,000 tons/week of gross processible solid waste tin two boilers (Von Roll-European Technology), and one generator with sale of electricity to FPC. In addition to the recovery of energy, WFI proposals include the recovery of post-incineration ferrous metals. The performance guarantees for both proposals are 615 kWh/ton gross electricity (560 kWh/ton net, with in-plant uses deducted). The base proposal involves the use of county financing as well as the county marketing the recovered energy and materials. The capital cost is $70,912,000. The initial operating fee of $12.88 per gross ton is the sum to be paid to WFI to operate the county-owned facility. The alternate proposal incorporates an equity position by WFI, revenue bond financing, and marketing of recovery energy and recovered materials by WFI. The operation cost of $11.50 per gross ton is the tipping fee to be charged by WFI.

Grumman Ecosystems

Grumman's proposal involved a three-boiler, two-generator facility (VKW-European Technology) designed to burn unprocessed solid waste (mass-burn), and convert the heat generated into electricity for sale to FPC. Their proposal offered the largest burning capacity of any mass burning system offered at 15,750 tons per week. In addition to the recovery of energy, Grumman process to recover post-incineration ferrous metals. The capital cost of $79,900,000 is exclusive of any financing costs. Grumman proposes to utilize electricity generated by the facility to satisfy in-plant needs and will guarantee 395 kWh/ton net electricity for sale to FPC. The operating

fee was given as $6.40/net ton. Grumman expressed no interest in an equity position with regard to financing and preferred county financing.

Union Carbide Corporation (UCC)

Union Carbide Corporation submitted two proposals both of which involve the same configuration of facilities but incorporate alternate methods of financing and ownership. The UCC physical facilities consist of a front-end processing system which feeds five pyrolytic converters which in turn convert up to 13,650 tons/week of the prepared solid waste into a medium BTU gas to be sold to FPC. In addition to the recovered energy, UCC proposes to recover ferrous metals from the waste stream prior to the pyrolysis process. The residue from the process, which is a quenched molten slag, is envisioned by UCC as a product which could be sold as construction aggregate.

UCC guarantees the energy recovery efficiency of 70 percent based on 5,000 BTU/lb. input and a ferrous metal recovery efficiency of 95 percent. The capital cost of the facility for county ownership was $106,074,700. the initial operating cost would be $23.22 per gross ton for the basic proposal. The alternate proposal offered the same physical facility with UCC being both owner and operator. The initial operating charge would be $11.06/gross ton.

Summary of Evaluation Conclusions

Combustion Engineering (CE)

1. The guarantee regarding boiler availability are such that the county would very likely receive economic benefits due to performance higher than the levels guaranteed in proposal A.
2. Technically, the system is sound. Although an overall system as proposed has not been constructed to date, all of the subsystems are in operation in various locations. CE has the expertise and corporate resources available to ensure a good reliable system.
3. This system also has the advantage of being flexible in light of the variety of fuels which could be fired if solid waste quantities and/or qualities change drastically in the future. Also, flexibility is offered in relation to materials recovery since a front-end processing system is proposed.
4. From information provided, it appears that the system, as proposed, can meet environmental criteria as well as any of the proposed systems.

Combustion Equipment Associations (CEA)

1. From information reviewed to date, there is some question as to the number and size of commitments made by CEA, and it would not be prudent to enter into a contract with them until the facilities contracted for have been operational for an extended period.
2. Several markets were mentioned in the proposal. Hooker Chemical, TEC, and FPC were mentioned as prospective markets, however, only sketchy letters of intent were supplied with no mention of possible prices to be paid for the fuel.
3. In past agreement, CEA has derived the financial strength required to participate in a project of this magnitude through a joint venture (Occidental Petroleum). Here, there was an implication that the same party would participate, however, there was never any formal agreement evidenced.
4. Demonstration of their technology has been very limited. There had been less than 1,000 tons of fuel produced in total from their existing facility as of the date of an interview trip in December 1977.

Grumman

1. Regarding the technology proposed, VKW has had extensive experience in Europe, however, all operating units are smaller than those proposed here. There appears to be no operating experience with the size units offered here anywhere. The system proposed has excess boiler capacity, however, this seems to be offered for the sake of standby redundancy since the turbine generator set is sized for approximately 12,000 TPW.
2. Grumman has least technical resources and very limited experience in solid waste activities in the U.S.
3. From information provided, it appears that environmental standards can be met as well, or better, than any of the other proposers.

Union Carbide Corporation (UCC)

1. Technically, the strength of the private financing offer is provided by the technical resources of UCC more so than the limited operational experience of the type facility proposed.
2. From information provided, the system can meet the existing environmentally acceptable features of all proposals.

Universal Oil Products (UOP)

1. Technically, the Martin/UOP system is as strong if not stronger than the other technologies offered.
2. Universal Oil Products/Martin is proposing equipment which does not extend the size of existing facilities in Europe. The Martin systems are the largest mass burning units in Europe with a facility in Paris which has a capacity of 2,640 TPD capacity with two boilers. In addition, there are Martin units operating successfully in Chicago and Harrisburg, Pennsylvania, although there is not electrical generation at these facilities.
3. Although UOP has little operating experience with solid waste in the U.S., the resources of UOP are mainly oriented toward high technology operations rather than equipment sales. In addition, UOP purchased the International Boiler Works Company which installed the two Martin units in the U.S.
4. From the information provided, it appears that the system proposed can meet the environmental criteria as well as any of the proposers.

Wheelabrator-Frye, Inc. (WFI)

1. The technology proposed is sound with working experience of a facility in the U.S. which has been operating for more than two years in Saugas, Massachusetts.
2. Wheelabrator-Frye, Inc. has extensive operating experience at the Saugas Plant.
3. From the information provided, it appears the system can meet environmental standards. The only potential problem involves the possible impacts resulting from the open truck maneuvering area, however, this is a problem that could be remedied for a relatively small cost.

Appendix D

Materials Recovery Process

Combustion residue initially falls into a vibrating conveyor from the ash discharger. A grizzly screen is located so as to keep most massive (over 10″ x 10″) pieces from damaging the conveyor. These massive pieces are handpicked of metals; non-metallics are landfilled (residues).

Upon entering the materials recovery building, the residue is sized at the end of the primary residue conveyor. First, the minus two-inch materials, smaller than two inches drop out, then materials greater than two inches but less than ten inches drop out, leaving any object larger than ten inches which the grizzly screen may have missed. The massive pieces are handled as above.

Prior to the initial sizing operation, a diverter chute has been provided so that repairs can be effected downstream while the combustion units continue to operate normally.

The two-inch to ten-inch residue falls from the primary residue conveyor to another vibrating conveyor. This fraction, primarily tin cans, is conveyed to a magnetic separator which removes the ferrous metal and deposits it on a conveyor belt. This ferrous metal is then transported to a storage/shipping/further processing area as required. The residue, smaller than two inches, from the primary residue conveyor falls to another vibrating conveyor which moves the residue to a second-sizing operation. At this point, the fine residue/ash is removed, combined with moistened electrostatic precipitator flyash and conveyor belted further downstream.

The remainder of the residue, smaller than two inches, moves via another vibrating conveyor to a magnetic separator, which removes the miscellaneous small ferrous metal to a conveyor belt for transporting to storage/shipping.

The non-magnetic material next travels by conveyor belt to a size reduction unit which breaks up the friable materials. From size reduction, the stream moves to a sizing operation which removes the larger metallics from the shattered friables and undersize metallics.

The larger metallics are elevated by bucket elevator to a heavy media unit. This heavy media system uses a ferrofluid to achieve an effective specific gravity of 3.0 or more. Under these conditions, the aluminum present floats, while the heavy nonferrous

metals sink. Both fractions are recovered as clean products and move by conveyor belt to storage/shipping.

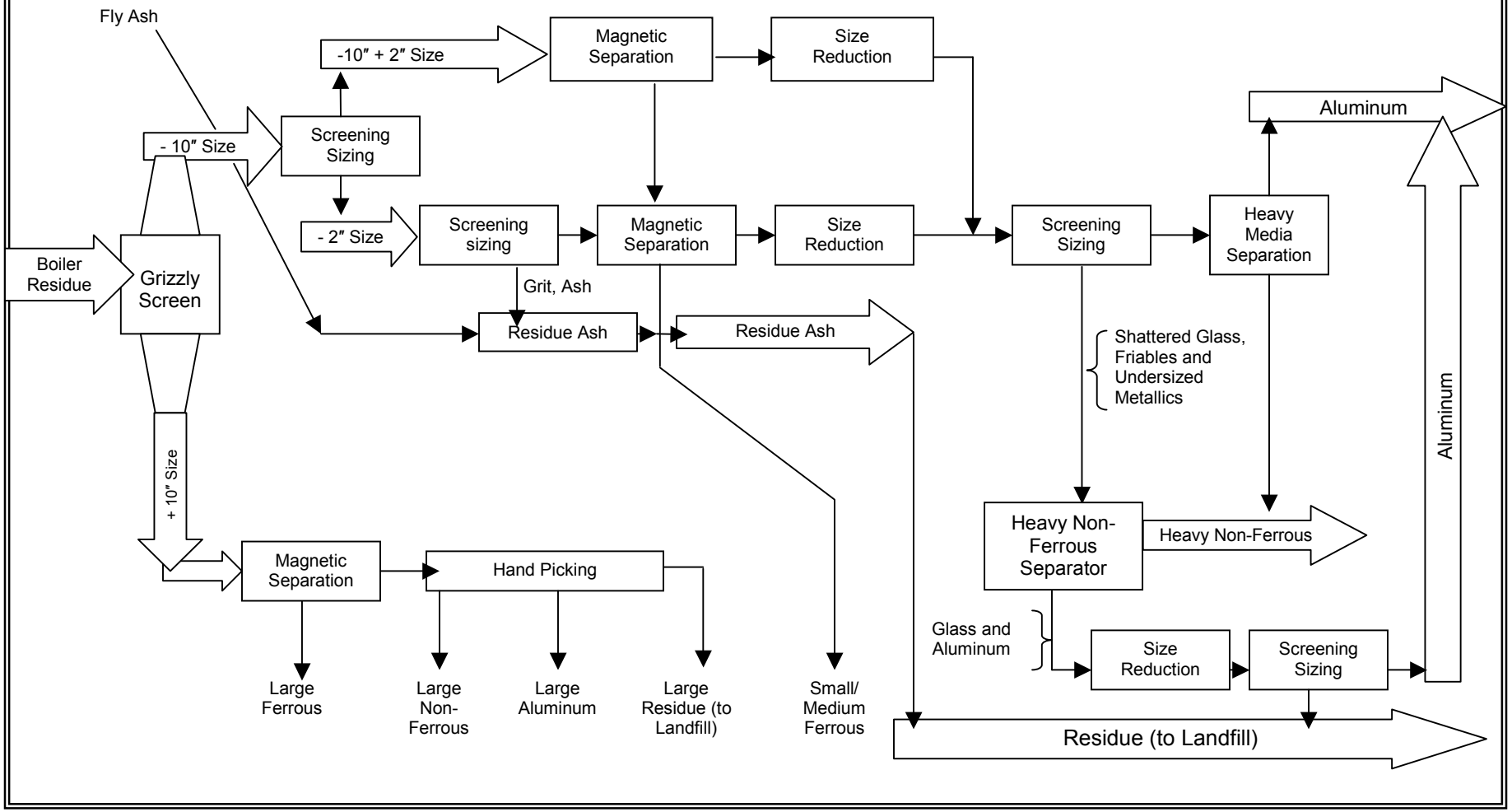
The undersize residuals from the sizing operation proceed by conveyor belt to a mineral jig which serves to segregate the heavy non-ferrous metals from the aluminum aggregate fraction. This jig also produces a fine aggregate product which is dewatered and mixed with the fine residue/flyash stream. After dewatering, the heavy non-ferrous jig product moves by conveyor belt so as to combine with the heavy non-ferrous from the heavy media system. The glass and remaining recoverable aluminum are also dewatered and then conveyor belted to a size reduction unit which crushes the friable glass, ceramic, etc. The aluminum tends to flatten into flakes during this operation.

A conveyor belt takes the crushed and flattened material to a final sizing step, where the aluminum is recovered and moves by conveyor belt to storage/shipping/further processing. The undersize materials fall to the aggregate conveyor belt where it combines with the fine aggregate, fine residue and flyash previously produced. This material is suitable for use as the aggregate portion of asphalt.

The material handling system is adaptable to the addition of recovery equipment for other materials, such as glass, as market demands make sure measures economically viable.

The entire materials recovery process is graphically depicted in Figure 49, Materials Recovery Schematic.

Figure 49
Materials Recovery Schematic



Source: UOP, Proposal for Solid Waste Resource Recovery Program for Pinellas County, Fla., Nov., 1977.

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Footnotes

[1] PPC, *Conservation & CZM Element of Pinellas Co. General Plan,* 1979, p. 40.

[2] PPC, *Conservation Element*, p. 119.

[3] PPC, *Conservation Element*, p. 151.

[4] PPC, *Conservation Element*, p. 202.

[5] PPC, *Conservation Element*, p. 19.

[6] PPC, *Demographic Study – Pinellas County, Florida*, 1978, p 7.

[7] HDR, *Solid Waste Energy & Resource Recovery,* 1976, p. 3-10.

[8] Ibid.

[9] TBRPC, *Solid Waste Resource Recovery*, 1975, p 62.

[10] Ibid.

[11] Taken in part from: HDR, *Solid Waste Energy & Resource Recovery,* 1976, p. 2-4.

[12] PCPC, *Demographic Study - Pinellas County, Florida*, 1978, p. 38.

[13] HDR, *Solid Waste Energy & Resource Recovery,* 1976, p. III-1

[14] TBRPC, *Solid Waste Resource Recovery*, 1975, p. 191.

[15] HDR, *Solid Waste Energy & Resource Recovery,* 1976, p.IV-1.

[16] TBRPC, *Solid Waste Resource Recovery*, 1975, p. 68.

[17] HDR, *Solid Waste Energy & Resource Recovery,* - Appendix, 1976

[18] HDR, *Solid Waste Energy & Resource Recovery,* 1976, p. IV-6.

[19] HDR, *Solid Waste Energy & Resource Recovery,* 1976, p. IV-9.

[20] This section of the report came from: HDR, *Solid Waste Resource Recovery, Evaluation of Proposals*, Jan. 1978.

[21] BCC, RFP –S*olid Waste Resource Recovery Program, Pinellas Co., Fla*., July 1977, p. 14.

[22] BCC, Site Evaluation for the Countywide Solid Waste Resource Recovery Operation, Aug. 17, 1976.

[23] HDR, *Pinellas Co. Resource Recovery Proposal Evaluation,* May 1978.

[24] Ibid.

[25] UOP, *Proposal for Solid Waste Resource Recovery for Pinellas County, Florida*, 1977, p. 3-4.

[26] UOP, *Proposal for Solid Waste Resource Recovery for Pinellas County,* 1977, p. 3-24.

[27] UOP, *Proposal for Solid Waste Resource Recovery Program for Pinellas County, Florida*, 1977, p.6-1.

[28] UOP, *Proposal for Solid Waste Resource Recovery Program*, 1977, p.3-12.