SOURCE REDUCTION AND RECYCLING ELEMENT

UNINCORPORATED AREA, COUNTY OF SAN DIEGO

County of San Diego

Source Reduction and Recycling Element

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EXECUTIVE SUMMARY

The unincorporated area of San Diego County, in compliance with the California Integrated Waste Management Act (IWMA), has developed this Source Reduction and Recycling Element (SRRE). The intent of the IWMA is to mandate that all municipalities develop solid waste programs that achieve a 25 percent reduction in the quantity of solid waste disposed by 1995 and a 50 percent reduction by the year 2000. To meet these goals, the County has formulated this SRRE document providing details on the development and implementation of a comprehensive program of source reduction, recycling, and composting for the unincorporated area. This SRRE document identifies specific goals and the manner in which the unincorporated area will attain these goals.

The report is divided into the following ten sections:

1.0 Statement of Goals and Objectives

2.0 Initial Solid Waste Generation Study

3.0 Source Reduction Component

4.0 Recycling Component

5.0 Composting Component

6.0 Special Waste Component

7.0 Education and Public Information Component

8.0 Facility Capacity Component

9.0 Funding Component

10.0 Integration Component

The County organized and coordinates the San Diego Integrated Waste Management Task Force with appointed representatives from each city, representatives from the County, and representatives from the public at large working closely to develop compatible solid waste management alternatives. The Task Force has three committees: a policy committee of elected officials, a technical advisory committee and a citizens advisory.

These groups work together to develop solid waste management alternatives which are brought before the entire task force for a decision.

SOLID WASTE GENERATION STUDY

Solid waste is typically identified as residential, commercial, industrial, special waste, and household hazardous waste. Solid waste generated by the unincorporated area is collected by 34 waste haulers. In addition to regularly scheduled solid waste pickup, some residents are provided with special collection events. Such events include bulky waste pickup, in which the solid waste hauler collects large items from the residents, by request.

Solid waste in the County is disposed at eight different landfills (Miramar, San Marcos, Sycamore, Otay, Ramona, Borrega, Las Pulgas and San Onofre). Five of the eight landfills (San Marcos, Sycamore, Otay, Ramona and Borrego) are owned and are operated (through contracts with private firms) by San Diego County. Las Pulgas and San Onofre are owned and operated by the Navy. In addition to these landfills the County of San Diego operates ten rural container stations for more remote areas in the eastern part of the County.

The determination of a per capita solid waste generation rate for an area provides a numerical value which can be applied to population increases to project future solid waste quantities. As identifies in Section 2.0, the degree of waste disposal control, the individual amounts of wastestream classifications (residential, commercial, industrial, and special wastes), seasonal variations, and the characteristics of the community all impact the per capita rate.

Based on County waste characterization data, the waste generation rate for the unincorporated area was estimated to be 8.65 pounds per person per day. Using this rate as the basis for per capita solid waste quantities and applying this to the population projections, estimated future solid waste quantities for the unincorporated area can be computed.

SOURCE REDUCTION

Source reduction refers to any action which causes a net reduction in the generation of solid waste and includes, but is not limited to, replacing disposable materials and products with reusable materials and products, reducing packaging, and increasing the efficient use of materials. Although individual source reduction measures are difficult to quantify and document, the cumulative effect of several such measures, in conjunction with an effective recycling program, could significantly reduce the volume of solid waste going to disposal facilities. A source reduction program will also conserve energy, avoid collection and disposal costs, increase public awareness of waste disposal issues, and contribute to the overall success of solid waste management plans.

Source reduction programs typically focus on:

- reducing the use of non- recyclable materials
- replacing disposable with reusable materials
- reducing packaging
- reducing amount of yard waste generated
- encouraging the purchase of durable products
- in creasing the efficient use of materials
- reducing unwanted mail deliveries

A variety of materials have source reduction potential and the more materials that are targeted, the higher the probability of achieving a noticeable reduction in the wastestream. The materials that can be targeted for the County of San Diego's source reduction program include: disposable diapers, yard waste, textiles and leather, paper and styrofoam cups, disposable beverage containers and tableware, excess product packaging, durable products, appliances, shopping bags, furniture, office products including toner cartridges, and live Christmas trees.

There are two categories of source reduction activities underway in the unincorporated County of San Diego: those that contribute to quantifiable diversion credit, and those that contribute to source reduction but are difficult or impossible to quantify. The two programs that account for existing and planned diversion credit are diaper service and home composting.

Approximately 337 tons of disposable diapers were diverted from the wastestream in 1990 according to diaper service accounts in San Diego County. It is estimated that 10 percent of the total diversion target for yard waste in the years 1995 and 2000 will be achieved through the practice of home composting. Activities that contribute to source reduction currently performed by businesses or residents on a small scale include double- sided copying, limited use of disposable items, or plant process changes that reduce waste generation.

The County of San Diego is formulating educational programs for businesses within the County to reduce their total generation of solid waste. The County of San Diego has implemented volume reduction methods such as recycling centers and separate collection programs. The County of San Diego also purchases and uses recycled paper for letterheads, envelopes, and other office supplies. Although the implementation of some source reduction programs may be beyond the capability of local government, the County can influence public attitudes and behavior through education and outreach programs.

RECYCLING

Recycling is defined in the IWMA as "the process of collecting, sorting, cleaning, treating, and reconstituting materials that would otherwise become solid waste, and returning them to the economic mainstream in the form of raw material for new, reused, or reconstituted products which meet the quality standards necessary to be used in the marketplace." For the purposes of the Integrated Waste Management Act planning, the practice of producing mulch at centralized yard and wood grinding facilities for reuse as mulch is quantified as recycling.

The County's targeted percentages for recovery for the short- term and medium-term objectives are to remove at least 30 percent of the materials identified for recycling by 1995 and 80 percent by the year 2000. This can be accomplished through a combination of facilities and programs.

Programs for the short- term objectives include the regional implementation of the Mandatory Recycling Ordinance for all targeted waste generators. In addition, other activities supporting shot- term objectives include zoning classification revisions to encourage recycling activity in appropriate zones, modification of County procurement policies, and expansion of the County recycling education services contract.

Programs for the medium- term objectives include the construction of new processing facilities (i.e., MRF or CDF), evaluation of thrift shop markets and identification of alternative markets for textiles.

In addition, the County will also continue to encourage and promote recycling programs for waste generators not included in the scope of the County's Mandatory Recycling Ordinance.

COUNTY RECYCLING ORDINANCE

The San Diego County Mandatory Recycling Ordinance, Chapter 5 of Division 8 of Title 6 of the San Diego County Code to Regulate Storage, Collection, Transportation, and Disposal of Solid Waste was unanimously approved by the County Board of Supervisors on May 28, 1991 and adopted following the second reading of the item on June 11, 1991.

The Mandatory Recycling Ordinance includes the following elements:

- designation of materials to be recycled from residential, commercial, and industrial sources;
- a prohibition against disposal of designated recyclable materials with mixed refuse at County solid waste facilities;
- a requirement that waste haulers operating in the unincorporated areas of the County must provide their customers with collection of designated recyclables in accordance with the regional implementation schedule; and
- a requirement that waste generators in the unincorporated area must store designated recyclables separately from solid waste for pick- up.

Beginning in the North County region August 1, 1991, where existing ceapacity is more constrained, the Mandatory Recycling Ordinance is projected by the County to divert more than 250,000 tons of recyclables from disposal at the San Marcos Landfill in FY 91/92. Based on current estimates of unincorporated area disposal at San Marcos, almost 40,000 tons of this diversion will come from unincorporated area homes, schools, and businesses.

There are a number of recycling programs currently in operation in the unincorporated County of San Diego. These include:

- Source separation and curbside collection of residential recyclables

- Collection of office paper beverage bottles, and newspaper from County offices. Pilot cardboard collection program operating at several East County locations

- Sales and delivery of material to local buyback and drop- off centers by residential and commercial generators

- Yard waste grinding

- Donation of material to nonprofit organizations

- Metal Salvaging by scrap dealers

- Supermarket recycling at participating stores: paper bag buyback, plastic bag collection, polystyrene collection

- Annual Christmas tree collection and drop- off programs

COMPOSTING

The short-term composting objective for the unincorporated area of the County is to divert at least 8 percent of the commercial and residential yard and wood wastestream to composting operations. This will yield approximately a 1.5 percent composting goal for the total wastestream. The medium-term composting objective for the unincorporated County is to divert at least 20 percent of the commercial and residential yard and wood wastestream to composting programs. This will yield approximately a 3.8 percent composting goal for the total wastestream.

SPECIAL WASTE

Special wastes are materials that require special handling or disposal because of physical, chemical, or biological characteristics. Some examples of special waste are asbestos, sewage sludge, septic tank and grease pump trappings, infectious waste, auto bodies, used tires, white goods, concrete and asphalt, and construction and demolition debris. White goods and concrete and asphalt are covered by the County's Mandatory Recycling Ordinance. Construction and demolition debris recycling presently accounts for substantial diversion.

Over 80 percent of all the municipal wastewater sludge now generated within San Diego County is currently composted by the windrow method by Chino-Corona Farms at their 200 acre site in Thermal, California. Yard waste materials obtained locally in the Palm Springs area are used as a bulking agent for this operation. Upwards of 2,000 tons per day of waste materials are currently being composted and marketed. Chino-Corona Farms may soon be handling wastes from the Carson Treatment Plant under an agreement with Kellog Supply. Chino-Corona Farms owns a 120 acre site near Pauma in San Diego County that could potentially be used for composting of San Diego County sludge and yard waste.

EDUCATION AND PUBLIC INFORMATION

The goal of the education and public information programs for the unincorporated area of the County is to broaden the public awareness of and participation in, recycling and related solid waste issues. The short-term objectives are to continue working with the County's recycling staff in using mass mailings and the distribution of brochures which promote continued participation in current programs and inform the public on future programs such as composting. Medium-term objectives will include a recycling staus report update. Residents of the unincorporated County will be informed of the community's progress toward meeting the mandated 25 percent diversion goal. Depending on the results of monitoring and evaluation data, promotions and reminders will be updated.

The current education and public information programs serving all County residents are based on the educational program formulated by the Board of Supervisors. A variety of public education and information programs have been designed to target every age group and income within the County. For the past five years, the County has contracted for public education services with a local environmental organization known as "I Love A Clean San Diego County, Inc." (ILACSDC). This organization manages a toll free recycling hotline, funds an ongoing series of school and community presentations, and provides logistical support in arranging the annual Christmas tree recycling programs.

FUNDING

The unincorporated area of San Diego County is presently supporting its solid waste programs through appropriations from the tipping fee charged at County landfills. The County will continue to use this mechanism to fund the recycling component of the solid waste program.

In addition, the County will review additional funding sources as the need arises.

INTEGRATION

The purpose of the integration component and resulting implementation plan and schedule is to depict the SRRE work activities and establish the proper sequencing to allow decisions to be made in a timely fashion.

Table ES-1, The Unincorporated San Diego County Integration Component Goals, lists the wastestream reduction attributable to each particular component. In developing the implementation approach, the system alternatives selected for inclusion in the County element recognized the following priority: (1) source reduction, (2) recycling, (3) composting, and (4) proper disposal through transformation and land disposal.

TABLE ES-1

1.0 STATEMENT OF GOALS AND OBJECTIVES

1.1 INTRODUCTION

To ensure that California's solid waste is managed in an effective and environmentally sound manner, the Integrated Waste Management Act (IWMA), State Assembly Bill 939, was signed into law on September 29, 1989; thereby enacting the California Integrated Waste Management Act of 1989. This bill is an essential part of the state's comprehensive program for solid waste management.

IWMA addresses a range of issues related to management of solid waste materials. It establishes the California Integrated Waste Management Board (CIWMB) and requires preparation of countywide integrated waste management plans. It requires all municipalities to divert 25 percent of their solid waste from landfill disposal through sources reduction, recycling, and composting by January 1, 1995. By the year 2000, 50 percent of the wastestream must be diverted. IWMA requires that each jurisdiction prepare a Source Reduction and Recycling Element (SRRE) to document existing diversion practice and formulate plans meeting IWMA diversion targets. This report represents a preliminary draft of the final SREE.

Assembly Bill 1820 amends certain portions of IWMA. These modifications and the implementing regulations are now being finalized as a part of Title 14 of the California Code of Regulations which sets forth guidelines and procedures for preparing the countywide plans. This section presents a summary of the goals and objectives designed to assist the unincorporated areas of the County of San Diego in meeting mandated source reduction, recycling, and composting goals. In this document, the term "unincorporated County" refers to the portion of the boundary of the County of San Diego outside the 18 incorporated cities.

1.1.1 SOURCE REDUCTION

According to IWMA, source reduction is defined as "any action which causes a net reduction in the generation of solid waste. Source reduction includes, but is not limited to, reducing the use of non-recyclable material, replacing disposable materials and products with reusable materials and products, reducing packaging, reducing the amount of yard waste generated, establishing garbage rate structures with incentives to reduce the amount of wastes that generators, and increasing the efficiency of the use of paper, cardboard, glass, metal, plastic, and other materials in the manufacturing process." Although individual source reduction measures are difficult to document, the cumulative effect of several such measures, in conjunction with an effective recycling program, could significantly reduce the

volume of solid waste going to disposal facilities. A source reduction program will also conserve energy, avoid collection and disposal costs, increase public awareness of waste disposal issues, and contribute to the overall success of solid waste management plans. Overall, the goal of the source reduction program is to minimize the generation of waste at the source. This will be accomplished through the expansion of existing programs and the development of new programs.

Short- and medium-term objectives of the unincorporated County program are to extend and emphasize implementation of programs already underway to encourage reduction of the generation of waste materials in the County including:

- Reducing the use of non-recyclable materials
- Replacing disposable materials and products with reusable materials and products
- Reducing the amount of yard wastes disposed and reducing the amount of yard wastes generated
- Modifying County procurement practices
- Assisting with commercial waste audits and promoting waste exchange activities
- Reducing the delivery of unwanted or "junk" mail
- Supporting state and national legislative efforts
- Requiring source reduction measures in County of San Diego contracts

Methods of reporting and monitoring source reduction activities are being developed. As a result, diversion goals can be readily quantified and adjusted accordingly. Initially goals of 0.6 percent diversion in the short- term and 1.4 percent in the medium-term can be recognized until better reporting methods are developed.

1.1.2 RECYCLING

According to the IWMA, recycling is defined as " the process of collecting, sorting, cleansing, treating, and reconstituting materials that would otherwise become solid waste, and returning them to the economic mainstream in the form of raw material for new, reused, or reconstituted products which meet the quality standards necessary to be used in the marketplace."

Recycling programs developed and implemented by private haulers, recyclers, and the County will form the cornerstone for achieving the 25 and 50 percent diversion goals established by the IWMA. These programs provide the most effective way to divert large quantities of material from disposal facilities.

To achieve the 25 percent diversion goal, a reasonable target is to remove, at a minimum, 25 to 35 percent of the readily recyclable materials from the wastestream. These materials include:

- Newspapers
- Cardboard
- Office Paper
- Glass
- Plastics
- Tin cans
- Aluminum cans
- Yard Waste
- Wood waste

This short-term objective can be realized by:

- Enforcement of the Mandatory Recycling Ordinance (Appendix A)

- Continuing public education support for existing curbside recycling programs

- Encouraging purchase of recycled content products through the San Diego County Purchasing Department

- Continuing support of the Recycling Hotline, referral services, and publishing a recycling directory

- Establishing a "clean green" mulching program at the rural container sites

- Expanding the current " clean green" program at the landfills

- Continuing the Technical Assistance Program (TAP) grants

To achieve the 50 percent diversion goal, a reasonable target is to remove at least 75 percent of readily recyclable material from the wastestream. This medium-term objective can be realized by:

- Encouraging and promoting recycling programs for wastestream generators not included in the scope of the Mandatory Recycling Ordinance

- Evaluating thrift shop markets

- Identifying alternative markets for textiles

- Implementing construction of mixed waste recycling and composting facilities in the South County (PIA project) and East County

In summary, the short-term diversion goal of 25 percent requires a minimum removal of 25 to 35 percent of recyclable materials from the wastestream and the 50 percent medium-term diversion goal requires that at least 75 percent of recyclable materials be removed from the wastestream. Both the short- term and medium-term objectives for developing markets include assessing the existing and potential markets (end-users and markets) for recyclable materials.

1.1.3 COMPOSTING

Composting is a process of biological decomposition of organic debris such as leaves, grass clippings and other organic material commonly found in the municipal wastestream. The short-term objective for the unincorporated county is to determine the feasibility of composting projects incorporated yard, wood wastes and other organics. This can be approached regionally with the other jurisdictions in the County. Pilot programs should be incorporated towards the end of the planning period and the existing mulching program should continue to divert yard and wood waste to the existing Fallbrook composting facility. Another part of this composting program is the processing of yard waste as boiler fuel. As stated by the IWMA, transformation is defined as incineration and cannot be counted towards diversion until the medium- term. Therefore, the CIWMB will not credit yard and wood waste diverted as boiler fuel until 1995. The County is meeting its short-term diversion goals without counting the quantities diverted through transformation. In the medium- term, a reasonable goal is to divert 20 percent of the total yard and wood waste to composting projects.

1.1.4 SPECIAL WASTE

Special waste refers to any waste which has been classified as a special waste pursuant to Section 66744 of the Title 22 of the California Code of Regulations, or which has been granted a variance for the purpose of storage, transportation, treatment, or disposal by the Department of Health Services pursuant to Section 66310 of Title 22 of the California Code of Regulations. Special waste also includes any solid waste which is specifically conditioned in a solid waste facilities permit for handling and/or disposal, because of its source of generation, physical, chemical, or biological characteristics or unique disposal practices. In the short- and medium- term, a reasonable goal is to divert 16.8 percent of the total special wastestream with the majority being asphalt, concrete and white goods.

Short- and medium- term objectives for handling of special waste include:

- Continuing public information program for diverting white goods and construction and demolition debris

- Continuing implementation of Mandatory Recycling Ordinance for designed special wastes

- Continuing supply of yard and wood waste to sludge co-composting programs

- Implementing ash recycling in conjunction with transformation facility residue

1.1.5 EDUCATION AND PUBLIC INFORMATION

There are many ways to increase public awareness of, and participation in, recycling, source reduction, and composting projects. The best overall strategy is a comprehensive mix of techniques that include:

- Public education

- Promotions and events

- Publicity and reminders

To accomplish the 25 percent and 50 percent reduction goals set forth in the IWMA, it is essential for the County of San Diego to maintain and expand its innovative public education program. Throughout the operation of a recycling program, a multi- faceted promotional campaign is required to achieve and maintain high levels of materials recovery and participation. The short- and medium- term activities include continuation of existing County of San Diego public education activities and the following:

- Conduct a coordinated public education and information campaign and achieve 90 percent public awareness of the County Mandatory Recycling Ordinance by 1995.

- Conduct periodic random surveys to establish baseline participation in source reduction and recycling activities to evaluate effectiveness of education and information programs.

- Provide a copy of the Recycle and You Save (RAYS) curriculum to all interested K through 6 grade County school teachers. Develop and implement a 7 through 12 grade recycling and resource conservation curriculum.

- Continue to provide up-to-date recycling and waste reduction information through public information services as the toll-free Recycling Hotline and publication of the County Recycling Guide.

- Develop additional public information and educational publications that reach non-English speaking audiences.

- Investigate methods for County citizens to reduce the amount of unsolicited mail they receive.

1.2 SUMMARY OF DIVERSION GOALS

Table 1-1 presents the overall source reduction and recycling element program for the unincorporated County. More detailed derivation of these data are included in Tables 1-2 and 1-3 and in Sections 2 through 6. These component targets were established by analysis of the wastestream characterizations presented in Section 2.0 and comparison to mandated overall SRRE targets. These programs and activities are targeted to achieve a minimum of 25 percent reduction in the total wastestream by 1995 and a 50 percent reduction by the year 2000.

The remainder of this document presents background data and an overview of alternatives available to the unincorporated County to achieve these targeted goals for each individual component included in the SRRE. Description of these components includes a presentation of their respective advantages and disadvantages.

Table 1-1

Table 1-2

Table 1-3

2.0 SOLID WASTE GENERATION ANALYSIS

2.1 INTRODUCTION

In accordance with the requirements of Article 6.1, Chapter 9, Title 14 of the California Code of Regulations, the Solid Waste Generation Component includes a characterization of the unincorporated County's waste generation, disposal, and diversion. The Solid Waste Generation Analysis component establishes baseline data for the calendar year 1990 based upon a comprehensive analysis of the unincorporated area of San Diego County.

The solid waste generation study must be representative of all residential, commercial, industrial and other sources of waste generation in the jurisdiction, as well as representative of all solid waste source reduction, recycling, composting, transformation and disposal activities and facilities in the jurisdiction or normally used by the jurisdiction and its residents and businesses.

2.1.1 PURPOSE AND SCOPE

The general requirements of this solid waste generation study are to provide:

- The total quantity of solid waste generated within the jurisdiction, including diversion and disposal, for purposes of identifying the quantities and types of materials to be diverted pursuant to sections 41780 and 41781 of the Public Resources Code.

- A projection of the solid waste to be generated, diverted, and disposed by the jurisdiction, for at least a 15 year period from the date of the local adoption of the SRRE. The projection is to include the amounts, waste categories and waste types generated, diverted, and disposed under (1) the solid waste management system conditions and diversion activities existing at the time that the solid waste generation study is prepared, and under (2) the solid waste management system conditions expected to be realized after a jurisdiction's implementation of its SRRE and its attainment of the statutory diversion mandates.

- A representative determination of the composition of solid waste generated, diverted, and disposed by the jurisdiction, by waste category and waste type using one or more of the following methodologies: 1) quantitative field analysis; 2) materials flow

methodology; 3) jurisdiction-specific data; and 4) existing data from comparable jurisdictions. (These methodologies are described in Title 14, Chapter 9, Article 6.1, Section 1872.)

This section presents data for incorporation into the final Initial Solid Waste Generation Study for the unincorporated County SRRE. Background data about the unincorporated area of the County of San Diego and its characteristics is presented, followed by a summary of existing solid waste programs, a review of the solid waste characterization study performed by the County of San Diego for the unincorporated area, and finally a projection of future solid waste quantities.

2.2 BACKGROUND INFORMATION

2.2.1 LOCATION

The County of San Diego is located in the extreme southwestern corner of California bounded on the west by the Pacific Ocean, on the south by The Republic of Mexico, on the north by Riverside and Orange Counties, and on the east by Imperial County. This location is indicated in Figure 2-1. The incorporated area of the County comprises over three quarters of the total land area of 4,238 square miles. As indicated in Figure 2-2, most of the incorporated area lies east of the coastal urban area, although small islands of unincorporated land exist within the incorporated cities.

2.2.2 GENERAL LAND USE

Land use patterns in the unincorporated area vary dramatically from suburban development on the margins of the urban corridor, to rural towns, isolated settlements and desert wilderness in the east. Population distribution is a key to understanding the characteristics of the region from the perspective of solid waste planning. This is illustrated in Figure 2-3. Of a total estimated population of 414,590 persons residing in the unincorporated area of the County in 1990, the overwhelming majority are located in a suburban ring around the coastal urban core. This coastal urban corridor extends from Camp Pendleton in the north to the south suburban area near the international border. Fewer than 20,000 persons reside in the entire East County area which comprises approximately one half of the County's land area. The unincorporated portion of the county is home to 17

FIGURE 2-1

FIGURE 2-2

FIGURE 2-3

FIGURE 2-7

Indian Reservations, most adjacent to the Cleveland National Forest in the central portion of the County.

Land use trends are illustrated in Figure 2-4. Over one-half of the total 832,579 acres of the unincorporated County is classified as "unusable" by the San Diego Association of Governments (SANDAG). Only 8 percent (67,692 acres) was classified as developed acreage in 1986. (Refer to Table 2-1). This is expected to increase to almost 23 percent (200,000 acres) by the year 2010.

Employment trends are indicated in Figure 2-5. The single largest employment category in 1986 was uniformed military at over 40 percent with approximately the same percentage of local service jobs followed by 20 percent in basic industries like mining and agriculture. Employment forecasts indicate a growing service sector by the year 2010. Employment totals are illustrated in Table 2-2.

Housing trends are shown in Figure 2-6. In 1986 almost three quarters of the housing units in the unincorporated County were single family dwellings, sixteen percent were part of multi-family complexes and 10.5 percent were mobile homes. Housing totals for 1991 are shown in Table 2-3.

2.2.3 SCHOOLS

School districts in the unincorporated area are administered as a part of the San Diego County Office of Education. The Office of Education lists 14 elementary school districts, 2 high school districts, and 3 unified school districts within the unincorporated area. Refer to Table 2-4 for a list of schools and 1990 enrollment.

2.2.4 TRANSPORTATION

As indicated in Figure 2-2, San Diego County is served by four interstate highways: Interstate Highway 5 connects the County with Orange County to the north and is the primary artery for north-south intercity traffic along the Coastal zone. Interstate 805 provides additional north-south access on the eastern margin of the City of San Diego. Interstate 15 is the third high volume north-south access route connecting downtown San Diego with Riverside County to the north. Interstate 8 provides high volume east-west access from the Pacific Ocean at the City of San Diego to the eastern part of the County passing through La Mesa and El Cajon, the Cleveland National Forest, the Viejas, Campo, La Posta, and

FIGURE 2-4

TABLE 2-1

FIGURE 2-5

FIGURE 2-6

TABLE 2-2

TABLE 2-3

TABLE 2-4

Manzanita Indian Reservations to the southern extremity of the Borrego Desert State Park.

Five airports provide regional access for the unincorporated County. The San Diego International Airport is located off Pacific Highway north of San Diego Bay. Montgomery Field is located off State Highway 163 south of Miramar Naval Air Station. Gillespie Field is located in the City of El Cajon. Brown Field is located in the San Ysidro area north of Mexico. Palomar Airport serves general aviation needs in the North County and Imperial Beach Airport serves the South County. The more remote East County areas are served by several airstrips including those at Borderland, Tecate, Jacumba, Agua Caliente, Ramona, Carroll, Octotillo, Borrego, Wohlford, Pauma Valley, and Fallbrook Community. Military airstrips are located at Miramar and North Island in the City of San Diego and at Camp Pendleton in the unincorporated area.

Railroad service in the County of San Diego is provided by the Atchison-Topeka and Santa Fe Rail Lines along the Pacific coast. Eight northbound and southbound trains carry passengers and three northbound and southbound Santa Fe trains carry cargo. The San Diego and Arizona Eastern Railroad in the southeast owns a rail line that runs between San Diego and Imperial Valley. A portion of that track is currently unusable, but in the past both cargo and passengers traveled between San Diego and Imperial Valley. Port services for the County is provided by the Port of San Diego.

2.2.5 WATER AND WASTEWATER UTILITIES

Water servic in the County is provided by numerous private companies and public agencies. Sources of supple include local water from ground and surface water reservoirs and water imported to the County from the Colorado River and Feather River supply system. Wastewater collection and treatment is provided by a similarly diverse collection of districts.

2.3 EXISTING SOLID WASTE PROGRAMS

2.3.1 INTRODUCTION

The following sections summarize the solid waste systems that are currently in operation, including:

- A definition of terms used
- Existing collection practices
- Existing disposal practices
- Existing diversion practices (including source reduction, recycling, and composting)

For the purposes of this analysis, the term "solid waste" has been divided into classifications which generally describe material characteristics and sources of generation. The following are descriptions of these solid waste characteristics as defined by the California Integrated Waste Management Board, Title 14, Chapter 9.

- Residential Solid Waste means solid waste originating from single family or multi-family dwellings.
- Commercial Solid Waste means solid waste originating from stores, business offices, commercial warehouses, hospitals, educational, health care, military, and correctional institutions, non-profit research organizations, and government offices. Commercial solid wastes do not include construction and demolition waste.
- Industrial Solid Waste means solid waste originating from mechanized manufacturing facilities, factories, refineries, construction and demolition projects, and publicly owned treatment works.
- Special Waste includes any solid waste which, because of its source of generation, physical, chemical or biological characteristics or unique disposal requirements, is specifically conditioned in a solid waste facilities permit for handling and/or disposal.

- Household Hazardous Wastes are those wastes resulting from products purchased by the general public for household use which, because of their quantity, concentration, or physical, chemical or infectious characteristics, may pose a substantial known or potential hazard to human health or the environment when improperly treated, disposed, or otherwise managed.

2.3.2 SOLID WASTE PRACTICES

Collection

The County is served by 34 licensed solid waste collectors and transporters (Appendix B), the majority of whom serve areas within the unincorporated area. No contracts are maintained for service to given areas within the unincorporated area. A list of waste haulers servicing the unincorporated County is presented in Tables 2-5 and 2-6. Sixteen haulers responded to a CDM survey as serving the unincorporated areas as of September 1991. Six haulers responded that curbside recycling programs were offered as part of their service to unincorporated area users.

Disposal

The County of San Diego owns and operates by contract five solid waste landfills, all of which may be used by anyone in the County.

- San Marcos
- Sycamore
- Otay
- Ramona
- Borrego

In addition to these 5 landfills, the Marine Corps operates two landfills on the Camp Pendleton site in the North County:

- Las Pulgas
- San Onofre

TABLE 2-5

TABLE 2-6

TABLE 2-6

The City of San Diego operates a landfill near the Miramar Naval Air Station. This landfill also serves portions of the unincorporated area. In addition to these landfills the County operates ten rural container stations for more remote areas in the eastern part of the unincorporated area. Presently five sites are supervised. Landfills and rural container stations are shown in Figure 2-7.

The three major solid waste disposal sites operated by the County in the western part of the County at San Marcos, Sycamore, and Otay are operated by the Herzog Contracting Corporation under the 5- year contract. County personnel attend the scalehouses.

The County Solid Waste Enterprise Fund was established in 1982 to segregate revenues from landfill tipping fees, and serves as the primary revenue source for County waste management activities. Disposal fees are assessed at County scalehouses at each County landfill on a weight delivered basis. A differential rate schedule is charged depending upon load contents: $23 per ton for vehicles carrying refuse and $15.25 per ton for vehicles carrying "clean green" yard and wood wastes.

Accurate estimates of the amount of solid waste currently being disposed has a direct impact on the quantities of recyclable materials available and adequacy of existing facilities. Disposal quantities recorded by the County of San Diego in 1990 for the unincorporated area are presented in Table 2-7. As shown in the table, waste from the unincorporated areas was disposed in 8 separate landfills in 1990. Quantities shown are derived from San Diego County estimates for the point of origin.

2.3.3 SOLID WASTE DIVERSION

"Solid waste diversion refers to any activity which results in the beneficial reuse or reduction in solid waste at the source of generation, or the diversion of solid waste from disposal through recycling or composting." When quantifying activities that result in waste diversion, it is essential to avoid double counting of materials. For example, adding the total weight of materials collected by a curbside recycling collector to the weight of materials sold by a recyclables processor would double count tonnage if the curbside collectors materials were sold to the processor. The County has used a variety of techniques including landfill and rural container station weight receipts, telephone and written surveys, and scale records from recyclable material processors to derive waste diversion statistics.

FIGURE 2-7

TABLE 2-7

Source Reduction

Source reduction is the practice of reducing waste at the source of generation thereby preventing materials from ever entering the wastestream. Methods that can be employed to effect source reduction include creating preferences for durable, reusable products rather than disposables, facilities waste exchange between material generators and material users, and manufacturing process changes that result in improved production efficiencies of feedstock materials.

Many source reduction activities are difficult to quantify as diversion, however, the success of these programs may become apparent through reductions in waste disposal and the results of waste composition analysis of materials disposed. On a residential basis, there are two source reduction activities which the County will quantify as diversion in the unincorporated area: the practice of home composting and the use of reusable cloth diapers rather than disposables. For the baseline year 1990, this SRRE includes a source reduction of 337 tons based on the number of cloth diaper accounts in the unincorporated area (415), the average number of changes per week as reported by the service provider (65), and the average weight of a soiled diaper (.48), on an annualized basis.

TON EQUATION

Recycling

A number of recycling programs are currently in place in San Diego County. These programs have been developed by County staff and the private sector over the last five years in anticipation of a need to reduce waste of reusable materials and to extend the life of County landfills. These programs include:

- County tonnage grants
- Rural container recycling
- Buy-back recycling at County landfill sites
- Curbside residential recycling

- Military facility recycling
- County office recycling
- County technical assistance program grants
- Commercial and industrial recycling
- Yard waste grinding
- Christmas tree recycling

Records for most of these recycling efforts are available from the County of San Diego and the individual recycling companies. Table 2-8 shows estimated quantities of recyclables recovered in 1990 from the unincorporated area. Quantities for the rural container station program are based on County weight estimates. Buy-back recycling, Christmas tree, and yard waste shredding totals have been disaggregated from landfill totals on the basis of the proportion of the unincorporated area populations to the population of the entire County exclusive to the City of San Diego.

Estimates shown in the table for residential curbside recycling are based in County records of a total of 16,405 residences participating in curbside recycling programs. Because there is not sufficient unincorporated County data, the unit rate of 334 pounds per household per year is derived from pilot test data from Liberty Recycling for the City of Carlsbad.

A detailed questionnaire survey was used to measure the extent of recycling activities in the commercial and industrial sectors of the unincorporated County. The questionnaire included in the Appendix E was sent to 3,500 businesses that were identified from the records of the County tax assessor. Over 1,300 responses were received. From these responses, total quantities of recycled materials were obtained as presented in Table 2-8.

Babyland Diaper Service of San Diego offers a recycling service doe disposable diapers. They report 145 accounts in the unincorporated area which results in a total diversion of 118 tons per year in the base year.

TABLE 2-8

TON EQUATION

The County of San Diego operates a "clean green" yard waste grinding operation at the Otay, Sycamore and San Marcos landfills. As mentioned previously, a differential tipping fee has been established to encourage diversion of yard and wood waste materials to this program. The program is a "drop-off" operation at the present time. The yard waste phase of the San Diego County Mandatory Recycling Ordinance is scheduled to begin on January 1, 1992. Commercial haulers and residential users with loads of uncontaminated yard or wood waste materials are directed to a designated area at each landfill. Contractor personnel are on hand to direct traffic and inspect loads as they are being dumped. Material is ground to a coarse mulch and can be coarsely screened. The resulting mulch is sold to large users in bulk and is available free of charge to the public during landfill hours on a self-loading basis.

Approximately 24,964 tons of "clean green" yard waste was taken to San Diego County Landfills in 1990. Using a population ratio (0.2979) of the unincorporated area divided by the total of the County (less the City of San Diego), the unincorporated area's contribution of yard waste to the landfills was 7,437 tons. A portion of this yard waste was composted (1,394 tons) and the remainder was used as boiler fuel and mulch. The boiler fuel comprised of 2,008 tons (27 percent of the 7,437 tons); the remainder (4,035 tons) was recycled as mulch. In accordance with IWMA, the material sold as boiler fuel falls in the category of transformation. Since no credit is given for transformation until 1995, the transformation amounts will be stated but not included in the diversion totals for the 15 year projection (Appendix F) until the year 1995.

The Board of Supervisors established the San Diego County Recycling Tonnage Grant Program to provide an incentive for the diversion of designated residential recyclables. Through this program, grants will be awarded to all cities, excluding the City of San Diego, and to collectors that serve residents in the unincorporated areas of the County. Grants will be based on the reported amount of designated residential materials recycled within their jurisdiction during Fiscal Year 1991/ 1992. The County provides tonnage grants to encourage the maximum diversion of recyclable materials from County solid waste disposal facilities. To meet the Tonnage Grant Program Guidelines, documentation must include copies of sales or weight scale receipts which detail the type and weight of recycled material, the

collector, processor or converter purchasing or adopting the materials, and the date of the transaction.

The County of San Diego has instituted an aggressive office paper recycling program to recover materials from all of its offices. Since the majority of the offices are located in the incorporated areas of the County, no diversion credits are taken for the unincorporated area for recycling. The County Office Recycling Program (CORPS) is discussed in Section 4.0.

Composting

As stated in the Recycling Section, 24,964 tons of "clean green" yard waste was taken to San Diego County landfills in 1990. The County reports that 4,680 tons are used as a bulking agent for thermophylic composting and vermicomposting by the Fallbrook Sanitary District. The unincorporated area's portion of this bulking agent is 1,394 tons.

Special Wastes

Bulky material recycling is a significant contributor to recycling diversion in San Diego County. A telephone survey of asphalt recyclers by County of San Diego staff in January 1991 indicated a total of 204,000 tons of asphalt recycled during 1990 in the entire County. On a percentage basis the estimated recycled asphalt originating in the unincorporated area amounts to 34,000 tons. On the same basis, a survey by County of San Diego staff indicated concrete recycling amounts to 76,500 tons. This total of industrial recycling is significantly larger than all other types of recycling identified to date in the unincorporated area. A follow-up survey of asphalt and concrete recyclers will be performed to confirm the results of the earlier survey.

White goods and tires are another contributor to special waste. Twenty-nine tons per year of white goods and 126 tons per year of tires are removed from the wastestream which brings the total diversion for special waste to 110,655 tons per year in 1990. The lower special waste figures for 1995 and 2000 (shown in Tables 1-2 and 1-3) reflect the reduction in unincorporated area population.

2.3.4 SOLID WASTE GENERATION

The total solid waste generated by the County of San Diego can be expressed as follows:

$$GEN = DISP + DIVERT$$

Where:

GEN= the total quantity of solid waste generated within the area.

DISP= the total quantity of solid waste generated within the area which is disposed of in permitted solid waste facilities.

DIVERT= the total quantity of solid waste generated within the area which is diverted from permitted solid waste facilities through existing source reduction, recycling, and composting programs.

For FY 1990 solid waste generation for the unincorporated portion of San Diego County is estimated as follows:

Classification	Subtotal	Total
Disposal		527,189
Diversion		
Composting	1,394	
Source Reduction	337	
Recycling	13,176	
Special Waste Recycling	110,655	125,562
Transformation (Yard and Wood Waste)		2,008
Total Generated		**654,759 Tons**

2.4 SOLID WASTE COMPOSITION

2.4.1 BACKGROUND

Waste characterization studies are a part of an ongoing commitment by the County of San Diego to identify and monitor the types and quantities of waste entering the county's landfills. The IWMA now requires each jurisdiction in the state to provide current data and fifteen year projections describing the quantities of waste generated, disposed, and diverted by waste component. AB 1820 amended the IWMA by permitting the use of regional data in the Initial Solid Waste Generation Study for the SRRE.

The County of San Diego, Department of Public Works, Solid Waste Division has extensive regional data on waste composition in San Diego County. A customized ScaleWare data system was installed and now operates at each of the County's landfills, except the Borrego Landfill. This system automatically generates reports on quantities disposed by truck type.

Under the direction of the County, consultants conducted studies between 1988 and 1990 to characterize the waste at each landfill. This data, in conjunction with hauler surveys, makes it possible for each city and the unincorporated area in the County to estimate the specific characterization of its wastestream. This section describes the methods used to determine the composition and the results.

2.4.2 METHODS USED FOR SOLID WASTE CHARACTERIZATION

To determine the origin of waste arriving at County landfills, the County conducted a hauler survey at the Sna Marcos, Syacamore, Otay and Ramona landfills for the period of August 15 to September 15, 1990. Analysis of the results of this survey enabled an allocation of jurisdiction. Approximately 77 percent of the total tons disposed at each landfill was accounted for during this period. For purposes of this study it was assumed that the remaining wastestream was constant for all jurisdictions.

The next step in the analysis was to determine the source of solid waste by sector. The three sectors are defined as clusters of truck types that carry residential, commercial, and industrial wastes. Analysis of ScaleWare data, generated from the computerized charge- by- weight system at the landfills, enables accurate accounting of the amount of waste disposed by each truck type. The ScaleWare system does not currently provide data by jurisdiction, but coupled with the hauler

survey data results, an estimate can be made of the breakdown of the unincorporated area's wastestream by residential, commercial, and industrial sectors.

The following assumptions were made to define each waste generation sector.

Residential

- 100 percent of rear loaders and side loaders
- 50 percent of front loaders
- Residential self- haul (cars, vans and non-decaled pick-ups)

Commercial

- 100 percent of compacted roll-offs
- 50 percent of front loaders
- 50 percent of open roll-offs
- 100 percent of decaled pick- ups

Industrial

- 50 percent of open roll-offs
- All other non-compactor vehicles (excluding cars, residential and self-haul vehicles)

Waste disposal tonnages were apportioned by truck type and jurisdiction for each landfill, based on results of the hauler survey and ScaleWare data. These numbers were then applied to waste composition estimates by truck type and landfill, and by the percentage of each jurisdiction's contribution to each landfill, ultimately yielding a unique wastestream composition for each jurisdiction in the County.

2.4.3 RESULTS

Table 2-9 presents results of the waste characterization studies performed to date. Waste characterization for Miramar, San Marcos, Sycamore, and Otay were based on the analysis of both the uncompacted and compacted wastestreams entering each landfill using the methods described above. The waste characterization for Ramona is based on the compacted wastestream only. No characterization studies are available for the Borrego or Las Pulgas landfills. Waste characterization shown in the table were based on the studies at Ramona for Borrego and at San Marcos for Las Pulgas.

Waste breakdown by sector is presented in Table 2-10. The residential sector represents approximately 39 percent, the commercial represents approximately 36 percent, and industrial approximately 25 percent of the total wastestream.

Table 2-11 presents a summary of total waste generation data gathered to date in the format required for the SRRE. One limitation in targeting programs necessary to achieve the short-term and medium-term goals in the lack of detailed breakdown on materials classified as "other miscellaneous" which comprise a large percentage of the total wastestream. A more detailed analysis will be performed during the shot-term planning period based on CIWMB regulations and procedures. The County of San Diego is presently working with the haulers serving the incorporated and unincorporated areas of the County to incorporate a data system which tracks the wastestream by sector and jurisdiction.

2.5 PROJECTED SOLID WASTE QUANTITIES

To provide a framework for future solid waste management alternatives, projections of solid waste quantities are required. These projections will influence the size and location of proposed facilities. In addition, waste projections are required as part of the Initial Solid Waste Generation Study, (Title 14, Chapter 9, Article 6.1 of the California Code of Regulations).

Population projections and per capita solid waste generation rates are the tools used to arrive at solid waste quantity projections. The numerical value of a solid waste generation rate is determined by dividing the total waste quantity produced in a particular area by the total population within the same area. Assuming population and waste quantity data are reliable, this number will be representative of the per capita waste quantity produced. However, solid waste generation rates are sensitive to change as a result of any or all of the following factors.

Table 2-9

Table 2-10

Table 2-11

- The degree of control over waste disposal practices
- Amounts of residential, commercial, industrial, and special wastes generated
- Construction and development activities
- Social patterns
- Product packaging
- Community characteristics (rural versus urban, etc.)

Accurate estimates of per capita solid waste generation are important in projecting future solid waste quantities. By determining the existing per capita generation, future waste quantities can be forecasted by applying per capita generation rates to future population projections.

2.5.1 POPULATION PROJECTIONS

SANDAG has prepared estimates for population characteristics, historical data and projections of future populations for the unincorporated area. Population trends are shown in Figure 2-9.

2.5.2 PER CAPITA GENERATION RATES

Determination of a per capita solid waste generation rate for an area provides a numerical value which can be applied to population increases to project future solid waste quantities. As previously discussed, several factors including wastestream classifications and the community characteristics, all impact the per capita rate.

Per capita waste generation rates for the unincorporated area of the County, based on data contained in this report are:

Figure 2-9

2.5.3 SOLID WASTE PROJECTIONS

Historically, the per capita generation of solid waste in the United States increased at the rate of three to four percent per year through the 1960s and early 1970s. The historical increase was a result of the greater use of paper in packaging and disposable products, along with a general rise in the standard of

Living. In the latter half of the 1970s, this rate of increase slowed considerably as a result of the general economic conditions and the increased awareness and concern about the recycling and the reuse of solid wastes.

Another factor working to slow the increase in the waste generation rate was the increased cost of raw materials and the resultant incentive to increase the use if recovered materials. This factor, coupled with the energy savings from using recovered materials, encourages more recycling at the source and thus increases efficiency in product use.

Waste production for the next 15 years for the unincorporated portion of San Diego County are presented in Table 2-13. Table 2-13 illustrates total waste disposal, diversion and generation rates for 15-year projections. In these projections a constant per capita rate of 8.65 pounds per capita per day was used based on the previous discussion. Refer to Appendix F for 15- year projected waste generation, diversion and disposal streams for the short-term and medium-term planning years under current conditions and after SRRE program implementation. Diversion quantities for the short-term were assumed at a rate of 30 percent for readily recyclable materials, 20 percent for diapers, and 95 percent for asphalt and concrete recycling. In the medium-term, diversion goals of 75 percent, 50 percent and 95 percent, respectively, were used. It should be noted that the short-term percentage for readily recyclable material was selected to achieve a 34 percent diversion in 1995. Because of the Mandatory Recycling Ordinance's goal of 100 percent diversion of designated recyclable materials, the 30 percent used for calculations in conservative.

Table 2-12

Table 2-13

3.0 SOURCE REDUCTION COMPONENT

3.1 INTRODUCTION

Source reduction refers to any action which causes a net reduction on the generation of solid waste and is popularly associated with the reduce and reuse portion of the "3 Rs" (reduce, reuse, recycle). The Integrated Waste Management Act (IWMA) places source reduction at the top of the waste management hierarchy, followed by recycling and composting. Source reduction programs can significantly reduce the flow of solid waste to disposal facilities through consumer preference for durable, reusable products rather than disposables, the practice of home composting, and improved manufacturing process efficiencies, among others. Inn addition to minimizing waste at the source, a source reduction program works to conserve resources and energy.

The concept of source reduction may be best summed up by the old New England adage: "use it up, wear it out, make it do, or do without."

Source reduction techniques differ from the other waste management strategies in that they do not involve specific techniques, rather they focus on changing attitudes and behavior of both producers and consumers. Typically, source reduction programs attempt to:

- Reduce the use of non-recyclable materials
- Replace disposable materials with reusable materials
- Reduce packaging
- Reduce the amount of yard waste generated
- Encourage the purchase of durable products
- Increase efficiency of use of materials
- Facilitate waste exchange and material substitution programs
- Reduce unwanted mail deliveries

3.2 OBJECTIVES

The following objectives will be implemented in the short-term (1991- 1995), and continue through the medium- term (1996- 2000) planning period, and identify the waste types to be targeted.

3.2.1 SHORT- AND MEDIUM- TERM OBJECTIVES

- Reduce the use if non-recyclable materials
- Replace disposable materials and products with reusable materials and products
- Reduce the amount of yard wastes disposed, and reduce the amount of yard waste generated
- Modify County procurement practices
- Assist with commercial waste audits and promote waste exchange activities
- Reduce the delivery of unwanted or "junk" mail
- Support state and national legislative efforts

Table 3-1 presents source reduction diversion goals for the unincorporated area for both the short- and medium-term. Diversion goals for reduction in use of disposable diapers are based on an assumed increase in the base year from approximately five percent to 20 percent by the year 1995 and to 50 percent by the year 2000. Waste reduction goals for home composting are based on the assumption that approximately 10 percent of the total diversion target for yard waste will be taken up with home composting for the years 1995 to 2000. The County of San Diego recognizes that the adoption of the rate structure modifications, various process changes that can impact packaging and production, and consumer behavior, can have a significant effect on the wastestream.

TABLE 3-1

3.3 PRIORITY WASTE TYPES FOR DIVERSION

A variety of materials have source reduction potential and the more materials that are targeted, the higher the probability of achieving a noticeable reduction in the wastestream. The materials that can be targeted for the County of San Diego's source reduction program include, but are not limited to:

- disposable diapers
- yard waste
- textiles and leather
- disposable beverage containers and tableware
- excess product packaging
- mixed paper
- durable products
- appliances
- shopping bags
- furniture
- office products including toner cartridges
- live Christmas trees

These materials are specifically targeted because of the significant contribution they make to the current disposal stream (estimated at more than 15 percent by weight for the County of San Diego), and the fact that they have limited recyclability.

According to the waste stream characterization that was performed between August and September, 1990 as part of the Initial Solid Waste Generation Study, disposable diapers account for 3.7 percent of the County of San Diego's residential waste stream. Consumers will be encouraged to patronize a local cloth diaper service or diaper recycling service as an alternative to using disposables.

Almost 13 percent of the County's total disposal waste stream is yard waste. If this material can be composted through home composting programs, or otherwise utilized at the source of generation by the use of mulching mowers, it would help to achieve the mandated 25 and 50 percent reduction goals as well as reduce the sizing requirements for a central composting facility.

Used clothing and shoes are included in the textiles and leather category. These materials could easily be diverted from landfill disposal. Most non-profit organizations, such as the Salvation Army, will accept used clothing for repair and reuse.

The remainder of targeted materials are the mixed paper and mixed plastic categories which account for 6 percent and 4 percent of the unincorporated County's total disposal waste stream, respectively. Any reduction in this material would contribute to achieving the short and medium range goals. Simple methods that can be used to reduce the generation of these materials include:

- avoid using disposable materials
- have names removed from "junk" mailing lists
- purchase products with little or no packaging

3.4 EXISTING SOURCE REDUCTION PROGRAMS

There are two categories of source reduction activities underway in the unincorporated County of San Diego: those that contribute to quantifiable diversion credit, and those that contribute to source reduction but are difficult to quantify.

Programs Accounting for Existing and Planned Diversion Credit

Home Composting. A successful home composting program has the potential to prevent a large portion of residential yard and/ or food wastes from entering the wastestream. The compost produced through this activity is commonly reused on site for gardening and landscaping.

Waste reduction goals for home composing are based on the projection that 10 percent of the total yard waste in the short-term and 10 percent in the medium-term will be achieved through the practice of home composting. For each

household practicing home composting, the County anticipates that such activity will result in a 50 percent capture rate, on average, for residential yard waste.[1]

Based on the following assumptions and calculation, the estimated number of households practicing home composting necessary to achieve a 2,154 ton diversion of yard waste is approximately 16,854 households:

- 50 percent capture rate
- 180 pounds of residential yard waste per person per year based on 1990 sector breakdown data extrapolated to 1995
- 2.84 persons per household
- 1995 diverted yard waste quantity is 21,543 tons

TON EQUATION

Diaper Service Diversion. The CIWMB has determined that diaper service accounts can count towards diversion goals. According to Babyland Diaper Service of San Diego, the only diaper service in the County, approximately 118 tons of disposable diapers were diverted from the wastestream in 1990.

Unquantified Diversion Credit. Source reduction is difficult to quantify since little or no documentation is maintained. There may be some small scale source reduction activities currently performed by residential, commercial, and industrial entities within the County, but the difficulty lies in developing an accurate method to quantify such programs. As part of the mail survey that was conducted as part of the Initial Solid Waste Generation Study, the businesses surveyed were asked if they currently perform any source reduction activities such as double-sided copying, limited use of disposable items, or plant process changes that reduce waste generation.

Education Programs and County Procurement Policy. The County of San Diego is in the process of formulating educational programs, in the form of seminars and workshops, for commercial businesses within the County with the objective of reducing the total generation of solid waste from commercial businesses. The County of San Diego has implemented volume reduction methods such as recycling centers and separate collection programs. The County

[1] 50 percent capture rate based on program data from the City of Seattle backyard composting program.

of San Diego also purchases and uses recycled paper for letterheads, envelopes, and other office supplies.

3.5 EVALUATION OF PROGRAM ALTERNATIVES

Most source reduction objectives can be accomplished using a broad based program that incorporates rate structure modifications, economic incentives, technical assistance, instructional alternatives, and regulatory programs. The following alternatives could be implemented jointly or on an individual basis to help the County achieve quantifiable source reduction. Table 2-3 evaluates the source reduction alternatives using the state and CIWMB criteria.

3.5.1 RATE STRUCTURE MODIFICATIONS

There are a limited number of rate structure modifications that can be used to promote source reduction. User fees for solid waste services could be established on a cost per service basis and could take on the form of variable can rates, or surcharges. This type of system would create public awareness of the true cost of solid waste collection and disposal, and also provide an economic incentive for waste reduction.

In 1980, the City of Seattle, Washington instituted a variable can rate in which the monthly charge for weekly collection of two cans was about 125 percent greater than for one can. From 1981 to 1984, the number of rate payers using two cans was decreased, recycling tonnage increased by 60 percent, and per capita waste generation increased at a lower rate than in large cities around the country.

Advance disposal fees imposed at the state level could be used to discourage manufacturers from producing excess packaging that becomes solid waste or litter. Packaging fees could be levied at the wholesale level or as point- of – sale surcharges and could provide exemptions for recyclable, recycled, or degradable materials.

The effectiveness of rate structure modifications on source reduction is uncertain, simply because the concept of source reduction is relatively new. Although people are usually outraged when public utility fees are increased, when done in conjunction with promotional and instructional activities, it could be a highly effective method of encouraging source reduction. However, a program that relies entirely on this alternative would have limited flexibility.

TABLE 3-2

TABLE 3-2

Rate structure modifications do not require the expansion or construction of any facilities and can therefore be implemented in the short-term planning period. They are consistent with local plans and policies and require no financial investment. Institutional barriers to implementation should be minimal. The availability of end uses of diverted materials does not apply to this alternative.

3.5.2 ECONOMIC INCENTIVES

Economic incentives such as grants and low- or –no interest loans can be used to finance source reduction programs. Although historically used to promote recycling activities, public funds could also be used to subsidize home composting and industrial process charges that minimize waste generation. In addition, business license fees could be reduced for companies that demonstrate a significant reduction in solid waste quantities. Deposits, refunds, and rebates are often used in recycling programs to recover specifically targeted materials and are typically at a state level.

Economic incentives and disincentives can be very effective behavior modification tools, and have been proven in areas such as recycling and water conservation. Incentives such as grants, loans, rebates and reduced fees do not create any health or safety hazards and are flexible enough to accommodate changing conditions. From a regional perspective, consequences on the waste are the same as for rate structure modifications. If there is a significant reduction in disposal quantities, there will be a corresponding reduction in the revenue derived from landfill disposal fees.

Economic incentives can also be implemented during the short-term planning period and do not require the expansion or construction of any facilities. Incentives are consistent with local conditions and require no financial investment. In general, there should be no institutional barriers to implementing economic incentives, however, the County may be opposed to the reduction of business license fees, as it may result in a loss of revenue. The availability of end uses of diverted materials is not applicable.

The County of San Diego's Recycling Tonnage Grants program awards a $7.75 per ton grant for diversion of materials that would otherwise be disposed of in County of San Diego landfills. The County of San Diego is considering extending this award of tonnage grants to additional reusable residential materials. Foe example, curbside collection of textiles, appliances, furniture, and other bulky household items could be considered as an option for expanding the tonnage grants in the future.

3.5.3 TECHNICAL ASSISTANCE

County sponsored technical assistance can be directed toward both the residential, commercial, and industrial sectors and may include activities such as waste evaluations, demonstration projects, and waste exchanges. Waste evaluations are used to determine the physical and institutional changes necessary to institute a successful source reduction program and could be provided to interested businesses, industries, institutions, and multifamily residential complexes. Demonstration projects on home composting and mulching could be developed for the residential sector.

Technical assistance alternatives such as waste evaluations and demonstration projects are not very effective as stand alone programs, and may be moderately effective when used in conjunction with financial incentives and instructional alternatives. There should be no health or safety hazard created by most technical assistance alternatives and only a minor potential hazard created by most technical assistance alternatives and only a minor potential hazard associated with home composting projects.

Technical assistance programs can easily be modified to accommodate changing conditions and can be implemented in the short-term planning period. Waste evaluations and demonstration projects should not require any construction or expansion of facilities and should have minimal consequences on the waste. Technical assistance programs consistent with local plans and policies and should have no institutional barriers to implementation. Waste evaluations and demonstration projects may require a significant financial investment, depending on the County's level of commitment. The availability of end uses of diverted materials does not apply to this alternative.

Waste exchanges can also be considered a form of technical assistance. They provide a needed service to both purchasers and suppliers, and eliminate the need to dispose of large quantities of material. The California Waste Exchange, established in the early 1980s, is a state-run system that acts as a clearinghouse for industries wishing to dispose of or obtain certain wastes. There are similar exchanges established throughout the county.

Reusing material that would otherwise be disposed in a landfill could significantly contribute to meeting the diversion target. Participation in existing waste exchange programs should be encouraged and local opportunities for waste exchanges should be developed. Materials that should be considered for waste exchanges include used lumber, wood chips, pallets, shipping materials and plastics. Depending on the types of materials that are exchanged, there could be some health and safety considerations. If the County merely acts as an information center, a waste exchange program should be consistent with existing

policies and would have minimal financial implications. There may, however, be institutional barriers to implementation.

It is unlikely that a County- sponsored waste exchange program could be implemented in the short-term planning period; however, participation in existing state and national programs could be accomplished in the short-term. This would eliminate the need for any new or expanded facilities. Because of the potential for transferring waste material between jurisdictions, there would be moderate consequences on the waste.

Program cost estimates would depend greatly on the extent of the County's involvement. It could range from no investment for participating in existing waste exchanges, to a considerable investment for developing and operating a program within the County of San Diego. By the nature of a waste exchange program, end uses of the diverted materials would exist.

3.5.4 INSTRUCTIONAL ALTERNATIVES

Public education is probably the most important element of a source reduction program. Consumers should be made aware of the solid waste problems caused by disposable items, excessive packaging, and junk mail. Durable products are often less expensive in the long run, even though they may have a higher initial purchase price than disposable products. Consumers should be encouraged to purchase bulk food items and to transport bulk dispensed products with reusable bags or similar consumer supplied containers. California Against Waste is presently conducting a statewide "buy recycled" campaign promoting minimizing waste at the source by choosing products that reduce packaging to a minimum, products made from recycled materials, and products that are readily recyclable or reusable.

Homeowners should be encouraged to leave grass clippings on their lawn (use mulching mowers) and to turn other yard debris into mulch. Because it helps soil retain moisture, mulch will conserve water as well as landfill disposal capacity. In this instance, solid waste education could be combined with water conservation education. Technical assistance programs can be used to initiate and support home composting projects.

Reducing waste paper quantities is probably the simplest source reduction activity available. Community members should be informed regarding available methods to control or eliminate junk mail, and encouraged to use paper and cardboard efficiently (e.g., write on both sides of a piece of paper, use brown paper bags and cardboard boxes more than once).

The proliferation of unsolicited mail deliveries in recent years has contributed to a hefty portion of mixed paper in the residential wastestream. In the FY 90/91 unincorporated area waste characterization, mixed paper accounts for 9.3 percent of all residential waste disposed. The County "Easy Steps for Eliminating Unwanted Mail" will describe methods of reducing unsolicited mail in several categories: catalogs and credit card solicitations, professional and non-profit organizations, and resident/ occupant mailings. County staff will evaluate measures to reduce the delivery of unwanted phone directories in the future and may support state legislation to regulate the use, reuse and trade of mailing lists.

A public education program geared toward source reduction has the greatest potential for effectively meeting any diversion target, as well as being extremely flexible. The program can be tailored to suit various ethnic groups, age groups and economic levels. As conditions change, it can be modified accordingly. For the County of San Diego, it can be implemented during the short-term planning period in conjunction with other outreach and education programs.

Because public education programs do not create personal or environmental hazards, there are no health and safety implications. From a regional perspective, the consequences on the waste would be significant and no facilities would be required. Instructional activities are consistent with existing local ordinances, plans, and policies and have no barriers to implementation. The activities, however, require financial investment; with the degree of investment being dependent on the size of the program. The availability of end uses of diverted materials is not applicable.

3.5.5 REGULATORY PROGRAMS

This discussion of regulatory programs includes a variety of ordinances that could be enacted by the County to achieve significant source reduction. Some examples of legislative measures are:

- Local ordinances of criteria for procuring products such as durablity, recyclability, reusabilty, and recycled material content.
- Local adoption of bans on products and packaging
- Local requirements of waste reduction planning and reporting by generators.

Procurement ordinances and product bans may be difficult to implement on a local level, however the County can provide leadership in these areas by expanding its in-house source reduction plan and adopting a comprehensive procurement policy. The County of San Diego staff are currently preparing a comprehensive procurement policy for review and possible adoption by the County Board of Supervisors. This will set an example for both the general public and local businesses, and also serve as an important promotional tool. Such a plan would require one or more of the following steps:

- Conduct an audit of the unincorporated County's current waste stream in order to develop more specific reduction strategies

- Design a program that minimizes paper waste through double-sided copying, routing material through an office rather than making multiple copies, and reusing paper and cardboard whenever possible.

- Revise the County of San Diego's procurement specifications for equipment and supplies to ensure that more durable products with a minimum of packaging are purchased.

- Lobby federal and state governments for legislation to promote source reduction programs.

- Monitor other jurisdictions for new source reduction techniques.

Where feasible, it is recommended that all County of San Diego offices purchase recyclable aver non-recyclable materials, products made from recycled products with minimal packaging over products with excess packaging, and reusable products over disposable products. At a later date, the County of San Diego can re-evaluate the need for procurement ordinances.

Product bans have recently become a legitimate approach to waste reduction. Many jurisdictions across the country have enacted bans on materials such as foamed polystyrene and polyvinyl chloride, or products such as plastic garbage and grocery bags, and multi- resin containers.

It will be necessary to require generators to report source reduction activities if the County is to receive diversion credit. This can be done in conjunction with reporting of recycled quantities. Additional effort will be required for the preparation of source reduction plans.

The effectiveness of regulatory programs depends on the degree of enforcement that is available. Flexibility is limited by the procedures used to pass local ordinances. No health or safety hazards are created by these alternatives and here are no consequences on the waste.

Regulatory alternatives do not require new facilities and can be implemented in the short-term planning period. Most ordinances are consistent with local conditions and have few institutional barriers to implementation. The availability of end uses of diverted materials is not applicable.

3.6 PROGRAM SELECTION

The selection of a source reduction program has been based on the objectives set forth in Section 3.1, consideration of the existing conditions in the unincorporated County, and the need to maintain program flexibility. The source reduction program will incorporate instructional and promotional alternatives, new San Diego County procurement guidelines, and an evaluation of economic incentives and rate structure modifications.

The criteria used to select source reduction program components include: (1) the proportional representation of a particular material or waste type in the total waste stream, (2) the cost effectiveness of reducing the presence of the material or waste type in the wastestream, (3) the potential for targeted waste type or material to be recycled or composted, and (4) an assessment of the existing County educational program and information gathered from commercial and residential surveys.

The overall effectiveness of the source reduction program will be evaluated at the end of the short-term planning period. Product and packaging bans have not been selected. However, such measures may be considered in the medium-term planning period if materials have not been reduced in the wastestream through source reduction, recycling, or composting.

Alternative selected	Comments
Home composting	Conduct educational program to encourage home composting; monitor program success and document diversion.

Cloth diapers	
Legislation	Education program will encourage use of cloth diapers.
Source Reduction Education	Will support state and national legislation that furthers source reduction goals.
Rate structure	County educational programs will continue to emphasize source reduction as the first waste management
Procurement	Evaluate the impact of fee for disposal rate structure at rural container sites.
County Offices Model Program	Modify County procurement specifications
Waste Audits	County CORPS sets an example for waste reduction and recycling
Waste Exchange	Provide assistance to businesses to evaluate their waste stream in conjunction with phasing of Ordinance
Economic Incentives	Support IWMB program and encourage local businesses to participate in state and local programs.
Easy Steps for Eliminating Unwanted Mail	County Technical Assistance grant Program (TAP) will favorably evaluate proposals that reduce waste.
	The County will produce a comprehensive listing of proven methods citizens can utilize to reduce unwanted mail deliveries. This resource will be available along with other County education materials through the Recycling Hot Line, County events, and to citizens upon request.

3.7 PROGRAM IMPLEMENTATION

Implementing a program that reduces the generation of solid waste at the source may be beyond the capacity of the local government. However, County government is able to influence public attitudes and behavior through education and outreach programs. In addition, local packaging and procurement policies that reduce waste are possible. The County also has the option of TAP funding and tonnage grants.

An implementation schedule must identify all activities which must be accomplished in order to successfully implement the source reduction program. The schedule can help assure that these decisions are well informed and made on a timely basis. The implementation schedule must also provide project continuity as the personnel, laws and regulations, and other factors change over time during program development.

The implementation schedule is an evolving document and must maintain flexibility. The results of decisions made as part of early activities may significantly alter the program's scope and direction as well as that of the solid waste management system. Following each major decision to proceed with project elements, the implementation schedule should be reviewed and revised as necessary. Table 3-3 outlines the proposed schedule for implementation.

3.8 MONITORING AND EVALUATION

Accurate program monitoring will be critical if the unincorporated County wants to take credit for the quantity of material that is diverted through source reduction. The first step will be to determine reliable methods of quantification. One way to quantify source reduction is by subtracting total diversion and disposal quantities from projected generation quantities; the difference would be attributed to source reduction. However, this method does not take into account other factors such as economic trends or population shifts that can impact generation rates. Another way to quantify source reduction is through documentation of specific programs, and estimates of material quantities. Both methods have a high potential for error, but could yield useful results if performed concurrently as a double check for accuracy. Reporting methods for the source reduction component will be refined during the short-term planning period.

In order to assess the effectiveness of a source reduction program, it is essential to gather and evaluate a variety of operational data. Most of the source reduction

TABLE 3-3

monitoring activities can be performed in conjunction with recycling monitoring, as much of the information will be useful for evaluating both programs.

Short-term monitoring will consist of gathering source reduction program specific information and evaluating the effectiveness of various techniques to monitor the County of San Diego's progress in meeting the goals. The results if the short-term activities will provide for the selection of a specific medium-term source reduction monitoring strategy that provides accurate data and fits within the overall reporting requirements for all the components.

4.0 RECYCLING COMPONENT

4.1 INTRODUCTION

Recycling is defined in the Integrated Waste Management Act (IWMA) as " the process of collecting, sorting, cleansing, treating, and reconstituting materials that would otherwise become solid waste, and returning them to the economic mainstream in the form of raw materials for new, reused, or reconstituted products which meet quality standards necessary to be used in the marketplace." For the purpose of Integrated Waste Management Act planning, the practice of producing mulch at centralized yard and wood waste grinding facilities for reuse as mulch is quantified as recycling.

Recycling programs will form the cornerstone of effective solid waste management plans designed to achieve the 25 and 50 percent diversion goals established by the IWMA. These programs provide the most effective way to divert large quantities of material from disposal facilities. The initial analysis of available technologies or systems to meet the goals established by the IWMA must be based on the ability to successfully target materials for recycling. Data obtained from the County waste characterization studies indicates that approximately 30 percent of the unincorporated area wastestream is composed of readily recyclable material such as glass, paper, metal, yard and wood waste. Regional collection programs to divert these and other marketable materials from disposal are underway in conjunction with the implementation of the County Mandatory Recycling Ordinance. The Mandatory Recycling Ordinance will contribute to increasing recycling rates for designated recyclables and will help ensure that participation rates in recycling programs will be the best possible. When fully implemented, an 80 percent capture rate is projected to be attained for designated recyclables.

The County doe not perform curbside refuse or recycling collection. However, the County Ordinance requires permitted waste haulers in the unincorporated areas of the County to provide source separated collection of designated recyclable materials from their customers. The County is working cooperatively with waste haulers to ensure a smooth transition to mandatory recycling and collections expansion. For residential curbside recycling, the County is providing haulers with "Recycling Reminder" enforcement tags that explain the Ordinance and how to participate. In the event participation is not forthcoming, County public nuisance abatement staff have the authority to issue citations.

Participation rates in Mandatory Recycling Ordinance programs are being monitored and evaluated across the country. David H. Folz of the University

of Tennessee surveyed 264 recycling coordinators and came to the conclusion, "Citizen participation in mandatory programs was almost twice as high as in cities where recycling was voluntary."[2]

Based upon waste generation studies and analysis of existing recycling programs, the unincorporated area is currently diverting through recycling approximately 13,357 tons of waste annually or 2.1 percent of the total waste generated. The generators contributing to this diversion include residential at 75 percent, commercial at 25 percent, and industrial at 0 percent. Even though concrete and asphalt are being recycled and are reported as an industrial waste, they are classified by IWMA as a special waste. The quantities of concrete and asphalt being recycled are therefore reported under the special waste component.

4.2 OBJECTIVES

4.2.1 SHORT-TERM (1991- 1995)

Regional Implementation of the Mandatory Recycling Ordinance including:

- Source separation and curbside recycling collection for all residents in single- family dwellings served with curbside refuse collection, including source separated collection of yard waste.

- Source separation and recycling collection for all multi- family dwellings, including source separated collection of yard waste.

- Source separation and recycling collection for all commercial buildings of more than 20,000 square feet.

- Source separation and recycling collection of designated recyclables for all restaurants and taverns.

[2] Public Administration Review, May/ June 1991, pg. 230.

- Diversion of homogeneous loads of asphalt, concrete, dirt, land clearing brush, sand and rock from industrial generators.

- Expansion of recycling collections to all rural container station disposal sites.

- Expansion of yard waste grinding capacity to serve all rural container sites.

Additional Activities Supporting Short- term Objectives

- Continuation of the Recycling Tonnage Grant Program and Technical Assistance Program to provide economic incentives for the diversion of recyclables.

- Implement a mixed waste recycling facility in the North County.

- Continue waste composition studies.

- Expand County Office Recycling Programs (CORPS).

- Establish pilot curbside collection events for textiles and furniture.

- Evaluate the effect of Ordinance implementation.

- Promote thrift shop sales.

- Propose and support zoning classification revisions to encourage recycling activity in appropriate zones. Complete and submit to the State of California an application for Recycling Market Development Zone designation for San Diego County.

- Modify County procurement policy to create preferences for recycled content products.

- Expand County recycling education services contract to accommodate increased public outreach and information support. Implement $250,000 contract to support education and promotion programs for the Mandatory Recycling Ordinance.

4.2.2 MEDIUM-TERM (1996- 2000)

In addition to continuation of short-term objectives, medium- term objectives include:

- Implement construction of mixed waste recycling and composting facilities in South County (PIA project) and East County.
- Encourage and promote recycling programs for waste generators not included in the scope of the Mandatory Recycling Ordinance.
- Evaluate thrift shop markets.
- Identify alternative markets for textiles.

4.3 PRIORITY TARGET MATERIALS FOR WASTE DIVERSION

Priority materials for waste diversion through recycling are based upon the County waste generation study and provisions of the Mandatory Recycling Ordinance. Targeted materials are listed in Table 4-1.

4.3.1 COUNTY RECYCLING ORDINANCE

The San Diego County Mandatory Recycling Ordinance, Chapter 5 of Division 8 of Title 6 of the San Diego County Code to Regulate Storage, Collection, Transportation, and Disposal of Solid Waste was unanimously approved by the County Board of Supervisors on May 28, 1991, and adopted following the second reading of the item on June 11, 1991.

Provisions of this ordinance fulfilled the Board's directive of March 1, 1988, that the solid waste ordinance be rewritten by July 1, 1991, to institute mandatory recycling if a 30 percent reduction in the amount of wastes going to County landfills was not achieved by that date.

TABLE 4-1

The Mandatory Recycling Ordinance includes the following elements:

- designation of materials to be recycled from residential, commercial, and industrial sources;
- a prohibition against disposal of designated recyclable materials with mixed refuse at County solid waste facilities;
- a requirement that waste haulers operating in the unincorporated areas of the County must provide their customers with collection of designated recyclables in accordance with the regional implementation schedule; and
- a requirement that waste generators in the unincorporated area must store designated recyclables separately from solid waste for pick-up.

Beginning in the North County region August 1, 1991, where existing disposal capacity is more constrained, the Mandatory Recycling Ordinance is projected to divert more than 250,000 tons of recyclables from disposal at the San Marcos Landfill in FY 91/92. Based on current estimates of unincorporated area homes, schools, and businesses.

4.3.2 MARKET INFRASTRUCTURE

Market development is an important feature of successful recycling and has both local and broad based elements. In conjunction with the Ordinance, the County has developed a recycling Tonnage Grant Program that will be awarding non-competitive tonnage grants to cities, with the exception of the City of San Diego, and to haulers in the unincorporated area based on the tons of designated residential recyclables documented to have been diverted from County landfills. Tonnage grants will be awarded at the rate of $7.75 per ton of designated residential material collected.

In 1990, a comprehensive market and waste characterization study of the secondary, or recoverable, materials industry was conducted for the County. According to this study, the current market for recovered materials is irregular and varies due to many factors which impact market prices, such as:

- Condition of domestic and world economics
- Supply of materials, virgin and secondary, on the domestic and world markets
- World relationships between supply sources, domestic and foreign market production, and generation rates
- Capacities of secondary materials production facilities
- The level of demand and price competition in the marketplace
- Variations in export freight pricing policies
- The fluctuation of the virgin commodity markets
- Currency exchange rates in relation to the U.S. dollar

Recent markets for recovered material have varied greatly with supply and demand in both the domestic and import markets. In order for marketability of recovered materials to increase, demand for these materials must be increased. This will occur if:

- Cost for the recycled materials is less than that for the competing virgin material.
- Quality of the product produced from the recovered material is equal to that made from the virgin material.
- Secondary materials can be used by the end user in the production process.

In promoting demand to be increased, the following steps are suggested:

- Encourage investment in facilities which use recycled materials.
- Encourage developments in technology which improve the quality of recycled products.

- Insure that the prices of virgin materials are not artificially low due to laws and policies.

The prices for secondary materials are cyclical and volatile. They can vary from 40 to 100 percent within a six to twelve month time frame. Trends in the pricing cycle can be used to define median, more realistic materials prices, and help project long-term pricing forecasts. Table 4-2 shows price ranges of secondary materials for San Diego markets, mid- 1990. Refer to the Appendix G for identification of market outlets.

The success of a recycling program is most dependent on the development of markets for recyclable materials and for these markets to be long-term and dependable. The materials for which market development is most needed are mixed paper, newspaper, used tires, plastics, glass and tin cans. Market development may benefit other materials such as cardboard, scrap metal and high-grade paper. Aluminum is now being recovered at a rate equal to demand and needs no further market development.

4.4 EXISTING PROGRAMS

Recycling Tonnage Grant Program

The Board of Supervisors established the San Diego County Recycling Tonnage Grant Program to provide an incentive for the diversion of designated residential recyclables. Through this program, grants will be awarded to all cities, excluding the City of San Diego, and to collectors that serve residents in the unincorporated areas of the County. Grants will be based on the reported amount of designated residential materials recycled within their jurisdiction during Fiscal Year 1991/ 1992. The Tonnage Grant Program is intended to create economic incentives to encourage the maximum diversion of recyclable materials from County solid waste disposal facilities.

There are a number of recycling activities currently in operation in the unincorporated County of San Diego. The materials recovered in 1990, categorized by waste type, are quantified in Table 4-3. The actual recycling programs are summarized in Table 4-4.

TABLE 4-2

TABLE 4-3

TABLE 4-4

4.4.1 RURAL CONTAINER STATION RECYCLING

The County maintains and operates ten Rural Container Station (RCS) sites for residential refuse drop-off in the unincorporated area. These sites function as rural transfer stations where refuse is collected prior to disposal for residents in areas that are not generally serviced with curbside refuse or recycling collection. At the present time, five RCS sites (Boulevard, Campo, Viejas, Barrett, and Julian) offer drop-off recycling collection for newspaper, glass, and aluminum. In FY 90/91 the tonnage of recyclables collected at these sites increased nearly three-fold over the prior fiscal year.

In conjunction with the regional implementation of the Mandatory Recycling Ordinance, the County intends to expand recycling collections to include all designated residential recyclables at each RCS location. The provisions of the Ordinance will also be enforced at Rural Container Stations. While some residents may prefer to redeem CRV recyclables for cash, RCS users have demonstrated a willingness to utilize drop-off recycling services where available.

4.4.2 BUY- BACK RECYCLING

Buy-back centers are facilities that pay for the recyclables received. They are similar to drop-off centers, but buy-back centers accept and pay for materials received directly from the consumer at the facility site. Buy-back centers may also serve as processing centers for a network of collection systems before shipment to market, and can therefore also operate as materials recovery facilities.

There are two types of buy-back center sites – non-permanent and permanent. Non-permanent buy-back centers may include mobile recycling trucks (MRTs), temporary containers for materials drives, or company-provided containers. The MRT, which is compartmentalized and equipped with scales, is used to collect recyclable materials on a regularly scheduled cash-back basis. The materials can be sold to a local recycler at the end of each day, or taken to a MRF and subsequently sold directly to a market. The MRT can be owned/ operated by either the public of private sector, and can be used in rural or urban settings.

Permanent buy-back recycling centers operate as intermediate collection or processing centers between the supply sources and end-use markets. Operated

by private or public sector sources, these recycling centers are supervised facilities. Recovery rates at buy-back centers for individual materials such as aluminum or newspaper fluctuate depending on the price received.

Reverse-vending machines are designed to accept, weigh, crush, and store aluminum beverage containers, then pay the consumer for the cans in cash. The convenience of the operation and the cash incentive encourages aluminum can and California redemption glass recycling. This recycling system is usually operated by a private enterprise.

4.4.3 RESIDENTIAL PROGRAMS

Residential curbside collection programs have been operating in the unincorporated area since 1988. By mid-1991, approximately 20 percent of all unincorporated area single-family households were served with curbside collection of recyclables. These programs typically collect newspaper, glass, aluminum, tin cans, and plastic containers. Both commingled single container and multiple container collection strategies are employed for source separated recyclables. Regional implementation of the Mandatory Recycling Ordinance will ensure that all single-family homes with curbside reuse collection will also be served with curbside recycling collection by September 1, 1992.

The County of San Diego was the recipient of a Department of Conservation (DOC) grant to assist in establishing rural recycling. This grant was targeted for unincorporated areas curbside recycling program in North County and for establishing and expanding recycling activities in Borrego Springs. Through the TAP (Technical Assistance Program) II program the County was able to award the DOC funds to programs that proposed to serve these areas.

Buy-back center recycling includes materials collected at DOC mandated "convenience zones" and independent recycling centers. Convenience zone recycling centers are required by the DOC to be located within a half-mile of a major supermarket (those with receipts exceeding $2 million per year). Convenience zone recycling centers serve as redemption centers for California Redemption Value (CRV) beverage containers. While the location of these centers may be convenient for consumers, many do not accept recyclables other than CRV containers. Some centers may consist of only a reverse vending machine. There were 11 convenience zone recycling centers operating in the unincorporated area as of November 14, 1991.

There is a network of private buy-back centers operating in the unincorporated area. These facilities commonly receive recyclables including CRV containers, newspaper, and cardboard. Other recyclables such as non-CRV glass, HDPE beverage containers, and tin and bi-metal cans are often accepted on a donation basis. In mid- 1991, there were 11 buy-back centers in the unincorporated area.

4.4.4 CAMP PENDLETON

The U.S. Navy's environmental policy includes a commitment to the conservation of natural resources. The Navy's recycling efforts on the Camp Pendleton Marine Corps Base have targeted mixed paper, tires, and metal as the primary recyclable components of the wastestream. The Navy has developed recyclables collection programs that divert these primary components, as well as several miscellaneous components such as steel cable, cotton, and canvas from the base's wastestream.

4.4.5 RESIDENTIAL PROGRAM SUMMARY

Table 4-5 is a summary matrix which evaluates each residential program according to effectiveness, hazard created, and flexibility.

4.4.6 COMMERCIAL PROGRAMS

County Office Recycling Programs

The County of San Diego has instituted aggressive County Office Recycling Programs (CORPS) to recover and market recyclable materials from County of San Diego operations. CORPS' unique office recycling program is staffed by a combination of Public Works and Social Services employees. The Department of Public Works provides planning and management through its solid waste division. The Department of Social Services provides laborers through its Workfare Program. This cooperative operation has been effective both for the CORPS and

TABLE 4-5

the Workfare personnel. CORPS staff made presentations to more than 200 County of San Diego supervisors and managers and approximately 7,000 County of San Diego employees on how to recycle. With grant support from the California Department of Conservation, more than 2,000 recycling containers were distributed for employee work stations.

In fiscal year 89/90 the CORPS collected 765 tons of office paper, newspaper, aluminum, cans, glass and plastic beverage containers from more than 150 County of San Diego offices, a 47 percent increase over the previous year. Since the majority of County of San Diego offices are located within the County of San Diego, diversion credits for these programs are taken by the City of San Diego.

Technical Assistance Program

The County of San Diego's Technical Assistance Program (TAP) was established to provide financial and technical assistance to increase recycling activities throughout the County, and to stimulate market development to absorb increasing supplies of recycled feedstocks.

In the first round of TAP (TAP II), twenty-six grants were awarded to provide technical, financial and public education assistance to residential and commercial sectors of the County. TAPII provided $500,000 in funding for residential programs and $500,000 in funding for commercial/ industrial programs. Of the residential programs funded, $398,301 was awarded for expansions of various curbside recycling programs. Three residential grants were awarded to fund curbside recycling service in the rural unincorporated areas of the County: one for $36,074 to Solana Recyclers to provide curbside recycling to North County unincorporated areas; a second grant to San Diego Recycling for $200,000 for pilot home composting programs in the unincorporated areas of Mt. Helix and Fallbrook; and the third for $45,625 to Desert PATROL to provide curbside recycling in Borrego Springs.

The County also awarded TAP II funds for private sector recycling programs including: $80,000 for concrete recycling in all regions of the County, $44,819 for

plastics recycling equipment for a regional collection project, $37,725 for recycling programs in Oceanside schools, and $47,425 for composting of landscape wastes in a new housing development in Chula Vista. Two commercial grants were awarded to expand commercial activities in the unincorporated areas: one for $39,850 to Henry's Enterprises for expansion of the Borrego Springs Materials Reprocessing Facility; and the second for $20,000 to Fallbrook Sanitary District to expand their regional vermicomposting project.

Supermarket Recycling

Lucky, Ralph's, Thrifty, and Vons are among the supermarkets and drug store chains in the County that offer plastic bag recycling to their customers. Some chains collect only grocery and produce bags that they supply, while others accept clean plastic retail bags from any source. Several local firms have also begun recycling programs for roamed polystyrene (PS) packing materials. The San Diego franchise of Mail Boxes, Etc., accepts PS "peanuts" delivered by citizens for refuse or recycling. Also. Local computer and electronics manufacturers like Sony and Hewlett Packard are routing PS packing shapes into recycling channels. These programs are proving popular with the stores' customers. (Refer to Table 4-6).

4.4.7 YARD WASTE PROGRAMS

The County of San Diego currently operates a "clean green" yard waste grinding operation at the Otay, Sycamore and San Marcos landfills. Approximately 24,964 tons of yard waste and wood waste was processed at these facilities in fiscal year 90/91. Of this total, 7,489 tons came form the unincorporated area. As mentioned previously, a differential tipping fee has been established to encourage diversion of yard and wood waste materials to this program. The program is a "drop-off" operation at the present time. Commercial haulers and residential users with loads of uncontaminated yard or wood waste materials are directed to a designated area at each landfill. Contractor personnel are on hand to direct traffic and inspect loads as they are being dumped. Material is ground to a coarse mulch and is sold to large users in bulk and is available free of charge to the public during landfill hours on a self-loading basis. Yard waste diversion from residential sources will increase in conjunction with implementation of the Mandatory Recycling Ordinance.

TABLE 4-6

4.4.8 CHRISTMAS TREE RECYCLING

The County waives the "Clean Green" tipping fee for loads of Christmas Trees each year in conjunction with the Countywide Christmas Tree Recycling Program. In FY 90/91, 236 tons of trees were mulched from the unincorporated are at County grinding sites.

4.4.9 COMMERCIAL PROGRAM SUMMARY

Table 4-7 is a summary matrix which evaluates each commercial and industrial program according to effectiveness, hazard created, and flexibility.

4.5 EVALUATION OF ALTERNATIVES

This section evaluates alternative diversion strategies for collection, processing, marketing, promotion, financing, and disposal site diversion available to the County for compliance with diversion goals established by the IWMA.

4.5.1 COLLECTION

The method of collecting recyclable materials may directly impact the participation, recovery rates and material revenues. The collection alternative chosen must be compatible with the San Diego County Mandatory Recycling Ordinance and the conditions found in each community. This section briefly describes several collection methods that may be used either individually or in combination by the County of San Diego. All of the methods discussed below may be used to recycle the targeted materials identified previously.

Commercial/ Office Collection

On-call collection is usually achieved by placing storage containers at commercial establishments, restaurants and industrial facilities. The materials recovered vary by program. The containers are collected by private or municipal haulers when called by the person responsible for the site. On-call collection is viable for commercial establishments that do not generate large volumes of waste on a regular basis. Examples include the collection of corrugated cardboard from commercial and retail establishments, and glass and aluminum containers from restaurants. The success of on-call collection programs will depend on public

TABLE 4-7

education, person to person contact with commercial establishment owners and/ or managers by local government representatives to explain the advantages of this recycling method, and current disposal fees in the community.

On-call collection can result in high-volume recycling by commercial establishments, office buildings, government complexes, and other high-volume generators. This commercial/ office collection alternative operates as an on-call or regularly scheduled collection program in which bins are collected by local private recyclers or waste haulers or through a community collection system. The materials collected primarily include high-grade office papers, corrugated cardboard, aluminum, and glass. Businesses provide a source of potentially contaminant- free materials that require minimal processing before shipment to market, and which command high market prices. Additionally, incentives are available to these establishments in the form of avoided disposal costs and/ or sales proceeds for the recycled materials.

Commercial recycling programs are usually operated by the private sector. They require contracts between the collector and the business for materials collection and distribution of storage containers to the client. It is possible for local government to augment commercial collection programs by instituting recycling activities at government offices, encouraging such programs through personal meetings/ contacts with commercial enterprises, and technical assistance.

Residential Curbside Collection

Curbside recycling is the term used for programs in which recyclables are collected at the curb. Residents are required to separate recyclable materials at the source of generation (in the home) and the separated materials are placed at the curb for collection. The collection and hauling is usually accomplished using compartmentalized vehicles operated by municipal or private haulers. The collected recyclables are then transported for further processing or sold directly to a market. A large number of curbside recycling programs are in operation in the United States at this time. Curbside recycling programs continue to increase in number in urban areas across the nation as recycling becomes an integral component of overall solid waste management systems.

Curbside programs are generally operated by having residents place designated recyclable materials in specially designated containers at the curb once per week on a regular collection day or other designated day. Containers for this purpose are furnished by the hauler or the community. Curbside recycling has proven to be most successful where there is an existing mandatory collection program, as is now

being implemented in the unincorporated area.[3] Without mandatory collection, participation rates in curbside recycling programs are much lower, and more extensive public education required.

4.5.2 PROCESSING

There are two basic types of processing facilities: central processing facilities (CPFs) and materials recovery facilities (MRFs). CPFs separate recyclables materials from a mixed municipal solid waste (MSW) stream, while MRFs sort and process only mixed recyclable materials.

Central Processing Facilities (CPFs)

CPFs process mixed municipal waste and, through either hand-sorting or mechanical separation methods (or a combination of both), extract selected recyclable materials for marketing. The remaining fraction of the MSW can be landfilled or further processed into refuse-derived fuel (RDF) or MSW compost material. CPFs can be characterized as highly mechanical processing facilities which receive the entire wastestream form a community with no pre-sorting. These larger, more mechanically complex CPFs have had problems operating at capacity and marketing processed materials.

The major advantage of a CPF is that mixed municipal wastes can be delivered directly to the facility as collected. CPFs are used in cases where separate collection recycling systems such as curbside programs or drop-offs are not feasible or desired or where other recycling systems do not achieve higher rates of recovery. Their disadvantages can include higher capital and operating costs than source separation recycling systems as well as lower quality product resulting from contamination.

Materials Recovery Facilities (MRFs)

MRFs as evaluated in Table 4-7 include both manual (labor intensive) and more mechanized facilities (such as NCRRA). MRFs are designed to store, sort and process mixed recyclable materials (e.g. newspaper, cardboard, office paper, glass, metal, plastic). These facilities have historically been owned and operated by the private sector (secondary materials processors) and non-profit organizations (Goodwill Industries), and have also operated as buy-back centers. However, as the scope is becoming more involved in the implementation of MRFs for storing

[3] Public Administration Review, Recycling Program Design, Management, and Participation: A National Survey, May/ June 1991, Vol. 51, No. 3.

and processing the increasing amounts of available recyclable materials that local dealers/ processors either cannot or will not handle, and for preparing large quantities of recyclable materials for possible shipment to distant markets or end users. MRFs are currently operated in San Diego County by Mashburn Sanitation, EDCO Disposal, Waste Management, and Coast Waste Management.

MRFs are characterized by a combination of hand-sorting operations and certain mechanical equipment (e.g., balers, conveyor belts, plastic granulators, magnets, glass crushers, forklifts, trailer trucks, etc.) for preparing recyclable materials for marketing users/ manufacturers who use these materials in the production of new products. Depending on local market conditions and the scope of the local recycling program, MRFs can become an integral part of a source separation recycling program, especially when intensive curbside recycling is incorporated as part of the program.

Proposed Processing Facilities for North and South County

Two facilities are being considered in San Diego County. Both would be regional, with one in North County and the other in South County.

North County Resource Recovery Facility. The County has approved a service agreement with the North County Resource Recovery Authority (NCRRA) for the design, construction, and operation of a material recovery and processing facility. This facility will occupy a 15.7 acre site to be located next to the San Marcos Landfill.

The NCRRA facility will include a commingled materials recovery processing system with a waste receiving tipping floor and five independent processing lines. Facility design may offer the flexibility to remove and process materials from a mixed wastestream, as well as the processing of loads of commingled recyclables, and yard and wood waste. The facility is projected to process 550,368 tons of waste annually.

Construction on the NCRRA project is expected to begin in January of 1992. The facility is scheduled to be constructed in 18 months and undergo acceptance testing for an additional 6 months before coming on-line.

Prison Industry Authority Materials Recovery Facility. The Prison Industry Authority (PIA), proposes to construct a 1,000 ton per day waste recycling and energy generation facility adjacent to the Otay Landfill in the south County region. The PIA project would utilize inmate labor from Donovan Correctional Facility to separate recyclable materials from mixed municipal solid waste. The organic fraction of the received wastestream would be anaerobically digested with sewage sludge from the prison. This process would harness biogas to produce energy.

The PIA design is presently conceptual in nature and subject to permitting, approvals and negotiations. The County will begin negotiations with the PIA in the first quarter of 1992.

Typical Costs

Typical costs for MRF facilities can be obtained from a 1991 survey published in July, 1991 by *BioCycle* magazine. The typical costs surveyed are for facilities with less than 200 tons per day since data is limited for larger facilities. The average operating facility costs presented here include the initial capital costs and annual operating costs for both manual and mechanized MRFs. The survey reported initial capital costs ranged from $11,000 to $53,000 per ton of daily capacity and operating costs ranged from $42.03 to $45.67 per ton of input, based on single shift operations.

Costs vary according to the following factors:

- Facility location
- Land availability and cost
- Facility type (i.e., technology employed)
- Facility capacity
- Financing expenses
- Labor expenses
- Stability of wastestream input to facility

The survey revealed that economies of scale typically expected for processing facilities were not evident. Capital costs of planned facilities with a daily capacity of 100 tons per day (tpd) or less was lower ($32,500 per ton of daily capacity) than those with a daily capacity of 200 tpd and greater had a capital cost less than other facility capacities ($29,900 per ton of daily capacity).

4.5.3 MARKETING

Market development is an important feature of successful recycling and has both local and broad based elements. In 1990, a comprehensive market and waste characterization study of the secondary or recoverable materials industry was conducted by Recovery Sciences, Inc. (RSI) & EcoAnalysis, Inc. According to their study, the current market for recovered materials is irregular and varies due to many factors which impact market prices.

Recent markets for recovered material have varied greatly with supply and demand in both the domestic and import markets. In order for marketability of recovered materials to increase, demand for these materials must be increased. The success of a recycling program is most dependent on the development of markets for recyclable materials and for these markets to be long-term and dependable. The materials for which market development is most needed are mixed paper, newspaper, used tires, plastics, glass and tin cans. Market development may benefit other materials such as cardboard, scrap metals and high grade paper. Aluminum is now being recovered at a rate equal to demand and needs no further market development.

4.5.4 PROMOTION

In a recent survey of recycling programs conducted by CDM, public education was cited as one of the most significant elements of the more successful programs. Programs that experienced less than 50 percent participation attributed their lowered participation rates to lack of support, short operation time, poor management, and lack of funding for public education. Programs with high participation rates attributed their success to convenience, incentives, enforcement, public education, and good central program management.

The goal of the education and public information programs for the unincorporated county is to promote, broaden public awareness of, and participate in, recycling and related solid waste issues. Early initiation of public education and information campaigns, as part of a recycling and solid waste disposal project, results in much higher public acceptance and support for project objectives.

4.5.5 DISPOSAL SITE DIVERSION

Building upon the success of County diversion programs at the landfills for materials such as yard waste and marketable recyclables programs could be developed for additional materials. In addition, Camp Pendleton has a strong program for diversion of waste tires from their disposal facilities. These programs work by setting aside an area within the boundary of the disposal site for the collection of source separated materials. Additional recyclables or reusables that could be diverted to drop-off areas include scrap metal, toilets and other plumbing fixtures, textiles, and furniture.

4.6 PROGRAM SELECTION

The selection of a recycling program has been based upon the objectives set forth in Section 4.1, consideration of the existing conditions in the County of San Diego, and the need to maintain program flexibility. The key to program flexibility for the short- and medium- term planning periods is to focus on the 50 percent diversion goal. The program is designed to achieve the 50 percent goal at full implementation, and will achieve the 25 percent goal at partial implementation.

The following is a summary of program elements targeted for implementation during the short-term planning period.

1. Commence multi-material curbside collection education and support program for all generators included in the Mandatory Recycling Ordinance. (January 1992)

2. Incorporate yard waste collection as part of the curbside program.

3. Phase in collection programs at multi-family structures for designated recyclables pursuant to the Mandatory Recycling Ordinance.

4. Expand existing general public education programs including Recycling Hotline referral service and implement a new public education and promotion program designed to reach all waste generators targeted in the Mandatory Recycling Ordinance.

5. Evaluate additional staffing needs within the Solid Waste Division for program implementation and evaluation.

6. Evaluate a recycling rate structure to generate sufficient revenues to cover the costs of the programs.

7. Extend provision of drop-off recycling to all rural container sites.

This approach gives the recycling program needed flexibility to respond to possible future changes in state laws and regulations, to establish a specific local data base concerning materials recovery rates and materials market development, and to educate people who live and/ or work in the County of San Diego about the importance of waste reduction and public participation for goal achievement.

4.7 PROGRAM IMPLEMENTATION

An implementation program identifies activities which will help meet the short- and medium- term objectives and schedules the activities. An implementation program is an evolving plan and must remain flexible to allow for price fluctuation in the market place and start dates that need to be adjusted. The implementation plan must also enforce the Mandatory Recycling Ordinance plan. The implementation dates are listed in Table 4-8. Tables 4-9 and 4-10 outline the short-term and medium-term recycling program tasks and implementation dates.

4.7 MONITORING AND EVALUATION

4.8.1 RESIDENTIAL PROGRAMS

In order to assess the effectiveness of a residential program, it is essential to gather and evaluate a variety of operational data. The key items to be monitored are:

- Set-out rates
- Participation rates
- Recovery quantities
- Material capture rates
- Compliance with processing specifications (e.g. level of contamination, minimum quantities)
- Vehicle performance and collection
- Costs and revenues

Much of the data will be assembled by program staff on a regular basis through the ScaleWare data, however, some information will require periodic surveys. There are a number of mechanisms to measure the success of recycling programs, both overall and for individual program components. The following discussion taken from The National Recycling Coalition Measurement Standards and Reporting Guidelines presents a summary of these measures.

TABLE 4-8

TABLE 4-9

TABLE 4-10

Set- Out Rates

The set-out rate has been defined by the National Recycling Coalition (NRC) as the number of individual set-outs put out for recycling collection by a participant. Set-out rates are not measured by commodity. Programs vary in the way that set-outs are differentiated. Usually a set-out denotes one household's entire set-out rate.

$$\text{Set-out Rate} = \frac{\text{number of individual set-outs on the collection day}}{\text{total number of households served}}$$

A set-out rate is an empirical measure obtained by counting the number of households that set out materials on their assigned collection day and the number of households in the service area. The set-out rate is not a measure of true participation, as participants may choose to set out materials less frequently than the service is provided.

The limitation to measuring true participation is the variance of the definition of "set-out" from program to program. Usually, a house that sets out only newspaper and a house that sets out four materials are each counted as a single set-out. Although counting set-outs is difficult in dense urban areas and in multi- family unit neighborhoods, it may be possible to track set-outs if serial numbers, names, or addresses are affixed to each container.

Participation Rates

Set-out rates are not necessarily indicative of participation rates. Participation is defined by the NRC as the number of households that are source separating their recyclable materials divided by the total number of households served. Participation rates are difficult to accurately assess without a carefully tracked system of monitoring individual household set-outs over an extended period of time. In setting where there are single-family detached homes, it is possible to calculate the participation rate by keeping a set-out log, by address, for every household. Twelve weeks is a common tracking period. A "participant" is defined as any household that contributes materials at least once during this period. The frequency of collection should also be described since these variables can have a significant effect on participation rates.

$$\text{Participation Rate} = \frac{\text{number of households source separating}}{\text{total number of households served}}$$

Variables to specify when reporting participation rates are:

- Household density
- Time period
- Service unit
- Household counts
- Frequency of service

Recovery Rate

The recovery rate is defined as the total amount of solid waste recovered through source reduction, reuse, and recycling in a given community. The recovery rate is commonly expressed as a percentage of total solid waste generation.

$$\text{Recovery Rate} = \frac{\text{material recovered}}{\text{reference waste}}$$

$$\text{Annualized per capita Material recovery rate} = \frac{\text{material recovered in 12 consecutive months}}{\text{population}}$$

Variables to specify when presenting a recovery rate include: designated materials, service unit, population, time period, and reference waste.

Capture Rate

Capture rate refers to actual secondary materials recovered with respect to the designated materials available.

$$\text{Capture rate} = \frac{\text{designated materials recovered}}{\text{total designated materials available}}$$

Variables to specify when reporting a capture rate are:

- Designated materials (glass, paper, etc.)

- Reference waste (total glass, paper, etc. available in the wastestream)
- Service unit (route, entire County, etc.)
- Time period (month, year)

Capture rates refers to actual material recovered with respect to the designated materials available. The capture rate mat represent all materials targeted in the program, but more commonly is used to describe individual categories of materials only. Standard reporting practice requires all materials considered in the capture rate to be identified and capture rates for each individual material.

When reporting a capture rate, the definition of designated materials and the method of estimating quantities of available designated materials are very important. The total designated materials available would ideally be derived from generation rates based on wastestream sampling and characterization studies done in conjunction with a recycling audit. Where this data does not exist, "surrogate" data may be borrowed from studies conducted in similar areas or from national estimates. For certain materials, such as local newspapers, it may be feasible to obtain distribution and consumption figures to estimate the amount of material available. A capture rate for designated material should include redeemed deposit containers.[4]

In addition to measuring set-out, participation, recovery and materials capture rates, a recycling program can be monitored and evaluated by measuring costs and revenues of the program. Most recycling programs cost more than the revenues received on the materials collected and processed, mainly due to the volatility of the materials markets and costs of collection. However, monitoring costs and revenues can help to evaluate the economics of a program method. Periodic evaluation of equipment performance and capacity requirements is also necessary.

[4] "The National Recycling Coalition Measurement Standards and Reporting Guidelines," by National Recycling Coalition, 1101 30th St., N.W., Suite 305, Washington, D.C. 20007, October 31, 1989, pp.28, 31-34.

4.8.2 COMMERCIAL PROGRAM

The commercial recycling program will be based on the Mandatory Recycling Ordinance with guidance and direction from County staff. The items that can be monitored include:

- Material capture rates (number of trailer pulls and tonnage records)
- Periodic surveys
- Wastestream audits

Monitoring the effectiveness of the program is essential to establishing a workable database from which proper decisions can be made regarding whether these programs will meet the state diversion goals or the Mandatory Recycling Ordinance.

4.8.3 INDUSTRIAL PROGRAM

Industrial programs are monitored similar to commercial programs as stated above.

5.0 COMPOSTING COMPONENT

The CIWMB defines composting as "a process of biological decomposition of solid organic debris, such as leaves, grass clippings and other organic materials commonly found in the municipal wastestream. "Compost" refers to the stable humus or soil-like end product of the decomposition process which can be used as a soil conditioner, mulch or fertilizer, depending on its physical properties." The key distinction in the CIWMB definition is that to be classified as a composting operation the process of biological decomposition must be controlled and performed at a permitted facility. Yard and wood waste that is reused as mulch following grinding or size reduction operations, which has not undergone controlled biological decomposition, is qualified according to CIWMB regulations in this SRRE under the Recycling Component.

Composting will be the second most critical component in achieving the 25 and 50 percent diversion goals mandated by the IWMA. It provides an effective way to divert yard and organic wastes away from disposal facilities. This section specifies diversion quantities to be achieved through composting and set market development objectives for both short-term and medium-term planning periods.

According to the waste characterization described in Chapter 2, approximately 19 percent of the unincorporated County's wastestream is composed of yard and wood wastes. Yard debris (e.g., leaves, brush, grass clippings) accounts for 13 percent of the wastestream. Wood waste accounts for 6 percent of the wastestream. Yard and wood wastes are a bulky portion of the solid wastestream that can easily be turned into a useful product and thereby avoid landfill disposal. Waste composition studies conducted prior to 1990 did not include food wastes as a separate category. Therefore, percentage targets are not included in this preliminary draft. The final SRRE will incorporate target food waste composting goals. The County is currently conducing waste composition studies that characterize food wastes, as well as other suggested CIWMB categories.

5.1.1 SHORT-TERM OBJECTIVES

The short-term comporting objective for the unincorporated County is to divert at least 8 percent of the commercial and residential yard and wood wastestream to waste composting operations. This will yield approximately a 1.5 percent composting goal for the total wastestream. In addition, the County plans to implement a food waste composting pilot project, which will be included in diversion goals contained in the final SRRE. Short-term goals for targeted materials are summarized in Table 5-1.

5.1.2. MEDIUM-TERM OBJECTIVES

The medium-term composting objectives for the unincorporated County is to divert at least 20 percent of the commercial and residential yard and wood wastestream to composting programs. This will yield approximately a 3.8 percent composting goal for the total wastestream. The County will also evaluate the feasibility of expansion of the food waste composting pilot project. Medium term objectives for targeted materials are presented in Table 5-2.

5.1.3 MARKETING OBJECTIVES

Methods for expanding compost markets are many and varied. They can focus on increasing the use of yard waste compost through educational programs and procurement by government agencies, or they can increase the marketability of a facility's specific compost through quality assurance testing and aggressive pricing.

Several factors influence markets for yard waste compost and the availability of local soil amendment consuming industries: public or private ownership/ operation of the composting facilities, presence or lack of a profit- making incentive, the quality and quantity of available compost, and the local industries. Due to relatively high transportation costs, compost markets are usually restricted to local areas. Possible local markets include individual residents, nursery and landscaping industries, construction firms, public agencies, private institutions, soil amendment retailers and wholesalers, sod dealers, landfill operators, and farmers. Free delivery to users is a particularly useful marketing strategy, especially when the supply exceeds the demand and when there is limited storage space.

The County will continue the Technical Assistance Program grants to support innovative market development activities.

5.2 EXISTING CONDITIONS

Yard and wood waste are primarily composting ingredients and the quantity of these materials processed by the "clean green" mulching program at County landfills in FY 90/91 is summarized in Figure 5-1.

TABLE 5-1

TABLE 5-2

FIGURE 5-1

The quantity of yard and wood waste processed countywide in FY 90/91 totaled 24,964 tons as shown in figure 5-1. Based on population distribution in the County, 4,143 tons or 16 percent originated from the unincorporated area. The mulch that results from the clean green program is diverted to several end uses including composting, recycling, and transformation.

The portion of the unincorporated are clean green material diverted to composting results from two sources: material diverted to the Fallbrook Sanitary District and fines screened from the material diverted to boiler fuel markets. In FY 90/91, 1,394 tons of clean green mulch was composted in the vermicomposting process at the Fallbrook Sanitary District. Of the 2,008 tons of clean green mulch diverted to boiler fuel markets, 15 percent or 301 tons were screened out and used for composting. This represents a total of 1,695 tons or approximately 0.3 percent diversion of the total wastestream diverted to composting.

Over 80 percent of all municipal wastewater sludge now generated within San Diego County is composted by the windrow method by Chino-Corona Farms at their 200 acre site in Thermal, California. Yard waste materials obtained locally in the Palm Springs area are used as a bulking agent for this operation. Upwards of

2,000 tons per day of waste materials are currently being composted and marketed. Chino-Corona Farms may soon be handling wastes from the Carson Treatment Plant under an agreement with Kellog Supply. Chino-Corona Farms owns a 120 acre site near Pauma in San Diego County that could potentially be utilized for composting San Diego County sludge, yard and wood wastes.

5.3 EVALUATION OF COMPOSTING ALTERNATIVES

Composting of municipal waste materials may be considered as a series of unit processes each with characteristic elements. A schematic of the composting process indicating each of the unit process elements is presented below.

FIGURE 5-2

Prior to implementation of a successful composting program a variety of alternative related to each of these elements need to be evaluated. Alternatives may be considered in five broad areas:

- Separation/ Collection
- Feedstocks
- Processing Technology
- Program Scale
- Marketing

In the following text, each of these basic categories is discussed and alternatives for consideration by the unincorporated County presented.

5.3.1 SEPARATION/ COLLECTION

The manner of separation and collection of compostible materials from the mixed municipal wastestream sets the tone for an entire composting program. Alternatives for separation of compostible materials may be considered in broad categories:

- Source Separation
- Commingled
- Mixed Solid Waste

Source Separation

Source separation, as defined by the National Recycling Coalition, is the "separation by the waste generator of materials designated for separate collection for some form of materials recovery or special handling. "Source separation minimizes contamination that may result when recyclables are "commingled" with refuse. The County Mandatory Recycling Ordinance requires the source separation and collection of yard waste in the unincorporated area from residential generators. In addition, the differential "clean green" tipping fee acts as an economic incentive for commercial generators and collectors to deliver source separated yard and wood waste to the appropriate grinding areas at County disposal facilities.

Commingled Collection

At the present time, there are no facilities in the County separating yard and wood waste that has been commingled with refuse. Proposed material recovery facility projects, however, offer the future flexibility to separate compostable materials not presently included in the scope of the Ordinance from refuse.

Mixed Solid Waste Composting (MSW)

In the decade of the 1950s a number of projects were developed in the United States and Europe to compost materials separated from a mixed municipal wastestream. The Dano process, for example, involves a rotating drum equipped with aeration. Waste materials are presorted and magnetically separated. Sorted materials are delivered to the rotating drum where they are mixed and pulverized. Product from the drum may then be directed to another separation step and then to a composting process. Few of these original plants are operating in the United States today. Odor complaints, mechanical breakdown, and most importantly, poor product quality were experienced at many plants. The 1990's have seen a resurgence of interest in MSW composting. It provides a means of potentially diverting a larger quantity of the wastestream than yard and wood wastes; however, product quality and marketability remain significant question marks.

Summary

Source separation and collection of yard and wood waste from residential generators coupled with the "clean green" differential tipping fee ensures a high quality feedstock for composting operations in San Diego County. Proposed material recovery facilities and the scope of the County Ordinance offer the flexibility to capture commingled materials and divert additional source separated materials in the future.

5.3.2 FEEDSTOCKS

It is possible to compost all of the organic material found in a municipal solid wastestream. Materials such as newspaper, mixed paper, cardboard, textiles, food waste, manure, and wood can be shredded and composted. With such a wide variety of materials entering the composting facility, however, the quality and purity of the end product as well as the required processing time, can be very inconsistent. A more reasonable approach is to limit the types of material entering the facility.

The composting process is affected by a number of important variables including:

- Moisture content
- Carbon/ Nitrogen ratio
- Available volatile solids content

Candidate feed stocks for composting generally fall into two broad categories depending on their nitrogen and moisture contents:

- High carbon/ Low moisture
- High nitrogen/ High moisture

Generally feedstocks from each category need to be included in a successful compost mix. Typical high carbon/ low moisture feedstocks are wood waste, agricultural cuttings, and woody construction waste. Typical high nitrogen/ high moisture feedstocks are green yard waste, food waste and dewatered municipal wastewater sludge. It is recommended that three alternative feed stock mixtures be considered for the unincorporated County:

- Green/ wood waste mixture
- Mixed yard waste/ sludge mixture
- Other source separated organic waste

Choice of feedstock is influenced by both process and market considerations. In general a yard waste based compost can be marketed to the public as a higher quality product than one which contains sewage sludge because of commonly held concern about higher risk of bacteriological and metal contamination in the latter. In fact, the sludge based product may have higher horticultural value due to higher nitrogen concentrations. This may not affect the market perception, however.

From the process standpoint, the yard waste/ sludge mixture may be more consistently controlled to optimum conditions for carbon to nitrogen ratio and moisture content. A yard waste mixture will usually require supplemental water supply to increase moisture content. Nitrogen contents may also be lower than optimal in a yard waste compost resulting in a longer required compost time to achieve adequate stabilization.

5.3.3 PROCESSING TECHNOLOGY

Preprocessing Technology

Effective composting of municipal waste materials typically requires that these materials be processed. A typical need is to reduce material particle size. Size reduction increases the surface area available for microbial activity which, in turn, increases rates of breakdown of materials in the composting process. A typical preprocessing operation includes shredding or grinding, such as that presently performed in the County yard and wood waste mulching program, and may include screening.

Composting Technologies

Municipal composting installations confine the processes of decomposition of organic material that occur naturally in soil to a controlled environment providing optimal moisture content and oxygen supply for microbial activity. The controlled process requires less time than natural decomposition and generates heat to produce temperatures that are high enough to deactivate pathogens. Composting process arrangements for materials found in municipal solid waste may be conveniently divided into three classes as follows:

- Windrow/ static pile
- Aerated static- pile
- In-vessel systems

Windrow / Static Pile Composting

Windrow or static pile composting is a fundamental composting technology. Compostable materials are mixed using a front-end loader or compost turning machine followed by active composting in long "windrows." Windrows are constructed by en-dump trucks and shaped by bulldozers. Aeration is provided by periodically "turning" the windrows using a machine designed o mix and aerate material in-place while moving down the pile. Composting time for the windrow process can vary from 30- 120 days depending on feedstocks and required degree of stabilization. After the active composting period, during which the piles may be turned five to ten times, the frequency of turning is reduced until the piles are "cured", that is, sufficiently stabilized for subsequent horticultural or agricultural uses. The windrow process is frequently used for composting yard waste materials.

One of the largest windrow composting installations in the world has been, until recently, operated by the Los Angeles County Sanitation Districts at its Carson Treatment Plant. The Carson plant composted anaerobically digested sludge for over 30 years for sale to a retail processor and marketer. The composting operation at Carson was suspended indefinitely in June, 1991 due to odor complaints. Sludge is currently being composted by a private contractor at a remote site.

An example of a successful windrow composting program for mixed yard waste is the Cedar Grove Compost Company project in Seattle, Washington. Cedar Grove, a private company under contract to the City of Seattle, composts up to 60,000 tons per year of yard waste from Seattle's "Clean Green" curbside pickup program. Mixed yard waste is sorted, shredded, and placed in windrows on a concrete surface. Windrows are turned using a "Scarab" composting machine. Active composting for two months is followed by at least one month of "curbing" in non-aerated static piles and then screened prior to sale or blending into topsoil or other horticultural products.

Advantages of windrow composting include:

- It is the simplest of all compost methods.
- It is typically less expensive than other methods.
- A good deal of experience is available.
- Operation requires knowledge of only basic diesel driven equipment commonly used in the general construction industry.

Disadvantages are:

- Odor releases are more difficult to control.
- Site land area may be more than for other methods.

Aerated Static- Pile Composting

The aerated static-pile compost system is an adaptation of the windrow process. The process was developed by United States Department of Agriculture (USDA) researchers at their Beltsville, Maryland site. For this reason aerated static-pile system aeration is sometimes referred to as the "Beltsville" method. In the aerated static-pile system aeration is provided by force ventilation of the piles using air compressors operating in either a pressure or vacuum cycle. Typically, the

vacuum cycle is used. With this technique the need to turn the material is eliminated.

The advantages of the aerated static-pile system are:

- The system is mechanically simple and should result in mechanically reliable operation.
- A shallow compost pile is used so there should be little concern over compaction causing uneven air distribution.
- The operator can inspect the material as it is placed, composted, and removed.
- The aerated static-pile process results in good product stabilization/ pathogen kill.

Disadvantages are:

- Compared to in-vessel systems, a relatively large land area is required.
- Operations are affected by climatic variability.
- The system has a low degree of mechanization and is therefore labor intensive.
- Odors have been a problem, but less than the windrow method.

In-Vessel Composting

In-vessel composting uses a confining structure to enclose waste materials during the biologically active phase of composting. Reactors have been constructed in a variety of shapes: circular or rectangular towers, horizontal tunnels, and bin or box-type vessels. In-vessel composting often is used when materials from the municipal solid wastestream are co-composted with municipal wastewater treatment sludge.

Basic process flow for in-vessel composting is similar to aerated static-pile systems—feedstocks are mixed, aeration is provided for biological respiration and moisture removal, and finally, compost is cured to achieve additional stabilization prior to storage or marketing.

The term in-vessel is used to describe systems which incorporate (at least) vertical walls to enclose the active composting mass. Thus both "plug flow" and "agitated bed" systems are included in this classification.

Plug flow systems may be either vertical or horizontal. In the case of vertical reactors the compost feedstocks are added at the top of the enclosed compost mass and withdrawn from the bottom using screw conveyors. Systems of this type have been manufactured by Taulman- Weiss. Horizontal plug flow systems move compost material within the reactor by hydraulic means. The tunnel reactor manufactured by Ashbrook-Simon-Hartley is a horizontal plug flow reactor.

Agitated bed systems mix the compost mass during active composting using either a rotating auger or a turning machine similar to that used in the windrow process. In rectangular agitated bed systems the turning machine is typically mounted on fixed rails along the concrete walls of the compost vessel. The original "Fairfield digester" is an agitated bed system. Other manufacturers of agitated bed systems include International Process Systems, Buhler- Miag, and Compost Systems Company.

Agitated bed systems necessarily require an open top for access and movement of the agitation equipment. If an agitated bed composting system is to be enclosed for odor control the entire compost vessel must be enclosed in a supplemental building. Exhaust gases from plug flow systems can be more easily captured for odor control.

The rotating drum of the Dano process could be considered an "in-vessel reactor." Since particle residence times in the rotating drum of the Dano process are typically in the order of several days rather than the 10-20 day residence times typical for other systems considered here, the Dano drum is more properly considered a preprocessing technology in the sense described above. Full stabilization of compost discharge from a Dano drum with a residence time of 2-3 days will require supplemental composting to achieve adequate stabilization.

Operating experience with in-vessel composting of municipal solid wastestream materials is limited, although the partially enclosed Dano process was used relatively extensively for mixed solid waste composting in the United State and Europe in the decade of the 1950's. Most of these original plants have been abandoned for a variety of reasons including odor complaints, lack of mechanical reliability, and unfavorable market conditions. A good deal of experience has been gained in recent years from startup and operation of a number of in-vessel systems for composting of wastewater treatment plant sludge using, typically, sawdust as a bulking agent. A number of successful installations were started up in the decade of the 1980's.

Advantages of in-vessel compost systems include:

- The system provides a combined disposal system for wastewater treatment sludge and municipal solid waste.
- The system allows the decomposition of materials at a higher rate where mixing, aeration, and moisture content can be strictly controlled.
- In-vessel systems require less land and are not generally affected by weather conditions when compared to static-pile systems that are uncovered and operated outdoors.

Disadvantages of in-vessel systems are:

- The system is more mechanically dependent and therefore more subject to breakdowns.
- The system has not fully demonstrated the capability of handling the entire organic fraction of the municipal solid wastestream.
- Financial institutions have sometimes been reluctant to incur the risks associated with facilities due to operating problems and the lack of stable markets.
- The end product from an in-vessel system is not always adequately stabilized for horticultural purposes and must be cured.

5.3.4 PROGRAM SCALE

A fundamental factor in evaluation of alternative composting programs is the decision of program scale. Programs could range in scale from small, locally operated yard waste composting operations to large regional facilities handling a variety of feedstocks. Considerations of scale can effect the desirability of a candidate program in several ways. Scale impacts include transportation impacts, permitting issues, and cost. In general, smaller scale operations may have the advantages of :

- Less transportation impact
- Greater community control and program involvement

Conversely, advantages of larger operations include:

- Lower unit cost
- Consolidation of permitting efforts

For this evaluation it is recommended that impact of scale be investigated by preparation of alternatives for three different scales of operation:

- Local program
- Subregional program
- Countywide regional program

Local. The local alternative may be considered as yard waste only windrow or static-pile facility operated by private parties or County of San Diego personnel on County land with distribution of product to wholesalers or use of product on public lands.

Subregional. The subregional alternative may be considered as an aerated static pile or windrow yard waste facility or a yard waste/ sludge in-vessel facility operated at current County landfill sites. This may be considered as an extension of the County of San Diego's current "clean green" program from a mulching program to a full composting process. Another option for a subregional program could include County supply of yard waste from expanded "clean green" programs to another party who would operate a composting process. Potential agents within the County include the private company Chino-Corona Farms, the Metropolitan San Diego Clean Water Program, and the Prison Industry Authority. Each of these agents has potential need for yard waste materials in quantities comparable to those of the projected subregional wastestream.

Regional. The regional alternative may be considered as a sludge/ yard waste in-vessel facility sited to serve the entire County. The Clean Water Program of the City of San Diego has announced preliminary plans for a sludge processing center to be located in the south end of the County. One site which has been identified is at Southeast Otay Mesa, adjacent to a possible future County landfill site. The Clean Water Program, if it composted all of the sludge generated in the

metropolitan system, could potentially use most of the yard waste now in the County.

5.3.5 MARKETING AND DISTRIBUTION

The most critical factor in the success of a composting program may be the effectiveness of the marketing program developed to distribute the resulting product to beneficial end uses. Markets should be established prior to establishing any composting program. Lack of markets for the finished product is one of the most frequently cited factors in failure of composting programs in the past.

A preliminary market survey was conducted by CDM during June 1991 to determine the current potential market demand and price for soil amendments in San Diego County. Results are summarized in Table 5-3. Three compost retailers and eight compost wholesaler sellers of soil amendment products were contacted by phone. The survey found the retail price of compost type soil amendments to be in the range of $25 to $35 per ton in bulk form and $60 tp $70 per ton as a bagged product. None of the wholesalers would cite a wholesale sales price. It may be assumed to be approximately half of the retail price or in the neighborhood of $12 to $20 per ton in bulk form. When asked the question explicitly, none of the retailers expressed an interest in yard waste or sludge- based soil amendment material. Sludge-based products are widely marketed in Southern California, however. The Kellog Company processes and markets sludge compost from the Los Angeles County Sanitation District's Carson Treatment Plant. Kellog products are sold, in fact, by one of the retailers contacted in the survey.

The market survey was not extensive enough to identify firm total demand on a Countywide basis. A survey completed in 1985, however, as part of the North County Sewage Sludge Management Study by John S. Murk Engineers, suggested a total market demand in San Diego County (mostly in the agricultural industry) of 300,000 wet tons per year (at 60 percent solids concentration) in the year 2000 compared to an estimated maximum total quantity of county-wide sludge/ yard waste compost potential of approximately 500,000 tons per year. A more recent study by Metcalf & Eddy, Inc. Final Report- Preliminary Assessment of San Diego County Compost Market completed as a part of evaluations for the Clean Water Program identified a waste-based product market of approximately 500,000 tons per year out of a total market of approximately one million tons per year. It is seen that the projected market is of the same order of magnitude as total County compost production potential.

Alternative marketing and distribution programs can be evaluated for:

- Local distribution to County parks
- Bulk sales to wholesalers

TABLE 5-3

The importance of market development on implementation of the compost program cannot be over- emphasized. The target market and market location for the compost product affects the overall success of the composting program. Required finish processing will be dictated by end market specifications. Transportation impacts are highly dependent on the eventual product market. Lastly, if market demand is inadequate, the fundamental goal of diversion of materials from County landfills may not be met if landfills become the "market" of last resort.

5.3.6 SUMMARY EVALUATION OF ALTERNATIVES

Alternatives discussed in this section cover the range of factors affecting successful implementation of composting projects as a part of the unincorporated County's goal to meet the mandated targets for waste diversion of 25 percent in 1995 and 50 percent in the year 2000. Results of these evaluations are presented in a series of evaluation matrices in each of the broad areas of evaluation in Tables 5-4 through 5-8. The matrix format uses the criteria proposed in the CIWMB checklist to compare technologies and methods available for implementation of a composting program. The criteria for effectiveness, hazard created and flexibility should be given more consideration in the evaluation than the remaining criteria, since these factors significantly impact successful implementation. The criteria of cost is obviously of considerable importance.

To evaluate projects with alternative feedstocks and scale, a compost system design was prepared. The prototype designs identify requirements for compost reactor (or pile) size, aeration, and moisture addition/ removal. Based on the required system size and material flows, a preliminary unit cost range was prepared as shown in the evaluation matrix.

5.4 SELECTION OF PROGRAM

The choice of the preferred alternative in each category is based on factors of local experience and preference, in addition to the factors listed in the evaluation matrices. A key to selection of alternatives is to focus on the short- and medium-term goals of diversion of 25 percent of all waste materials by 1995 and 50 percent by the year 2000.

Separation / Collection

Throughout the planning period, the existing "clean green" drop-off program for source separated yard and wood waste materials will be continued to residential

TABLE 5-4

TABLE 5-5

TABLE 5-6

TABLE 5-7

TABLE 5-8

self-haul, commercial, and industrial generators. Achieving short- and medium-term goals will be possible as a result of increasing quantities of source separated yard waste materials coming on-line in conjunction with the regional implementation of the Ordinance.

Feedstocks

Targeted feedstocks for the short- term and medium-term include source separated yard waste, wood waste, and food waste. Wastewater treatment sludge in the County is handled by several agencies and special districts, each of whom have separate plans and responsibilities for sludge disposal. Nearly all of these agencies at present compost their sludge or are considering to do so in the near future. The County should move forward with negotiation with these agencies to provide ground mulch from an expanded "clean green" mulching program as a bulking agent for composting. Once a successful program had been established using these higher quality feedstocks, materials which are more difficult to handle or compost may be incorporated into the program on a trial basis or adopted after pilot tests. County intends to implement a food waste composting pilot program to determine the viability of implementing large-scale programs.

Composting Technologies

Selection of the appropriate composting technology for a given project is highly site specific and can not be made until siting issues are thoroughly investigated. Windrow or static pile composting is appropriate for remote or rural sites where land prices are lower. Windrow composting uses more land than other technologies and may require more buffer land to control escape of odors from the composting site. In-vessel systems can be located closer to populated areas because of lower land area requirements and better ability to control odor release. Aerated static pile technology is intermediate between these two extremes.

Alternative Scales

The existing County of San Diego waste management infrastructure demonstrates a subregional approach to minimizing transportation impacts while maintaining the advantages of economy of scale in serving concentrated population centers. This foundation will expand as increasing quantities of source separated yard and wood waste materials are diverted in conjunction with implementation of the Mandatory Recycling Ordinance in the short-term (through 1995). In the medium-term (1996-2000), the County may evaluate, as part of the IWMA- required Siting Element, alternative projects for implementing a subregional or regional composting project.

Marketing Alternatives

Marketing of mulch material is a continuing need for the County which will grow in importance as increasing quantities of separated yard and wood waste are generated within the County. Negotiations with current users may be pursued initially to increase their use. As separated quantities grow, however, new users will be required. As a part of evaluations recommended above for new projects these new users must be identified and contracts for supply confirmed.

5.5 IMPLEMENTATION

An implementation schedule must identify all activities which must be accomplished in order to successfully implement the composting program. The schedule can help assure that these decisions are well informed and on a timely basis. The implementation schedule must also provide project continuity as the personnel, law and regulations, and other factors change over time during program development.

The implementation schedule is an evolving document and must maintain flexibility. Results of decisions made as part of early activities may significantly alter the program's scope and direction as well as that of the solid waste management system. Following each major decision to proceed with project elements, the implementation schedule should be reviewed and revised as necessary. Phased implementation of the composting program is recommended.

During the initial phase of implementing the composting facility, yard waste from the unincorporated County will be shredded and screened into high quality mulch. In the final phase of implementation yard wastes may be mixed with sewage sludge and could be composted at the local wastewater utility facility or at the common MRF and composting site. Table 5-9 and 5-10 present short- and medium- term implementation schedules for the unincorporated County.

5.6 MONITORING AND EVALUATION

Assessment and evaluation of the composting component requires the accurate and timely collection of data from a variety of sources. Scale data from the proposed facilities will provide a basis for evaluation since all quantities will be weighed. The ultimate measure of program reduction will be reported as the total reduction

TABLE 5-9

TABLE 5-10

in the overall wastestream from the result of composting activities.

The monitoring of the composting program will be closely linked to the recycling program. The monitoring parameters for the residential, commercial, and industrial composting programs will be similar to those discussed in the recycling component. The combination of these two programs will determine the overall success of the program.

6.0 SPECIAL WASTE COMPONENT

6.1 INTRODUCTION

Special waste refers to any waste which has been classified according to Section 66744 of Title 22 of the California Code of Regulations, or which has been granted a variance for the purpose of storage, transportation, treatment, or disposal by the Department of Health services pursuant to Section 66310 or Title 22 of the California Code of Regulations.

Examples of special wastes include, but are not limited to, the following:

- Asbestos
- Sewage sludge
- Septic tank pumpings
- Grease trap pumpings
- Infectious waste
- Ash
- Auto bodies
- Used tires
- Street sweepings
- White goods
- Concrete
- Asphalt
- Construction and demolition debris

6.1.1 SHORT- AND MEDIUM- TERM OBJECTIVES

The County of San Diego will pursue several objectives in the unincorporated area to minimize the quantity of special wastes that ultimately require proper handling and disposal in the short- and medium-term. In the short- term the County will continue public information programs for diverting white goods, construction and demolition debris, asphalt and concrete. The County will also continue to supply yard waste to sludge co-composting programs. In the medium-term the County will research the feasibility of implementing ash recycling in conjunction with the transformation facility residue.

6.1.2 PRIORITY WASTE TYPES

The special waste types that are targeted for division during the short-term planning period are white goods, construction demolition debris, asphalt, concrete and used tires. Targeted materials for the short- and medium-term planning periods are presented in Table 6-1.

6.2 EXISTING CONDITIONS

Each special waste type has different handling and disposal requirements and will therefore be discussed separately.

6.2.1 ASBESTOS

Asbestos is a known carcinogen that primarily affects the respiratory tract. Proper handling, storage and disposal are important because of its hazardous nature. Asbestos wastes are generated during building maintenance, repair, renovation and demolition operations, particularly for pre- 1979 buildings. These wastes are typically found in ceiling and floor tiles, wallboard and insulation on pipes, boilers and ducts. Asbestos requires special handling. It must be transported in sealed nonreturnable containers or in closed vehicles.

TABLE 6-1

Although asbestos is classified as hazardous in California, it can be disposed in landfills that are permitted by the Regional Water Quality Control Board to accept asbestos wastes. The three landfills in Southern California that can accept all hazardous wastes are BKK (Class I) in West Covina; Chemical Management's Kettle Hills (Class I) in Kettleman City; and Casamalia Resources Inc. (Class I) in Santa Barbara.

Sycamore and Miramar landfills are the only landfills in the County accepting specified asbestos wastes. They only take non-friable asbestos that meets certain conditions. Friable asbestos is material which can be crumbled, pulverized, or made into a powder by hand. The hauler must provide a laboratory analysis showing the percentage and type of asbestos; a letter stating how the material was removed and that it is non-friable; obtain a "nonhazardous noninfectious special waste manifest;" double wrap the asbestos in 6-mil double plastic bags; and give the landfill 48 hours advance notice of disposal. Due to the hazardous nature of asbestos, no diversion or recycling alternatives of material are feasible.

6.2.2 SEWAGE SLUDGE

Sewage sludge is a waste product of municipal wastewater treatment. It has the potential for beneficial use as a soil conditioner but requires digestion, stabilization, dewatering, and composting before it can be considered a useful resource.

A variety of treatment plants operated by several agencies and special districts serve the diversion region of the unincorporated County. The County of San Diego operates a series of sewer districts and treatment plants in the unincorporated area. Table 6-2 presents a summary of wastewater districts flows, equivalent dwelling unit (EDU) capacity, estimated 1991 sludge quantities in wet tons per year and the current means of sludge disposal. Five districts drain to the San Diego Metro System. Sludge for Metro are currently composted at Thermal, CA by a private contractor, Chino-Corona Farms. The remaining plants and districts dispose of sludge by direct agricultural reuse. Sludge estimates in the table are based on an assumed rate of sludge production of 4.9 tons per million gallons of wastewater flow treated.

In addition to these County of San Diego operated plants, several other treatment plants treat wastewater for isolated unincorporated areas including the Encina Water Pollution Control Facility, the San Elijo wastewater treatment plants owned by the Cities of Oceanside and Escondido. Sludge from these plants is digested and composted at Thermal, CA by the Chino- Corona Farms. The Fallbrook

TABLE 6-2

Sanitation District reclaims wastewater for the Fallbrook area. Fallbrook sludge is vermicomposted using yard waste from the San Marcos Landfill as a bulking agent.

Landfill disposal of sewage sludge is both difficult and expensive because of the required 50 percent solids content. As a result, the CIWMB considers landfill disposal a "last resort" alternative. Emphasis is given to those alternatives that promote beneficial reuse of sludge and sludge products such as composting and land application.

6.2.3 SEPTIC TANK PUMPINGS

Septic tank wastes do not go to landfills, but are disposed at sewage treatment plants.

6.2.4 GREASE TRAP PUMPINGS

A grease interceptor is an underground tank used to capture grease, oil, and other floatable material that is disposed of by restaurants and businesses. If not removed form the wastewater stream, these materials can clog sewer lines and interfere with treatment plant operations. Grease interceptor wastes generated by unincorporated businesses are collected by a multitude of private hauling companies. Grease and related wastes such as animal fats are used to make animal feed, soaps, cosmetics, and other products. Most if not all, of the companies supply the rendering plants with additional grease. None of the landfills in San Diego County accept liquid waste from grease traps.

6.2.5 INFECTIOUS WASTE

This material is kept separate from the general wastestream at all times. All infectious material is deposited in red plastic containers and kept in a secure area until it is collected by the hauler. Approximately 10 percent of the total is pathological and anatomical material that requires incineration. The remaining medical wastes may be disposed of at any landfill provided that it is decontaminated, an appointment is made for disposal, and manifest is provided.

6.2.6 INCINERATOR ASH

At the present time there are no large incineration facilities in the unincorporated County, and therefore there is no generation or disposal of incinerator ash.

6.2.7 AUTO BODIES

Auto bodies are not normally landfilled because of the high demand for spare parts and ferrous scrap. As a result, all waste automobile parts and bodies are recycled. Most used auto dealers are linked together by computers, which aids in part selection. When vehicles are stripped of all usable parts, the remainder is sent to a steel mill for reprocessing.

6.2.8 USED TIRES

The County assesses a special handling fee surcharge for used tires that range from $1 for standard car and truck tires to $100 for tires with an inside diameter in excess of 24.5 inches. Tires received at the Otay and San Marcos landfills are shredded prior to disposal to reduce volume. The County will continue to evaluate alternative markets for tire diversion during the short-term and will implement a tire diversion program in the medium-term planning period.

6.2.9 STREET SWEEPINGS

The majority of the street sweeping that occurs in the unincorporated area is performed under contract with private entities. Collected street sweepings are disposed in County landfills.

6.2.10 WHITE GOODS

White goods include enamel- coated major appliances such as refrigerators, stoves, washing machines, dryers, and water heaters. Under the provisions of the County

Mandatory Recycling Ordinance, white goods are a designated recyclable from residential and hospitality industry waste generators. All County disposal site recycling centers will be collecting white goods in conjunction with the regional implementation of the Ordinance. The San Marcos drop-off recycling centers an Otay buyback recycling center presently collect white goods.

6.2.11 CONSTRUCTION AND DEMOLITION DEBRIS

Waste materials generated as a result of construction and demolition activity commonly include concrete, asphalt, dirt, rock, and sand (all "designated" industrial recyclables in the County Ordinance), as well as roofing materials, drywall, and mixed construction wastes. As discussed in the Solid Waste Generation component, almost 90 percent of all concrete and asphalt waste generated in the unincorporated County is currently diverted through several recycling activities. Diversion rates for concrete and asphalt are attributable to the variety of markets that accept these materials (more than ten Countywide), the County Technical Assistance Program including grants and promotion of market alternatives, the pay-by-weight structure modification, and the County Ordinance.

6.3 EVALUATION OF ALTERNATIVES

Only those special waste types with feasible diversion alternatives will be considered. All asbestos waste generated will continue to be disposed in properly permitted facilities. All infectious hospital waste will continue to be handled by commercial haulers. In addition, materials such as grease trap wastes and auto bodies, that are currently being recycled, will not be evaluated.

6.3.1 SEWAGE SLUDGE

There are a variety of diversion alternative available for sewage sludge. Sewage sludge can be composted, directly applied as soil amendment, incinerated to recover energy, or following chemical fixation it can be used as daily landfill cover.

There is one composting facility proposed for the region but no decisions have been made regarding location or capacity. These decisions should be made by all adjoining jurisdictions, as any facility will most likely serve a number of nearby cities.

6.3.2 USED TIRES

Landfilling tires reduces the quantity available for recycling and reuse options. Because tires take up a lot of space, do not compact well and tend to migrate to the surface of the landfill, they are shredded at an additional cost.

Alternatives for used tire diversion include incineration, retreading, and crumb rubber uses. Due to the air quality problems in the regions, tire incineration is not considered a viable alternative at this time. Retreading is primarily done on bus, truck, airplane, and other large tires. At the present time, passenger car retreads cannot compete with new imported tire market prices. If disposal costs are included as part of the initial purchase price, retreading may become a more economically viable alternative.

Crumb rubber is created by a process of breaking tires into small particles by mechanical or cryogenic means. It can be used in asphalt, carpet backing, doormats, and other rubber products. It can also be used as an additive to asphalt for high traffic surfaces, such as recreational and feedlot surfaces.

None of the previously mentioned alternatives are very effective at diverting significant quantities of used tires away from landfill disposal and can, in fact, create additional health hazards. From a regional perspective, influence on the wastestream will not be significant because diverted quantities will probably be very small. It may be possible to implement tire shredding and crumb rubber use during the short-term planning period, and may require new or expanded facilities.

Used tire diversion is consistent with local conditions but may have institutional barriers to implementation. Depending on the chosen alternative, costs may be significant. The major drawback to tire recycling or reuse is the lack of end markets for the diverted materials.

6.4 PROGRAM SELECTION

The selection of a special waste program has been based upon the objectives set forth previously, consideration of the existing conditions in the unincorporated County and the need to maintain program flexibility. The short-term programs begin with the evaluation of private sector reporting requirements for other special wastes (tires, construction/ demolition and grease trap wastes). The burden of reporting special waste disposal could be established as a requirement of future business operating permits. Ongoing activities include evaluation of tire recycling markets; continuation of the supply of yard and wood waste to sludge co-composting programs; continuation of public information programs for diversion practices for construction of the implementation of the mandatory ordinance for designated special waste.

For the medium-term program the County will continue the supply of yard and wood wastes to sludge co-composting programs. Other special waste programs and private sector reporting will at this time be evaluated and program changes implemented, if necessary. Additional alternatives for used tire diversion will be evaluated from a regional perspective, with a goal of a complete ban of tires at the landfills by 1995. Economic incentives (or disincentives) can be implemented on a state level to encourage recycling of used tires. The County will also continue the implementation of the Mandatory Recycling Ordinance for designated special wastes in the medium-term.

6.5 PROGRAM IMPLEMENTATION

An implementation program identifies activities which must be accomplished in order to successfully implement the special waste recycling program. The implementation plan must remain flexible in order to account for changes in personnel, laws and regulations, and other program changes. Table 6-3 and Table 6-4 outline the short-term and medium-term program tasks and decision points. Following each major decision to proceed with project elements, the implementation should be reviewed and revised as necessary.

TABLE 6-3

TABLE 6-4

6.6 MONITORING AND EVALUATION

The assessment and evaluation of the special waste component will require the accurate and timely collection of data from a variety of sources. The collection of tonnage date at the proposed facilities will be relatively straightforward since all quantities will be weighed. The ultimate measure of program reduction will be reported as the total reduction in the overall wastestream from the result of composting and other diversion activities. Program measures for tires will need to be developed through commercial waste audits or other measures.

7.0 EDUCATION AND PUBLIC INFORMATION

7.1 INTRODUCTION

Comprehensive recycling education and public information programs are a vital component of the County's 1988 Recycling Plan. Consistent increases in recycling program participation over the last three years of the Plan indicate that increasing numbers of San Diegans are making waste reduction, material reuse, and recycling a regular part of their lives. This section summarizes existing education and public information activities and describes the program development and expansion that will be required to achieve the waste reduction goals established in this Source Reduction and Recycling Element.

County staff have implemented education and public information programs designed to reach residential, commercial, industrial, and public sector waste generators. Public information programs serve to increase awareness of recycling opportunities and explain how to participate in local programs. The County toll-free Recycling Hotline is an example of an effective public information service. Education programs, such as the County Recycle and You Save (RAYS) K-6 curriculum, communicate the importance of conserving resources and provide ongoing education of, and support for, the practices of source reduction, recycling, and composting.

Education and public information are complementary mechanisms that work toward the unified goal of encouraging and increasing participation in recycling and waste minimization. Since 1986, the County of San Diego has contracted for a variety of public education and information services with a non-profit environmental organization. To respond to increased public demand for additional recycling information services, County staff have revised and expanded this scope of work, and have received proposals for a new 5- year contract, expected to be awarded in the spring of 1992.

New public education and information services are also a component of the County Mandatory Recycling Ordinance, adopted by the Board of Supervisors on June 11, 1991. By prohibiting designated recyclables from residential, commercial, and industrial waste generators from disposal in County solid waste facilities, the Ordinance is projected to divert as much as 23 percent of the waste now disposed in County landfills when fully phased-in. Successful implementation of the Ordinance will hinge on effective public education and outreach programs that reach waste generators targeted in the Ordinance.

These two contracts, in conjunction with education and public information services provided by County staff, will provide the communication infrastructure with which County source reduction, recycling, and composting goals will be achieved.

7.1.1 SHORT AND MEDIUM TERM OBJECTIVES

The overall goal of the education and public information program for the unincorporated area of the County is to broaden public awareness of, and participate in, the County's recycling and waste reduction programs. The following objectives will be implemented in the short-term (1991- 1995) and will continue during the medium-term (1996- 2000) planning period:

- Conduct a coordinated Ordinance public education and information campaign and achieve 90 percent public awareness of the County Mandatory Recycling Ordinance by 1995.

- Through the use of periodic random surveys, establish baseline participation in source reduction and recycling activities, such as home composting and the purchase of living Christmas trees, and track increasing participation rates. Survey results will also be used to evaluate effectiveness of education and information programs.

- Provide a copy of the Recycle and You Save (RAYS) curriculum to all interested K-6 County school teachers. Develop and implement a grades 7 –12 recycling and source conservation curriculum. Continue series of in-service workshops to assist teachers with curriculum utilization.

- Continue to provide up-to-date recycling and waste reduction information through public information services such as the toll-free telephone Recycling Hotline and publication services such as the toll-free telephone Recycling Hotline and publication of the County Recycling Guide. Develop additional public information and educational publications that reach non-English speaking audiences.

- Investigate methods for County citizens to reduce the amount of unsolicited mail they receive. This information will be combined into a listing of "Easy Steps for Eliminating Unwanted Mail." The packet will be available at County events and to citizens upon request.

7.2 EXISTING PROGRAMS

The County's educational program was established as objective four of the County's none point 1988 Recycling Plan. The goal of the education objective is to create an atmosphere of understanding so that an informed public will know why and how to participate in waste reduction and recycling practices. The County's resulting recycling public education and information campaign was designed to target a range of age groups and income levels within the County and to utilize a variety of informational means.

For the past five years, the County has contracted for public education services with a local non-profit environmental organization, "I Love A Clean San Diego County" (ILACSDC). This organization publishes a directory of recycling markets throughout the County, operates a toll-free Recycling Hotline, and conducts an ongoing series of school an community presentations. In addition, ILACSDC also provides logistical support in coordinating the County's annual Christmas Tree Recycling Program.

An overview of County education and public information programs follows:

RAYS Curriculum

This County-funded K-6 recycling curriculum focuses on the 3-R's—reduce, reuse, recycle—and covers a wide range of integrated solid waste management issues. RAYS was developed and curriculum content refined with the input and guidance of local teachers and administrators. The final draft of the curriculum was completed in March of 1991 and is being distributed to all County schools at no cost. Staff are implementing a plan to make a copy of the RAYS curriculum available to each K-6 teacher in the County. To assist educators in adopting the RAYS curriculum, a series of in-service workshops is being conducted.

Recycling Guide

For four years, the County has co-sponsored, with the City of San Diego, the publication of a comprehensive listing of County recycling services. The San Diego County Recycling Guide lists all local recycling centers, the materials each accepts, and their hours of operation. The guide also serves as a resource for information on household hazardous materials, recyclable material categories and material preparation tips, and provides an overview of the County Mandatory Recycling Ordinance.

Recycling Hotline

To provide personal assistance to County residents with questions about source reduction, recycling, and composting, the County co-sponsors, with the City of San Diego, the funding of a toll-free Recycling Hotline. ILACSDC staff and volunteers operate the Hotline from 9:00 a.m. to 5:00 p.m. Monday through Friday, and 9:00 a.m. to 1:00 p.m. on Saturday. Demand for Hotline service has been steadily increasing. In FY 90/91, the number of calls received at the Hotline increased 50 percent over the prior fiscal year. Hotline staff routinely respond to an average 1,000 calls per month regarding local recycling markets, recyclability of various products, recycled product procurement, household hazardous material collection events, commercial events, commercial recycling services, and furniture and appliance reuse, among others.

Christmas Tree Recycling

The County has also co-sponsored, with the City of San Diego, a Christmas tree recycling program every year since 1988. The program includes the publication of a comprehensive listing of tree drop-off sites and curbside collection programs. These guides are distributed to local Christmas tree retailers, department stores, schools, businesses, and are mailed upon request. More than 100,000 guides were distributed in 1990/91. The program also draws the support and participation of waste haulers throughout the County, business associations, and retailers. The 1989/90 program features a television public service announcement with actor Robert Young.

To promote source reduction, the Christmas Tree Recycling Program encourages County residents to purchase live Christmas trees. The Christmas Tree Recycling Guide includes a directory of trees suitable for planting in Southern California and offers tree-planting tips. In the 1991/92 program the County will be re-planting live trees at County disposal site and several park and recreation facilities will also be accepting live Christmas trees for re-planting.

Cut Christmas trees are collected at sites throughout the County and are mulched at County and City landfill sites. The program collected 150,000 trees in 1990/91, a 50 percent increase over the previous year. Using the National Christmas Tree Growers Association estimate that one tree is sold per 7.2 residents, the 1990/91 program diverted 40 percent of all the trees sold in the County.

Community Presentations

The County's education services contractor gives presentations to community groups, service and youth organizations, and business associations. Materials

distributed at these presentations include the San Diego County Recycling Guide, activity books and brochures for children, and a guide to recycling and source reduction in the home. A total of 3,683 persons were reached in 1990 through these community presentations.

Phone Book Recycling

In 1990, the County funded the printing of banners for the San Diego County Phone Book Recycling Program. A total of 640 tons or approximately 30 percent of all Pacific Bell phone books distributed in San Diego County were recycled county-wide in 1990. The education contractor has recently been working to enlist additional private support to sponsor the next phase of the program.

County Offices Recycling Program

The County Offices Recycling Program (CORPS) serves 16,000 County employees in over 200 office locations. Employee education is a major CORPS component. At alternating County departments, CORPS staff provides a detailed orientation, brochure and demonstration to familiarize County employees with the CORPS program. The CORPS "Trash Buster" offers an additional incentive for County employees to recycle. The Trash Buster randomly inspects employee trash cans for recyclables and employees who are found to have kept CORPS recyclables out of their trash cans are awarded their choice of a canvas bag, t- shirt, baseball cap, or ceramic mug. The program also utilizes posters and pamphlets to remind employees to recycle. The CORPS program logo is prominently featured on all incentive awards, promotional materials, and deskside recycling containers.

Yard and Wood Waste Recycling

County staff employ a variety of public information techniques to market mulch generated in the County "clean green" yard and wood waste grinding program. Promotional materials describe the beneficial uses of mulch application in landscaping and water conservation. Free mulch is available to residents year-round and the County also provides free loading to the public on scheduled weekends as an added incentive for the public to pick-up mulch. Large mulch users may call the County and schedule loading in advance. In addition, the County gives away mulch samples at numerous public events throughout the year. Press coverage of many of these activities has greatly increased public awareness of the Yard and Wood Waste Recycling Program and free mulch availability.

County Disposal Site But-back and Drop-off Recycling Programs

The County operates buy-back centers at three County landfills in addition to five drop-off locations at rural bin sites in the unincorporated area's interior zone. At this time, there are County staff at four landfills and at five of the ten rural bin sites. Plans are being developed to staff the remaining rural bin site locations and add recycling services. Staffed disposal and recycling sites provide opportunities to monitor Ordinance participation, respond to questions from the public, and encourage recycling. In FY 89/90, these centers collected 1,282 tons of aluminum, paper, glass, plastics, oil, and other materials.

Technical Assistance Workshops

County staff have coordinated a series of workshops aimed to provide technical recycling assistance to local businesses and residents. Recycling topics addressed in these workshops have included recycling in rural areas, curbside collection of plastics, demolition material recycling, and mandatory recycling enforcement and education techniques. To assist local plastics recycling processors and to train County staff in conducting waste composition field studies, the County sponsored a plastics identification workshop at a local landfill. Technical workshops are an ongoing element of the County program to increase participation in the Mandatory Recycling Ordinance. Additional workshops will be developed in conjunction with the phasing of the Ordinance by waste generator and region.

Radio Traffic Announcements

The California Department of Conservation awarded the County of San Diego a competitive grant of $79,560 to fund a series of recycling messages to be broadcast by local radio traffic reporters. The radio recycling project first aired in November of 1990 and will conclude in mid-1992. Radio messages were scripted to generate community participation in the California Redemption Value beverage container recycling program. These announcements were aired in a variety of local radio stations during peak traffic hours an average of sixty times per week.

Household Hazardous Waste

The County provides funding for the Household Hazardous Waste Materials Program (HHWMP) administration by the County Department of Health Services. The program sponsors thirteen collection events and two permanent collection facilities. A listing of these events and facilities is distributed to landfill customers and interested citizens. In addition, the Department of Health Services has produced brochures, pamphlets, and magnet with the HHWMP "Toxics Gang"

mascot logo. The program collected over 41,200 tons of household hazardous materials in FY 89/90.

Under contract with the County, the Environmental Health Coalition prepared the Household Toxics Curriculum for grade levels K-12 and for local community colleges. A video and activity book accompanies the curriculum which outlines safe use and disposal of household hazardous products.

Landfill Tours

County staff periodically schedule and conduct landfill tours for school groups. These tours educate students on the operation of sanitary landfills and teach the importance of waste reduction, recycling, and composting.

Additional Programs

Several new public information and education programs will be implemented in conjunction with the two County educational services contracts to be on-line in FY 91/92. These programs have been designed to complement existing education and public information activities and will serve residents throughout the County, excluding those residing in the City of San Diego which manages its own education and public information program.

Recycling Education and Information Referral Services Contract

- **Surveys:** periodic surveys of callers phoning the Recycling Hotline will be conducted to determine recycling and waste reduction practices, and the viability of local markets. Results of these surveys will indicate where additional education and public information services are warranted and will be reported quarterly.

- **Technical assistance requests from business:** a database of all business recycling requests received will be maintained. The contractor will track materials recycled through a voluntary reporting mail-in form. Upon request, a commercial recycling and waste reduction information packet will be mailed to businesses.

- **Junior high/middle school and high school solid waste reduction curriculum:** the contractor will seek the assistance of administrators and educational professionals to develop a junior high/ middle school and high school solid waste reduction curriculum.

- **Compost education:** the contractor will coordinate a volunteer effort to assist the County in establishing a compost demonstration area at each landfill recycling site.

The County Ordinance education contract includes provisions for the following services:

- **Market Research:** a survey of County residents will be conducted to determine the level of public knowledge of the Ordinance. Results of this survey will be used to evaluate the public and private understanding of the Ordinance and recycling opportunities, and create targeted messages based on needs assessment to be derived from the survey results.

- **A mass media campaign:** a theme will be developed to promote Ordinance participation. Public service announcements and paid advertising in print and electronic media will be utilized to publicize the Ordinance and increase awareness of recycling opportunities.

- **Technical and general information publications:** newsletters, brochures, and manuals will be developed to explain how to implement programs and promote participation.

- **Education and training workshops:** to maximize participation in regional programs, educational and training workshops will be conducted for each category of waste generator identified in the Ordinance.

7.3 SELECTION OF PROGRAM ALTERNATIVES

7.3.1 TARGET AUDIENCES

The primary target audience for the County's public education programs is residents in the unincorporated areas of Sa Diego County, particularly the areas in the vicinity of the County's landfills at San Marcos, Otay, Sycamore, Ramona, and Borrego Springs, and the communities in the vicinity of the ten County rural container stations.

As defined in the Mandatory Recycling Ordinance, education and public information programs will be tailored to reach the following categories of the waste generators:

- **Residential:** single- family, multi-family, and citizens hauling their own wastes to County disposal facilities,

- **Commercial:** offices larger than 20,000 square feet, and the hospitality industry including all bars and restaurants,

- **Industrial:** generators of asphalt, concrete, dirt, land clearing brush, rock, and sand.

7.4 PROGRAM IMPLEMENTATION

The County of San Diego Department of Public Works will be responsible for the implementation of education and public information programs. The County presently has one recycling specialist assigned to education activities and has one quarter-time public information officer who coordinates special events and media outreach.

Education and public information activities provided under two contracts described above will be managed by County staff.

Table 7-1 outlines he proposed schedule for short and medium- term implementation.

7.5 MONITORING AND EVALUATION

To evaluate the effectiveness of a public education and information program, it is imperative to gather and evaluate a variety of public opinion and operational data. Indicators of waste reduction, recycling, and compost program effectiveness include:

- Public Awareness,

- Participation rates,

- Material capture rates,

- Buy-back center receipts and expenditures,

- Waste composition data,

TABLE 7-1

- Analysis of historical waste generation trends.

Public awareness can be determined through a variety of survey techniques. The County will routinely conduct random public opinion surveys to track awareness of Ordinance recycling programs and a variety of waste reduction, recycling, composting, and disposal practices.

Data obtained through the County Recycling Tonnage Grant Program and Technical Assistance Program will provide program operational data on a quarterly basis. Seasonal waste composition studies will provide up-to-date waste disposal data to be compared with baseline data presented in this SRRE.

7.6 PROJECTED COST OF PUBLIC INFORMATION PROGRAM ACTIVITIES

The budget for County public information and education programs in FY 91/92 is summarized in Table 7-2.

TABLE 7-2

8.0 FACILITY CAPACITY COMPONENT

8.1 BACKGROUND

The cities within the County of San Diego currently dispose of their municipal solid waste at the following sanitary landfills:

- San Marcos
- Ramona
- Miramar
- Sycamore
- Otay/ Otay Annex
- Borrego

Except for the Miramar Sanitary Landfill, which is owned and operated by the City of San Diego, the County of San Diego owns and operates all permitted disposal facilities within the County. According to the State Water Resources Control Board, Title 23, Chapter 15, all the above landfills can be classified an Class II Landfills for nonhazardous solid waste. Refer to Figure 8-1 for the general locations of the landfills in San Diego County. The following is a description of the disposal facility needs of each landfill, except Borrego. Borrego handles only a small quantity of the unincorporated County's wastestream with a remaining capacity approximately 253,000 cubic yards.

8.2 THE SAN MARCOS SANITARY LANDFILL

8.2.1 DESCRIPTION

The San Marcos Sanitary Landfill site is owned and operated (through private contract) by the County of San Diego. The site is located at the southern boundary

of the City of San Marcos, southwest from the intersection of Questhaven Road and Elfin Forest Road. The site began operation in November 1978. The total area of the site is 203 acres with approximately half used for active landfilling and the remainder as buffer zones and access roadways. The major limitation of the site is in the scarcity of remaining capacity.

It is anticipated that closure of San Marcos Landfill may occur in 1992. However, planning for its vertical and horizontal expansion is currently underway. Under the present staged development plan (1991), the landfill has less than two million cubic yards of remaining solid waste capacity. The County is presently developing an emergency contingent plan for diverting waste form the San Marcos Landfill to other facilities in the County if the necessary permits for expansion of the landfill are not issued prior to the completion of the site according to the closure plan. Waste transfer stations are planned for the North County cities presently disposing of solid waste in the San Marcos Landfill. If this plan is approved by the Board of Supervisors, solid waste would be transferred to the Sycamore or Otay Landfills in the South County. The County is also proceeding with the siting and permitting of new North County and South County Landfills.

Based on the ScaleWare data since September 1990 and the allocations to each landfill based on the County's preliminary hauler survey, the majority of the solid waste from the following cities is disposed at the San Marcos Landfill.

- Carlsbad
- Oceanside
- Vista
- San Marcos
- Encinitas
- Solana Beach
- Escondido

TABLE 8-1

Poway and the unincorporated area of the North County also contribute a significant amount of their wastestreams to the San Marcos Landfill. Refer to Table 8-1 for an estimate of the cities' contributions to the landfills in San Diego County.

The San Marcos Sanitary Landfill operates under the following permits:

- Regional Water Quality Control Board Permit No. 78-78
- California Waste Management Board Permit No. 37-AA-008
- City of San Marcos Special Use Permit No. PC77-733

The San Marcos Sanitary Landfill received approximately 1.0 million tons (2.0 million cubic yards) of municipal solid waste during 1990. A stipulated order was prepared by County DOHS for updating the permits.

8.2.2 CURRENT FACILITIES CLOSURE PLAN

A closure plan for the San Marcos Sanitary Landfill has been prepared and submitted to the County of San Diego, Department of Public Health Services, CIWMB and the Regional Water Quality Control Board San Diego District (RWQCB). Revisions to the closure plan were made by the County and were resubmitted in November, 1991. The facility will undergo closure as soon as it reaches capacity, which may occur as early as 1992. However expansion plans are underway and the actual closure date is pending the outcome of the RWQCB and IWMB decisions on the County's expansion proposal.

8.3 THE RAMONA SANITARY LANDFILL

8.3.1 DESCRIPTION

The Ramona Sanitary Landfill is owned and operated (through private contract) by the County of San Diego. The site is located approximately 2.5 mile north of the community of Ramona on Pamo Road, (refer to Figure 8-1). This facility began operation as a burn site in 1948, with burial of ash and waste residue. In 1969, burning ceased, and the site has operated only as a sanitary landfill since that time. The total area of the site is approximately 80 acres, with approximately half the

land used as the landfill. The landfill opens daily except for major holidays. The site presently serves the community of Ramona and the surrounding areas of Julian, Palomar Mountain and Sunshine Summit. The Ramona Sanitary Landfill operates under the following permits:

- Regional Water Quality Control Board Permit No. 70-R14
- California Waste Management Board Permit No. 37-AA-005

The County of San Diego estimates that the Ramona Sanitary Landfill received approximately 47,000 tons (78,000 cubic yards) of solid waste during 1990. A stipulated order was prepared by the County DOHS for updating the permits.

8.3.2 CURRENT FACILTY CLOSURE PLANS

A preliminary closure plan for the Ramona Sanitary Landfill is currently being prepared. The County of San Diego expects to submit the preliminary closure plan to the regulatory agencies in mid- 1992. Closure of the landfill is not anticipated within the next twenty years.

8.4 THE SYCAMORE SANITARY LANDFILL

8.4.1 DESCRIPTION

The Sycamore Sanitary Landfill site is owned and operated (through private contract) by the County of San Diego. The facility is located approximately 1.3 miles north of the intersection of Mission Gorge Road and Father Junipero Serra Trail, (refer to Figure 8-1). The sit has been operating since mid- 1962. The property size totals about 500 acres of which approximately 400 acres represent the active landfill area. The Sycamore Sanitary Landfill operates under the following permits:

- Regional Water Quality Control Board Permit No. 76-40 and 59-R16
- California Integrated Waste Management Board Permit No. 37-SS-015
- City of San Diego Special Use Permit No. CUP 6066/Amendment No.2

In 1991 the Sycamore Sanitary Landfill served the following cities:

- Lemon Grove
- Santee
- El Cajon
- La Mesa
- San Diego

The Sycamore Sanitary Landfill receives approximately 1,500 tpd. The facility received approximately 533,000 tons (888,000 cubic yards) of municipal solid waste in 1990. A stipulated order was prepared by the County DOHS for updating the permits.

In early 1991 the County of San Diego estimated the remaining capacity of the Sycamore Landfill at about 20 million cubic yards, providing more than 20 years of disposal capacity at the present landfill disposal rate. The County plans to relocate some power lines so that an additional 50 million cubic yards of disposal capacity can be gained.

8.4.2 CURRENT FACILITIES CLOSURE PLAN

A preliminary closure plan for the Sycamore Sanitary Landfill is currently being prepared. The County of San Diego expects to submit the preliminary closure plan in mid-1992. Closure of the landfill is not anticipated within the next 20 years.

The County of San Diego plans to expand the Sycamore Sanitary Landfill, and optimal size of the landfill expansion has been determined to be 50 million additional cubic yards. No municipal solid waste export plans exist st the present time.

8.5 THE OTAY/ OTAY ANNEX SANITARY LANDFILL

8.5.1 DESCRIPTION

The Otay Landfill and Otay annex are owned and operated (through private contract) by the County of San Diego. The Otay Sanitary Landfill is located within the corporate boundaries of the City of Chula Vista, the Otay Annex is within the unincorporated area of San Diego County, one mile east of Interstate Highway 805 on the north side of the Otay Valley Road, (see general location in Figure 8-1).

The site is presently permitted as two separate facilities. The Otay Sanitary Landfill is a 250 acre site and the Otay Annex Sanitary Landfill is another 250+ acres. The total area of the site is approximately 515 acres of which 98 acres are leased from the City of San Diego. A closed portion of the Otay Landfill site was designated as a Class I Waste Management Unit and accepted hazardous waste until November 1980. In 1990 the Otay/Otay Annex Sanitary Landfills served the following cities.

- Lemon Grove
- Chula Vista
- Imperial Beach
- National City
- Coronado

The Otay/Otay Annex Sanitary Landfill received approximately 680,000 tons (1,020,000 cubic yards) of solid waste during 1990. At the present time, solid waste is only being disposed at the Otay Annex Landfill located in the unincorporated area. No waste is currently being disposed within the city limits of Chula Vista.

The Otay Sanitary Landfill operates under the following permits:

- Regional Water Quality Control Board Permit No. 74-44
- California Integrated Waste Management Board Permit No. 37-AA-009
- City of Chula Vista Conditional Use Permit No. PCC-72-1

The Otay Annex Sanitary Landfill operates under the following permits:

- Regional Water Quality Control Permit No. 79-18
- California Integrated Waste Management Board Permit No. 37-AA-010
- San Diego County Special Use Permit No. P76-46

The County of San Diego estimates a total capacity of 1,700 tpd for the Otay Annex. In early 1991 the Otay/ Otay Annex Sanitary Landfill remaining capacity was estimated at approximately 24 million cubic yards. The County of San Diego is presently planning to redesign the configuration of the landfill. At the present landfilling rate of 0.6 million cubic yards per year and allowing for the necessary space of the cover material, the remaining capacity of 24 million cubic yards should permit the landfill life to extend beyond the planning period.

8.5.2 CURRENT FACILITY CLOSURE PLANS

A preliminary closure plan for the Otay/Otay Annex Sanitary Landfill is presently in the initial stages of preparation. The County of San Diego expects to submit the preliminary closure plan for these landfills in mid-1992. However, the actual closure of the landfill is not anticipated to occur during the planning period. A stipulated order was prepared by the County DOHS for updating the permits.

8.6 FACILITY CAPACITY NEEDS

The "disposal capacity needs assessment" was calculated using the assumptions that the current recycling rate would continue until the year 1995. Between the years 1995 and 2000 the disposal quantities would be reduced gradually to 25 percent, and after the year 2000 disposal quantities would be reduced gradually to 50 percent.

The capacity analysis incorporates the waste quantity projections for all the cities and landfills in San Diego County (except the City of San Diego and the Miramar Landfill) and the unincorporated areas of the County. In-place density for solid waste within a properly operated landfill has been shown to range between 1000 and 1200 pounds per cubic yard. For the purposes of this analysis 1000 pounds per cubic yard in-place density was used. Table 8-2 presents the results of this analysis for the 15-year planning period.

Using the County of San Diego's estimate of 97.6 million cubic yards remaining capacity, the landfills in the County will reach capacity beyond the planning period.

8.7 PLANNED NEW/ EXPANDED FACICLITIES

A vertical expansion proposal for the San Marcos Landfill was submitted to the RWQCBSDD in March 1991. As a result of the proposal's review by the RWQCB, the County of San Diego was requested to collect ad present additional ground water quality analytical information. The County submitted this information for review and a hearing is scheduled in January 1992. Another plan for lateral expansion of the San Marcos Sanitary Landfill is under consideration by the County. Although the County is actively pursuing the lateral expansion of the landfill, no fixed date has been established for this proposal submittal. An environmental impact report was prepared in 1991 covering both the proposed vertical and horizontal expansions.

The County of San Diego plans to expand the Ramona Sanitary Landfill to a total of 80 acres, which in turn could result in the addition of 50 acres of active sanitary landfill area. No municipal solid waste export plans exist at the present time.

TABLE 8-2

9.0 FUNDING COMPONENT

9.1 INTRODUCTION

The IWMA regulations require that jurisdictions demonstrate that sufficient funding is available for program planning, development, and implementation. In addition, this section includes cost estimates for programs scheduled for implementation in the short-term, and identifies potential revenue sources and contingency funding for component programs.

Adequate funding is essential to ensure the long-term viability of San Diego County waste management programs. Funding for current solid waste operations and recycling programs are budgeted through the County of San Diego Waste Enterprise Fund (the "Enterprise Fund").

The following sections describe existing County of San Diego funding practices, followed by typical component program costs and program funding alternatives available. Contingency funding is also discussed with respect to identifying revenue sources available to fund programs which might face unforeseen revenues shortfalls.

9.2 EXISTING FUNDING PRACTICES

The County Solid Waste Enterprise Fund budget results primarily from tipping fee revenues collected at County landfills. The Enterprise Fund was established in 1982 and now funds all County waste management activities. Approximately 4 percent of the Enterprise Fund budget consists of revenues received form permit fees and other waste management related activities.

In the past, the County Resource Recovery and Recycling Section (of the Solid Waste Division) budget has been supplemented with grant funding received from the California Department of Conservation and the Urban Consortium Energy Task Force.

Based upon the FY 1990/91 established tipping fee of $23 per ton for solid waste and $15.25 per ton for "clean green" yard and wood waste, the total FY 1990/91 Solid Waste Division budget is approximately $60 million. The FY 1990/91 Enterprise Fund budget is allocated as follows:

Active Landfill Operations	14.38%
Fee Collections	0.21%

Code Enforcement	1.26%
Operational Support	5.70%
Interior Zone Operations	0.92%
Rural Container Stations	0.88%
Rural Recycling	0.10%
Interior Zone Hauling Service	2.45%
Engineering	16.44%
Resource Recovery/Recycling	11.98%
Planning & Permits	1.48%
Administration O/H	6.11%
Landfill Contract	12.24%
Eastin Reserve	5.62%
Eastin State Charges	2.41%
Waste-to-Energy Reserve	1.98%
Program Contingency	2.29%
Bond Department	9.95%
Facilities Reserve Deposit	3.58
TOTAL	100.00%

Additional funding for the cities will come from County Recycling Rebates, which will be awarded at a rate of $7.75 per ton and the IWMA State Recycling Fund at $1.00 per ton. The County presently allocates assistance grants to each city.

Several capital improvements by the County are expected in the next ten years. Revenue bonds will need to be sold to finance some of these improvements. The sale and/or cost of the bond financing will, in part, be dependent on control of a sufficient amount of the wastestream to ensure adequate tipping fee revenues are collected to repay the annual debt service.

To pay for the continued maintenance of the active and closed landfills, the environmental and permitting work required for the proposed new landfills, landfill expansions and transfer stations and the recycling and diversion

requirements of the IWMA, the tipping fee at all landfills in San Diego County is projected to increase about $5.00 per ton per year for the next several years. The actual increase will depend upon the demand placed upon the Solid Waste Enterprise Fund by the projects proposed by the County and the timing of their implementation. The tipping fees are recalculated each year prior to proposing any change.

9.3 TYPICAL COMPONENT PROGRAMS AND FACILITY COST ESTIMATES

Short-term program planning, implementation and operation costs will be incurred by the County of San Diego and funded primarily through the Enterprise Fund. The construction of the NCRRA materials processing facility will be financed with the proceeds for Bonds issued by the California Pollution Control Financing Authority. The capital and operating costs associated with the various SRRE components are presented in Tables 9-1 through 9-3. Proposed program and facility expansion costs include:

- Adding recycling collection to remaining Rural Container Stations
- Expanding yard and wood waste grinding program
- Construction of NCRRA materials processing facility

All of the costs shown are based upon 1991 construction, equipment, and labor costs. Costs were developed based upon vendor information and County operational data. Land costs have not been included since it is assumed that all facilities would be located on County property. It is assumed that all facilities could be either publicly owned and operated, publicly owned and operated under private contract, or full service agreements.

Costs vary according to the following factors:

- Facility location
- Land availability and cost
- Facility type (i.e., technology employed)
- Facility capacity
- Financing expenses

- Labor expenses
- Stability of wastestream input to facility

The survey revealed that economies of scale typically expected for processing facilities were not evident. Capital costs of facilities with a daily capacity of 100 tons per day (tpd) or less was lower, ($18,100 per ton of daily capacity) than those with a daily capacity of between 100 and 200 tpd ($22,500 per ton of capacity) or 200 tpd and greater ($21,700 per ton of daily capacity).

According to Mr. Don Hastings, the facility supervisor for the San Diego Recycling Facility, capital costs for this facility range between $5 million to $6 million. Assuming a 300 tpd capacity, a cost of $20,000 can be estimated per ton of daily capacity. Experience with similar facilities shows an average capital cost of $30,000 per ton of daily capacity. Local operating expenses could not be obtained from any of the MRFs currently operating within San Diego County.

North County Resource Recovery Facility

The County has approved a service agreement with the North County Resource Recovery Authority (NCRRA) for the design, construction, and operation of the material recovery and processing facility. In 1985 the California Pollution Control Financing Authority (CPCFA) initially issued $185 million in bonds to finance a proposed waste-to-energy plant at the San Marcos landfill. Since that time the facility has been approved as a materials recovery accordingly to cover the $89 million cost of construction of the recycling facility plus financing costs. Financing costs include the reserve funds, underwriters and issuers costs, and interest during construction.

The tax status of these bonds, issued prior to the 1986 tax law changes, afford this project a savings of $4-5 per ton due to the favorable investment tax credit and the allowance of accelerated depreciation.

9.4 CONTINGENCY FUNDING

Approximately 12 percent of the existing solid waste funds are allocated to the planning and implementation of County recycling programs. Additional funds will be required for capital projects to support these programs, particularly as the amount of recyclable material increases over time and existing facilities within the County reach capacity.

TABLE 9-1

TABLE 9-2

TABLE 9-3

9.5 SUMMARY

Funding for the County of San Diego recycling program in the unincorporated area will continue under the auspices of the Enterprise Fund. The Enterprise Fund includes revenues to be used for program and operations contingencies, should the need arise. In addition, the Enterprise Fund is reviewed annually to determine that revenues are sufficient to fund program and operations expenses. It is the County's intent to maintain a disposal fee structure at County landfills adequate to fund the County program. Coordination with the City of San Diego ensures that tipping fee revenues may be reliably projected.

As part of the County solid waste workplan, alternative funding mechanisms such as variable can rates and advanced disposal fees will be considered in future program planning.

10.0 INTEGRATION COMPONENT

10.1 INTRODUCTION

The development and selection of alternatives for a source reduction and recycling program for the unincorporated portion of San Diego County were based on an evaluation of existing practices and conditions, discussions with County staff and review of projected growth patterns for the County. The goal is to have an integrated solid waste management system capable of meeting both the state mandated waste reduction goals and the needs of its citizens in the most environmentally sound, efficient and cost-effective manner. The mixture of technologies and programs selected must provided current and future decision-makers the flexibility to modify the plan as conditions dictate and technologies change.

The overall program must be able to fit into the existing infrastructure within the County of San Diego and provide opportunities for regional cooperation among the surrounding cities and the unincorporated portion of the County. The selected system must not significantly impact the current levels of service during implementation or expose the citizens to excessive first year costs. In consideration of these factors the integration component must present all activities which must be accomplished and the significant decision points in order for the element to be successfully implemented. One of the major reasons that reduction and recycling programs have failed across the nation ids the project participants' inability to resolve critical issues in a timely manner.

The purpose of the integrated component and resulting implementation plan and schedule is to depict the work activities and establish the proper sequencing to allow decisions to be made in a timely fashion. This section presents the results of the evaluations conducted for the SRRE, summarizes the technologies and programs selected, and presents the schedule for program implementation.

10.2 WASTE MANAGEMENT SYSTEM ALTERNATIVES

The integration of programs, technologies, equipment and personnel into a complete system for a community must maintain a flexible approach in order to accurately consider solid waste quantities and the availability of materials and compost markets while still maintaining compatibility with the requirements of the IWMA. The range of technologies and programs evaluated under the previous sections had to meet certain criteria in order to be considered further for selection as a component part of any overall system. These criteria were presented and discussed in Sections 4.0 and 5.0. The system alternatives also had to have potential for expansion or inclusion within regional facilities, since many of the

cities within San Diego County have indicated willingness to be actively involved in regional programs and facilities. The unincorporated portion of San Diego County is diverse, ranging from areas within the urban coastal area to very sparsely populated portions of the eastern desert area.

10.2.1 WASTE MANAGEMENT HIERACHY

The matrix at the end of this section presents the previously selected technologies which are suitable for implementation. In developing this approach, the overall selection of system alternatives was designed to include consideration of the hierarchy of waste management mandated by proper planning for total program implementation. The system alternatives selected for inclusion in the unincorporated element recognized the following priority for implementation:

- Source reduction
- Recycling and composting
- Proper disposal through transformation and land disposal

10.2.2 SELECTION OF INTEGRATED SYSTEM

The initial analysis of available technologies or systems to meet the goals established by the IWMA was based on the ability to successfully target materials for source reduction, recycling, and composting. The waste stream composition data discussed in Section 2.0 was used to identify those materials that are readily recyclable and to set target objectives for percentage reductions in the total wastestream quantities. According to information provided in the preliminary waste characterization study, about 55 percent of the materials in the total unincorporated County wastestream are technically processible through methods of recycling and reuse. The total solid wastestream was sub-categorized by the major target populations, residential wastes, commercial and industrial wastes.

Programs for the residential portion of the wastestream will differ from the programs evaluated for the commercial and industrial wastestream. This is due to the variation in the quantities produced from each sector (residential is about 42 percent and commercial/ industrial 58 percent) and to the different methods of

collection. The commercial and industrial sectors are combined due to the similarity of collection methods and the similarity of their respective wastestreams. Targeted programs for the County of San Diego are shown in Table 10-1. This table also presents the total wastestream reduction for the short-term and medium-term goals.

10.3 IMPLEMENTATION PROGRAM AND SCHEDULE

The County of San Diego initiated a comprehensive waste reduction program in 1987 with the approval of the nine objective Recycling Plan. The San Diego County Recycling Plan is working to develop the education, collection, processing, and market infrastructure upon which the goals identified in this SRRE may be achieved. The implantation schedule for activities described in the document is contained in Table 10-2.

TABLE 10-1

TABLE 10-1

TABLE 10-1

TABLE 10-1

TABLE 10-1

TABLE 10-1

TABLE 10-1

TABLE 10-1

TABLE 10-1

TABLE 10-10

TABLE 10-11

TABLE 10-12