CHAPTER 3

WASTE STREAM ANALYSIS

This chapter describes the amount of solid waste recycled, diverted, or disposed in the three collection and disposal systems in Pierce County and projects disposal needs for 20 years. It also evaluates the amount and type of waste disposed to: 1) assess the effectiveness of the waste reduction and recycling programs; and 2) identify remaining needs and opportunities for diversion or recycling.

3.1 Definitions and Measurements

The following definitions are used throughout this chapter:

Waste Generated: The sum of all waste disposed in mixed municipal waste (MSW) landfills, diverted for energy recovery or composting, and materials collected and recycled by both public and private entities. It does not include special wastes that are generally handled outside the municipal waste stream collection system of transfer stations, MSW landfills, and municipally or federally owned waste-to-energy facilities. Special wastes are those which are disposed in privately owned, limited purpose inert landfills, soil bio-remediation facilities, or used to produce industrial hog-fuel.

Waste Recycled: Materials collected for recycling or diverted from disposal by composting to public and private facilities. Materials not included are pre-consumer recyclables or those specialty wastes that would not generally, or only incidentally, enter the municipal waste stream collection system.

Waste Disposed: All waste disposed at in-county MSW landfills, diverted to municipally or federally owned MSW waste-to-energy facilities, or exported under contract to out-of-county MSW landfills.

Pounds per Capita per Day: Disposal, recycling, or generation rates reflecting the number of pounds disposed, recycled, or generated per person per day.

Measurement Methods: There are three, separate management systems in Pierce County: the Pierce County system serving the unincorporated areas and 19 cities and towns; the Tacoma system which also provides disposal for the Town of Ruston; and the Fort Lewis/McChord Air Force Base military system. The three management agencies use multiple measurement methods to evaluate their systems and to project the need for disposal or other facilities. They do not rely solely upon either the recycling rate or disposed tonnages. The jurisdictions look at a number of measured trends and compare them over time. The key question to be answered is whether the measurements show similar trends.

The measurement methods used by the jurisdictions include: 1) countywide disposal and recycling tonnage, recycling rates, and pounds per capita per day (pcd) disposed and recycled; 2) disposed tonnages for the three individual systems along with the pcd rate, broken down by generator sectors, if possible; and 3) changes in waste characterization determined by audits.

In Pierce County, the recycling rate is computed on a countywide basis rather than individually for the three systems. This is because the complexities of the combined municipal and private recycling systems which cross-jurisdictional lines make it nearly impossible to accurately allocate recyclables as coming from specific jurisdictions.

Waste reduction: Pierce County does not attempt to measure waste reduction by projecting total generated waste for the next year and then measuring the results the following year. There are too many yearly variables beyond the County's ability to control or influence, or even measure, to project total generated waste (disposal and recycling tonnage). Waste generation is affected by the local, regional and national economies, population growth, one-time events (such as floods and storms), individual business decisions, increases in disposal costs, and, even societal shifts. When the County looks at waste reduction, it assumes that decreases in disposed tonnages in certain sectors, may indicate, in part, waste reduction activities.

The most useful measurement of waste reduction efforts over time is to periodically conduct waste audits and compare the differences and tonnages of materials from various sectors with the previous audit. The resulting trends indicate how well various sectors respond to public outreach messages or take advantage of new opportunities and programs for diverting specific materials from disposal.

3.2 Historical Waste Stream Data

Beginning in 1990, the County began collecting disposal and recycling data for all three management systems in a consistent manner from year to year. The following four sub-sections look at what has occurred since 1990 for:

- ✓ Countywide disposal and recycling
- ✓ The disposed waste stream for the Pierce County management system with its 19 cities and towns
- ✓ Disposed tonnage for the Tacoma management system, which includes the Town of Ruston; and
- ✓ The disposed waste stream for Fort Lewis and McChord Air Force Base

(For historical disposal and recycling information prior to 1990, please see the 1989/1992 Plan documents.)

Countywide disposal and recycling - 1990 - 1998: The cooperative efforts by all jurisdictions working with private businesses to implement recycling and waste reduction programs resulted in a peak countywide recycling rate of 52 percent in 1996. While the amount of waste disposed has not increased appreciably since then, and in fact declined from 1997 to 1998, the overall percentage of the waste stream being recycled has dropped to 45 - 46 percent. Figure 3-1 portrays a snapshot of the countywide solid waste management system for 1998.

As illustrated in Figure 3-2, the total disposed waste stream for all three jurisdictions was approximately 620,000 tons in 1998. Since 1993, when waste disposal peaked at 638,000 tons, the total amount of waste requiring disposal has dropped by two percent despite 7.2 percent population growth over the same time period.

More indicative than gross tonnage calculations, are calculations of the per capita per day (pcd) rates, as illustrated in Figure 3-3. When evaluated over time, these rates incorporate both population and business growth and changes in the economy. Countywide, the disposed pcd rate peaked in 1993 at 5.45 and has since declined to 4.94, a ten percent decline.

The recycling pcd rate climbed steadily from 1.99 in 1990 to 5.25 in 1996. The rate dropped slightly in 1997 and fell to 4 pcd in 1998. The reader, however, should be cautious in interpreting this steady incline as solely the result of increased recycling and the drop off as an indicator that recycling has fallen out of favor. Much of the early increase, particularly in the period from 1990 to 1993 should be attributed to better record keeping. Increases which occurred between 1994 and 1996 are best explained by the fact that this was the time period in which most county recycling programs spread countywide and reached their "maturity."

In this same time period, in response to record high marked prices for recycled commodities, a number of entrepreneurs started recycling programs targeting the business waste stream, particularly office paper and construction and demolition debris.

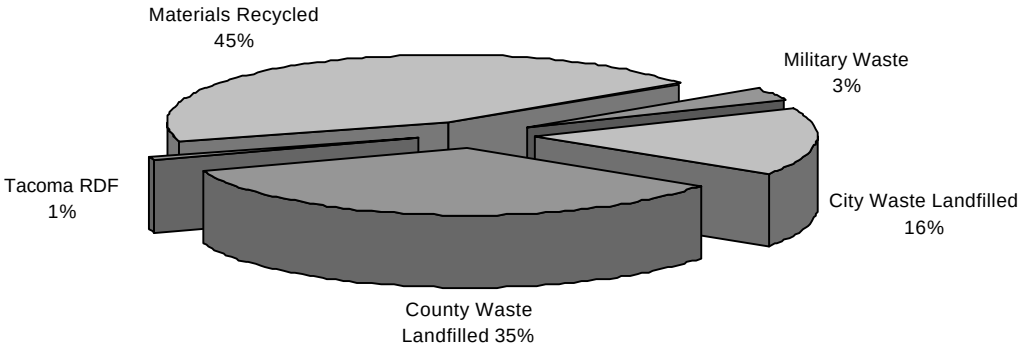
The decline in the per capita per day recycling rate over the past two years also has many causes. One hypothesis is that recycling issues are not receiving the same focus they received in years past and therefore, without constant reinforcement, people are not recycling. This explanation is belied by the fact that residential recycling continues to increase.

Another hypothesis is that some of the recycling ventures started in the mid-1990s folded as commodity market prices declined. This hypothesis is partially proven by the decline in companies providing recycling services to Pierce County businesses.

One other explanation for the drop in the gross tonnage and pcd recycling rate is that a few large recyclers are no longer able to desegregate, by county, their data on what is being recycled.

For evaluation purposes, what is important are the consistent and complimentary trends of an increasing recycling pcd rate and a decreasing disposal pcd. These trends have occurred at a time with substantial population growth and represent a strong impact from recycling collection programs. The disposal rate trend and the population trend are illustrated in Figure 3-3.

Figure 3-1
Waste Disposal, Recycling, and Energy Recovery in 1998



RDF = **R**efuse **D**erived **F**uel for energy recovery at the Tacoma Steam Plant

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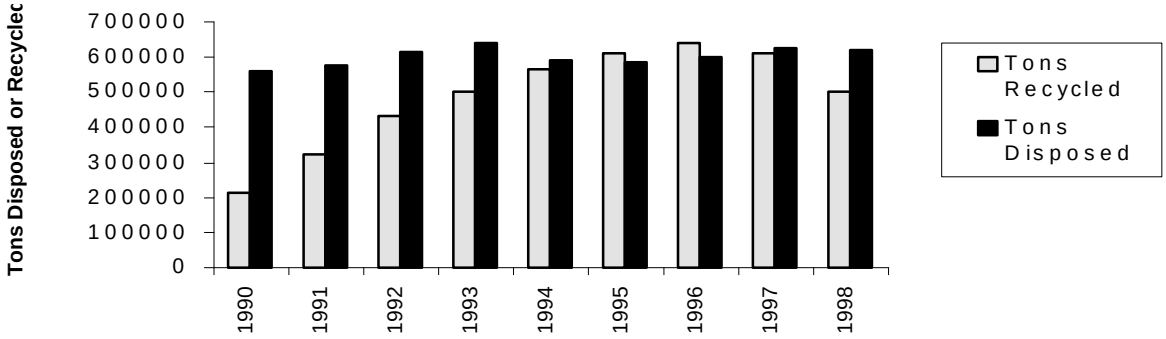
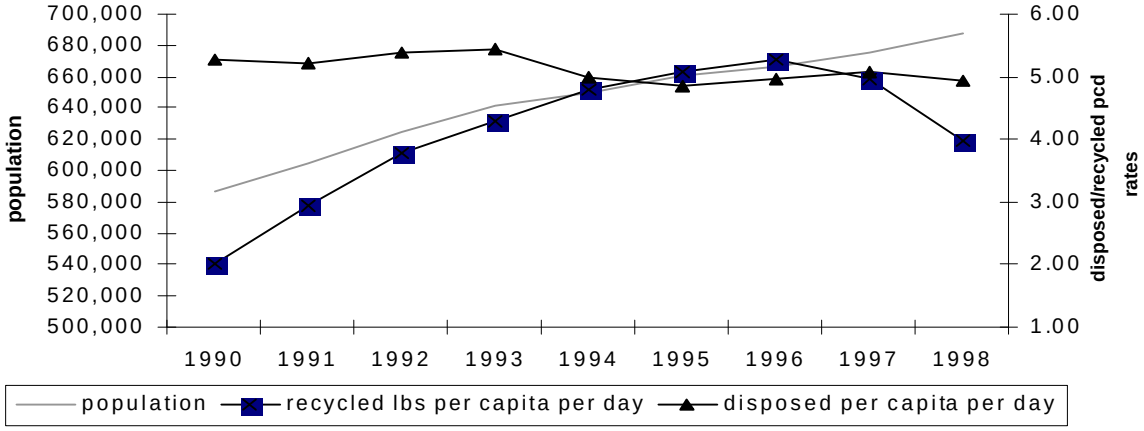
Figure 3-2
Waste Disposal and Recycling, 1990-1998



includes waste generated and disposed countywide

Figure 3-3
Poplation and Per Capita Recycling & Disposal Rates



Pierce County waste stream: The Pierce County wasteshed includes the population served in the unincorporated county and the 19 cities and towns which use the County's disposal system. Figures 3-4, 3-5, and 3-7 illustrate the trends discussed in the following paragraphs. Table 3-6 includes actual tonnages, pcd rates, and population from 1992 to 1998.

After peaking at 403,000 tons in 1993, disposed tonnage dropped in 1994 and 1995 and rose in 1996, 1997, and 1998, but is still below the peak. During the years since 1993, however, population grew by 7.6%.

The total disposed pcd rate, which includes all municipal solid waste (hauler-collected and residential self-haul) and commercial self-haul, peaked at 5.02 in 1993, declined to 4.37 in 1996, and has risen to 4.55 in 1998, which is below the countywide rate of 4.94. The pcd rate for municipal solid waste was 2.93 in 1998. This is a low rate when compared to other areas. It is indicative of the amount of recycling and diversion activities occurring in the county.

Trends: A number of interesting trends show up in an evaluation of the 1992-1998 Pierce County waste stream when three broad components are compared: 1) hauler-collected mixed residential and commercial waste; 2) residential waste self-hauled by the general public; and 3) commercial waste self-hauled by businesses, contractors, and industry. (A more standardized reporting format was begun in 1992, so comparable data was not available from 1990 and 1991.)

Both the commercial and residential self-haul waste streams have decreased since 1993 while the hauler collected waste stream has increased. The commercial self-haul waste stream was 16% less in 1998 than it was in the peak year of 1993. The residential self-haul waste stream was 36% less than in 1993. Hauler-collected waste has increased 18%.

Figure 3-4
Disposal in the Pierce County Wasteshed

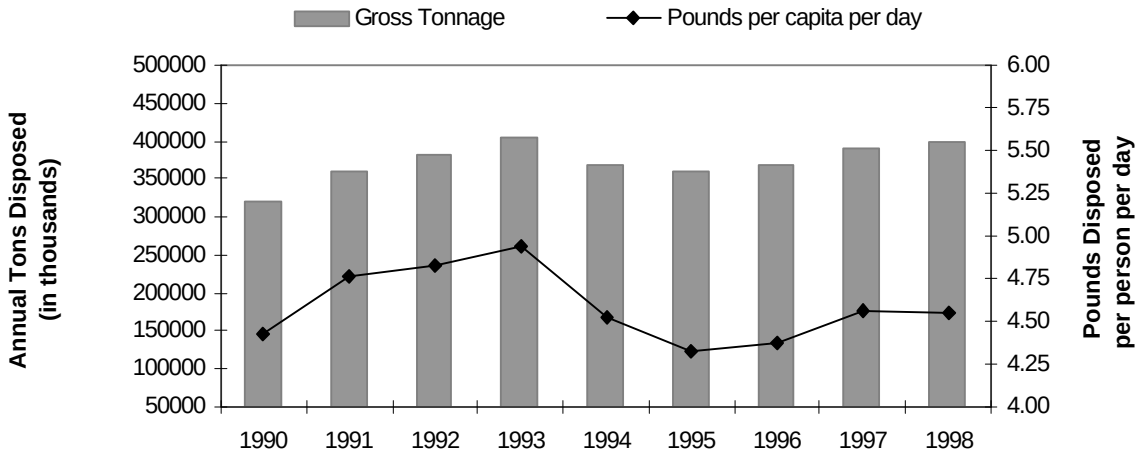


Figure 3-5
Disposed in the Pierce County Wasteshed by Broad Component

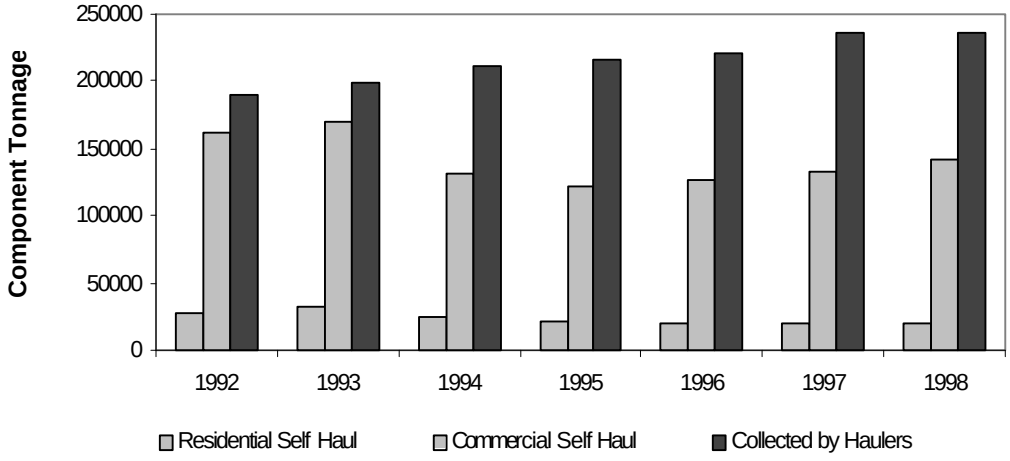


Table 3-6 Pierce County Disposed Tonnage and Population, 1992 to 1998							
	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Pierce County Wasteshed	381,650	403,177	368,522	360,396	368,043	390,243	399,415
Percent Change	+6.2%	+5.6%	-8.6%	-2.2%	+2.1%	+6.0%	+2.4%
• **Municipal Solid Waste - Total**	**220,075**	**234,166**	**237,938**	**238,462**	**241,623**	**257,278**	**256,812**
-Residential Self-Haul–sub total	**27,361**	**31,642**	**25,290**	**21,856**	**19,654**	**20,485**	**20,392**
-Hauler-Collected Solid Waste–sub total	**192,714**	**202,524**	**212,648**	**216,606**	**221,969**	**236,893**	**236,419**
Route Collection (Res. & Comm.)	189,672	199,627	211,680	215,936	221,174	235,894	235,342
Cleanups	2,152	1,965	351	152	241	330	195
State Roadside	176	148	96	59	53	72	59
County Roadside	714	784	521	460	500	591	823
• **Commercial Self-haul - Total**	**161,575**	**169,010**	**130,584**	**121,934**	**126,421**	**132,865**	**142,603**
Large Commercial/Industrial	65,603	62,198	43,768	34,694	35,631	34,367	40,792
Heavy Demolition [1]	818	164	90	127	1,266	74	56
Sheetrock	6,972	4,107	2,972	2,042	1,742	1,358	1,755
Roofing	23,799	18,595	10,206	8,763	7,298	8,112	7,758
Fluff [2]	54,169	61,470	66,254	73,223	79,528	88,009	91,333
Ash	8,887	20,842	4,547	1	3	8	10
Sludge [3]	895	1,444	2,631	2,905	880	856	832
Asbestos	228	99	51	104	17	49	25
Tires	202	110	65	75	56	32	42
Hauler-Collected pcd	**2.44**	**2.48**	**2.61**	**2.60**	**2.64**	**2.77**	**2.69**
Municipal Solid Waste pcd	**2.79**	**2.87**	**2.92**	**2.86**	**2.87**	**3.01**	**2.93**
Commercial Self Haul pcd	**2.05**	**2.07**	**1.60**	**1.46**	**1.50**	**1.55**	**1.62**
Total Disposed pcd	**4.84**	**5.02**	**4.53**	**4.33**	**4.37**	**4.56**	**4.55**
Service Area Population	**432,510**	**447,055**	**446,811**	**456,458**	**460,765**	**468,805**	**480,915**
Percent Change		+3.4%	-0.05% [4]	+2.2%	+0.9%	+1.7%	+2.6%

[1] For 1996, heavy demolition tonnage includes debris accepted by the County which resulted from the extensive flood and storm damage.
[2] Automobile fluff is used for daily landfill cover. Because it is included in disposal figures, it reduces the countywide recycling rate.
[3] The sludge category refers to industrial sludge. Biosolids from wastewater treatment plants are not included.
[4] The decrease is because of a recalculation of the population on the military bases.

Reasons for trends: Part of the trend decreases and increases can be attributed to population growth and a shift in collection as franchised haulers began collecting waste that used to be self-hauled by either the commercial or residential self-haul sectors. This is likely due to the increased density of development in the suburban and urban areas that occurred during these years. Residents of new subdivisions automatically signed up for collection services or were required to if they were within incorporated cities. Also, more residential collection services were available, such as yardwaste, which made self-hauling less necessary.

Part of the decrease, however, is because a portion of the self-hauled commercial waste stream left the disposal system. Since 1992, the amount of sheetrock, roofing, and heavy demolition materials has substantially dropped.

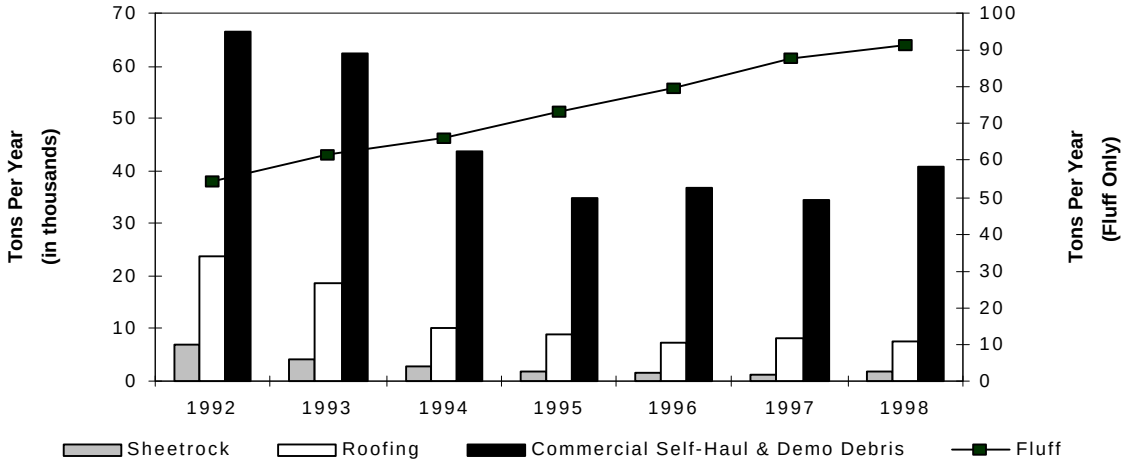
During this time period a number of new and expanded businesses began offering recycling services for demolition, roofing, and sheetrock materials while at the same time disposal costs rose. At the same time, the population growth slowed which probably resulted in less waste generated from development projects as compared to the 1991-1993 years.

The biggest change in the commercial self-haul category is due to increases in the amount of automobile fluff handled by LRI. Fluff is the non-metallic fraction that results from the shredding of cars and the separation of the recyclable metal scrap. Prior to its closure in late 1998, LRI used fluff as an approved alternative daily cover at the Hidden Valley Landfill.

Focusing on the general commercial self-haul of construction and demolition debris (and subtracting fluff) the commercial self-haul sector of the waste stream experienced a 41% drop between 1993 and 1998. These trends are illustrated in Figure 3-7 and in the tonnage pcd rates in Table 3-6.

This decline in disposal, however, does not result in a parallel rise in the County's recycling rate because some of the reduction can be attributed to “waste reduction” (i.e. the waste was never generated in the first place) and, of the material generated and recycled, not all of the tonnage was recycled within the County (and therefore not included within the County’s data)

Figure 3-7
CDL and Special Wastes, 1992 to 1998



Tacoma/Ruston waste stream: In 1998, most waste disposed in Tacoma's system was exported to the Hidden Valley Landfill or Roosevelt Regional Landfill. A smaller portion was processed into refuse derived fuel (RDF) for the Steam Plant or disposed at the City's landfill which is undergoing closure. Figure 3-8 illustrates disposed tonnage from 1990 through 1997.

Tacoma has not completed a recent waste characterization audit. Instead, the City has been re-evaluating its collection and processing methods to increase efficiency and improve data management systems. In addition, the City implemented a new curbside recycling program in 1998, as described in Chapter 4.

Figure 3-9 provides data for Tacoma's Household Hazardous Waste (HHW) Facility for the years 1993 through 1998. The data includes the number of users and tonnages of HHW generated at the Tacoma facility as well as the gallons of waste oil collected for recycling each year.

Since 1994, there has been a general trend in the tonnage and the use data for the Tacoma HHW Facility. The increases are directly related to the participation by Pierce County citizens. Through an interlocal agreement, residents of Pierce County and all of the incorporated cities have been able to use the services of Tacoma's HHW Facility. The use of the facility by Tacoma residents has remained stable. In 1998, over 2500 Pierce County customers used the services of Tacoma's HHW Facility.

The waste oil collected is a result of Tacoma's ongoing waste oil collection efforts. Tacoma has placed self-serve tanks at various locations throughout the City, including some Schuck's Auto supply stores, selected Texaco gasoline stations, and the Tacoma Landfill. Since 1994 there has been a steady decline in the amount of waste oil collected as a result of this program. It is generally believed that the decline is a result of two factors. First, in the period of 1994 to 1998, many more locations besides the City tanks started to collect waste oil from do-it-yourself oil changers. Second, it appears that there are less people performing oil changes at home. The proliferation of the quick lube type businesses and the fairly low prices for this service are likely a contributing factor.

Figure 3-8
Tacoma Waste Disposed (including Ruston)

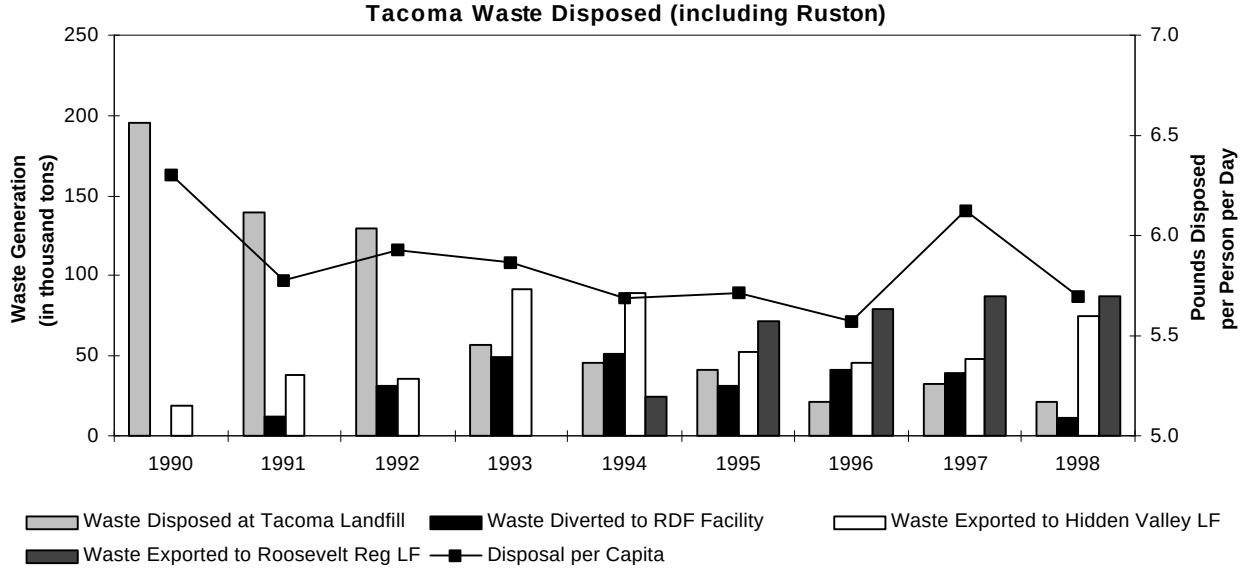
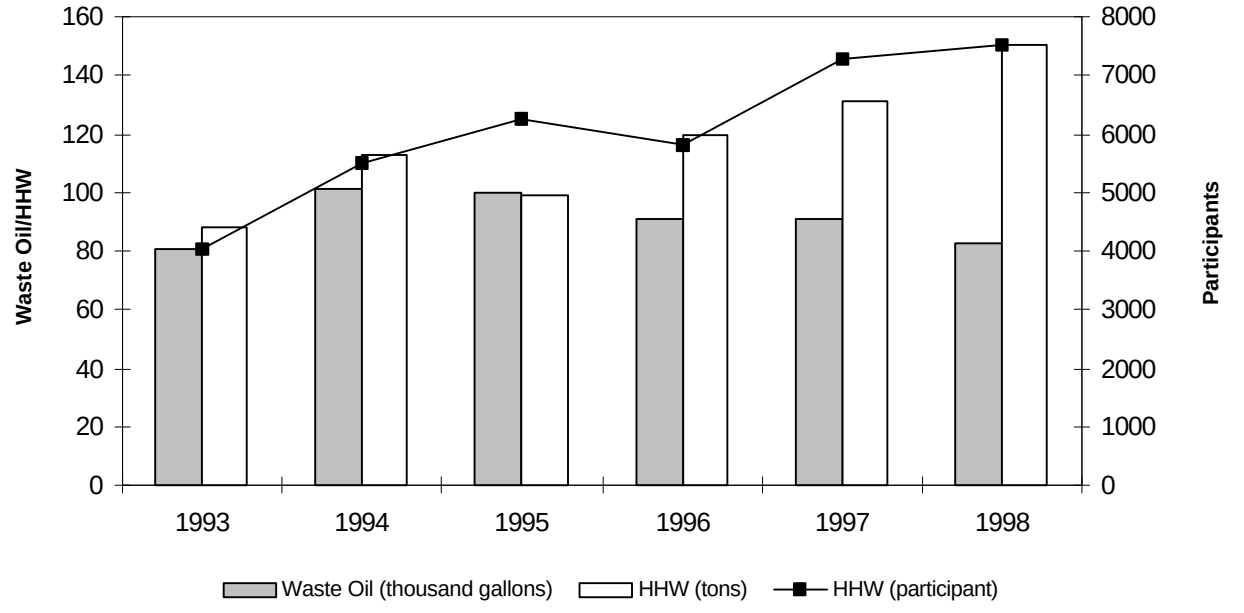


Figure 3-9
Tacoma Household Hazardous Waste Facility 1993-1998



Fort Lewis/McChord Air Force Base: The Fort Lewis system handles waste generated at Fort Lewis and McChord Air Force Base. Historical solid waste data for the military bases is summarized in this chapter and found in more detail in the 1995 Fort Lewis Solid Waste Management Plan. The Plan's 20-year planning period extends to 2015. The Fort is working on an update to the Plan. Waste quantity data was generated from landfill summary reports completed from 1992 through 1994 as reported in the Fort Lewis Plan. The information is illustrated in Figure 3-10.

Generation and composition: The total amount of solid waste generated in the Fort Lewis system increased by more than 300 percent from 1992 to 1994, primarily as a result of construction and demolition activity. The remainder of the Fort Lewis waste stream increased by 60 percent during that same period. The increase in demolition material and in the waste stream was mostly the result of base expansion. Residential population is expected to grow 11.6% from 1994 to 1999, along with an increase in civilian workers; all of which is expected to generate more waste.

The amount of solid waste generated at McChord Air Force Base between 1992 and 1994 remained essentially constant.

McChord AFB, 1995: McChord embarked on an extensive waste reduction and recycling program in 1995; setting ambitious goals and tackling a number of activities to achieve the goals. The result was that McChord achieved a 38% reduction in disposed tonnage as of December 1998. In one year, McChord's recycling rate went from 8% in 1994 to 57% in 1995. This is illustrated in Figure 3-12 which includes 1998 tonnages.

The military waste reduction and recycling programs are described in more detail in Chapter 4.

In 1994, Fort Lewis conducted a waste stream analysis to evaluate the composition of non-CDL waste generated at Fort Lewis and McChord Air Force Base. Over 23,000 pounds of municipal solid waste intended for landfilling was sampled. Results of the 1994 Fort Lewis Waste Stream Analysis are shown in Figure 3-11.

The 1996 total tonnage was 99,538 tons, which included 58,831 tons of CDL from the now completed demolition/expansion projects. Demolition/expansion projects are mostly complete.

Figure 3-10
Fort Lewis & McChord AFB
Waste Generation

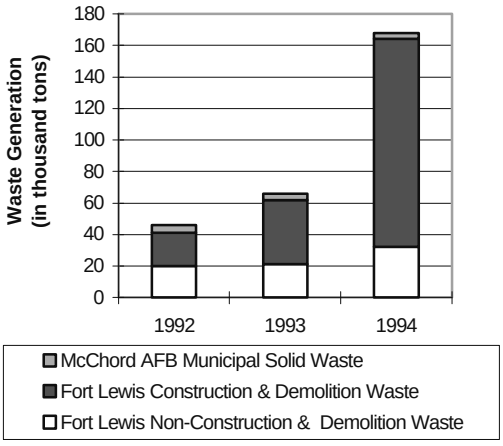


Figure 3-11
Fort Lewis Waste Stream Composition, 1994 Audit

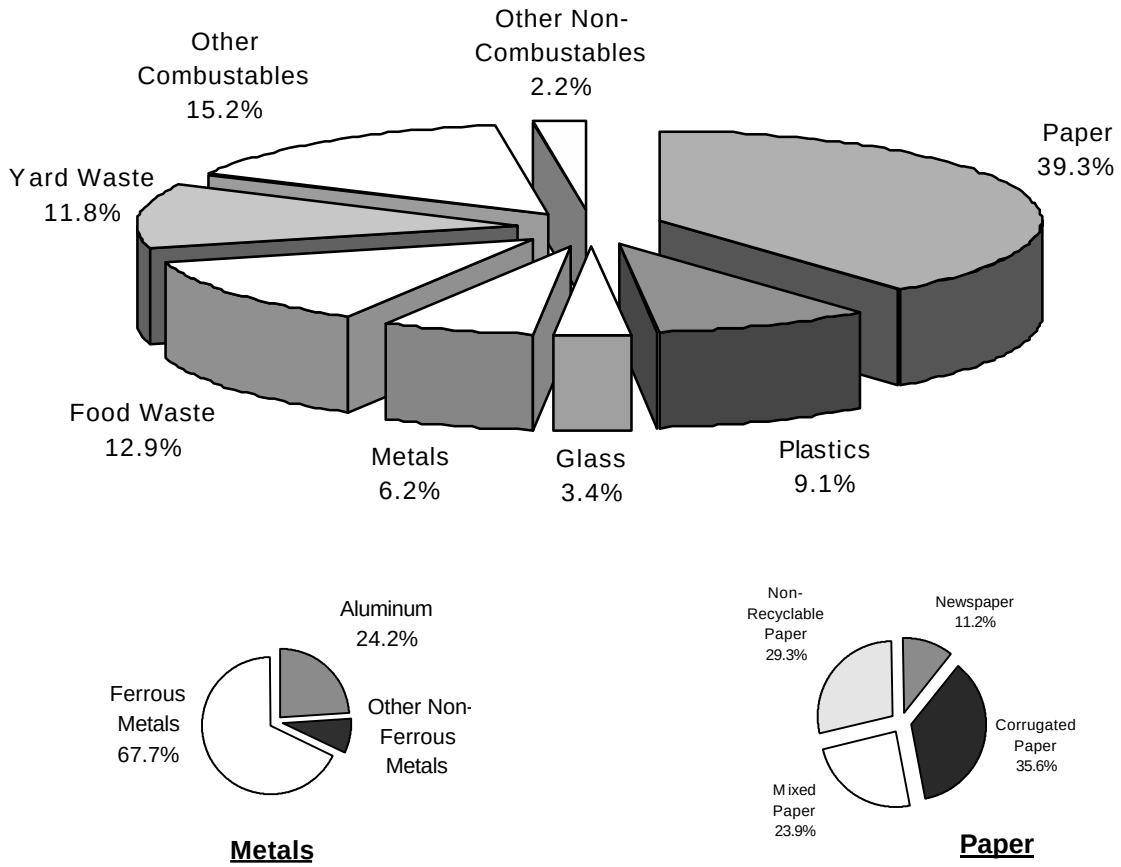
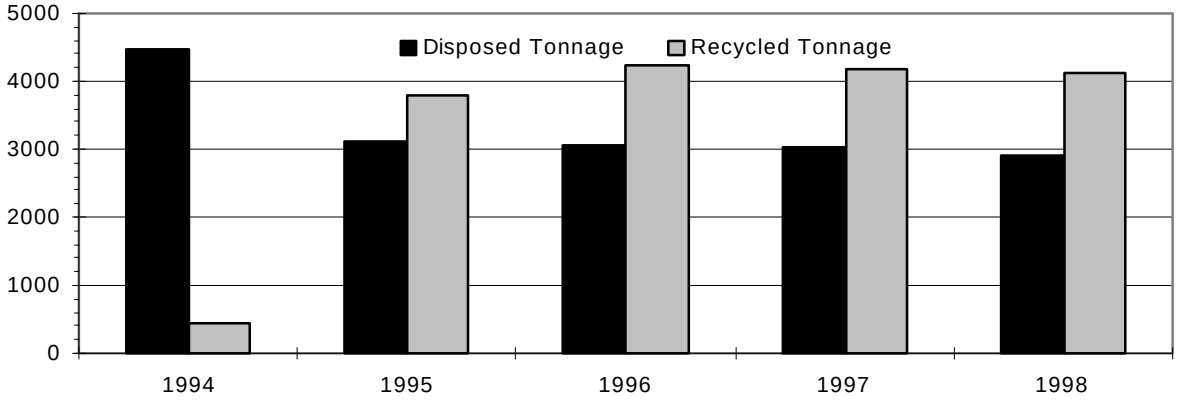


Figure 3-12
McChord AFB Waste Stream Disposal and Recycling
1994 to 1998



3.3 Projected Disposal Waste Stream

The County maintains 20-year solid waste forecasts for the entire Pierce County geographic area and for Pierce County's system using historical waste disposal data and population projections. The forecasts represent long-term trends but do not include projections of short-term or seasonal patterns.

The high range for long-term waste stream projections for the forecast period were developed using the following conservative assumptions:

- ✓ A constant per capita waste disposal rate of 4.5 pounds per day;
- ✓ A constant population growth rate of approximately 2.3 percent annually based on historical growth of the solid waste service area; and
- ✓ A 50-percent recycling rate.

Waste generation is also influenced by other demographic and economic factors, such as changes in the levels of employment and personal income, the value of recycled materials, and the price of disposal services. These factors can be interrelated or difficult to measure over time and, therefore, were not included in the long-term forecasts. The high range conservative assumptions provide leeway for planning if the recycling rate falls below 50%, population grows faster than projected, or a boom in the economy generates more waste. In order to more accurately monitor, evaluate, and refine existing disposal and recycling programs and implement new ones, the projections are updated annually based on population changes and yearly disposal and recycling data.

Disposal projections for Pierce County's system are presented in Table 3-13. Projections for the entire County, including Tacoma, Ruston, Fort Lewis, and McChord Air Force Base, are shown in Table 3-14.

Table 3-13	Pierce County Disposal Waste Stream Projections (tons/year) (Does not include Tacoma and Ruston, or Fort Lewis/McChord Air Force Base)			
	Population[1]		Waste Disposed (tons)[2, 3]	
Year	Low	High	Low	High
1997	467,560 --- 471,400		372,890 --- 387,100	
1998	476,250 --- 482,240		379,820 --- 396,040	
1999	485,100 --- 493,332		386,880 --- 405,150	
2000	494,122 --- 504,680		394,075 --- 414,470	
2001	503,300 ---516,290		401,400 --- 424,000	
2002	512,660 --- 528,165		408,860 --- 433,755	
2003	522,227 --- 540,300		416,489 --- 443,700	
2004	532,000 --- 552,730		424,283 --- 453,930	
2005	541,900 --- 565,443		432,180 --- 464,370	
2006	552,000 --- 578,550		440,234 --- 475,134	
2007	562,250 --- 600,857		448,408 --- 493,454	
2008	572,700 --- 614,700		456,743 --- 504,822	
2009	583,300 --- 628,900		465,196 --- 516,484	
2010	594,250 --- 643,365		473,930 --- 528,364	
2011	605,250 --- 648,165		482,702 ---532,305	
2012	616,500 --- 663,100		491,674 --- 544,571	
2013	628,000 --- 678,350		500,846 --- 557,095	
2014	639,650 --- 694,000		510,137 --- 569,948	
2015	651,600 --- 710,000		566,243 --- 583,088	
2016	663,700 --- 726,000		529,317 --- 596,228	
2017	678,000 --- 742,800		540,722 --- 610,024	
2018	690,600 --- 759,885		550,770 --- 624,055	
2019	703,445 --- 777,360		561,000 --- 638,407	
2020	716,530 --- 795,230		571,540 --- 653,083	

[1] Pierce County population is based on the 1996 solid waste service area population. The lower range uses the service area population and OFM projections for land use planning (1.86% average growth per year). The higher range uses a rate of 2.3% which reflects long-range historical growth of the solid waste service area population

[2] Pierce County population and projected waste disposal tonnage will be updated annually

[3] Waste disposal projections for the low range use the 1996 per capita rate of 4.37 pounds/person/day. The high rate assumes a constant per capita waste disposal rate of 4.5 pounds/person/day

Table 3-14 Countywide Disposed Waste Stream Projections (tons/year) (Includes Tacoma/Ruston and Fort Lewis/McChord Air Force Base)			
Year	**Population[1]**	**Waste Disposed[2]**	
		Low[3]	**High[4]**
1997	673,900	553,440 --- 594,026	
1998	686,000	563,378--- 604,692	
1999	699,000	574,054 --- 616,151	
2000	711,000	583,908 --- 626,729	
2001	724,000	594,585 --- 638,188	
2002	736,500	604,851 --- 649,206	
2003	749,191	615,273 --- 660,393	
2004	760,878	624,871 --- 670,695	
2005	772,747	634,618 --- 681,157	
2006	784,802	644,519 --- 691,783	
2007	797,044	654,572 --- 702,574	
2008	809,478	664,784 --- 713,535	
2009	822,105	675,754 --- 724,665	
2010	834,930	685,686 --- 735,970	
2011	847,954	696,382 --- 747,450	
2012	861,182	707,246 --- 759,110	
2013	874,616	718,278 --- 770,952	
2014	888,260	729,483 --- 782,979	
2015	902,117	740,863 --- 795,194	
2016	916,190	752,421 --- 807,599	
2017	924,870	759,550 --- 815,250	
2018	939,200	771,318 --- 827,881	
2019	953,800	783,308 --- 840,751	
2020	968,600	795,463 --- 853,797	

[1] Countywide population based on adopted OFM projections for land use planning.

[2] Countywide population and disposal data will be updated annually

[3] The low projection is based on a constant 4.5 lbs. per capita per day disposal rate

[4] The high projection is based on the 1996 countywide per capita disposal rate of 4.83

3.4 1995 Waste Characterization Study of Pierce County System Waste Stream

In 1995, the County conducted a detailed study of the disposal waste stream for the unincorporated area and the 19 cities and towns using the County's waste management system. (This did not include Tacoma or the military disposal systems.) The study had two primary goals:

- ✓ To identify how much and what types of recyclables remain in the disposed waste stream to evaluate the effectiveness of existing collection, recycling, and disposal programs.
- ✓ To establish baseline data from which to monitor the County's continuing waste reduction efforts and evaluate the effectiveness of the County's transfer stations and other facilities in meeting future solid waste disposal needs.

To achieve these goals, the County established the following objectives for the Waste Characterization Study (the 1995 Study).

- ✓ Determine the composition of the disposed waste stream in five geographic areas within the Pierce County system.
- ✓ Determine the composition of the disposed waste stream from the following generators:
  - Single-family residential
  - Multi-family residential
  - Self-hauled residential
  - Commercial
  - Self-hauled commercial
- ✓ Determine how the composition of disposed waste varies from season to season.

Methodology: The 1995 Study consisted of two primary elements: a solid waste composition audit and a gate survey of vehicles at Hidden Valley Landfill and the Purdy Transfer Station. It included field sorting of residential and commercial solid waste and self-hauled residential solid waste; and visual examinations of commercial self-hauled solid waste.

The Study's sampling periods were selected based on seasonal highs and lows, the peak of lawn-trimmings disposal, and the fall foliage season. Specifically, the 1995 Study was conducted in June, October, and December (representative of the summer, fall, and winter seasons, respectively). The auditors selected random samples from vehicles disposing waste from various geographic areas in the County and sorted the samples by hand into solid waste categories based on the category list contained in the 1992 Solid Waste Plan and the 1992 Ecology characterization study.

The purpose of the gate survey was to gain an overall understanding of the disposed waste stream and better characterize the self-hauled waste stream. In addition, the gate survey was used to determine the relative percentages of waste generated by various generator types and to characterize other elements of the waste stream not included in self-hauled residential and commercial solid waste.

Results and Implications: The data obtained from the Study will be used to help guide the County's implementation of waste reduction and recycling programs to divert as much material from the disposed waste stream as is cost-effectively possible. More specifically, the 1995 Study will help the County to:

- ✓ Determine which material types have the greatest potential for diversion from the waste stream.
- ✓ Determine which geographic areas to target for diversion of certain materials.
- ✓ Determine progress in reaching diversion goals.
- ✓ Compare the County's disposed MSW composition to that of other geographic areas.

Table 3-15 is a summary of the composition results obtained from the 1995 Study. The second column of the table represents the composition for refuse that is regularly collected by route collection trucks from residential and commercial generators. Based on other studies conducted for municipalities around the United States, the County's percentages for paper, yardwaste, and foodwaste are indicative of systems with aggressive material diversion programs.

The data presented in the third column represents all other disposed waste except for automobile fluff, ash, sludge, and unknown materials. This solid waste is predominantly made up of construction and demolition debris (typically self-hauled commercial waste) and self-hauled residential waste.

Table 3-15 Solid Waste Composition Data Summary[1]			
Material Categories	**Disposed MSW**	**Disposed Other**	**Total Disposed**
PAPER	**32.7%**	**8.6%**	**26.9%**
Newspaper	4.6%	0.9%	3.7%
Corrugated and Kraft Paper	7.1%	3.2%	6.2%
Uncoated Paperboard	3.4%	0.7%	2.7%
Computer Paper	0.2%	0.0%	0.1%
High Grade Office Paper	2.5%	0.3%	1.9%
Magazines/Catalogs	2.3%	0.3%	1.8%
Telephone Books	0.4%	0.1%	0.3%
Bleached Poly Coated Paper	1.3%	1.2%	1.0%
Aseptic Packaging	0.1%	0.0%	0.1%
Other Recyclable/Compostable Paper	8.8%	2.2%	7.2%
Non-Recyclable/Compostable Paper	2.0%	0.8%	1.7%
PLASTICS	**10.9%**	**5.3%**	**9.6%**
PET - Soft Drink Bottles (#1)	0.4%	0.1%	0.3%
PET - Other (#1)	0.3%	0.1%	0.2%
HDPE - Milk Jugs and Juice Bottles (#2)	0.4%	0.1%	0.3%
HDPE - Other (#2)	1.0%	0.6%	0.9%
Polystyrene	0.7%	0.5%	0.7%
Other Plastic Containers	0.7%	0.2%	0.6%
Film Plastic	4.7%	2.6%	4.2%
Other Plastic Packaging	0.9%	0.2%	0.7%
Other Plastics	1.9%	0.9%	1.7%
GLASS	**4.8%**	**2.3%**	**4.2%**
Clear Glass Containers	3.1%	0.8%	1.3%
Brown Glass Containers	0.7%	0.6%	0.7%
Green Glass Containers	0.6%	0.2%	0.5%
Fluorescent Light Bulbs	0.0%	0.1%	0.0%
Other Glass	0.4%	0.7%	0.5%
FERROUS METALS	**3.8%**	**7.2%**	**4.6%**
Tin Cans	1.5%	0.5%	1.3%
Aerosol Cans (Non-HHW)	0.2%	0.1%	0.2%
White Goods (Appliances)	0.1%	0.5%	0.2%
Other Ferrous Metals	1.9%	6.2%	2.9%
NON-FERROUS METALS	**1.3%**	**1.2%**	**1.3%**
Aluminum Beverage Cans	0.7%	0.2%	0.5%
Other Aluminum	0.3%	0.6%	0.3%
Other Non-Ferrous Metal	0.4%	0.5%	0.4%

[1] The Pierce County Waste Characterization Study was conducted in 1995 by R. W. Beck, Inc.

Table 3-15 (continued) Solid Waste Composition Data Summary			
Material Categories	**Disposed MSW**	**Disposed Other**	**Total Disposed**
ORGANIC	**28.8%**	**5.4%**	**23.2%**
Food Waste	19.2%	3.1%	15.3%
Textiles/Leather	2.8%	0.7%	2.3%
Disposable Diapers	4.0%	0.7%	3.2%
Miscellaneous Organics	2.8%	1.0%	2.4%
YARD WASTE	**3.7%**	**6.4%**	**4.4%**
Leaves and Grass	1.1%	1.8%	1.3%
Shrub/Tree/Bush Prunings	2.6%	4.6%	3.1%
CONSTRUCTION DEBRIS	**7.5%**	**60.4%**	**20.2%**
Land Clearing Debris	0.0%	0.9%	0.2%
Drywall (Sheetrock)	0.5%	5.8%	1.7%
Concrete	0.4%	1.6%	0.7%
Furniture	0.2%	3.8%	1.1%
Insulation	0.2%	0.7%	0.3%
Carpeting	1.9%	3.1%	2.2%
Untreated Lumber	2.6%	30.9%	9.4%
Treated/Painted Lumber	1.0%	7.0%	2.4%
Other Construction Debris	0.7%	6.7%	2.2%
OTHER	**5.7%**	**2.8%**	**5.0%**
Tires	0.2%	0.2%	0.2%
Rubber Products	0.6%	0.2%	0.5%
Mixed Materials	1.8%	0.4%	1.5%
Miscellaneous Non-Combustables	3.1%	1.9%	2.8%
HAZARDOUS	**0.8%**	**0.3%**	**0.6%**
Paint	0.2%	0.0%	0.2%
Adhesives/Solvents	0.0%	0.0%	0.0%
Cleaners	0.0%	0.0%	0.0%
Oil-Based Paints, Solvents	0.0%	0.0%	0.0%
Pesticides/Herbicides	0.0%	0.0%	0.0%
Car Batteries	0.0%	0.0%	0.0%
Ni-Cad/Button Batteries	0.0%	0.0%	0.0%
Alkaline Batteries	0.1%	0.0%	0.1%
Gasoline	0.0%	0.0%	0.0%
Motor Oil	0.1%	0.0%	0.1%
Asbestos	0.0%	0.2%	0.0%
Explosives	0.0%	0.0%	0.0%
Medical Waste	0.0%	0.0%	0.0%
Other Chemicals	0.2%	0.0%	0.2%
TOTAL MUNICIPAL SOLID WASTE	**100.0%**	**100.0%**	**100.0%**

Audit Conclusions: Table 3-16 shows, by material type, the program initiatives undertaken at the time the 1992 Solid Waste Plan was developed, as well as recommendations for future diversion efforts as stated in the Plan. Also included are observations on how the County is progressing in diverting solid waste by category, based on results of the 1995 Study.

Residential: Conclusions from the consultant concerning how much progress the County has made in diverting residential solid waste were made by comparing the 1995 composition data to previous County data. The solid waste characterization study conducted in 1992 by the Washington State Department of Ecology is the most relevant comparable study in terms of previous disposed solid waste composition data.

The 1992 Ecology Study contains composition data for disposed single-family and multi-family residential waste streams for the Central Puget Sound region (the City of Seattle and King, Pierce, and Snohomish counties). A comparison of the composition data contained in the 1992 Ecology Study to data contained in the 1995 Study is presented in Table 3-17. Although the composition data for each study represents different geographical areas, some notable observations can be made. These are:

- ✓ Based on the percentage data, it appears that since 1992, the County has significantly reduced yardwaste in the single-family residential generator type compared to the Central Puget Sound region.
- ✓ The percentages of the County's disposed single-family and multi-family residential foodwaste is significantly higher than that shown for the Central Puget Sound region.
- ✓ The County's residential foodwaste disposal is approximately 0.3 pounds per capita per day (pcd), compared to approximately 0.2 pcd for the Central Puget Sound region. Nationally, the total residential foodwaste disposal rate ranges from roughly 0.2 pcd to 0.3 pcd.
- ✓ The County's multi-family yardwaste disposal percentage is significantly higher than that shown for the Central Puget Sound region.
- ✓ It appears that, since 1992, the County has made some progress in diverting newspaper in both residential generator types and corrugated paper in the single-family generator type. It appears based on the 1995 data that considerable opportunity still remains for diverting both paper grades.
- ✓ It appears significant progress has been achieved in recent years in removing yardwaste from the single-family waste stream, although there is still progress to be made in removing yardwaste from the multi-family residential waste stream.
- ✓ Foodwaste percentages in the County are comparatively high for both residential generator types.
- ✓ There is opportunity for significant progress in recycling newspaper in the multi-family residential waste stream.

Commercial: Aggregated commercial composition data were not developed for the 1992 Ecology Study. However, conclusions by the consultant concerning the County's 1995 commercial MSW composition were made based on other studies conducted in the last several years. These are:

- ✓ There remain large tonnages of corrugated paper to recycle in specific geographic areas of the County.

There is a considerable tonnage (roughly 15,300 tons) of foodwaste being disposed annually.

- ✓ The low commercial yardwaste percentage for the County (roughly 2 percent) is evidence of the success of yardwaste diversion programs.
- ✓ There is opportunity to reduce film plastics disposal from the commercial waste stream, in which roughly 6,500 tons are currently being disposed annually.

Table 3-16 Evaluation of Waste Characterization Audit Data in Context of County Goals [1][2]

Material Type	Program Status — 1992	1992 County Recommendations	Observations
Newspaper	Single-family, multi-family curbside service, buy-back centers for businesses	Additional recycling alternatives for multi-family units, such as added convenience of containers, additional "pre-cycling," educational efforts	Percentage improvement could be made in multi-family residential generator type
Mixed Paper Grades	Some residential single-family and multi-family curbside collection; some magazines collected as early as 1990	More aggressive curbside collection of mixed paper grades recommended, including magazines.	More promotion may be warranted for magazines; additional opportunity for both residential generator types in other mixed paper grades for residential generator types; opportunity for commercial generator type in uncoated paper board and high grade office paper categories
Corrugated Kraft Paper	Some being collected at buy-back centers	County recommended expanding recycling opportunities	Significant tonnages are available for diversion in single-family residential and commercial generator types
Other Recyclable/Compostable Paper	None being collected	Mixed waste processing facilities discussed	Almost 10 percent of the disposed MSW waste stream consists of this grade of paper; however, it would need to be diverted in special programs
Glass, "Tin" Cans, Aluminum Cans	Collected curbside for multi-family and single-family residences, buy-back centers for businesses	Additional recycling opportunities for multi-family units, such as added convenience of containers; additional "pre-cycling," educational efforts	Some opportunity exists to divert both residential and commercial tonnages; however, tonnage contributions by individual materials will be relatively small
Plastics	Small quantities accepted at buy-back centers	Considered recycling more plastics	Significant overall tonnages, although markets still a problem; film plastics a significant commercial tonnage

Table 3-16 Evaluation of Waste Characterization Audit Data in Context of County Goals [1][2]

Material Type	Program Status — 1992	1992 County Recommendations	Observations
Yardwaste	Extensive dropoff, curbside programs in effect; yardwaste processing facility in place, 1993	Consideration of landfill bans; expanded educational programs targeted at backyard composting	Although roughly 73 percent of the total yardwaste in the County is being diverted, over 12,000 tons per year are still being disposed, particularly by the single-family and self-haul residential generator types
Foodwaste	No program in place	Discussed in 1992 CSWMP with no specific recommendations	Represents over 19 percent of disposed MSW waste stream, but diversion offers logistical, environmental, and technical concerns
Household Hazardous Waste	In the early stages of program development, including the collection of used oil	More aggressive program recommended for used oil; programs for other household hazardous wastes to be developed in the future	HHW percentages for County roughly in line with rest of country, but County HHW program (through City of Tacoma) one of the most aggressive in the country[3]
Woodwaste	No program in place	Discussed in 1992 CSWMP with no specific recommendations	Considerable tonnages of untreated, treated, and roofing materials being disposed

Footnotes:

[1] Based on *Tacoma-Pierce County Solid Waste Management Plan, Volume I*, December 15, 1992, by the Pierce County Department of Utilities.

[2] The numbers shown in the brackets following the comments under "R. W. Beck Observations" indicate the sources of information used in making the observations. The numbers in the brackets are keyed to the footnotes below.

[3] Even though the County and the City of Tacoma have implemented aggressive household hazardous waste collection efforts, the impacts of household hazardous waste programs on solid waste composition are difficult to determine due to the small quantities of household hazardous waste in the waste stream.

Table 3-17 Comparison of 1995 Waste Characterization Audit Data to that of the Central Puget Sound Region as shown in the 1992 Ecology Study [1] [2]

Material Type	Single-Family Residential		Multi-Family Residential	
	1995 Study	1992 Ecology Study	1995 Study	1992 Ecology Study
Newspaper	4.9	5.3	8.0	9.4
Corrugated Paper	4.8	5.7	7.0	7.0
Other Paper	22.8	21.5	19.6	20.1
Plastic	10.0	9.7	8.7	10.2
Glass	5.1	5.1	6.9	8.8
Ferrous Metals	3.7	4.0	4.1	3.6
Non-Ferrous Metals	1.4	0.9	1.7	1.3
Foodwaste	21.6	14.4	15.0	10.1
Woodwaste	0.6	1.5	2.4	1.7
Yardwaste	4.9	10.9	4.8	1.7
Other Construction Debris	0.9	3.5	2.7	2.7
Other Wastes[3]	19.3	17.5	19.1	23.4
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**

Footnotes:

[1] Washington State Department of Ecology, *1992 Washington State Waste Characterization Study, July 1993*, By R. W. Beck and Associates, Gilmore Research Group, Sharp Research, Gambrell Urban, Inc., and Social and Economic Science Research Center.

[2] 1992 Ecology Study included sorts in the City of Seattle, as well King, Snohomish, and Pierce counties.

[3] Includes disposable diapers, textiles, rubber products, large bulky items, household hazardous wastes, and special wastes, such as used oil and tires.

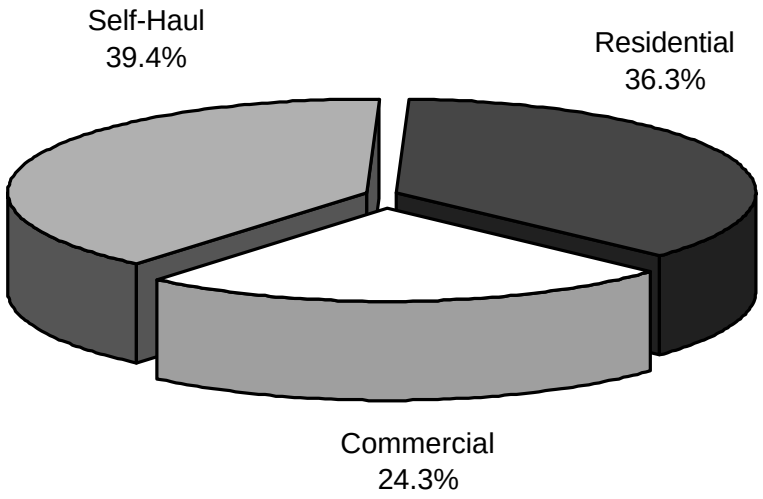
Waste Characterization by Sector: The total amount of solid waste disposed in the County's waste stream system in 1995 was 360,396 tons (MSW and self-hauled waste). Although the study characterized all categories of solid waste being disposed, its primary focus was on hauler-collected waste because it represented roughly 66 percent of the total waste disposed in 1995.

Furthermore, many materials in this waste stream represent significant opportunities to divert additional quantities of solid waste.

Based on a 1995 population of roughly 450,000 (the audit was completed six months before actual population figures were available. There are slight discrepancies between populations used for the audit and as finalized in Table 3-7) served by the Pierce County system, approximately 2.9 pounds per capita per day (pcd) of MSW were disposed in 1995, which is significantly lower than MSW per capita disposal rates for other parts of the country (4.0 to 5.0 pcd). This is a clear indication that significant amounts of materials are being diverted from the County's waste stream.

Figure 3-18 illustrates the total waste stream generated in the County by generator type. The following are observations related to the composition results for each generator. Figure 3-19 provides a map of the County showing Waste Audit geographic areas.

Figure 3-18
Total Disposed Waste Stream by Generator

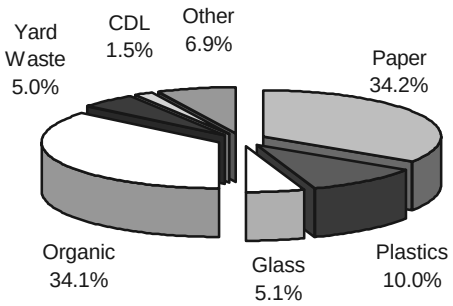


Insert Map (Figure 3-19)

Single-family residential: Figure 3-20 shows single-family residential waste composition results for the major material categories. Detailed composition results, with composition by geographic area and actual tonnages disposed, are included in Table 3-21. Based on these results, the single-family residential waste stream exhibits the following:

- ✓ A low percentage of newspaper (4.8 percent) relative to the Central Puget Sound region (5.3 percent).
- ✓ A relatively low percentage of yardwaste compared to regions outside the County and in parts of the country that do not have developed yardwaste diversion programs.
- ✓ Consistently high organics percentages, especially foodwaste, in all geographic areas of the County. (This has become a larger percentage partially because the County's programs have diverted yardwaste and other recyclables).
- ✓ Invariable percentages for the other categories from one area to the next, with the exception of disposable diapers.

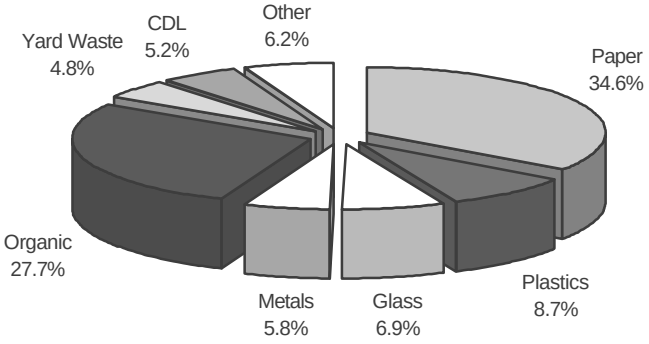
Figure 3-20
Single Family Residential
Waste Composition



Multi-family residential: Figure 3-22 shows multi-family residential waste composition results for the major material categories. Detailed composition results are included in Table 3-23. Based on these results, the multi-family residential waste stream exhibits the following:

- ✓ Similar waste compositions for each geographic area for each category, with the exception of organics (specifically foodwaste).
- ✓ Opportunities in all geographic areas to divert newspaper and corrugated and craft paper.

Figure 3-22
Multi-Family Residential
Waste Composition



Insert Table 3-21

Insert Table 3-21

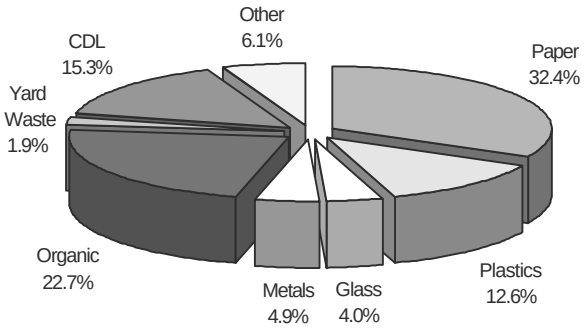
Insert Table 3-21

Insert Table 3-21

Commercial: Figure 3-24 shows commercial waste stream composition results for the major material categories. Detailed composition results, with composition by geographic area and actual tonnages disposed, are included in Table 3-25. Based on these results, the commercial waste stream exhibits the following:

- ✓ A lower percentage of commercial MSW paper (32 percent) than that observed in other parts of the country (35 to 40 percent). However, large quantities of corrugated paper were found in certain geographic areas.
- ✓ A higher percentage of foodwaste (17 percent) than in most of the country.
- ✓ A lower yardwaste percentage (roughly 2 percent) relative to other parts of the country (5 to 8 percent).
- ✓ A high disposal rate for commercial film plastics for most geographic areas in the County.

Figure 3-24
Commercial Waste Composition



Self-hauled waste: Figures 3-26 and 3-27 show the composition of residential and commercial self-hauled waste, respectively. Detailed composition results for both generator types are included in Tables 3-28 and 3-29

Typically, residential self-hauled yardwaste is significantly higher than that experienced for the residential sector served by yardwaste collection. Currently, the County provides residents incentives to divert yardwaste.

The commercial self-hauled waste stream is made up principally of construction and demolition debris (about 72 percent), of which lumber makes up roughly 44 percent.

Figure 3-26
Residential Self-Haul

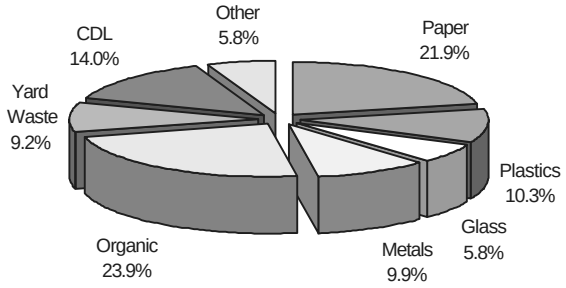
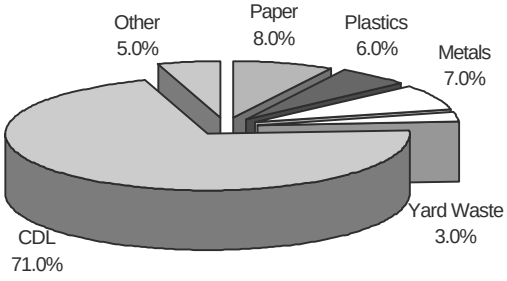


Figure 3-27
Commercial Self-Haul



Gate survey results: Although the gate survey results fluctuated on a seasonal basis, when annualized, the results were almost identical to the 1995 County data. Based on the gate survey results, the greatest contributors to the County's disposed solid waste stream are refuse collected by the franchise haulers, self-hauled waste, and automobile fluff (used for daily landfill cover).

Due to its very high variability, the 1995 Study characterized residential self-hauled solid waste based on both sort data and gate survey data. Table 3-30 shows the aggregated sort data, gate survey data, and combined sort and gate survey data for the residential self-hauled generator type. Although unable to characterize "cleanups" (one component of roadside litter) and heavy demolition waste, over 99 percent of the waste stream disposed by the County and 19 cities and towns was characterized.

Insert Table 3-25

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