United States
Environmental Protection
Agency

Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Solid Waste

EPA

# A TECHNICAL ASSISTANCE PROGRAM REPORT

## WYOMING RURAL SOLID WASTE MANAGEMENT STUDIES: BIG HORN COUNTY, CARBON COUNTY

A TECHNICAL ASSISTANCE PANELS PROGRAM REPORT

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Prepared for:

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Region VIII
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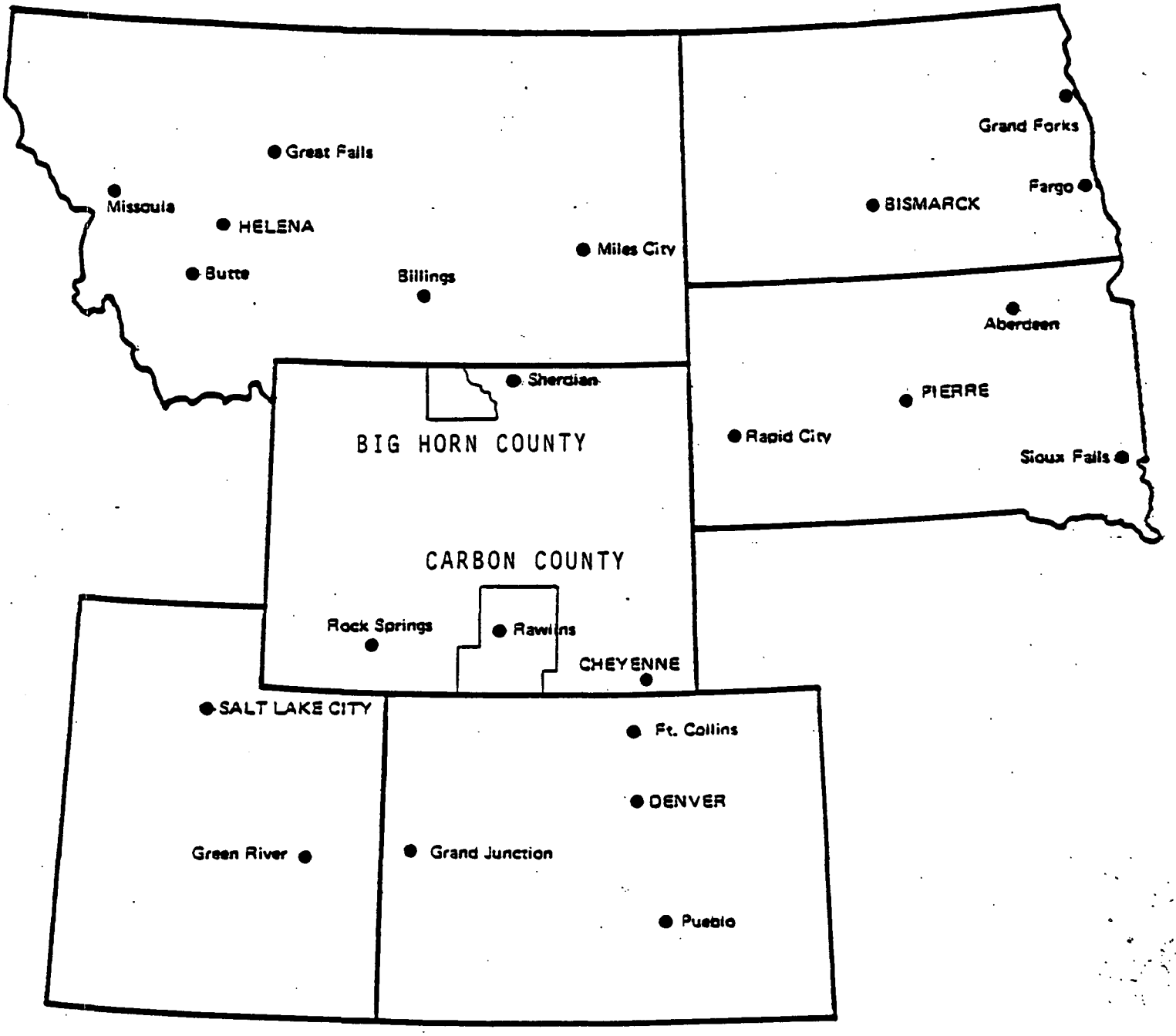
# WYOMING RURAL SOLID WASTE MANAGEMENT STUDY

## ENVIRONMENTAL PROTECTION AGENCY REGION VIII



Public Law 94-580 - October 21, 1976

Technical assistance by personnel teams. 42 USC 6913

RESOURCE RECOVERY AND CONSERVATION PANELS

SEC. 2003. The Administrator shall provide teams of personnel, including Federal, State, and Local Employees or contractors (hereinafter referred to as "Resource Conservation and Recovery Panels") to assist on solid waste management, resource recovery, and resource conservation. Such teams shall include technical, marketing, financial, and institutional specialists, and the services of such teams shall be provided without charge to States or local governments.

This report has been reviewed by the Project Officer, EPA, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Project Officer: William Rothenmeyer

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## ACKNOWLEDGEMENTS

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# EXECUTIVE SUMMARY

Solid waste management has become an increasingly complex problem for rural areas. Such limitations as siting, costs, capital availability, environmental impacts, and the availability of qualified personnel make the goal of efficient and effective waste management in these regions very difficult to attain. The rapid growth occurring in many areas within Region VIII compounds these solid waste management problems, and traditional management practices must be replaced by safe, convenient, prompt and economical waste collection and disposal in the near future to meet the requirements of the Resource Conservation and Recovery Act (RCRA) of 1976.

This study addresses some of the problems confronting rural areas of Wyoming. Waste management in Wyoming is affected by characteristics and conditions over which any solid waste management approach has little or no control. These factors include climatic conditions (severity of weather, lack of precipitation, high winds, etc.); a low-density population which generates wastes spread over a very large area; and land use, social and political characteristics which include wide-scale Federal governmental land ownership and local political processes which are not fully capable of addressing the complex waste management issues.

In order to evaluate these issues, problems, and uncertainties facing most rural communities in Wyoming, Big Horn and Carbon Counties were analyzed. The evaluation of Big Horn County can serve as a model for other rural, agricultural counties in the State, while Carbon County serves as a model for other rural, energy-impacted counties. The analyses included examinations of:

- baseline solid waste management costs;
- total volume of wastes generated and the annual and daily rates of generation;
- the origin of the wastes;

- o the seasonal cycles of waste generation;
- o the composition of the waste and relative contribution made by each waste category;
- o the number of private waste haulers, if any, and their individual volumes hauled;
- o the collection systems and equipment used by haulers;
- o the location, operation and life of all disposal sites; and;
- o outside influences on waste generation, collection and disposal.

The necessary data was obtained through personal interviews and field investigations. The data served as the basis for formulation of recommended solid waste management plans for each county, as summarized below.

The recommended management plan for Big Horn County would begin with the creation of a county-wide solid waste management district. The district would then close all but the two county operated disposal sites. Uncompacted roll-off transfer stations would be established at the locations of closed disposal sites for the first year of the plan to collect both household and bulky wastes. For the second year a side-loader collection system (compatible with an existing system in Greybull) consisting of smaller, dispersed containers would be introduced to handle all household refuse, with the roll-off system then handling bulky wastes exclusively.

Similarly, in Carbon County, the formation of a countywide solid waste management district is the first step of the recommended plan. The district would close most of the existing disposal sites and install an uncompacted roll-off transfer system at these sites. During the second year the district would complete the regionalization of landfills and fully establish the roll-off transfer system.

Although both of the counties studied in this report can accurately be thought of as rural, low-density areas with many similar problems and characteristics, the recommended solid waste management plans for these counties are very different. Therefore, it is important to keep in mind that characteristics and trends must be analyzed in detail before a workable solid waste management plan can be formulated and implemented within a county. There are no "typical" situations nor is there one standardized solution for solid waste problems.

However, central to the success of solid waste management plans for both counties is the formation of a centralized solid waste management district. Formation of such a district would help to increase waste management efficiency and effectiveness through:

- sharing of risk among communities;
- sharing of equipment and landfill costs among communities;
- expansion of available management options;
- elimination of duplication; and
- establishment of a sound county-wide financial base.

# I. BACKGROUND TO THE STUDIES

## A. Rural Solid Waste Management

### 1. Recognizing the Problem

Rural American States such as Wyoming are very slowly becoming aware of the need for integrated solid waste disposal practices, both as a matter of economics and to comply with the emerging State and Federal regulations for solid waste disposal. The traditional business-as-usual approach to solid waste management fails to accommodate community growth and the nation's commitment to effective environmental control. There has been widespread public apathy with respect to the real and potential environmental problems associated with inadequate solid waste management. This has resulted in:

- difficulty in convincing the public that a problem exists;
- a lack of adequate planning; and
- inadequate financing for solid waste management.

This problem is most apparent in the lack of adequate planning for the setting aside of suitable areas for land disposal operations in anticipation of community growth. In the rural areas of the U.S., especially within Region VIII, rapid growth is very common. Consequently, it is becoming increasingly difficult to provide suitable sites for solid waste disposal. This limits operational flexibility and increases disposal costs. This also creates political and technical problems affecting both short and long-term planning. More specifically, limited or poor planning and inadequate operations leads to high costs in the present, which in turn limits flexibility in planning for the future.

The aesthetic degradation of open dumps is difficult to assess in any but abstract terms; it is, nevertheless, very real. No accurate appraisal has been made of the impact a dump has on the value of neighboring or overlying prop-

erty; however, one fact is clear: nobody wants one near his home. When most people think of solid waste disposal, they have "a dump" in mind. This association of wastes and dumps is so well established that it is the major stumbling block to the siting, construction, and operation of new sanitary landfills.

Comprehensive solid waste management should provide for the safe, convenient, prompt and economical collection, transportation, and disposal of waste materials, while recycling and conserving valuable resources. Additionally, in Region VIII and Wyoming, where ties to the land and its value are so strong, the sensitive management and conservation of land resources, as well as disposed materials, is a goal of an integrated waste collection and disposal operation. The hazards and problems associated with traditional methods of waste disposal have brought about a new emphasis directed toward the resolution of these problems. The time for this emphasis on upgrading present systems and planning for the future is now.

With the passage in 1968 of the Wyoming law prohibiting the open burning of trash, local governments were forced to collect and dispose of materials which previously had been burned. Consequently the volume of wastes to be landfilled increased. Proper disposal of these wastes was further confronted by the fact that the different methods of waste disposal and collection available in 1968 were more costly, less efficient, and more labor intensive than systems which have been recently developed. Additional demands on traditional methods of waste disposal are caused by the steadily increasing (about two percent per year) waste volume per capita. Furthermore, population increases caused by energy and mineral development and by tourism have compounded waste disposal problems in the Rocky Mountain region. These impacts are especially pronounced in rural counties.

The problems listed above will generally stimulate costly and complex problems such as the political delicacy of financing, siting and implementation of improved solid waste management systems. In most cases, the necessary resources and skills to resolve these problems are beyond the economic and technical ability of local governments.

## 2. Goals of Improved Rural Management

The source of difficulties in solid waste collection and disposal in rural areas is the reliance upon traditional practice and the conflict created by legislated change in those practices. Current practice usually implies individual hauling to a traditional dumpsite, dumping on that site, burning the trash disposed at the site, limited maintenance of the site, limited environmental protection, and little or no provision for closure. The Resource Conservation and Recovery Act of 1976 was enacted to change these practices. The implementation of RCRA includes:

- o a listing of open dumps by the States;
- o closings of those dumps which cannot be upgraded;
- o setting criteria and guidelines for landfill disposal applicable to those sites which can be improved; and
- o insuring that those upgraded landfills are operated, maintained and eventually closed with continuing environmental safeguards.

State programs and laws must be equivalent to the Federal regulations. Small communities in rural areas however, often do not possess the resources or expertise to upgrade their solid waste disposal systems to comply with the regulations. It is often necessary for these small communities to consolidate their waste disposal services in order to improve existing practices.

The need for improved solid waste management in rural areas may be less apparent than in more urban areas, but the problems of solid waste management in rural areas are equally important. Improved and efficient solid waste management can be economically acceptable, especially for small communities which are plagued by low waste volumes and subsequent high disposal costs per ton of refuse. However, this may require significant capital expenditures to achieve the long-term operating economies. This short-term financial requirement may place solid waste management in direct competition with other public service requirements.

In addition to improved economic efficiency and lower costs, improved solid waste management practices provide greater protection to public health and the environment in rural areas. Current practice often encourages vector habitation. The danger of range fires from burning waste on-site and blowing embers is increased. Leachate from poorly managed or unprotected disposal sites poses the threat of contamination of local water supplies. Existing management practices many times present nuisances from blowing trash and noxious odors, causing land values to plummet should a dump be located nearby.

## B. Factors Affecting Rural Solid Waste Management in Wyoming

### 1. Environmental Factors

Weather factors affect solid waste management practices. Generally, the average climate of Wyoming is cold and arid. January temperatures average 20°F and range from -39°F to 64°F but summer temperatures climb above 90°F only twenty times a year. There are roughly 200 to 210 days per year in Wyoming when temperatures drop below freezing; the mean length of the freeze free period is about 90 to 120 days long. Precipitation ranges from eight to twelve inches per year, with highest precipitation occurring in April and May. Mean relative humidity is roughly 50 percent; evapotranspiration losses can be sixty inches and winds generally blow consistently from the southwest. Implications of these factors include:

- o due to the lack of moisture, there is little decomposition and leachate generation in landfills;
- o problems with fire and blowing trash and freezing conditions affect cover and equipment selection; and
- o high winds make efficient and effective collection and transportation difficult.

While the climate of Wyoming may be generally adverse to effective solid waste management, the soil and geohydrological conditions are usually favorable for solid waste disposal. For example:

- o the depth of the soil profile, the type of soil and the depth to groundwater are appropriate for sanitary landfill siting and operation;

- o because the soils generally are so deep, cover material is readily available;

- o the soils are comprised of clays, silts and sands; they compact well and can serve as impermeable liners if handled correctly; and

- o groundwater aquifers are deep except in those areas of fluvial deposits near rivers or creeks.

## 2. Demographic and Economic Factors

Wyoming has a population of 350,000 spread over almost 98,000 square miles. The density of 3.6 persons per square mile is among the lowest in the United States. Fifty percent of the counties have less than 10,000 persons and only four of the twenty-four counties have more than 20,000 residents. This dispersal of population means that any solid waste collection and disposal system will have to be more cost effective and efficient per person served and per ton of waste processed relative to more dense areas. This dispersal of population increases transportation costs and limits the advantage of economies of scale. Any solid waste management system operating in this situation must be kept simple and flexible.

The economic structure in the State has long been dominated by agriculture and ranching. The pattern of widely spaced settlements was encouraged by the development of farm production communities which required a large land base for production. In recent years, energy developments, service, and public sector growth have encouraged settlements to cluster and the population to live in towns where trade routes cross or services exist. Overall development, however, still reflects the dispersed patterns of historic agricultural and ranching influences.

The sophisticated solid waste management systems and technology in use in more urban areas are not appropriate for Wyoming. Waste generation rates are lower in Wyoming, and the waste that is generated is spread over a much larger area than in eastern and west coast States. Any system in Wyoming must overcome the disadvantage of smaller volumes on a per capita basis and the higher transportation costs. These economic factors point to a simple, low cost solid waste management system.

Additionally, resistance to a major investment in solid waste disposal may arise from the fact that for rural residents, waste disposal costs have consisted primarily of transportation expenses. Only in some cases have municipal or county taxes been used to marginally maintain sites. Essentially, then, solid waste control for many citizens within Wyoming has traditionally been provided at very little or no cost. As discussed previously, this situation generally leads to difficulty in convincing the public that a problem does, in fact, exist. Education of rural users is going to be the key to the success of any new or modified solid waste management system.

### 3. Land Use, Social and Political Factors

The use and conservation of the land as a heritage and resource are serious issues in Wyoming. The land is the source of wealth and any disturbances of that relationship are resisted vigorously. Outside interference in the local political process, especially from the Federal level, is generally opposed by the towns and County Commissioners. Planning for resource use must originate from the traditional values and the political process already established, and can be enforced from the outside only with great difficulty. In Wyoming, the owner's right to the use of his land is sacrosanct, and laws, traditions and social forces support this right. Proper solid waste collection and disposal need not be in conflict with these values. For example, RCRA places the States in the role of the solid waste regulatory authority if the State solid waste plan is approved by the Environmental Protection Agency.

The Federal government is the major land owner in the Western States. This dominant ownership concentrates development on limited private holdings among larger Federal parcels. The quantity and pattern of Federal ownership of land

by the Bureau of Land Management (BLM), the National Forest Service (NFS) and other U.S. governmental agencies is repeated throughout the States in Region VIII and is a serious concern and point of conflict among states and the Federal government. The Federal agencies responsible for land management have begun to recognize their operating responsibilities under RCRA. The local political process considers the management of solid waste disposal on Federal lands as a Federal responsibility.

## C. Study Goals

The goals of this study and the subsequent waste management plans developed within it are defined by the mandate of EPA, the needs of the state, and the constraints and resources of the counties and towns involved. They include:

- to review the literature on rural disposal and approaches by other areas;
- to develop a technical approach for evaluating rural solid waste disposal;
- to assist the State of Wyoming Department of Environmental Quality Solid Waste Management Program in the development of its Comprehensive State Plan; and
- to develop low-cost, flexible and implementable solid waste management plans for Carbon County and Big Horn County, Wyoming.

## II. STUDY APPROACH AND METHODOLOGY

### A. Literature Review

The literature addressing rural solid waste management in the context of Wyoming is limited. The experience with eastern rural systems has limited relevance to Wyoming. However, most of the waste management plans described in the literature provide a perspective on the general issues that any solid waste management plan must address. This general perspective was most useful in refining the scope of the study and defining issues and concerns to be addressed during the field visits. Issues which are critical to the formulation of solid waste management plans and districts in rural areas include:

- o economics and financing;
- o politics;
- o public participation and education;
- o technical recommendations; and
- o centralization.

Each item is discussed below.

#### 1. Economics and Financing

Generally, rural budgets are frugal. There is limited ability to expand an existing program or establish a new program without an accompanying reduction in service somewhere else or an unpopular increase in taxes. "What does the system cost?" and "How are we going to pay for it?" are two questions that must be answered by a solid waste management plan. The economics and supposed benefits of systems vary and must be carefully analyzed. "Is there a cost savings?" "Are we spending existing revenues correctly?" "We need a fire protection system but we're paying for garbage disposal." These are the types of concerns that will be raised. Additionally, the creation of a solid waste management district with its own taxing authority can be very controversial. In smaller communities there are no narrow economic issues; every issue is interrelated. Each is affected by the limited total budget for public expenditures.

Any economic analysis must begin with the establishment of the baseline (current) costs of the system, and the estimation of the costs for any proposed changes. Many of the theoretical models of solid waste management assume that baseline cost data are accurate and readily available. This is seldom the case in rural areas. In many areas equipment and personnel are shared among several programs and it is difficult to establish a cost allocation plan that can estimate the cost of each function. In rural areas, practical experience and comparisons with other areas may be the best cost estimation techniques.

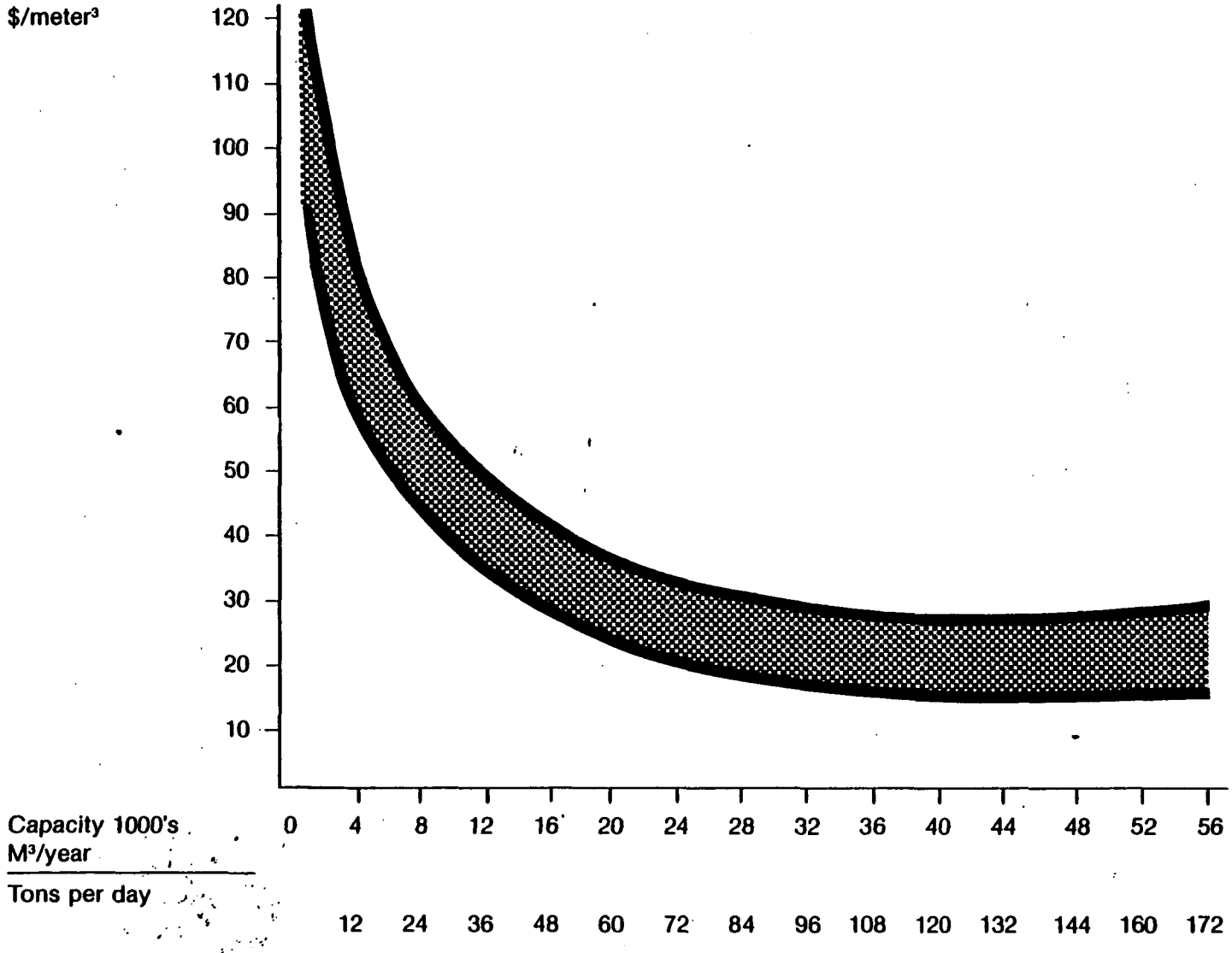
Centralized solid waste disposal normally provides a major opportunity for significant cost savings since there are major economies of scale in solid waste disposal. A ten fold increase in waste volume is estimated to achieve a reduction in unit costs by almost seventy percent . Figure 1 illustrates general economies of scale, but it is not a basis for cost estimates in this study. The balancing of the cost savings of centralizing disposal with the apparent increased transportation and collection costs is a major economic issue. Many times, increasing the efficiency of collection through centralization can also decrease overall transportation costs. Any analysis must be balanced by the uncertainty inherent in cost estimates in rural areas.

A financial analysis ties anticipated costs into a package with the appropriate revenues, sources and contractual arrangements. This process presents management and administrative problems in rural areas. Additionally, solid waste management must compete for funds with other local priorities. Financing options include pay-as-(or before)-you-go; leasing; and long-term borrowing, including revenue bonds and general obligation bonds (Zausner, 1972). The choice of financing technique depends on the specific situation and the statutory authority of the governmental unit.

Kunes, et.al. (1973) present an excellent outline of a range of alternatives for administering and financing management systems, including taxes and user fees, and contractual approaches, agreements and ordinances. With regard to the equitable sharing of costs, Kruth (1973) strongly recommend a formal contractual arrangement for allocating costs. An informal agreement nearly invalidated all effort accomplished in establishing a waste management district

FIGURE 1

# ECONOMIES OF SCALE IN LANDFILLS




Note: Tons per day figure assumes that the waste has the same density as water

Source: Arthur D. Little, Inc. Integrated Economic Impact Assessment of Hazardous Waste Regulations: Preliminary Draft Report Washington, D.C.; U.S.E.P.A.; May 1978

in Tennessee. The benefits and costs should be clarified and relationships and responsibilities written into a contract among the involved jurisdictions so that no one participant obtains an advantage or a benefit at less than a fair share of the costs.

## 2. Politics

Politics is, in many cases, the dominant factor affecting the development of solid waste management plans and districts in rural areas. Plans must address the solid waste problems as perceived by local and county governments. Many times this requires an intensive information and education process. In rural areas the active support of local and county governments is essential before any plan can be implemented. A discussion of the political process is a common thread through each study examined during the literature review. The political situation is reported more often as the limiting variable in implementation than is cost or technical feasibility (Johnson, Fermalia and Crank, 1978; Toftner, 1973; Winfrey, 1972; and Kunes, et al, 1973).

The decision-makers are different in each political jurisdiction. Whoever they are, they must be involved to insure the success of any rural operation. For instance, in Klamath County, Oregon, the County Engineer's Office, initiated a program to clean up abandoned vehicles in the county (W.T. Dehn, 1974). The collection and disposal of junked cars by the County was provided as a service to community, although there was a per-vehicle charge for vehicles taken from private property to defray the costs of the portable baler. In Humphreys County, Tennessee, the County Court (similar to County Comissioners) was the advocate for the establishment of a solid waste management district (Kruth, et al, 1973). In Montana (Hennington, Durham and Richardson, 1976), the state government worked closely with the legislators and the counties in the different State Districts to formulate feasible plans. The towns and counties were responsible for waste management and the state assisted by providing technical assistance through EPA grants to fund planning at the local level.

### 3. Public Participation and Education

From the inception of any effort which may change existing solid waste operations, the public must be involved. Any program for improved solid waste management must recognize that dramatic changes in traditional methods of waste disposal may be required. Frequently these changes have very significant cost and the benefits are not readily apparent to the general public. Individual citizens are the basis of support for change and the effectiveness of any change relies on their cooperation. The plan must respond to their needs and must be explained in their terms. The involvement of the citizens throughout the plan development process is a necessity.

Many studies recommend public information campaigns and public participation in plan development. Toftner (1973) develops an excellent theoretical model for developing solid waste management plans in the context of computing public priorities. This approach is more applicable to areas more urbanized than Wyoming, but it does a provide a useful framework for understanding the diverse and complex forces acting within a community.

In Humphreys County, Tennessee, the county fair served as a vehicle for public education. The EPA Source Separation Report outlining a community awareness program in two Massachusetts towns serves as an excellent source of ideas for developing a public participation program. The study suggests the presentation of data through the media, the schools, community groups and workshops and also provides guidelines for developing a community awareness program. In Newcastle, Wyoming, community volunteer activity, sponsored by the Junior Chamber of Commerce, was the key to removing junk autos and cleaning up neighborhood debris (Dehn, 1974).

In planning for rural solid waste management, other rural planning experiences are helpful. For example, in Big Horn County, Wyoming in 1974, (Nellis, 1980), there was public opposition to land-use planning; however, by mid-1975 the comprehensive land-use plan was underway. The major turnabout in public attitudes was accomplished through attention to the local problems and sensitivities, an emphasis on local and not national priorities; and the utilization of appropriate rural, not urban, planning tools and methods. The requirement

that any planning, including solid waste, must have an empathy for rural value and needs and must be tied to public participation was made abundantly clear by the success of land-use planning in Big Horn County.

In many smaller communities the local dump is a community gathering place (Goldberg, 1974). Any "improved" solid waste management plan must carefully consider the existing patterns and practices and how any change will disrupt the public. This highlights the need for an extensive public participation program to educate the public and inform decision-makers of local concerns.

## 4. Technical Recommendations

In rural areas, technical sophistication dooms many a cost-effective solution to failure. As mentioned previously, systems with a high initial capital cost may be beyond the financing means of a community. Sophisticated systems with major requirements for constant maintenance by specially trained mechanics may also be doomed to failure. The technology must be appropriate to the problem and to the financing and operational constraints of the community.

There exists a large body of literature on landfilling techniques, collection and disposal systems and resource recovery options. The small population and waste stream in Big Horn and Carbon Counties make many of the disposal techniques inappropriate. The population density and dispersal, the limited collection options and operational arrangements and the dearth of resource recovery markets all but eliminates the potential for materials reclamation and energy recovery. Hart (1979) outlines landfill technologies appropriate to a broad range of waste volumes and economies; the techniques are related to Section 1008 of RCRA and some are feasible for rural areas. Goldberg (1973) discusses a variety of small-scale collection systems including the two proposed within this report. Resource recovery in rural areas comparable to Big Horn and Carbon Counties has been determined to have limited feasibility (Hennington, Durham and Richardson, 1976). However, a resource recovery survey of North Dakota completed under the Region VIII Technical Assistance Panels Program outlines a variety of options which may prove feasible for rural areas in the future. At present, resource recovery in rural areas is limited in most cases to aluminum recycling and abandoned vehicle reclamation.

### 5. Centralization

The benefits of consolidation landfills and the centralization, or regionalization, of collection and disposal systems are widely discussed in the literature. As discussed previously, there are significant, and very apparent, economies of scale in solid waste management. To be most efficient, equipment must be fully utilized. Centralization can group the demands of individual communities together so that they can support an appropriate level of capital investment.

## B. Data Requirements and Sources

The primary data needs of an analysis of solid waste management alternatives include existing and projected costs, waste characteristics, and documentation of existing management practices.

For this study, the establishment of baseline costs relied on existing data, the literature and the experience of the study team. Prior experience with Colorado counties and information from County files provided the basis to develop cost estimates for solid waste operations in Wyoming. Many times, especially in rural areas, the actual costs of solid waste collection, hauling and disposal are only partly accounted for by the budgeted line items for solid waste management. Communities often transfer operating funds or share costs with other budget areas, e.g., equipment and personnel may be shared with the highway department. These problems make the estimation of the costs of collection and disposal difficult. Specific assumptions in this regard are discussed in the text.

In order to plan an integrated solid waste disposal system and insure its technical feasibility, a planner or engineer must establish the following factors:

- total volume of wastes generated and the annual and daily rates of generation.
- the origin of the wastes;

- the seasonal cycles of waste generation;
- the composition of the waste and relative contribution made by each waste category;
- the number of private waste haulers, if any, and their individual volumes hauled;
- the collection system and equipment used by haulers;
- the location, operation and life of all disposal sites; and
- outside influences on waste generation, collection and disposal.

Personal interviews and field investigations established the technical and operational nature of current practices. Many times, secondary sources or personal observation had to substitute for comprehensive data collection and analysis. Verbal rather than written exchanges dominate the rural experience, and more can be determined by asking a few, well-defined questions than by reviewing the small volume of literature focused on Wyoming Solid Waste Management. The general literature available on rural solid waste problems assisted in defining the scope of the questions asked.

The following methodology was used in modeling and describing the existing solid waste situation:

- The boundaries of the area to be studied were selected and all communities or population centers within those boundaries were identified. Population data, including a measure of the "relative dispersement" (which is used to allocate resources for incorporated areas), growth trends, and seasonal cycles were gathered from the best available sources such as the local Chamber of Commerce, the Regional Councils of Governments, telephone company and post office, or State Economic and Planning Agency.

- Estimates of waste quantities were made for each community using the population data and an appropriate regional average for daily per capita waste generation. Special attention was given to commercial and industrial waste generators. For the purpose of waste generation quantity calculations, a figure of 3.5 pounds per capita per day, with a density of 350 pounds per cubic yard was used for the rural areas; 5.0 pounds per capita per day, with a density of 250 pounds per cubic yard was used for the towns. A figure of 4.3 pounds per capita per day is an average waste generation rate. The quantities estimated were substantiated or revised, where possible, with field data obtained from local haulers or disposal site operators. This step serves to correlate the "model" with actual conditions.

- Estimates of waste quality were also made using the above information sources as a basis. Combining data on waste quantity and quality gave an indication of overall demands on the existing system. In order to estimate the different equipment needs of the rural and town areas, the generation factors of the various waste streams were analyzed separately.

## C. The Choice of Big Horn and Carbon Counties as Representative Models

Big Horn County, Wyoming, was chosen for this solid waste management study and plan as representative of rural counties in Wyoming which are predominantly farming and ranching areas with low population densitites and moderate rates of growth. The county has grown slowly in the past ten years with no significant development impacts to spur uncontrolled growth. Additionally, the State DEQ determined that the county could not comply with Federal and State solid waste regulations without some degree of outside help. This study examines the solid waste management system in Big Horn County, and the plan can serve as a model for other rural, agricultural counties in Wyoming.

Contrasting the situation in Big Horn County, Carbon County is heavily impacted by energy development and experiencing a relatively high growth rate. This growth places significant burdens on public services such as solid waste management, and there is an immediate need for analysis and planning to prevent or lessen impacts. Carbon County, then, serves as a model for other rural, energy-impacted counties in Wyoming.

# III. BIG HORN COUNTY SOLID WASTE MANAGEMENT

## A. Background and Introduction

### 1. Specific County Problems and Goals in Solid Waste Management

Big Horn County is divided into North and South Bridge and Road Department districts. Each district has the responsibility for the operation of a landfill; the landfills are about thirty miles apart. Despite indiscriminate dumping at local sites, the County government has not initiated any efforts to modify individual hauling and dumping practices or to close the local landfills. The County does, however, provide some assistance in operations by covering particularly offensive indiscriminate sites on an irregular basis.

The problems with the existing solid waste management system begin with the dispersed population, which has settled along the corridors of roads and irrigation canals. This pattern influences the creation of roadside dumps and hinders the existing system from coping with wastes. Population growth is currently two percent annually and the county is growing again after reaching a low point in 1970. The population growth will make the existing solid waste system inadequate very soon. The population is generally older and less able to support the investment in infrastructure which will be required for solid waste and other public services.

Furthermore, revenues generated by taxation and assessment have reached their economic and constitutional limits. Mining activity and minerals production reached peak output decades ago while the mill levy tax has reached its peak limit of twelve mills per dollar assessed valuation. The limited revenue base makes it impossible to upgrade existing disposal sites to meet State standards or repair equipment at the southern site without reducing services in other areas.

The Bureau of Land Management (BLM) owns 62 percent of the land within the County border and the National Forest Service (NFS) owns 18 percent. Their ownership reduces the land-use flexibility for solid waste disposal. This situation constrains development while encouraging indiscriminate dumping on

Federal land. The parcels which BLM leases to towns for waste disposal have no stipulations which would require environmentally-sound disposal operation practices. The rural population has become accustomed to individual hauling and indiscriminate dumping and has resisted any improvement in the system if it restricts current practice. This occurs despite the local values placed on conservation of land.

The goals of a solid waste management plan in Big Horn County are to establish a cost-effective system which can meet State standards and handle all the wastes generated in the county.

## 2. Population and Trends

As the railroad laid tracks along the Big Horn River in the second half of the last century, construction camps were set up to follow the progress of the road bed. Several of these camps became water and fuel stops for trains; some became trading posts. Many of these original camps are now settlements and towns. People settled in these towns due to the transportation afforded by the railroad and the river. Irrigation systems developed in the early 1900's were another significant influence on settlement patterns. The irrigation system served farming areas; thus, farming areas were focused along the irrigation canals, creeks and rivers.

The lowest population in Big Horn County in the past fifty years occurred in 1970. This population decline has reversed. From 1970 to 1976, the county grew by approximately 760 persons; from 1976 through 1979 the population grew by 1,384 persons. Sixty-one percent of this growth has occurred in rural areas.

This study defines Lovell, Greybull, and Basin as towns; all other areas will be considered rural. A constant population estimate of 12,349 for the county is used in figuring per capita waste generation and disposal costs through 1985.

Sources for present and projected population data are the "Big Horn County Population Estimate", and the "Final Population Matrix", published by the Wyoming Department of Economic Planning and Development.

### 3. Waste Generation

The northern portion of the county, which includes the town of Lovell, has a population of 5,804 or forty-seven percent of the county population. The southern portion of the county has a population of 6,545 or fifty-three percent of the county residents. The waste generation is distributed along the routes of trade and along the irrigation system.

The volume of household solid waste remains nearly constant throughout the year. Yard and farm wastes increase during the frost free season and expand the total waste stream by as much as fifteen percent above the average annual volume in the rural areas. Waste volume increases during the summer months as much as thirty percent due to local trade activities, tourism, and late spring or early fall cleanup.

Of the 9,656 tons of waste generated in Big Horn County, sixty-one percent is collected and disposed of in the two regional landfills. The remaining thirty-nine percent is disposed of in other landfill locations. These sites are located as near as possible to rural populated areas. However, the distance which most residents must travel to dump their trash encourages the search and use of alternative disposal sites which are scattered throughout the perimeter of the populated areas.

### 4. Waste Composition

There is a difference in the waste generated by rural and settled areas. Town-generated solid waste consists of general household refuse, commercial trash, industrial waste and waste generated by tourists. Town solid waste is less dense per cubic yard than rural farm waste. The commercial fraction of solid waste is generally of low density and includes corrugated containers, packing material and crating. Bush and shrub trimmings from residential yards also reduce density.

Farm waste consists of general household waste, trees, stumps, demolition debris, and worn-out farm machinery. This type of waste, excluding household waste, is termed "bulky waste" and must be handled in a manner different from that of household refuse. Two types of waste generated by farming activities

must be treated with special care. These wastes include pesticide containers and septic tank pumpings. Empty pesticide containers should be triple-rinsed and punctured prior to disposal in a sanitary landfill. Pumpings from septic tanks are a type of waste common to rural areas. Currently, pumpings are disposed of by tank truck operators on their own or at local wastewater treatment lagoons. Wastewater and sewage treatment sludge is generated in small quantities and is not a disposal problem.

## B. The Existing Solid Waste Management System

### 1. Solid Waste Collection System

In Big Horn County, Wyoming, solid waste collection and disposal are decentralized. The towns of Lovell, Greybull and Basin, and the rural community of Byron, each have a waste collection service. These communities account for fifty-seven percent of the county population of 12,349. The remaining households provide their own transportaton to a disposal site.

The typical charge for household collection ranges from $2.50 to $3.75 per month. The collection of solid waste is partially subsidized, so the actual cost of collection is greater than these figures. For this analysis the household cost is assumed to be $3.50 and the annual cost of solid waste collection is estimated to be greater than $120,000. This assumes that there is no cost to households transporting their own wastes.

### 2. Solid Waste Disposal System

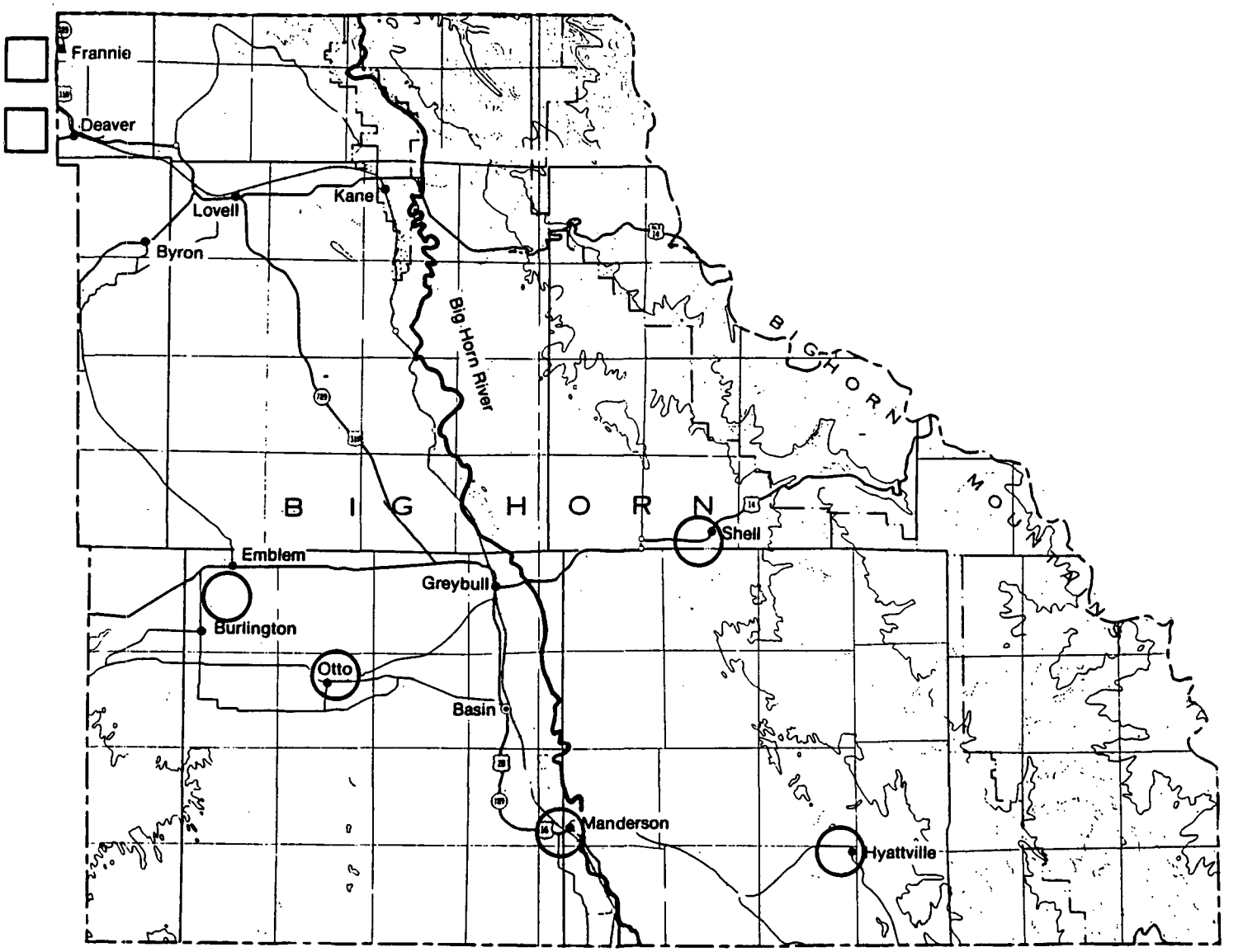
Disposal of solid wastes in Big Horn County takes place at two county dumps and seven community dumps. It is estimated that almost 10,000 tons of solid waste are generated and disposed of annually (see Table 1). Each disposal site is discussed below and is shown in Figure 2.

County Landfills. Big Horn County operates two landfills which are centrally located within the more populated zones of the County. The northern landfill is near Lovell and the southern landfill is between Basin and Greybull. The County does not have a county solid waste management district. The

# FIGURE 2

## SOLID WASTE DISPOSAL SITES

## BIG HORN COUNTY, WYOMING




EXISTING SOLID WASTE DISPOSAL SITES WITHIN BIG HORN COUNTY

EXISTING SOLID WASTE DISPOSAL SITES WITHIN PARK COUNTY

TABLE 1

POPULATION AND SOLID WASTE GENERATION (1979)
BIG HORN COUNTY

| COMMUNITY | | POPULATION | ANNUAL (1979) SOLID WASTE GENERATION | |
|---|---|---|---|---|
| TOWNS | RURAL | | Tons | Cubic Yards ($yd.^3$) |
| Lovell | | 2729 | 2490 | 19,920 |
| | Byron | 540 | 345 | 1,967 |
| | Cowley | 470 | 300 | 1,710 |
| | Frannie | 171 | 105 | 621 |
| | Deaver | 198 | 126 | 718 |
| | Remaining North Section | 1656 | 1058 | 6,031 |
| Greybull | | 2400 | 2190 | 17,520 |
| | Burlington | 165 | 105 | 599 |
| | Otto | 58 | 37 | 211 |
| | Shell, Greybull Heights | 775 | 495 | 2,822 |
| | Remaining Central Section | 395 | 252 | 1,436 |
| Basin | | 1325 | 1209 | 9,672 |
| | Manderson | 193 | 125 | 713 |
| | Hyattville, Paint Rock | 218 | 140 | 798 |
| | Remaining South Section | 1056 | 675 | 3,848 |
| TOTAL | | 12,349 | 9,656 | 68,586 |
| Town | | 6,454 | 5,889 | 47,112 |
| Rural | | 5,895 | 3,767 | 21,474 |

Road and Bridge Department has the responsiblity for the dump operation. The department is unable to keep up with landfill maintenance tasks due to its primary responsibilities which include road and bridge repairs in good weather and snow plowing in the winter. The operational problem of transferring equipment from jobs to the landfill site is cumbersome and expensive.

The County operates the regional sites five days per week but the dumping grounds are open to the public for disposal seven days per week. This practice accommodates those rural residents who can only haul and dump their wastes on the weekend. However, the practice of a seven day per week dumping privilege causes several operational problems in waste control. These include the disposal of wastes at inappropriate places; the disposal of inappropriate wastes; e.g., still glowing embers, and pesticide containers; blowing litter and trash; and the burning of wastes, either by carelessness or by design. Rural wastes, disposed of on weekends, are usually loose and uncompacted. These materials scatter much more readily in the wind than do compacted wastes hauled and disposed during the week by local collection services.

The northern district has only recently begun to employ the trench method of landfill disposal at their site. An intermittent stream flows along the southern boundary of the landfill. Disposal is within a relatively impermeable bentonite shale layer, and leachate migration into the stream has not been observed. Diversion ditches are present at the landfill to contain runoff, which evaporates. Blowing debris is occasionally a problem which could be mitigated through the use of windscreens. The usable life of the landfill is estimated at ten years, if disposal continues at the present rate.

The southern landfill is located in an ideal geological area west of Highways 16 and 20. There is land adjacent to the present site which is available for future landfill expansion. This would enable the site to serve the landfill requirements of the southern district for at least twenty more years. By dumping in an organized manner and by consistently compacting trash, available landfill area would be more efficiently managed. These improvements would extend the useful life of the site.

Deaver. The Deaver site serves Big Horn County but is located west of town in Park County on BLM land. Cover is not applied to the wastes and the site is poorly maintained.

Frannie. The disposal site near Frannie is located near the junction of State Highways 310 and 789, to the west of town in Park County. The wastes have been pushed into piles by a small Park County bulldozer around the perimeter of the site. At this location, very large steel oil tanks and parts have been deposited. No evidence of waste cover has been noted and it was obvious that some waste piles had been sitting uncovered for many years.

Burlington-Emblem. The disposal site near Burlington and Emblem is located between the two communities in a non-populated area west of Route 30. Wastes are disposed in a trench recently excavated by a local contractor. Problems with this site include infrequent cover, frequent burning, blowing litter, and dead animals.

Manderson. The disposal site at Manderson is located south of town in a drainage area. The site currently has the potential for pollution of surface water supplies. It has problems with blowing litter, dead animals, and uncontrolled burning. A new site has been planned south and east of the present site, which will be opened with State approval.

Hyattville. The disposal site used by Hyattville is located in a gully. Problems include uncontrolled burning, dead animals, blowing waste and the potential for surface water pollution.

Shell. The town of Shell runs a five acre site located east-southeast of town. This site services the local residents and a Girl Scout camp. Problems include uncontrolled burning, blowing waste, and dead animal disposal.

Otto. The Otto site is located north of town. This site is periodically covered by a local resident as a public service. Problems at this site include uncontrolled burning, blowing wastes and drainage into the trench from surface runoff.

For 1979, the total costs of solid waste disposal in Big Horn County are estimated at $68,000 by the County government. There are obviously some costs of operation of the non-County disposal sites which are not included in this estimate. These costs are difficult to estimate since many of the operations are on a casual or informal basis.

## C. Alternative Solid Waste Management Systems

There exists three basic alternatives for future solid waste management in Big Horn County:

- o maintenance of the status quo;
- o upgrade the existing system to minimum legal requirements; and
- o development and implementation of a regional integrated solid waste management system.

Each alternative is discussed below.

### 1. Continued Use of the Existing (Baseline) System

The total costs of solid waste management in Big Horn County can be conservatively estimated to be over $188,000 annually. This includes $120,000 for collection and $68,000 for disposal. Realistically the annual costs are probably closer to $200,000. This higher figure does not include depreciation of capital equipment or the cost of land. Thus a "true cost" would probably be closer to $250,000. This corresponds to a annual cost per capita of $16.20 to $20.25. For the purposes of this analysis an annual cost of $200,000 was used. Table 2 projects county-wide collection and disposal costs through 1985 escalated by an inflation rate of 12 percent per year. Table 2 also includes planned capital expenditures necessary to maintain the present County waste handling operation in its current status through 1985.

Several of the communities in the county are planning to purchase equipment in the next five years. Greybull has recently ordered a side-loading collection system which will be installed in 1980. Byron has established a local solid waste management district and will install a new collection system

TABLE 2

ANNUAL COST PROJECTIONS 1980-1985
BIG HORN COUNTY

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|
| Present Method of Waste Management<br>• No change in county operations<br>• 12% annual inflation factor | $200,000 | $224,000 | $251,000 | $281,000 | $315,000 | $352,000 | $395,000 |
| Greybull New Sideload System | | 12,300 | 12,300 | 12,300 | 12,300 | 12,300 | 12,300 |
| Byron New System | | | 22,900 | 22,900 | 22,900 | 22,900 | 22,900 |
| Lovell New Collection Truck | | | 4,900 | 4,900 | 4,900 | 4,900 | 4,900 |
| Basin New Collection Truck | | | | | 4,900 | 4,900 | 4,900 |
| Greybull New Collection Truck | | | | | | | 7,300 |
| Annual Cost - Business As Usual | $200,000 | $236,300 | $291,100 | $321,100 | $360,000 | $397,000 | $447,300 |
| Annual Cost Per Capita | $16.20 | $19.14 | $23.57 | $26.00 | $29.15 | $32.15 | $36.22 |

including new trucks in 1980-81. Lovell is purchasing a new collection truck next year. Basin and Greybull should purchase new collection vehicles by 1985 to serve as front line vehicles so that older equipment can be utilized as spares for down-time or overload capacity. These capital costs were included in the baseline scenario and were annualized assuming a ten-year life and a discount rate of ten percent.

The costs outlined in Table 2 assume a business-as-usual approach to solid waste management and include annualized capital costs for all new equipment. This scenario assumes that, the operations of the County would remain stable and that no new equipment would be purchased by the County.

2. Upgraded Systems

Present and pending State and Federal regulations will increase the annual costs of solid waste management in Big Horn County. To meet State requirements for the existing rural satellite disposal sites, the County must upgrade its operations. The County would be required to dig trenches at those sites which do not have trenches for disposal; cover the wastes disposed at each site on at least a monthly basis; fence the sites; and construct wind screens at each site. The major capital cost would be for a dozer to dig the trenches, compact and cover the wastes. One dozer could serve the County and could be transported on a rotating basis to each satellite.

The capital cost for the necessary equipment and facilities is estimated $318,000. This corresponds to an annualized cost of $51,750 over ten years at ten percent interest. Annual operating expenses are estimated at $25,000 (Table 3). Total costs to the County at large for the business-as-usual scenario and the satellite system upgrading scenario are displayed in Table 4.

The upgraded, unmanned sites would have several operational shortcomings, including:

- o open burning dumps;
- o multiple sources of air and water pollution;
- o disposal of dead animals and bulky wastes;
- o indiscriminate dumping.

TABLE 3

COSTS TO UPGRADE RURAL SATELLITE SITES, BIG HORN COUNTY

| | |
|---|---|
| **CAPITAL EXPENDITURES** (1980 Dollars) | |
| - Dozer with ripper | $230,000 |
| - Wind Screen and Fencing<br>7 Sites @ $4,000 | 28,000 |
| - Truck and "Lo-Boye" Trailer | 60,000 |
| - TOTAL | $318,000 |
| - ANNUALIZED CAPITAL COST<br>(10 years @ 10%) | $ 51,750 |
| **OPERATING COSTS** (1980 Dollars) | |
| - Labor:<br>Part-time help | $ 10,400 |
| - Maintenance | 2,000 |
| - Fuel | 10,000 |
| - Miscellaneous | 2,600 |
| - TOTAL ANNUAL OPERATING COST | $ 25,000 |
| TOTAL ANNUAL COST | $ 76,750 |

TABLE 4

ANNUAL COST PROJECTIONS 1980-1985
UPGRADING OF RURAL SITES
BIG HORN COUNTY

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1980-1985 TOTAL |
|---|---|---|---|---|---|---|---|---|
| Baseline | $200,000 | $236,300 | $291,100 | $321,100 | $360,000 | $397,000 | $447,300 | $2,052.800 |
| Upgrading | | | | | | | | |
| o Annualized Capital Cost | - | - | 51,750 | 51,750 | 51,750 | 51,750 | 51,750 | 258,750 |
| o Operating Cost (1980 Dollars Inflated @ 12%) | - | - | 28,000 | 31,360 | 35,120 | 39,340 | 44,060 | 177,880 |
| Total Annual Cost | $200,000 | $236,300 | $370,850 | $404,210 | $446,870 | $488,090 | $543,110 | $2,489,430 |
| Annual Cost Per Capita | $ 16.20 | $ 19.14 | $ 30.03 | $ 32.73 | $ 36.19 | $ 39.52 | $ 43.98 | - |

3. A Regional Integrated System

In order to resolve the solid waste management problems associated with even an upgraded system, Big Horn County must consider a comprehensive program including the following:

- o Establish a county-wide Solid Waste Management District (SWMD).
- o Install a Bulky Waste Management System.
- o Close all local open solid waste disposal sites.
- o Implement a county-wide waste collection system.
- o Upgrade the existing county disposal sites.

The establishment of a SWMD provides for the centralized management and secure financing necessary to obtain a cost-effective solid waste management system that has the flexibility to accommodate long-term demands on the system.

This proposed integrated system consists of two separate sub-systems which work together to manage residential and commercial wastes and bulky waste items. Bulky waste items will be handled with a large container system, or roll-off system. Components of this roll-off system include a diesel truck, a tilt frame and 14 containers.

The capital cost of roll-off system is estimated to be $120,200. The annualized capital cost is $19,600; operations costs are $32,500 (Table 5). The roll-off system is illustrated in Figure 3.

Residential wastes and any commercial wastes will be collected from the towns and rural areas by a side-load system operated by one person. This system is on order for Greybull. The components of this system include two side-loader collection units and 600 three cubic yard containers. This system is illustrated in Figure 4.

TABLE 5

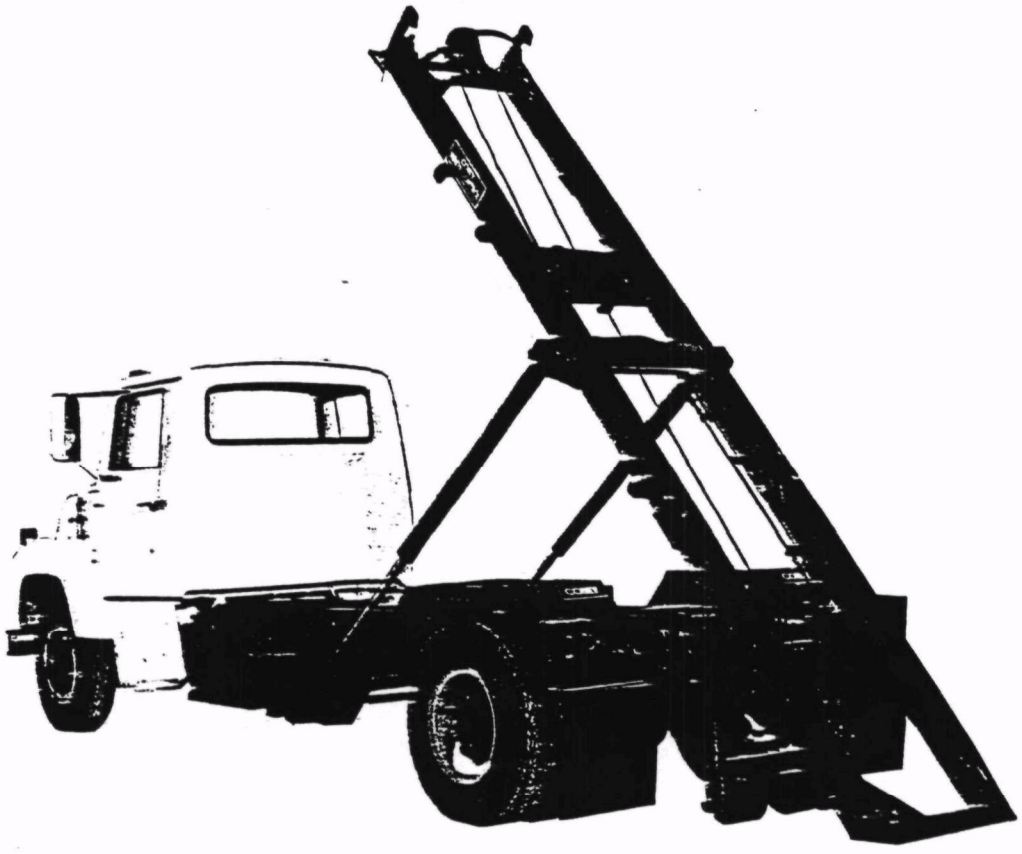
PROPOSED SOLID WASTE MANAGEMENT SYSTEM
BIG HORN COUNTY

| | | |
|---|---|---|
| **Capital Expenditures** | | |
| o Roll-off System | | |
| Truck Tilt Frame | $48,000 | |
| 14 Containers @ $3,300 | 46,200 | |
| 13 Site Preparation @ $2,000 | 26,000 | |
| TOTAL | | $120,200 |
| o Side-load System | | |
| 2 Collection Trucks @ $48,000 | $ 96,000 | |
| 3 cu. yd. Containers 600 @ $240 | 144,000 | |
| TOTAL | | 240,000 |
| o Landfill Upgrade | | 20,000 |
| Total Capital Expenditure | | 380,200 |
| Annualized Capital Cost | | 61,875 |
| **Operating Costs** | | |
| o Roll-off System | | |
| Labor | $20,800 | |
| Maintenance | 2,500 | |
| Fuel | 6,600 | |
| Miscellaneous | 2,600 | |
| TOTAL | | 32,500 |
| o Side-load System | | |
| Labor | $41,600 | |
| Maintenance | 3,500 | |
| Fuel | 27,300 | |
| Miscellaneous | 3,600 | |
| TOTAL | | 76,000 |

o Landfill Costs

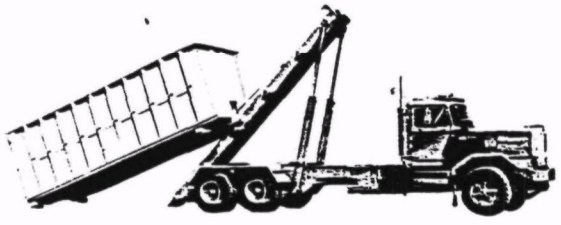
| | | |
|---|---|---|
| Labor (shared with Roll-off) | $31,200 | |
| Fuel | 4,600 | |
| Maintenance | 3,500 | |
| Miscellaneous | 2,000 | |
| TOTAL | | $ 41,300 |
| Administrative Costs | | 25,000 |
| Total Operating Costs | | 174,800 |
| Total Annual Cost | | 236,675 |

**FIGURE 3**
**ROLL-OFF SYSTEM**



**A) TILT-FRAME TRUCK**

(Source: Perfection-Cobey, Co.)

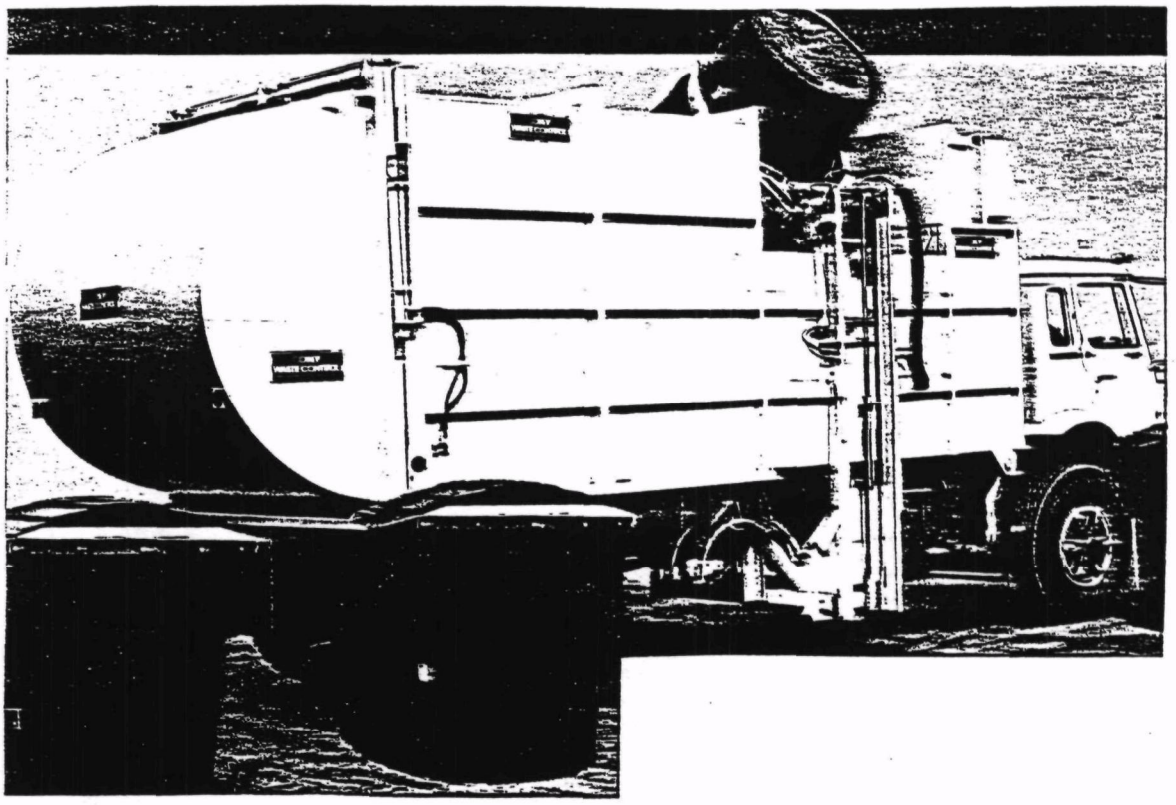


**B) TILT-FRAME TRUCK AND CONTAINER**

(Source: Accurate Industries, Inc.)

**FIGURE 4**
**SIDE-LOAD SYSTEM**

(AUTOMATED COLLECTION TRUCK AND CONTAINERS)



(Source: Perfection-Cobey, Co.)

The capital costs of the side-load system are estimated at $240,000. The annualized cost is $39,100. Operating costs are $76,000 (Table 5).

In estimating expenses for waste collection, and transfer and disposal, direct district management was assumed. If private and County-run systems were equally efficient, a County-run operation should have lower capital costs and operating expenses. The County would be exempt from sales, fuel and road taxes, and might receive a discount on equipment. A County-run system would not be economically obligated to produce a profit, although that motive would encourage a private contractor to operate more efficiently.

4. Conclusions

The first alternative discussed above, that of maintaining the status quo with the continued operation of the existing (baseline) system, must be considered an unrealistic and undesirable alternative due to the facts that:

- it would generally not meet existing and pending solid waste management rules, regulations and guidelines; and

- would further entrench existing inefficiencies while ignoring long-term goals.

Cost information obtained from analysis of this alternative, however, can serve to provide a basis of comparison with the other two alternatives.

The second alternative, upgrading the existing system, consists essentially of the minimum steps which need to be taken to comply with the rules, regulations and guidelines referred to above. The operational shortcomings for this alternative (listed previously) point out the fact that while such a system would be legal, it would also be somewhat inefficient, provide only for short-term needs, and leave unsolved several environmental problems.

However, the third alternative provides for a far-sighted efficient management system. If implemented, this regional integrated approach would allow the following goals to be met:

- o cost effectiveness;
- o compatibility with existing or recently planned systems;
- o capability to handle all solid waste generated within the Management District;
- o capability to handle seasonal volume and composition variations;
- o flexibility to expand to meet future needs;
- o accessibility and convenience to all residents;
- o long-term management of solid waste;
- o compliance with local, State, and Federal laws; and
- o protection of public health, safety and the environment.

The proposed system will eliminate the need for rural satellite disposal sites and limit disposal to existing upgraded county sites. The system will be able to collect commercial and residential waste from the towns and rural areas on a weekly basis and to collect and dispose bulky items on a county-wide basis.

The annual per capita cost comparisons through 1985 for the three alternative management scenarios are summarized below:

Systems Cost (per capita)

| Year | Business As Usual | Present Plus Rural Upgrade | Proposed Integrated |
|---|---|---|---|
| 1980 | $19.14 | $19.14 | $19.14 |
| 1981 | $23.57 | $29.44 | $23.16 |
| 1982 | $26.00 | $32.14 | $17.95 |
| 1983 | $29.15 | $35.52 | $16.38 |
| 1984 | $32.15 | $38.79 | $17.82 |
| 1985 | $36.22 | $43.18 | $19.42 |

These estimates conservatively assumed a constant population rather than growing population. If population increases, the advantage of the proposed system will be greater.

For the above-stated reasons, it is recommended that the regional integrated system be implemented, as discussed below.

## D. Implementation of the Recommended System

A very critical requirement for success of the proposed integrated system is that its component systems be implemented in the proper phases. The existing disposal methods and operations are to be phased out during 1980 and 1981 while the SWMD is being assembled administratively. The plan then requires that the roll-off system be installed in 1981 prior to any other capital or construction activity. The roll-off system will replace the present rural disposal sites in Big Horn County.

### 1. Establishment of a Solid Waste Management District

The establishment of a county-wide solid waste management district entails a tremendous amount of political front-end work, public education and public participation. Prior to the formation of the SWMD, the County should approach the towns and rural landowners with the plan and cost figures. Time should be spent explaining the goals, operation, and economics of an improved system. Next, the commissioners should formally establish, by resolution, a SWMD under Section 18-11-101 of the Wyoming State Statutes. The commissioners should then appoint a three member governing board to head the district; the board would then assume any further responsibility for political, financial, and technical matters. The Board would continue to meet with the towns and rural areas to enlist their support and involvement in the district. A special effort should be made to win over town support and to demonstrate the benefits of an integrated system. Six more board members could be appointed to the district from the towns if and when all entities reach agreement. The nine governing board members would evaluate the feasibility of the proposed plan, its implementation

strategy, the existing and proposed costs and alternative sources of revenue. The plan proposed by this study provides a starting point for consideration by the Board.

## 2. Phase I

Containers will be located in thirteen strategic locations, inluding those of the present disposal sites, which will be closed and covered during container site preparation. Clean up costs for present sites were included in Site Preparation expenditures, Table 5. The locations should be selected close to rural centers and on paved, all-weather roads. Five containers will be placed in the northern portion of the county and eight containers will be located in the southern portion. One container shall always be used for replacement of full containers when loading occurs.

The landfill closure and site construction would enable rural haulers to dump wastes into the roll-off containers just as they would have dumped onto the existing sites. The roll-off containers take the place of the rural landfills. During the first year of roll-off operations, the towns would be collecting and disposing their wastes in the same manner as they do now. Only the rural residential/commercial and rural bulky wastes will be collected in the roll-off containers in 1981.

The following materials would be forbidden for the roll-off system to insure optimal operation:

- dead animals;
- burning or smoldering material;
- tree limbs greater than four feet in length;
- construction and demolition debris and tree stumps; and
- car bodies.

Car bodies, tree stumps and large tree limbs will be collected by the roll-off driver, using the tilt frame truck and a flatbed attachment, and disposed of at a regional landfill. County residents will contact the landfill operators when the service is required. Dead animals may be removed for use at a rendering plant in Worland, Wyoming. If the animals cannot be taken by the rendering plant, they can be picked up by the roll-off driver at the request of county residents. The dead animals should be disposed of in a separate pit at the landfills and should be given an immediate cover of two to three feet of soil. Expenses were incorporated into Table 5. Generators of construction or demolition debris will need to negotiate a contract with landfill operators to obtain use of a roll-off container, or pay a user fee at the landfill and deliver their materials personally.

The roll-off containers should be emptied once a week when they are collecting both the rural residential/commercial wastes and the rural, bulky wastes in 1981. The roll-off truck will carry the empty container to a site, exchange empty for full, haul to the nearest regional landfill (Figure 5), dump and return the emptied container to the site of the next full container. Operations change in 1982 when the side-load system comes on-line.

### 3. Phase II

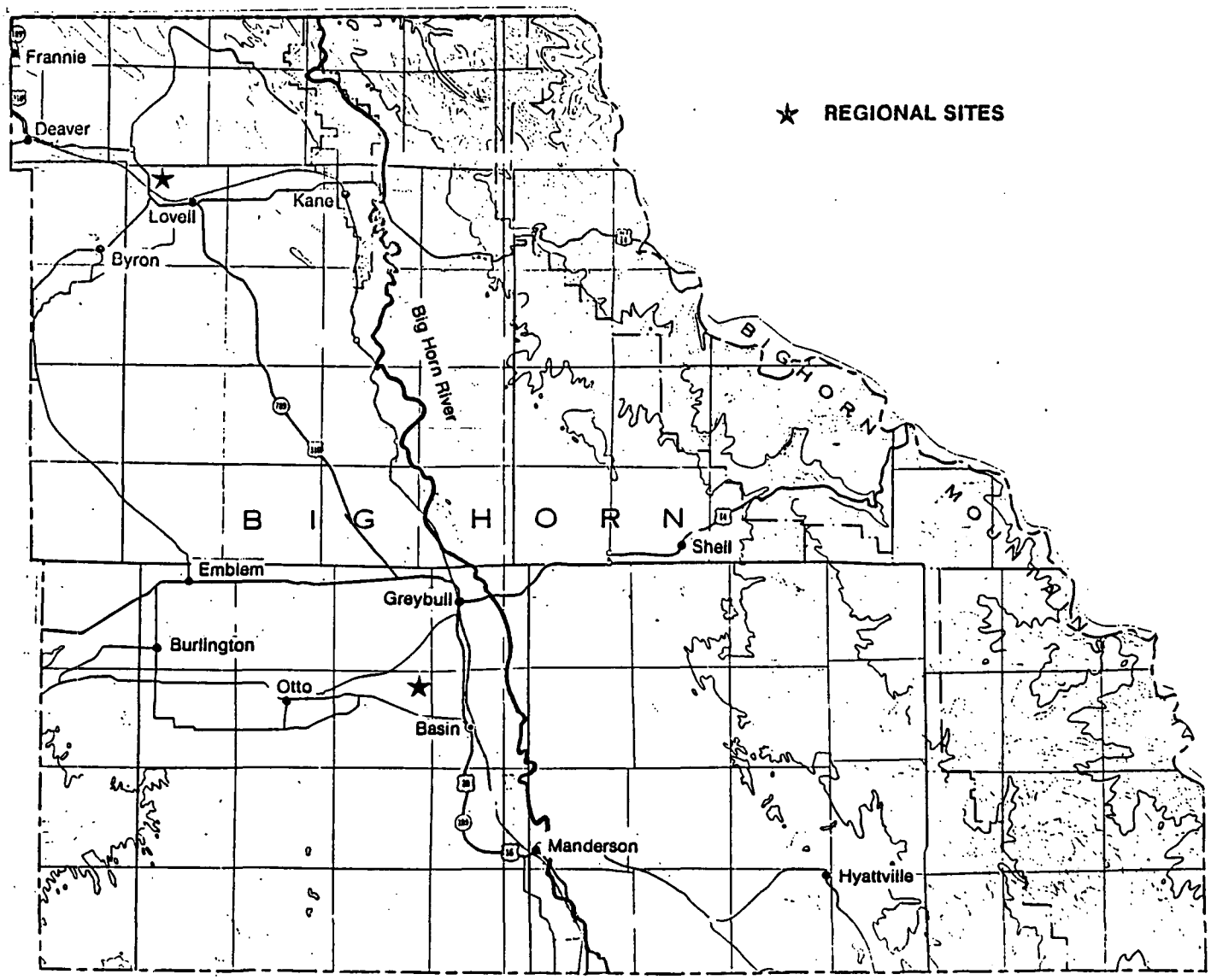
The second phase of the integrated system will be implemented in 1982 when the side-loader collection and container (3 $yd^3$) system is installed. The side-loader system will collect all town and rural residential and commercial wastes beginning in 1982. This will allow the roll-off system to be redirected to collection and disposal of non-putrescible, bulky wastes such as refrigerators, stoves, furniture and other large items only.

In 1981, two landfill operators and a roll-off driver will be employed by the system. The landfill operators will upgrade present disposal sites in the morning and compact and cover wastes in the afternoon. The roll-off operator will be working full time hauling containers. In 1982, the roll-off operator could run the side-load system while the landfill operators are part-time on the landfill in the afternoon and run the roll-off system in the morning. The

# FIGURE 5

## REGIONAL LANDFILL SITES

## BIG HORN COUNTY, WYOMING



roll-off system, since it would collect only bulky wastes in 1982, would haul each container only once every two weeks; thus, costs for the roll-off system will decrease. The specialization of each system in 1982 would reduce the costs of operation by 1983 for the roll-off system to 31% of those of 1981.

The side-load system will be installed in towns, along alley ways, at commercial docksides, in recreational areas and at town facilities. In rural areas, the side-load containers will be located along well traveled paved roads, at the roll-off sites and near rural centers. Household garbage, paper, cardboard and other household waste items will be placed by residents, in the 3 cubic yard containers which will be emptied at a minimum of once per week. Table 6 shows the proposed route schedule and collection activity of the integrated system.

Long-term upkeep of the roll-off and side-load containers and sites will be necessary, due to anticipated vandalism and dumping outside of containers. Costs for these factors were covered under labor and maintenance in Table 5. An option to control vandalism and encourage dumping in containers is to fence roll-off sites. Fencing costs for a 40 foot by 60 foot area would reach about $2700, an expense which has not been included in cost estimates.

This system is consistent with existing local practices and the proposed town systems. The town of Greybull has ordered a side-loading system to upgrade its collection operation. Also, Byron was planning to purchase a similar one-man system by 1985. Since these systems are compatible with the proposed system, the process of phasing in the proposed system will be simplified.

### 4. Financing the System

If all areas of the county are working towards common goals with a common governing board, then options for financing become broader based and more likely to succeed. There are two potential methods of funding -- a sales tax or an valorem levy. The County Commissioners and other elected officials are those persons best qualified to make these decisions.

TABLE 6

ROUTE SCHEDULE AND COLLECTION ACTIVITY, BIG HORN COUNTY

| | Location and Waste Type Northern Portion | Location and Waste Type Southern Portion |
|---|---|---|
| Monday | Lovell commercials plus half of residential containers | Greybull commercials plus half Greybull residential |
| Tuesday | Remainder of Lovell residential, Byron plus rural SW of Lovell | Shell Valley rural plus balance of residents in Greybull |
| Wednesday | Frannie/Deaver and rural area northwest of Lovell | Half Basin residential plus commercial. Hyattville, Manderson plus south rural |
| Thursday | Remaining rural area east of Lovell. Lovell commercials as required. | Remainder of Basin residential plus Barlington/Emblem and Otto |
| Friday | Possible rural route south on Highway 32 and back north on 310. Survey must be made for weekly and semi-monthly generation rates | Greybull and Basin commercial |
| Notes | Landfill is located northwest of Lovell, north of Route US 14 alternate. | Landfill located between Greybull and Basin, west of Route 26 Wyoming. Only a limited number of commercials need to be collected twice per week, but they are large generators. |

A solid waste district with a sound financial base would provide the funding necessary for the independent operation of the solid waste management district. This predictable funding would enable the District to plan a capital development program and the necessary operating requirements.

This independent method of financing would free those portions of the County and Town budgets which subsidized solid waste handling. This provides towns with the incentive to become affiliated with the District.

5. Resource Recovery Potential

A centralized county-wide system, where waste is collected and disposed in one or two locations will offer greater opportunities for resource recovery. However, the only items currently offering an opportunity are various metals. Junked automobiles, farm machinery and household appliances, if accumulated at each landfill, would serve as a stored resource base. When sufficient quantities are collected, reclamation activities could be put out for bid to companies in the recycling, reuse, or reclamation business. For instance, companies with portable car crushers would be able to separate valuable materials from useless parts, compact the iron and steel car bodies and, finally, haul them to a scrap iron market. The markets closest to Big Horn County include Billings, Montana for scrap dealers and Denver, Colorado for shredders. Since there is such a large national market for recycled aluminum cans, the efforts of citizens to reclaim scrap aluminum and cans constitute an initial phase of resource recovery.

# IV. CARBON COUNTY SOLID WASTE MANAGEMENT

## A. Background and Introduction

### 1. Specific County Problems and Goals in Solid Waste Management

Carbon County can be divided into six distinct population centers. These centers encompass eighteen cities, towns or communities, and approximately fifteen separate solid waste disposal sites (see Figure 6).

The County government at present has no responsibility for operation of the disposal sites and wants to continue that position. Towns generally maintain their own disposal sites to some extent with the exception of Hanna/Elmo which uses a nearby abandoned coal mine. The County has recently begun to provide some assistance in covering disposal sites on an irregular basis.

The current situation of many, poorly maintained disposal sites reflects the County's growth pattern and dependence on energy development. The Hanna coal field has been mined extensively for many years and was the major supplier of coal for the Union Pacific Railroad. Residential development grew in clusters around the mines and along the railroad lines rather than the typical agrarian/ranching pattern following irrigation ditches, typical of Big Horn County.

Carbon County is currently at its ad valorem tax limit of twelve mills and must depend on increases in property values, mineral severance taxes and royalties, and sales taxes for real revenue growth. This financial constraint insures that new or expanded County programs will be examined critically.

The towns are also facing budgetary constraints due to infrastructure investments required by the high growth rate. Rawlins is planning to build a new water distribution line. Other public facilities and roads throughout the County will need upgrading, repair, or replacement to serve the increased population. The basic services of water, sewerage, and roads will have a high priority on any available capital or operating funds. Solid waste management competes with these other needs for limited public funds.

## CARBON COUNTY
## WYOMING

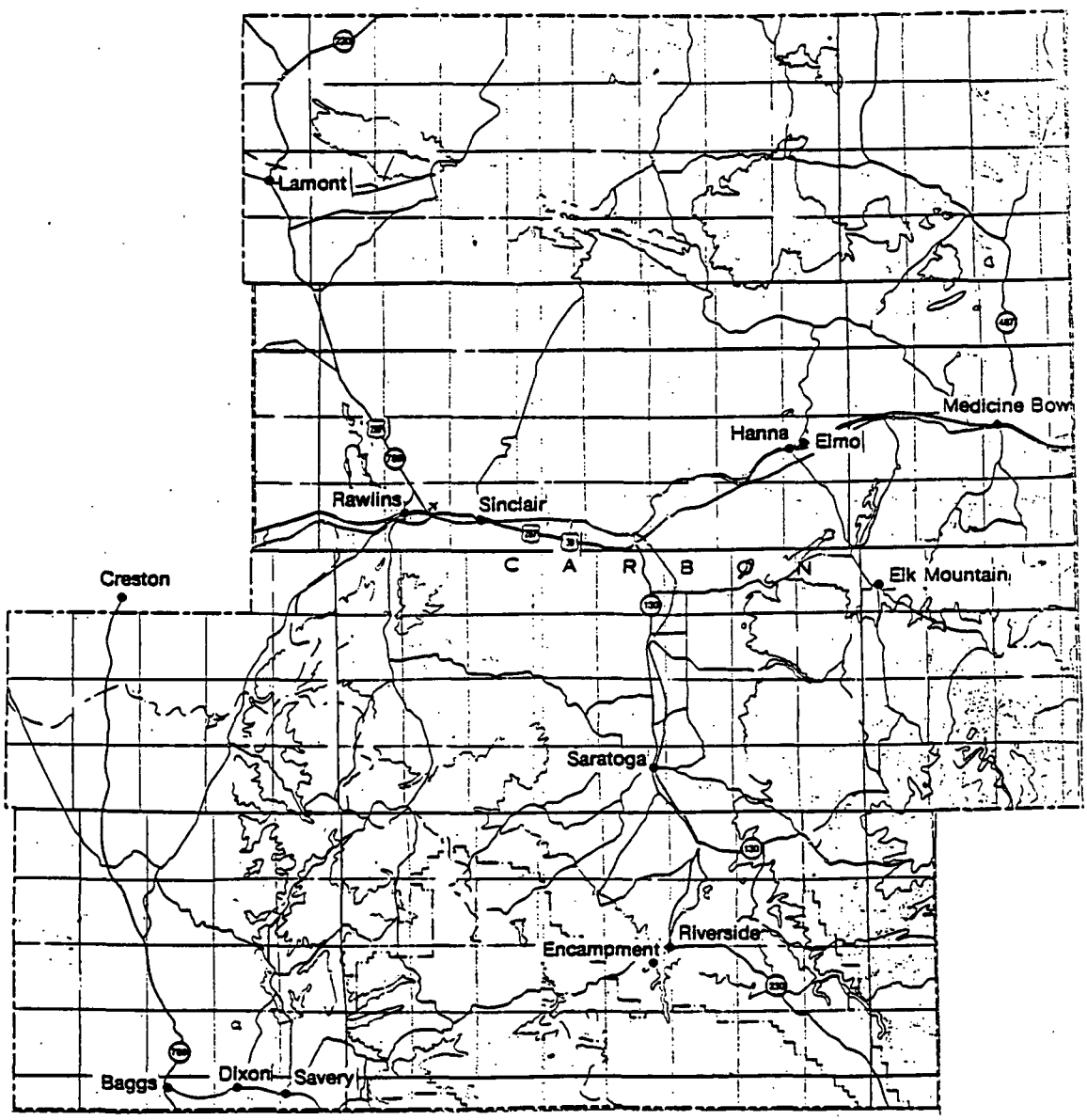



FIGURE 6

Federal agencies and the State of Wyoming own or control 62 per cent of Carbon County. The Bureau of Land Management controls 41 percent of the land. BLM has a policy of providing leased land to communities for landfill purposes for a token fee. Thus, the towns are accustomed to having cheap land and low operating costs for their disposal operations.

2. Population and Trends

Since 1869, Carbon County, named for the extensive coal deposits which underlay it, has been supported by the railroads, which mined the coal for their own use. Today, energy related mineral extraction and ranching form the economic base of the county. Population has grown rapidly in spurts, due to the resurgence of coal and the influx of workers associated with the approval and startup of new mines.

There are eighteen communities considered as distinct in this study. For six of these (Lamont, Savery, Shirley Basin, Arlington, McFadden, and Walcott) population data were not available. For the purposes of this study, Shirley Basin is assumed to have 650 people; Arlington, McFadden and Lamont are assumed to have 150 each, and Savery and Wolcott are assumed to have 50 each for a total of 1,200. This is about 5 per cent of the total county population.

This study treats Rawlins, Hanna/Elmo, Medicine Bow, and Saratoga as urban communities or towns. The rest are treated as rural communities. The total population is estimated to be 25,699 and this is used to estimate waste generation rates. Table 7 summarizes the population estimates for each community.

Population data for communities was obtained from the "Wyoming Council of Governments Planning Projections," 1979, and county-wide population is based on the "Final Population Matrix," published by the Wyoming Department of Economic Planning and Development. An annual growth rate of 1% was used in population projections, as derived from the "1970 Census of Population," by the U.S. Department of Commerce.

TABLE 7

POPULATION AND WASTE GENERATION
IN CARBON COUNTY

| Community | | | | |
|---|---|---|---|---|
| Town | Rural | Population | Yards Weekly | Tons Annually |
| Rawlins | | 14,500 | 2,030 | 13,231 |
| | Sinclair | 488 | 34 | 311 |
| | Baggs/Dixon | 463 | 33 | 301 |
| Hanna/Elmo | | 2,699 | 378 | 2,457 |
| Medicine Bow | | 1,440 | 202 | 1,310 |
| | Elk Mtn. | 231 | 16 | 147 |
| Saratoga | | 2,725 | 382 | 2,480 |
| | Encampment/ Riverside | 797 | 56 | 507 |
| | Other Rural | 2,339 | 164 | 1,490 |
| TOTAL | | 25,682 | 3,295 | 22,233 |

Average per capita waste generation - 4.7 lbs/person/day
(Source: Carbon County Planner)

### 3. Waste Generation

The population in Carbon County is generally located near established community centers with relatively little dispersion. The communities presented in Table 7 are considered as the solid waste generation centroids (excluding construction and industrial wastes). The solid waste generation is relatively constant throughout the year. Based on the number of hotel/motel beds and the campground spaces, the tourist population in Carbon County is less than one per cent of the total county population.

### 4. Waste Composition

The composition of wastes must be considered in the design of any system to manage those wastes. Residential, commercial, and institutional wastes are the primary concern of the study. In general, there is no reason to believe that national averages for the composition of residential wastes are not applicable. However, a large proportion of the waste stream in Carbon County is generated by the construction industry attempting to meet the demands from the high growth rate in the county. These wastes impose special requirements on waste collection and disposal and on the financial management of the waste disposal system. Traditionally, in many rural areas, the construction industry has not paid a proportionate share of the total disposal costs due to the lack of user charges at landfills, and the fact that most of the disposal costs (e.g. Rawlins) are covered by utility assessments. Any integrated waste management system should require individually negotiated contracts with major construction companies to insure that companies pay an equitable cost for disposal of their wastes.

Other types of waste categories of special interest are abandoned cars and bulky wastes such as stoves, refrigerators, and miscellaneous iron, steel, and other metal items. These categories present difficulties in conventional disposal systems because they are hard to handle and compact. Efficient management of these wastes must be provided in an integrated plan. No county-wide data on the volume of these wastes are available; however, a preliminary estimate is that the management of these wastes require less than 10 per cent of the resources required for total waste management.

Industrial wastes are not included in this study. Generally, the Sinclair Refinery is the only generator of industrial wastes, and separate negotiations should be conducted to address their special requirements. Problems which must be considered include whether or not refinery wastes will be subject to hazardous waste program requirements, and how liability for disposal should be shared.

Septic pumpings in the County are mostly taken to wastewater treatment plants for disposal. Some illegal dumping on land probably occurs, but the volume of pumpings is so low it does not support even one full time pumper in the County. None of the existing wastewater or sewage treatment plants generate sludge in large enough volumes to cause disposal problems.

## B. The Existing Solid Waste Management System

### 1. Solid Waste Collection System

The two existing private haulers currently serve the two largest communities, Rawlins and Saratoga, in addition to segments of other communities. Collection service is contracted for by individuals and billed by the company directly to that individual. The largest hauler operates out of Rawlins and charges $5 to $8 monthly for once a week residential service in or near Rawlins. For a comparison of the advantages and disadvantages of private vs. county-run collection and disposal systems, see Chapter 3, Section II A.

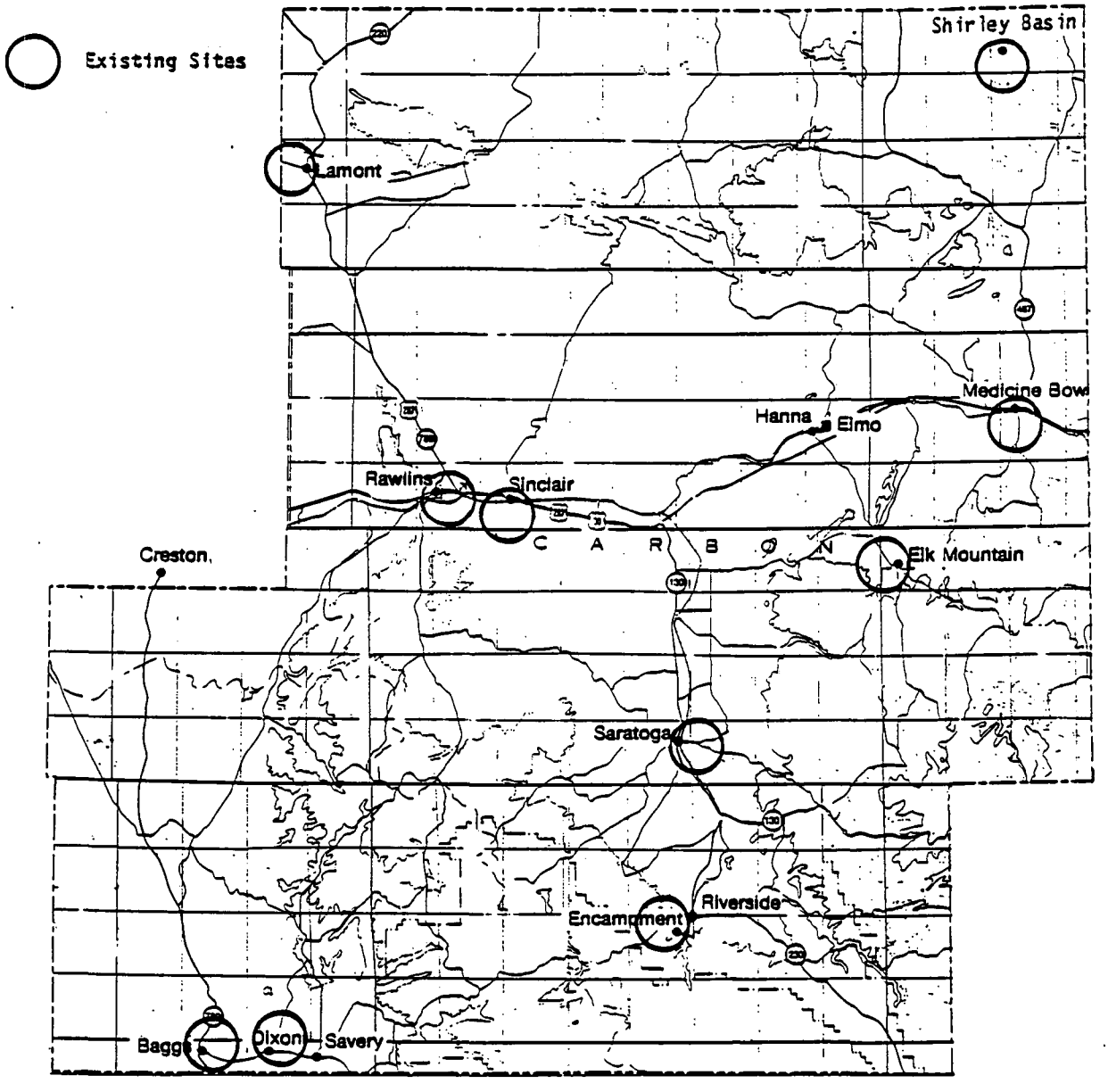
### 2. Solid Waste Disposal System

Disposal in Carbon County is currently the responsibility of municipal governments, and occurs at ten disposal sites. Some of these sites are currently operated in compliance with State requirements. It is estimated that more than 22,000 tons annually of solid waste are disposed at these sites. These sites are described in more detail below and are shown in Figure 7.

# FIGURE 7

## SOLID WASTE DISPOSAL SITES

## CARBON COUNTY, WYOMING



Rawlins. This recently expanded disposal site is located approximately two miles north of town on BLM land, and has at least twenty years of capacity left. Environmental problems are few and are limited to operational difficulties in winter and spring; no environmental or health hazards are apparent except for blowing litter. The operation is an area fill and has severe problems with the lack of stockpiled cover material. The system is being converted to a trench and cover operation. This is expected to solve these problems. The landfill operation budget was $154,000 for fiscal year 1980. New buildings and extensive earthwork will increase the 1981 budget to $350,000, about 50 to 60 per cent of which will be operational costs. There are two dozers, a scraper, and a landfill compactor dedicated to the landfill operation. Rawlins is currently receiving about thirty-seven tons per day and could probably handle up to fifty tons per day without increasing personnel or equipment. No problems are anticipated with respect to regulatory compliance. However, the operating cost seems high compared to similar systems.

Baggs/Dixon. The town of Baggs has already formed a limited solid waste district, the Snake River Solid Waste District, and is operating a trench and cover landfill in compliance with State regulations. Operation is contracted out and funded by ad valorem taxes within the district. Daily tonnage is estimated to be one ton per day. Dixon did not participate in the Snake River Solid Waste District and has a separate disposal site consisting of an extremely deep trench licensed by the state. The trench is covered infrequently. Residents of Savery also dump at this site. Operation costs are assumed to be negligible, and, because of the depth of the trench, no environmental problems have been encountered.

Saratoga. Saratoga has franchised operation of a small landfill to a private party. The original operator recently sold his interest in the franchise to a third party, who has requested the town purchase additional equipment for the landfill operation. The site is on forty acres of BLM land. Operation consists of trench and cover, and the site was originally projected to last twenty-five years. Environmental problems are mainly related to blowing litter and fire hazards.

Encampment/Riverside. These towns run a small burning trench operation just outside Encampment which is covered infrequently. There appears to be capacity for several years at the site, but town officials are concerned that dumping by non-residents of the towns is using up trench space too fast. Wind and blowing debris are problems here, as elsewhere, but some fencing has been installed around the trench. The State DEQ will probably require more fencing and cessation of burning. In this case the towns will deplete their available space more rapidly.

Hanna/Elmo. These towns utilize an uncontrolled open dump east of Hanna. Dumping currently occurs on private property and no equipment or manpower is dedicated either for cleanup or proper disposal operations. The major environmental and public health hazards involve open burning, blowing debris, insect and rodent vectors, and general public nuisances.

Medicine Bow. The town operates a small disposal site on BLM land quite close to the Medicine Bow River. The town has looked for another site in conjunction with BLM but is constrained by a lack of financial resources and the fact that most of the accessible land nearby is privately owned. The town has also considered instituting a collection service and hauling to another landfill, but cannot afford the capital investment. This site has the most serious potential for water pollution in the county by virtue of its proximity to water. The site would probably require major capital intensive improvements, such as a groundwater monitoring system and impervious cover material, to bring it into compliance with State Department of Environmental Quality regulations.

Elk Mountain. This town's disposal site is located in an abandoned gravel pit east of town. The site is covered infrequently by the Highway Department and is often burning. There appears to be some potential for water pollution if large quantities of liquid wastes are dumped therein, and fire hazards and blowing debris are also problems. Availability of suitable cover might be a problem in upgrading this site.

Rural communities other than those previously listed and rural residents account for approximately 2,700 people and about 2,000 tons per year of solid waste. These communities, such as Sinclair, Shirley Basin, Lamont, McFadden,

Arlington, Savery, and Wolcott must be provided for in a comprehensive plan. Currently, Sinclair, Shirley Basin, and Lamont have readily accessible disposal sites, of which Shirley Basin is the only one currently in compliance with State requirements.

The present annual cost of disposal in Carbon County is estimated to be at least $200,000 and possibly as much as $250,000. More accurate estimates are difficult to arrive at, due to the problem of evaluating so many separate operations. However, Rawlins, with the largest single landfill, is spending about $165,000 annually.

The disposal sites at Rawlins, Saratoga, Shirley Basin, Baggs, and Dixon are all licensed by the State. Costs at these sites would be expected to rise as fast as the rate of inflation. Sites at Lamont, Encampment and Sinclair must be improved to receive State approval. The Elk Mountain and Medicine Bow sites may require extensive costly improvements due to potential water pollution, and the Hanna/Elmo site will have to be cleaned up and operated at great expense. Table 8 shows estimates of costs required to run a sanitary landfill operation at these sites, assuming no other changes in the system. The estimates are based on a study for Carbon County prepared by Johnson, Fermelia and Crank (JFC), and two different estimating procedures prepared by Booz-Allen (BA) and Fred C. Hart Associates (FCH) using population data. A cost estimate for a county-wide system based on a North Dakota study recently completed by Fred C. Hart, Assoc. is also included. The JFC method was chosen as the basis for further analysis later in this chapter because this study was conducted specifically for Carbon County, while the other methods are general estimating techniques. As the individual towns comply with State requirements, many will be forced to contract out operations and can be expected to have costs on the same order of magnitude as presented in the study for Carbon County.

## C. Solid Waste Management Systems

### 1. Rationale for a Centralized Regional Management System

The towns and County have three basic solid waste management alternatives:

TABLE 8

ESTIMATED LANDFILL OPERATION COSTS, CARBON COUNTY

| Town | JFC[1] | BA[2] | FCH[3] | % County Pop. |
|---|---|---|---|---|
| Rawlins/Sinclair [4] | $162,900 | $64,224 | $76,448 | 58.3 |
| Saratoga | 75,250 | 11,803 | 23,758 | 10.6 |
| Hanna/Elmo | 37,050 | 11,575 | 23,758 | 10.5 |
| Medicine Bow | 32,850 | 6,175 | 12,544 | 5.6 |
| Encampment/Riverside | 19,800 | 3,418 | 6,948 | 3.1 |
| Baggs/Dixon | 39,100 | 1,986 | 4,037 | 1.9 |
| Elk Mountain | 19,600 | 991 | 2,014 | 0.9 |
| Total | $386,550 | $100,172 | $149,517 | 90.9 |
| Total for County | 386,550 | 110,200[5] | 164,485[5] | |

Cost for County based on North Dakota Resource Recovery study - $156,420.[6]

1. Based on the Johnson, Fermelia and Crank study, 1978, describing a two year plan of operation for a proposed solid waste district, and setting forth cost estimates. No basis for the estimates is given. Costs shown do not include engineering and management fees shown in the original study.

2. Based on the 1975 Booz-Allen report on unit costs for transfer, shredding, and landfilling. Costs are 1975 dollars adjusted to 1980 dollars at an annual inflation rate of 10%. Expenses are reported on an annual cost per ton basis. The smallest landfill in this study received 99 tons per day, more than 2 1/2 times as much as the largest landfill in Carbon County, i.e., Rawlins. Therefore, the effect of economies of scale is magnified when using these figures for cost estimates in Carbon County.

3. Based on a Fred C. Hart Associates, Inc. study on the economics of landfill disposal, including the effects of RCRA sanitary landfill criteria. Costs are reported in 1978 dollars which have been adjusted to 1980 dollars at an annual inflation rate of 11 1/2%. This study presents costs versus tons per day for 10, 100, and 300 TPD facilities. Rawlins/Sinclair, at approximately 37 TPD, was calculated by straight line interpolation. Saratoga and Hanna/Elmo costs were assumed equal to that of a 10 TPD facility, with approximately 6.8 TPD each and the rest are estimates based on a population ratio of the town in question to Saratoga.

4. Rawlins was grouped with Sinclair because of geographic proximity and the fact that there is currently a private hauler in the area. Geographic proximity resulted in the grouping of Hanna with Elmo, and of Encampment with Riverside. Baggs was grouped with Dixon because of geographic proximity and relative isolation from other communities. Note that JFC costs are based on two landfills for the Baggs/Dixon area, whereas BA & FCH costs assume one landfill.

5. Total county costs for the BA and FCH studies are arrived at by dividing total community costs by 90.9%, the percentage of county population living in communities.

6. Based on a Fred C. Hart study on Resource Recovery in North Dakota, in which an estimate of costs per ton for landfilling was calculated in three ways, for comparison with resource recovery costs. The average cost portion was $6.67, which, when applied to the county population of 25,708 people generating 5# per person, per day, yields an estimate of $156,420.00. This is given as a comparison of experienced landfill costs in Region VIII.

1) continuation of the status quo;
2) upgrading the existing system; or
3) formation and implementation of a centralized regional management system.

Similary to the situation described in the Big Horn County analysis in Chapter 3, the first two options represent short-sighted planning. The first alternative will not be sufficient for complete compliance with rules, regulations, and guidelines, while the second alternative solves some immediate problems, but leaves open the probability for further changes to be needed within a few years due to the continued existence of environmental concerns and operating inefficiences.

The third, or preferred alternative, formation of a solid waste management district and the centralization of disposal, allows the County to take advantage of economies of scale in landfill operation costs. Savings in the disposal operation can be greater than the cost of transfer, thereby realizing a cost savings for the total solid waste management system. Table 9 presents a comparison of the costs of the second and third alternative and adds a new alternative, the direct haul option. The direct haul option provides a higher level of service as compared to the other alternatives and involves the collection and direct haul of wastes from the rural communities to the existing landfill sites.

The following steps are recommended for the establishment of a county-wide system to resolve solid waste problems in Carbon County.

- create a county-wide Solid Waste Management District (SWMD);
- appoint a Board of Directors representative of the county;
- take over and upgrade the operation of selected disposal sites (i.e., Hanna/Elmo, Saratoga, Baggs, Dixon) as funding and equipment become available; and
- close other disposal sites and implement a collection or transfer service for the affected areas as funding and equipment become available.

TABLE 9

SOLID WASTE MANAGEMENT ALTERNATIVES
COST ESTIMATES FOR CARBON COUNTY
1980-1985

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|
| **Existing Disposal System, Upgraded** | | | | | | |
| Annualized Capital Costs | $ 85,100 | $ 85,100 | $ 85,100 | $ 85,100 | $ 85,100 | $ 85,100 |
| Operating Costs | 301,600 | 337,800 | 378,300 | 423,700 | 474,500 | 531,500 |
| Total Annual Costs | $386,700 | $422,900 | $463,400 | $508,800 | $559,600 | $616,600 |
| **Recommended System** | | | | | | |
| Annualized Capital Costs | $ 47,200 | $ 64,100 | $ 67,400 | $ 67,400 | $ 67,400 | $ 67,400 |
| Operating Costs | 56,200 | 86,800 | 108,700 | 120,500 | 133,700 | 148,200 |
| Total Annual Costs | $103,400 | $150,900 | $176,100 | $187,900 | $201,100 | $215,600 |
| **Direct Haul Option** | | | | | | |
| Annualized Capital Costs | $ 52,400 | $ 56,900 | $ 56,900 | $ 56,900 | $ 56,900 | $ 56,900 |
| Operating Costs | 54,100 | 137,900 | 154,400 | 173,000 | 193,700 | 217,000 |
| Total Annual Costs | $106,500 | $194,800 | $211,300 | $229,900 | $250,600 | $273,900 |
| Annual Savings of the Recommended System over the Existing System | $283,300 | $272,000 | $287,300 | $320,900 | $358,500 | $401,000 |

The establishment of a district offers several advantages not otherwise available to individual communities. Management can be centralized for optimum efficiency and responsiveness to the community. A secure financial base can be obtained which would allow greater flexibility and ensure system stability. Equipment can be standardized, leading to reduced maintenance costs. A district could work with other entities such as coal mines to form working agreements which would be difficult if not impossible for individual communities.

The proposed centralized system consists of two (possibly three) regional landfills to handle the entire county in place of the ten or more sites currently in use. A 40 cubic yard uncompacted roll-off container system, illustrated in Figure 3, would take the place of the disposal sites which were closed. Alternatively, a twenty yard rear-loading compactor truck, with a two-man crew could serve Shirley Basin, Medicine Bow, Elk Mountain, Sinclair, Encampment/Riverside, Baggs, Dixon and Lamont. The provision of publicly supported door-to-door collection service for these commmunities must also consider that Rawlins, Saratoga and Hanna presently pay a private hauler for waste collection. The District must obtain a track dozer with ripper, and a Lo-Boye trailer and tractor rig for use at the landfill during its first operational year.

## 2. Benefits of the Proposed System

Should the recommended or a similar plan be implemented, the following positive accomplishments will be achieved:

- optimum efficiency;
- capability to handle all residential and commercial waste generated in the county;
- flexibility to accommodate growth and changing needs;
- convenience for all residential users;

- o regulatory compliance; and

- o protection of public health and the environment.

Cost savings resulting from the implementation of the recommended plan versus the costs of keeping an upgraded version of the existing situation are shown in Table 9.

## D. Implementation of the Preferred System

### 1. Creation of a Waste Management District

The creation of a SWMD is not a simple undertaking. In Carbon County, much of the groundwork has been completed. The critical steps would be the choice of a Board of Directors representative of and responsive to the communities, and a choice of funding mechanisms. Hiring experienced staff familar with solid waste operations is crucial to the success of the effort.

The Board, assisted by the District staff, should take the recommended plan, evaluate its feasibility and costs, and modify it as appropriate. This plan should be a starting point for consideration by the Board. Our analysis indicates that the plan proposed by this study would provide an equitable level of service for the entire county, and be much less costly in the long run than upgrading the existing system.

### 2. A Phased Approach

A phased timetable, providing for consolidation of the landfills over a period of two to three years, would allow for orderly acquisition of manpower and equipment. A phased approach allows the responsible agency to grow into full implementation. A phased implementation would allow any legal or administrative problems with existing contracts to be resolved before the system becomes fully operational.

A two person District staff would be appropriate for initial operations. The District manager would be responsible for all District operations including public relations, liaison between the Board, towns and the County, and other administrative functions such as budget preparation. The second staff member would be an equipment operator, trained in landfill operations. Eventually this person could serve as foreman and manager of all other District employees.

After the initial phase, the District can assume responsibility for disposal site operations, start to purchase transfer equipment and phase out certain landfills. Phasing out includes final clean-up of each site and installation of a 40 cubic yard roll-off container. The first priority for phasing out disposal sites would be to phase out Encampment/Riverside and haul to Saratoga; phase out McFadden, Elk Mountain, and Medicine Bow, and haul to Hanna; and phase out Dixon and haul to Baggs. Alternatively, Baggs and Dixon could be grouped together and both hauled to Rawlins. This, however, is not a first priority and should depend on local needs and requirements. The District should explore the use of a coal mine pit near Hanna for waste disposal.

New equipment to be purchased during the second operational phase included one tilt-frame truck, at $48,000, and twelve 40 yard roll-off containers, at $3,300 each, for a total of $88,000.

Site preparation includes closing and covering former sites, and building container dumping stations. Cost is estimated at about $2,000 per site, for a total of $16,000. Total capital outlay should be approximately $104,000, or an amortized annual payment of $16,000 per year.

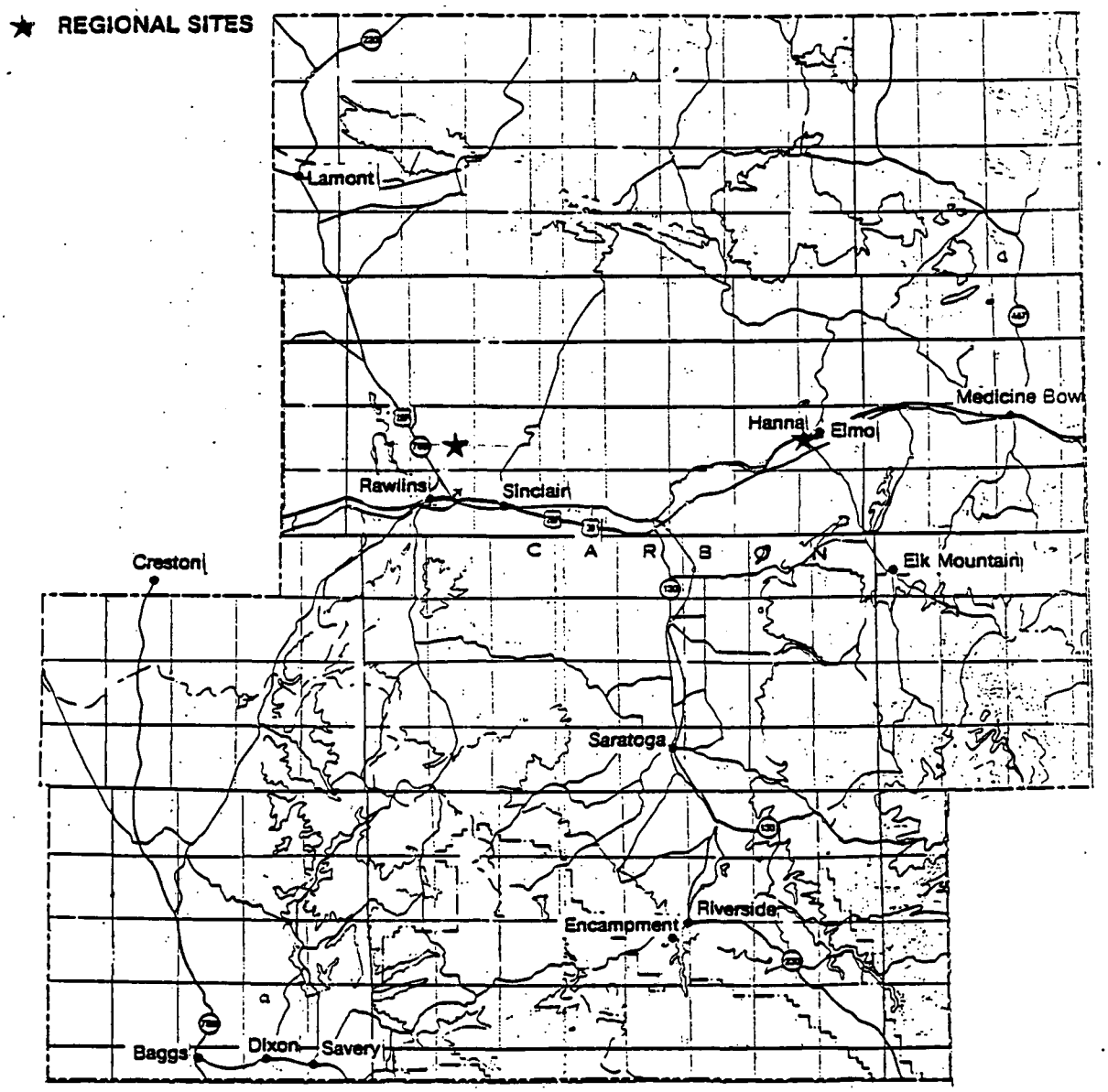
Landfill costs are assumed equivalent to equipment, fuel, and maintenance costs incurred in the first year, with fuel and maintenance costs increased by 12% due to inflation.

During the third operational phase, the District would complete the process of consolidation and phasing out of landfills other than two regional landfills at Rawlins and Hanna (see Figure 8). Additional equipment required would include at least six 40 yard roll-off containers (assuming no compaction).

# FIGURE 8

## REGIONAL LANDFILL SITES

## CARBON COUNTY, WYOMING



Five containers would be stationed at Saratoga and serviced twice weekly for 10 more trips per week. One container would be stationed at Baggs and serviced every other week. Additional fuel costs due to these stations are estimated at $12,480, more than doubling the transfer costs for the second year. Because of the long haul from Baggs to Rawlins, and the waste volume at Saratoga, District staff would carefully evaluate the relative economics of uncompacted transfer, compacted transfer, and maintaining sanitary landfills at Baggs and Saratoga. Based on estimates of sanitary landfill costs, uncompacted transfer would be marginally less expensive in this case, and transfer with compaction would probably be even less expensive. Continuing costs for the District through 1985 are shown in Table 10, assuming 12% inflation annually, and no equipment, such as stationary compacters, used to reduce haul costs. Expenditures for upkeep of roll-off sites and containers were included in operating expenses in Table 10. Fencing of sites might be considered as a means of reducing vandalism and confining disposal to containers.

Annual capital costs would be $47,200, the first year, rising to $67,400 in two years. Operating costs would increase from $56,200 to $148,200 in five years. The change in costs for a direct haul system for rural communities would be an additional $45,000.

Rawlins' landfill costs were not included in Table 10, due to the discrepancy between reported costs and estimates for landfills of that site. The estimating procedures show costs of approximately $85,000 for 1980, or roughly half of reported costs. At $85,000 per year adjusted for 12 per cent annual inflation, 1980 and 1984 costs are, respectively, $213,190 and $356,490. These costs should still be feasible for District operation.

Throughout the entire implementation period, the District must place special emphasis on planned, constructive, and intensive public education. This dialogue should include town governments, local haulers, coal companies, other industries, and as many other elected, appointed, or volunteer civic or municipal organizations as possible. The District must be especially responsive to community concerns about operation economics, to individual requirements and problems, and to the political climate in order to build a strong base of support throughout the community.

TABLE 10

RECOMMENDED SOLID WASTE MANAGEMENT SYSTEM
CARBON COUNTY

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|
| **Capital Costs[1]** | | | | | | |
| Tracked Dozer with Ripper | $ 37,400 | $ 37,400 | $ 37,400 | $ 37,400 | $ 37,400 | $ 37,400 |
| Lo-Boye Trailer & Tractor Rig | 9,800 | 9,800 | 9,800 | 9,800 | 9,800 | 9,800 |
| Tilt-frame Truck | - | 7,800 | 7,800 | 7,800 | 7,800 | 7,800 |
| 12-40 yd. containers @ $3300 ea. | - | 6,500 | 6,500 | 6,500 | 6,500 | 6,500 |
| 6-40 yd. containers @ $3400 ea. | - | - | 3,300 | 3,300 | 3,300 | 3,300 |
| Site preparation and container installation, 8 sites @ $2000 ea. | - | 2,600 | 2,600 | 2,600 | 2,600 | 2,600 |
| Total Capital Costs | $ 47,200 | $ 64,100 | $ 67,400 | $ 67,400 | $ 67,400 | $ 67,400 |
| **Operating Costs[2]** | | | | | | |
| Labor | | | | | | |
| Manager | $ 20,000 | $ 22,000 | $ 24,200 | $ 26,600 | $ 29,300 | $ 32,200 |
| Equipment Opeartor/Foreman | 18,000 | 19,600 | 21,800 | 24,000 | 26,400 | 29,000 |
| Transfer Driver | - | 16,000 | 17,600 | 19,400 | 21,300 | 23,400 |
| Fuel | | | | | | |
| Landfill maintenance | $ 4,000 | $ 4,500 | $ 5,000 | $ 5,600 | $ 6,300 | $ 7,100 |
| Transfer | - | 8,800 | 22,300 | 25,000 | 28,000 | 31,400 |
| Maintenance | | | | | | |
| Sites, Containers | $ 5,200 | $ 5,800 | $ 6,500 | $ 7,300 | $ 8,200 | $ 9,200 |
| Miscellaneous | $ 4,000 | $ 4,500 | $ 5,000 | $ 5,600 | $ 6,300 | $ 7,100 |
| District Office Expenses | 5,000 | 5,600 | 6,300 | 7,000 | 7,900 | 8,800 |
| Total Operating Costs | $ 56,200 | $ 86,800 | $108,700 | $120,500 | $133,700 | $148,200 |
| Total Annual Cost[3] | $103,400 | $150,900 | $176,100 | $187,900 | $201,100 | $215,600 |

[1]Capital Costs have been amortized at 10% over a 10 year period. Years remaining on the capital investment: tracked dozer and Lo-Boye trailer and tractor - 5 years; tilt-frame truck, 12-40 yd. containers, and site preparation - 6 years; 6-40 yd. containers - 7 years.

[2]Operating Costs have been estimated using an annual 10% increase for labor, and a 12% inflation factor for all other categories.

[3]Rawlins landfill costs are not included. See page 52.

The recommended system is compatible with existing social customs in Carbon County. With some cooperation, the system can also be made compatible with existing haulers.

### 3. Financing

Financing options include user fees and charges, ad valorem taxation, or a sales tax. Of the three, the first is politically and socially impractical at this time (not only in Carbon County but throughout the rural West). Based on 1978 revenues, a one mill property tax would yield about $188,600. A half percent sales tax would be $375,470. The decision as to which funding method is best is more political than technical and thus should be left to the County Commissioners and the Board of Directors of the SWMD. It should be noted that the three mills statutory limit for a SWMD as statutorily authorized is apparently independent of and in addition to the 12 mill limit for which the County government is authorized. Thus, both the property tax (for a SWMD only) and the sales tax do not reduce operating funds of the County or the towns, although they do add slightly to the tax burden of the citizens.

### 4. Resource Recovery Potential

Depending on the degree of centralization of waste management obtained by the District, and improvements in waste processing/resource recovery technology, the District should investigate the potential for reducing total costs of the waste management system through some type of resource recovery project (probably energy recovery). This investigation should begin with surveys of potential markets, notably the Sinclair Refinery, and should be updated every one or two years in the case of negative initial results.

## V. APPLICABILITY OF THIS STUDY TO OTHER SITUATIONS

### A. Differences Between the Two Solid Waste Management Plans

Although both of the counties studied in this report can accurately be thought of as rural, low-density areas with many similar problems and characteristics, the recommended solid waste management plans for these counties are different. Therefore, it is important to keep in mind that characteristics and trends must be analyzed in detail before a workable solid waste management plan can be formulated and implemented within a county. Counties which on the surface appear similar may in reality require totally different solutions to their respective waste management problems. There are no "typical" situations nor is there on standardized solution for solid waste problems.

For example, Big Horn County can be characterized as primarily agrarian in nature, with some impact from increased tourism in recent years. The population is settled generally outside of incorporated areas, and is widely dispersed throughout the county. The solid waste system is characterized by many small disposal sites which are convenient to the majority of the dispersed population. In this situation, a collection system designed to continue this convenience is a necessity. Otherwise, those used to this convenience will dump their solid waste illegally into undesignated sites. On the other hand, Carbon County's population, heavily impacted by energy development, is primarily concentrated into population centers. This population is dependent upon several regional landfills for solid waste disposal, and has developed a habit of transporting their waste to these landfills. In this situation, residents in the county don't need a far-ranging elaborate collection system. They instead require upgraded (to RCRA specifications) landfills so that they can continue their current practices.

### B. Use of This Information by Other Counties

Community solid waste management is a complicated science requiring experience, training, and knowledge of the area. With the enactment of RCRA in 1976 and the promulgation of subsequent solid waste management rules and

regulations in 1979 and 1980, waste management must become efficient and environmentally sound. However, there are no easy solutions to most management problems.

Individual communities are finding it extremely difficult to handle solid waste management duties by themselves. With the strict landfill upgrading requirements of RCRA, equipment needs, and rising landfill costs, rural, low-density communities within a specific geographic area are finding that it makes sense to band together into a regionalized waste management system. In the case of Wyoming, the formation of a county-wide district to manage solid waste functions should solve many of the problems facing individual communities. It should be pointed out once more, however, that different situations will require different solutions after the formation of a solid waste district. What is appropriate for one county may not be appropriate for another.

The formation of a district accomplishes several important goals in increasing waste management efficiency and effectiveness. These include:

- sharing of risk among communities;
- sharing of equipment and landfill costs among communities;
- expansion of available management options;
- elimination of duplication; and
- establishment of a sound county-wide financial base.

These are further discussed below.

Risk can be thought of as the chance for encountering loss. In solid waste management, risk can be thought of the uncertain capability of a municipality or other level of government to successfully collect and/or dispose wastes. Through combining the resources of several municipalities into a joint venture, the degree of risk to any single municipality is reduced.

The equipment necessary for convenient and efficient waste management may be inappropriate for any individual community for reasons such as initial cost, lack of waste volume, or unavailability of trained personnel. By joining forces, municipalities can share the money, personnel and other resources to buy, operate and maintain the proper equipment. In this way , the significant economies of scale enjoyed by larger operations can also be taken advantage of by individual smaller communities.

The combined resources of several communities allows for consideration of an expanded number of waste management technological and policy options. For example, a wider range of collection frequency, storage, transportation, processing, and resource recovery options may be applicable to a group of municipalities than to any one individual location. It may also allow for more efficient handling of special (hazardous, hospital, sludge, tires, waste oil, bulky items, etc.) wastes. These options can then be analyzed to determine the best alternative based on local and regional conditions and characteristics.

Without regionalization of waste management systems, several individual communities may be duplicating efforts which would best be accomplished in a joint manner. In addition to the duplication of equipment and personnel previously discussed in this section, a common form of unnecessary duplication in many rural, low-density areas is maintenance of local landfills. The problems of increasing operating costs, environmental concerns, low volumes of waste (no economies of scale), and a complex set of rules and regulations facing many small local landfills may best be solved by the development and designation of regional landfills.

Finally, regionalization allows for an expanded tax base from which to acquire revenues. Additionally, the financing options and credibility of a district are increased through local authority and control and specialization of services.

In summary, the first step to be taken by rural Wyoming communities is the consideration of a county-wide solid waste management district. The district if deemed appropriate would specialize in and be solely responsible for

waste management. This initial step will increase efficiency and effectiveness through the advantages described above. Once the district is established, individual waste management alternatives can be evaluated so that the best option is chosen based on local and regional conditions and characteristics. While there are few universal rules of thumb to aid in the evaluation of these collection and disposal options, the benefits derived from regionalization of solid waste management organization, administration, and implementation should be taken advantage of by Wyoming communities.

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