How to Plan, Design and Finance Small Transfer Stations and Citizens’ Collection Stations

APRIL 14, 2010
Workshop Overview

- Introduction
  - Solid waste problems in rural Texas
  - Defining Citizens’ Collection Stations and Transfer Stations
- Citizens Collection Stations
  - Planning
  - Permitting and site selection
  - Site and facility size
  - Equipment
  - Personnel
- Transfer Stations
  - Planning
- Permitting and site selection
- Types of Transfer Stations
- Site and facility size
- Equipment
- Personnel
- Citizens’ Collection Stations and Transfer Station Considerations
  - Limiting off-site impacts
  - Health and Safety
- Project Financing
  - Finance options
  - Estimating capital and operating costs
Illegal dumping of household wastes has become one of the most challenging public health and safety problems for Texas today.

- In 1993, the U.S. Environmental Protection Agency (US EPA) introduced regulations concerning the safe design, operation and closure of Municipal Solid Waste (MSW) landfills.
- These directives proved to be too costly for many rural landfills, forcing many operations to close.
- MSW management became more expensive and less convenient for rural residents.
Outdoor burning and illegal dumping involve:

- Health hazards
- Aesthetic costs
- Environmental hazards
- Clean-up costs
Illegal Dumping

- The implementation of Citizens’ Collection Stations and Transfer Stations may help to lessen the presence of illegal dumping in rural Texas.
- As a result, costs associated with managing this waste will also be lessened.

<table>
<thead>
<tr>
<th>Local Government</th>
<th>Cleanup</th>
<th>Enforcement</th>
<th>Education and Outreach</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>City of Allen</td>
<td>$135,844</td>
<td>$11,166</td>
<td>$34,030</td>
<td>$181,040</td>
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<td>City of Grand Prairie</td>
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<td>Kaufman County</td>
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<td>$78,867</td>
<td>$91,627</td>
<td>$375,568</td>
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<td>Tarrant County</td>
<td>$198,970</td>
<td>$151,077</td>
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<td>$387,898</td>
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<td><strong>TOTAL</strong></td>
<td><strong>$779,740</strong></td>
<td><strong>$380,174</strong></td>
<td><strong>$228,571</strong></td>
<td><strong>$1,388,485</strong></td>
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</tbody>
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From 2003 NCTCOG Stop Illegal Dumping Cost/Benefit Analysis Study
Defining Transfer Stations and Citizens’ Collection Stations

- According to the Texas Administrative Code (TAC):
  - A Citizens’ Collection Station is “a facility established for the convenience and exclusive use of residents (not commercial or industrial users or collection vehicles).”
  - A Transfer Station is “a facility used for transferring solid waste from collection vehicles to long-haul vehicles (one transportation unit to another transportation unit). It is not a storage facility such as one where individual residents can dispose of their wastes in bulk storage containers that are serviced by collection vehicles.”
Deciding Between a Transfer Station and a Citizens’ Collection Station

<table>
<thead>
<tr>
<th>Citizens’ Collection Station</th>
<th>Transfer Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generally utilized by residents in lieu of curbside collection</td>
<td>Provides financial advantage for Cities facing longer hauling distances</td>
</tr>
<tr>
<td>Provides a cost-effective alternative to illegal dumping for residents</td>
<td>Costs should be less than hauling to landfill directly</td>
</tr>
<tr>
<td></td>
<td>Collection vehicles spend less time driving to/from disposal site and more time on route</td>
</tr>
</tbody>
</table>
Citizens’ Collection Stations
Key Steps for Planning a Citizens’ Collection Station

- Evaluate current waste collection, hauling and disposal practices within and near the jurisdiction
- Delineate the likely service area
- Make estimates of existing and future solid waste collection demand
- Identify likely service zones and plausible citizens’ collection station scenarios
Getting Organized

- Important to assign responsibilities to some individual or group
  - Local government administrator or staff
  - Citizen’s advisory council
  - Interim task force
  - Internal engineering department or contract with private consulting firm
- Open public process is critical for successful implementation of programs
A variety of data will be needed for planning process

**Primary Data** includes data collected from the jurisdiction where the wastes are generated and will be collected

- Waste stream characterization study
- Community survey

**Secondary Data** includes data obtained from published reports and studies but still offers reasonable baseline information

- Regional solid waste survey
- Waste collection or disposal data from nearby jurisdiction
Collecting Data - Primary Data

- An MSW survey is a cost-effective method of collecting primary data

- Survey can allow officials to answer key questions:
  - Are there enough residents interested in this type of service to warrant our going any further with current planning efforts?
  - What are the estimated participation rates for various “pay-as-you-throw” fee rates, or what is an acceptable monthly service payment rate?
  - What are the likely waste generation rates per household type?
  - What is the average maximum distance that residents indicate they would be willing to drive for a CCS?
Collecting Data - Secondary Data

- Primary data should be used whenever possible
- However, MSW surveys may cost more than a community is willing to pay for preliminary planning
- If so, the community must rely on “secondary” data sources
  - Utilize region-specific data when available
  - State and national data should only be used as a last resort
Evaluating Current Waste Collection and Handling Practices

- Identify all public and private waste collection providers
  - Price and convenience of these services will have a major impact on whether customers will utilize CCS
  - Do existing public and/or private waste collection service providers have any service expansions or withdrawal plans?

- Identify all legal MSW landfills and transfer stations
  - Locations, capacities, policies and fees
Defining a Likely Service Area

- Includes everything within the community that is outside the existing solid waste collection providers’ residential service zones

- Some users of voluntary waste hauling will shift to CCS service

- These shifts can be anticipated through:
  - MSW surveys (more precise data, more effort)
  - Town hall meetings (less precise data, less effort)
Estimating Existing and Future Solid Waste Demands

- Estimate current year service area population:
  - Detailed demographic information about member cities from their councils of government
  - United States Census data
  - County tax records (not as useful for areas with a high density of multi-family units)
  - Households added after the most recent census can also be determined using local property tax or utility service data
Estimating Existing and Future Solid Waste Demands

- Estimate service area population in 5 and 10 years:
  - Basic linear trend extrapolation, using historical data for the prior five year period
  - Abnormal increases (perhaps due to an annexation, etc) should be accounted for in analysis
Estimating Existing and Future Solid Waste Demands

- Estimate non-participation rates
  - Non-participation is generally from rural customers who:
    - Are willing to drive to a MSW landfill or contract for waste collection services themselves
    - Prefer to legally burn, dispose or compost their wastes
    - Are still going to illegally dispose of wastes
  - This estimate can be obtained from:
    - An MSW survey
    - Contact with private and/or public waste haulers
Estimating Existing and Future Solid Waste Demands

- Estimate number of CCS facilities necessary
  - Estimate current and future solid waste volumes
  - Consider travel distance for residents (ideally residents would not have to travel more than 3 to 10 miles to dispose of waste)
- Compare needs to available funding to determine number of stations to plan
- Develop service zones, or the geographical area for which the facility is intended to serve, for each CCS
Identifying Likely Service Zones

- When determining the service zone, items to consider include:
  - Concentrations of residents within the service area
  - Proximity to frequently-traveled roads so residents can complete multiple trip tasks including solid waste deposits
  - Location of facilities which will not create nuisance complaints or create hazards
  - Land where other capital costs can be minimized (e.g., existing lighting, fencing, paving, etc.)
Identifying Likely Service Zones

- Site selection may also be driven by waste collection container and hauling approach
  - **Example:** Large container fixed stations (with 40 cubic yard bins and compactors) will serve considerably denser populations or larger spatial areas than a mobile collection trailer (with 12 cubic yard capacity)
  - “Keep it affordable and convenient”
Once the locations of the CCSs have been established, operators must plan for the following:

- Hours of operation
- Collection pick-up frequency
- Storage capacity at various locations
Permitting and Site Selection
Permitting Overview

- The time required to site and permit a CCS can vary considerably depending on the site location.
- TCEQ requires CCS facilities to provide official notification of their operation.
  - CCS facilities are not required by the TCEQ to apply for an operating permit.
- TCEQ Chapter 330, Subchapter A provides overview of the notification process.
Site Selection

Factors to consider when choosing a site:

- Proximity to areas with high population densities
- Distance to landfill or transfer stations
- Visual impacts
- Site zoning, design and size requirements
- Site topography and geometry
- Site access (e.g., type of roadway, line of sight distances)
- Co-location with another facility (e.g., closed landfill or transfer station)
Site Design
Site Design

- CCS site designs can range from basic to advanced.
- Basic CCS sites meet solid waste demands by utilizing cost-effective design principles.
- Advanced CCS designs focus on streamlining the operation and have additional considerations including:
  - Grade separation
  - Traffic flow within the site.
Basic CCS Design
Advanced CCS Design
General CCS Design Factors

- Types of customers and how long it takes each to unload
- Number of vehicles that will use the station and their expected days and hours of arrival
  - Need to design to accommodate peak operations
- Growth in the waste stream over life of transfer station
- Access to external roadways
  - Need for additional supporting infrastructure (i.e.: turning lane from adjacent roadway)
- Stormwater drainage
  - Need for on-site detention or retention ponds
General CCS Design Factors (Continued)

- Parking for staff and citizens
- Staff facilities
  - Heated or unheated
  - Attached bathroom or portable facility
- Construction Materials
  - Gravel, Asphalt or Concrete for surfaces in CCS facility
- Facility security
  - Perimeter fencing, lighting
- Hours of operation
- Aesthetics and landscaping
The types of materials accepted have an impact on the size of the station and type of equipment used. In addition to MSW, CCSs may accept:

- **Brush**
  - Can reduce density of loads, or space required to grind brush
  - Hauling clean brush requires separation from other waste streams

- **Recyclables**
  - Material must be kept separate for other waste streams

- **HHW**
  - Material must be closely monitored to ensure proper storage measures are taken
Designs incorporating grade separation are utilized in more advanced CCS sites

- Allows for ease of disposal for residents
- Separates residential and load-out traffic
- Need to assess existing topography
  - Cut and fill activities represent additional costs
- May present additional safety concerns
  - Installation of handrails
Grade separation can be accomplished through the use of a Z-Wall design.

Z-Walls allow for CCS designers to use available space more efficiently and simplify load-out practices.

Types of Z-Walls include:
- Soldier piles with timber lagging
- Concrete block walls
- Cast-in-place concrete
Soldier Piles with Timber Lagging Z-Wall

Soldier Pile with Timber Lagging Z-Wall, Crow Wing Co, MN
Concrete Block Z-Wall

Concrete Block Z-Wall, Snohomish Co, WA
Cast-In-Place Concrete Z-Wall

Cast-In-Place Concrete Z-Wall, Snohomish Co, WA
Z-Wall Considerations

Other considerations include:

- **Cost**
  - A concrete block wall is considerably cheaper than a cast-in-place wall
  - A soldier pile and timber lagging z-wall varies in price depending on drilling costs for individual site

- **Aesthetics**
  - Generally, a cast-in-place wall is more visually appealing

- **Design**
  - A cast-in-place wall offers more flexibility in design as compared to a concrete block wall where design is limited by dimensions of concrete blocks
  - Furthermore, a cast-in-place wall can be sloped with grading and can be fitted with safety railings more easily
Traffic Flow

- A traffic flow plan helps to retain an acceptable level of safety in sites utilizing grade separation technology.

- Items to consider include:
  - Entrance and Exit treatments (shared or separate)
  - Segregation of residential traffic and load-out vehicles
  - Check - in protocol (if applicable)
  - Traffic overflow capability for peak hours
CCS Traffic Flow: Shared Entrances and Exits
CCS Traffic Flow: Separate Entrances and Exits
Operational Considerations
CCS Equipment

- CCS Equipment can include:
  - Roll-off container
  - Roll-off tractor
  - Stationary compactor
  - Small tractor or skid-steer (Bobcat)
  - Brush grinder (if applicable)
CCS Equipment

- Roll-off bins
- Roll-off truck
- Compactor
- Skid steer (Bobcat)
- Brush grinding equipment
A CCS facility can be staffed or unstaffed

Key benefits associated with having a staffed station include:

- Increased monitoring of site
- Improved control of materials in waste stream
- Increased opportunities for site maintenance
- Opportunity to collect usage fees

As can be expected, additional personnel costs are incurred with a staffed station
Additional costs associated with having a staffed CCS can be managed by limiting operating hours. When limiting operating hours, planners should consider:

- Including some weekend hours (typically most convenient for residents)
- Scheduling early opening or late closing hours during the week to increase the convenience for working residents
- Staggering early opening and late closing times during the week
Personnel Requirements

- The number of personnel used at a station will vary depending on the size of the station and the amount of waste processed.

- Typical positions for staffed facilities include:
  - Oversight/Administration
  - Site Supervisor
  - Site Workers/Laborers
Oversight/Administration

- Typically, this position is filled by either the City’s Solid Waste Director or the Public Utilities Director
- Works under very little direction, direct supervisor for other positions
- Responsible for the overall performance of program, oversees all operations and procedures, identifies areas where improvement is needed
- Represents the program at meetings, hearings, conferences, etc.

Site Supervisor

- Hires, supervises, counsels and instructs station employees, provides routine training when needed
- Oversees and designs all schedules and plans for transfer station
- Identifies and implements methods to improve production
Personnel Requirements

(Continued)

Site Workers/Laborers

- Perform daily tasks
- Clean and maintain CCS and equipment used
- Inspect waste received for any unacceptable materials or items
- Work safely and notify Site Supervisor of any safety hazard observed
- Operate heavy equipment safely and efficiently
- Inspect, clean, service and makes minor repairs to equipment
Specific training requirements for CCS operators are not mandated by TCEQ

- As discussed previously, a CCS can be unstaffed (and therefore without trained personnel)

Some basic training requirements are recommended and include:

- General Human Resources training
- Basic first aid
- Basic fire safety
- Detecting prohibited materials
- Basic recordkeeping
Transfer Stations
Evaluating Need for Transfer Station

Direct haul to landfill vs. long haul via transfer station

- When a city or entity face hauling waste “longer” distances, a transfer station may be a viable option.

- Transfer station costs should be less than the cost of hauling to the landfill directly with collection vehicles (direct haul).

- By using a transfer station, collection vehicles spend less time driving to/from the disposal site and more time on route. Therefore fewer collection vehicles need to be purchased.

- A common “rule of thumb” R. W. Beck uses based on experience with other transfer stations is that a transfer station begins becoming feasible when the travel distance to the landfill is 20-30 miles or more (one way).
Factors that affect financial feasibility include:

- Disposal Cost
- Distance/travel time to landfill
- Fuel Costs
- Annual tonnage hauled
- Payload of transfer trailers vs. collection vehicles

Evaluating Need for Transfer Station (Continued)

Why Consider a Transfer Station?

- Provides flexibility of disposal location
- May be less expensive alternative to hauling long distance to landfill
- Turnaround times for collection vehicles typically shorter
- Typically less wear and tear on collection vehicles
- Can serve as citizens collection station
- Can provide processing point for recyclables or other materials
Permitting and Site Selection
Permitting Overview

- The time required to site and permit a transfer station can vary considerably depending on where the site is located, potential neighbors, etc.

- R. W. Beck would recommend to anyone planning a transfer station to allow ample time for these activities.

- All transfer stations must be permitted, registered, or notification must be provided.

- TCEQ Chapter 330, Subchapter A provides permitting overview.

- TCEQ Chapter 330, Subchapter M provides location restrictions and some counties have siting ordinances.
Only notification is required for “low-volume” transfer station

- Storage capacity of less than 40 cubic yards and located in an unincorporated area

A transfer station can be registered if it meets following criteria:

- Municipality with population < 50,000
- County with population < 85,000
- Facility that transfer < 125 tons per day
- Located within permitted boundaries of Type I or IV landfill
Transfer stations that cannot meet requirements for notification or registration must be permitted.

Primary difference between permitting and registration is that the registration application is not subject to a hearing request or the administrative completeness determinations of TCEQ Chapter 281.
Factors to consider when choosing a site:

- Proximity to waste collection routes
- Distance to landfill
- Visual impacts
- Site zoning, design and size requirements
- Site ordinances
- Proximity to utility tie-ins
- Site topography and geometry
- Site access (e.g., type of roadway, line of sight distances)
- Co-location with another facility (e.g., closed landfill)
Facility siting criteria

<table>
<thead>
<tr>
<th>Exclusionary Criteria</th>
<th>Land Use Criteria</th>
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</thead>
<tbody>
<tr>
<td>• Airport safety</td>
<td>• Parks and open space</td>
</tr>
<tr>
<td>• Floodplains</td>
<td>• Residential land use</td>
</tr>
<tr>
<td>• Groundwater</td>
<td>• Population density</td>
</tr>
<tr>
<td>• Endangered or threatened species</td>
<td>• Protection of key environmental features</td>
</tr>
<tr>
<td>• Wetlands</td>
<td>• Impact on air quality</td>
</tr>
<tr>
<td>• Fault lines</td>
<td>• Impact on the local infrastructure</td>
</tr>
<tr>
<td>• Seismic impact zones</td>
<td>• Proximity to churches, recreation sites, residences and schools</td>
</tr>
</tbody>
</table>

1. Texas Administrative Code (30 TAC §330, Subchapter M)
Site Selection (Continued)

Example Composite of All Unsuitable Areas for County Siting Ordinance
Types of Transfer Stations
Types of Transfer Stations

- The type and size of the transfer station will depend on a number of factors, many of which are covered in this Workbook.

- Aside from operational requirements, the design may be influenced by climate and local policy decisions.

- Transfer stations can typically be categorized into several groups, although one station could be categorized as more than one:
  - Open-top, Surge Pit, Compactor/Precompactor, Baler, Intermodal.
Primary Transfer Stations Types

- **Open Top**
  - Waste is either unloaded directly into trailer below (direct dump) or dumped onto a tipping floor and pushed into trailer below (push load).

- **Surge Pit**
  - Variation of open top transfer station. Waste unloaded into an area below the level of the unloading vehicle. Transfer station equipment then pushes the material into trailer, typically open-top.

- **Compactor/Precompactor**
  - Waste is compacted into a trailer (compactor) or compacted then loaded into trailer (precompactor). Waste is typically loaded into the rear of fully-enclosed trailer.

- **Other (Baler, Intermodal)**
  - For baler transfer stations, loads of waste are baled then placed on a trailer for maximum load density
  - For intermodal, waste is loaded into containers that can be loaded onto rail cars.
  - Both are typically used when hauling long distances.
Open Top (Push Load)

**Application**
- Most common type of transfer station
- Design can be configured for both small and large transfer stations
- Allows for temporary storage of waste on tipping floor
- Examples: City of Killeen, City of Huntsville

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Simple technology</td>
<td>- Needs grade separation for top-loading trailers</td>
</tr>
<tr>
<td>- Lower capital costs</td>
<td>- Customers and floor equipment operating in same area</td>
</tr>
<tr>
<td>- Some storage of waste is available on tipping floor</td>
<td>- Waste is only lightly compacted</td>
</tr>
<tr>
<td>- Easier to inspect waste on tipping floor</td>
<td></td>
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</tbody>
</table>
Open Top (Direct Dump)

**Application**
- Typically for smaller volume transfer stations
- Some push-load facilities also have direct dump capability
- Example: City of Brenham

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Simple technology</td>
<td>Needs grade separation for top-loading trailers</td>
</tr>
<tr>
<td>Lower capital costs</td>
<td>No temporary storage of waste</td>
</tr>
<tr>
<td>No additional equipment needed for</td>
<td>Must always have trailer available for unloading</td>
</tr>
<tr>
<td>pushing waste into trailer</td>
<td>customer waste</td>
</tr>
<tr>
<td>Reduces the handling of waste</td>
<td>Waste is only lightly compacted</td>
</tr>
<tr>
<td></td>
<td>Limited inspection capability</td>
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</table>
Surge Pit

Application

- Most suitable for large transfer stations with uneven flows of incoming waste
- Examples: City of Dallas (Bachman), City of Garland

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term storage of waste</td>
<td>High capital costs</td>
</tr>
<tr>
<td>Bulky items can be broken down, waste compacted</td>
<td>Additional equipment needed to reload waste into transfer trailer</td>
</tr>
<tr>
<td>Simple technology</td>
<td>Fall hazard for people and vehicles</td>
</tr>
<tr>
<td></td>
<td>Larger floor area to maintain</td>
</tr>
</tbody>
</table>
Compactor/Precompactor

Application

- Ideal for transfer stations that need to haul waste long distances
- Examples: Cochise County (AZ), North Texas Municipal Water District

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Compacting produces densely packed loads</td>
<td>- High capital costs</td>
</tr>
<tr>
<td>- Waste can be stored in containers for shipment</td>
<td>- Complex technology</td>
</tr>
<tr>
<td>- Some compactors can be designed so that the need for a bi-level transfer station is eliminated</td>
<td>- Not suitable for all types of waste</td>
</tr>
<tr>
<td></td>
<td>- High energy consumption</td>
</tr>
</tbody>
</table>
Other (Baler, Intermodal)

Application

- Ideal for transfer stations that need to haul waste long distances
- Not commonly used in Texas, mainly found in areas where landfill space is scarce
- Examples: Snohomish County (WA) Airport Road TS, Harlem River TS (NY)

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allows for economical shipment of waste from transfer station over long distances</td>
<td>High capital costs</td>
</tr>
<tr>
<td>Baled waste can be placed in closed trailers or flatbed trailers for shipment</td>
<td>Additional complexity</td>
</tr>
<tr>
<td></td>
<td>Not widely used in Texas</td>
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</tbody>
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Site Design
Factors affecting the design of the transfer station site include:

- Waste stream demands
- Material types accepted
- Customer types
- Other on-site facilities
- Traffic flow within the transfer station
Waste Stream Demands

- To determine the capacity that a transfer station facility must manage:
  - Number of transfer trailers in use
  - Transfer trailer capacity
  - Time required to load transfer trailers
  - Number of vehicles that will use the station and their expected days and hours of arrival (need to design to accommodate peak operations)
  - Growth in the waste stream over life of transfer station
  - Hours of operation
The types of materials accepted have an impact on the size of the station and type of equipment used. In addition to MSW, transfer stations may accept:

- Construction and demolition debris
  - May require “heavier duty” equipment

- Brush
  - Can reduce density of loads, or space require to grind brush
  - Hauling clean brush requires separation from other waste streams

- Recyclables
  - Material must be kept separate for other waste streams
The types of customers serviced at the site will impact the design and operations of the site. Customer types might include:

- Residential and commercial collection vehicles
- Roll-off vehicles
- Residents and small commercial haulers
- Residential and commercial collection vehicles may require taller building and more maneuvering space.
- Roll-off collection vehicles have rear doors that open to the side, potentially requiring wider unloading lanes.

- Residents and small commercial haulers often unload material manually, which occupies an unloading lane for longer periods of time.
Other on-site facilities

- Other activities that may occur at the station (recycling, brush mulching/composting, HHW collection, etc.)

- Support facilities (e.g., vehicle maintenance, fueling station, administration/office space)

- Parking for collection vehicles, transfer tractors/trailers, staff, visitors
Traffic Flow Into and Within TS

- Understanding and accounting for how traffic will flow into, out of, and within the site will impact the size of the station.

- Issues to consider include:
  - Type of access roads and amount of non-station traffic around site
    - May affect how quickly traffic can get into and out of site
  - Queuing space at scale house
    - Need to ensure that peak flows will not result in lines beyond site boundary
  - Queuing space between scale house and building entrance (if applicable)
Items to consider (continued):

- Maneuvering space either within building or outside building
- Unloading lanes wide enough to provide safe distances between vehicles
- Separation between customer types (may require additional space)
- Timing of when customers arrive at the site
Items to consider (continued):

- **Number of scales**
  - One dual purpose scale (inbound/outbound)
  - One or more inbound, one outbound (usually more inbound scales than outbound scales)

- **Transaction processing at scale house**
  - Do drivers have to get out of their vehicles to interact with scale house attendant?
  - Will collection vehicles wait behind small haulers and residents?
  - Storing tare weights for consistent customers (collection vehicles) helps reduce transaction time
  - Radio-frequency identification and other automated systems help reduce transaction time
Transfer Building Design
Design considerations for the transfer building include:

- Wind loading
- Lighting and ventilation
- Sizing and storage
- Expansion capability
- Floor topping
- Green building requirements
Regardless of what type of transfer station is chosen, the size, climate, and location may influence whether the transfer station is an open-air station (with or without a roof), partially enclosed, or fully-enclosed.

- Most transfer stations are at least partially enclosed to help manage windblown litter, dust and odor.

- Fully enclosed transfer stations have additional requirements for internal dust control and heating/ventilation.

- Lighting must also be considered to improve safety and increase operational efficiency.

- Energy efficient lighting systems.
Sizing and storage

- Building size depends partially on the type of transfer station technology utilized
- Other building size considerations include:
  - Need for adequate storage space on tipping floor or pit, if applicable (1/2 day to 3 days is typical)
  - Adequate space for loader maneuvering
Expansion Capability

- Design should account for options to expand
- Ways to accomplish this might include:
  - Expand hauling operation: add transfer trailer, increase operating hours, implement “drop and hook” operation
  - Expand tipping floor for additional storage capacity
  - Add scales or scale house automation (e.g., radio-frequency identification tags)
  - Add/open additional hoppers in top-load facility (preferably without adding lanes). The hoppers may already be in place with the holes covered
  - Add citizen collection station to reduce small hauler traffic within the transfer station
Expansion Capability (Continued)

- Leave sufficient room for improvements to site infrastructure such as:
  - Storm water ponds
  - Buffers between site and adjacent properties
  - Additional internal roads
  - Additional scales
Some floor topping can provide increased durability and longer life between repairs.

<table>
<thead>
<tr>
<th>Material</th>
<th>Comparative Abrasion Resistance</th>
<th>Estimated Life (Years)</th>
<th>Cost Comparison Ratio&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Install and Cure Time (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Weight Concrete</td>
<td>Low</td>
<td>2-3</td>
<td>1.0</td>
<td>9</td>
</tr>
<tr>
<td>Epoxy with Aggregate</td>
<td>Medium</td>
<td>8-10</td>
<td>4.5</td>
<td>7</td>
</tr>
<tr>
<td>Epoxy with Emery Aggregate (1/4-inch depth)</td>
<td>High</td>
<td>4-6</td>
<td>1.6</td>
<td>5</td>
</tr>
<tr>
<td>Concrete with Iron Aggregate</td>
<td>High</td>
<td>10-12</td>
<td>1.6</td>
<td>9</td>
</tr>
<tr>
<td>Polyurethane Concrete with Iron Aggregate</td>
<td>High</td>
<td>10-12</td>
<td>1.6</td>
<td>3</td>
</tr>
<tr>
<td>Epoxy with Emery Aggregate (Full Depth)</td>
<td>High</td>
<td>10-15</td>
<td>4.5</td>
<td>5</td>
</tr>
<tr>
<td>Concrete with Emery Aggregate</td>
<td>Very High</td>
<td>15-20</td>
<td>1.6</td>
<td>9</td>
</tr>
</tbody>
</table>

1) Ratio of costs for specific application. May vary by area and depth of transfer station floor, among other factors.
Green Building Requirements

- Public sector entities are facing increasing pressure to develop new facilities in an environmentally friendly manner.
- Some cities have their own green building programs.
- Some cities have adopted ordinances to require that municipal facilities meet requirements of the Leadership in Energy and Environmental Design (LEED) rating system (examples include Cities of Austin and El Paso).
Equipment
Most common equipment used to manage and load waste within transfer stations include:

- **Wheeled front loaders**
  - Quicker and more maneuverable than tracked loaders
  - Rubber tires produce less wear on floor

- **Tracked loaders**
  - Better for volume reduction before loading into trailers
  - Tracks cause additional wear on floor surfaces (need to maintain thin layer of waste on floor to help reduce wear)
  - More common in surge pit transfer stations
Transfer Station Equipment (continued)

Wheeled Loader

Track Loader

Source: Caterpillar website
In open top (push load) facilities, additional equipment is used to distribute and compact loads. Most common equipment is:

- **Excavators**
  - Can be moved around transfer station for other uses as needed
  - Back-up unit can be brought in when primary unit is being repaired

- **Stationary cranes**
  - Typically less expensive than excavator
  - Dedicated to loading waste (fixed in one location)
Transfer Station Equipment (continued)

Stationary Cranes

Excavator
Other ancillary equipment may include:

- Skid steer (Bobcat)
- Small forklift
- Sweeper
- Brush grinding equipment (if applicable)
Evaluating Transfer Trailer Needs

System Level Decisions vs. Efficiency of Individual Trailers

<table>
<thead>
<tr>
<th>System Level Decisions</th>
<th>Efficiency of Individual Trailers (Life Cycle Costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Type of transfer station system chosen will influence type of transfer trailer needed</td>
<td>Factors to consider:</td>
</tr>
<tr>
<td>- Example: If the transfer station is an intermodal station, typically an open-top</td>
<td>- Purchase price of trailer</td>
</tr>
<tr>
<td>trailer will not be used</td>
<td>- Annual maintenance and repair cost</td>
</tr>
<tr>
<td></td>
<td>- Payload capacity</td>
</tr>
<tr>
<td></td>
<td>- Expected useful life</td>
</tr>
</tbody>
</table>
Types of Trailers

Open Top

- Used for top load facilities
- Can be made of steel or aluminum
- Equipped with tarp to prevent materials from blowing out during transportation
- Maximum waste loads are typically attained with open top trailers made of aluminum
- Can either be straight bottom or “possum belly” style trailers
Types of Trailers (Continued)

Compactor/Precompactor

- Both types are fully enclosed with an full or partial opening in the rear
- Compactor trailers typically made of steel and reinforced, smaller waste payload due to additional weight of trailer
- Precompactor trailers can have less reinforcement and therefore may be lighter weight, potential for larger waste payload
Types of Trailers (Continued)

Aerodynamic

- Smooth sides vs. sheet-and-posts design
- Debatable if increased fuel efficiency offsets additional costs and potential reduced durability
- Optional open airflow tailgate design offers further reduced fuel consumption when the truck is driven empty
- Recent article in *MSW Management* offers additional reference on subject matter

Containers

- Different than transfer trailers
  - Stand alone storage container
  - Often based on ISO shipping containers

- Typically used for intermodal transfer stations
  - Containers are transferred from transfer station to rail yard by transfer vehicles, or directly placed on rail at the transfer station

Source: Waste by Rail, Inc. website
Self-unloading Trailers

- Generally more expensive
- Offers flexibility of hauling to multiple landfills
- May be heavier than other types of trailers (less hauling capacity)

Types
- Full Eject (Hydraulic Ram)
- Dumping
- Live Floor (e.g., Walking Floor®)
Tipper Trailers/Containers

- Typically used with high volume of trailers going to one destination
- Cost of tipper offset by low cost of trailers
- Potential waste payload increase vs. self-unloading trailers
- Need to know how trailers will unload when tipper is down for repair or maintenance
## Aluminum vs. Steel

<table>
<thead>
<tr>
<th></th>
<th>Aluminum</th>
<th>Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Higher</td>
<td>Lower</td>
</tr>
<tr>
<td>Durability</td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Weight</td>
<td>Lower</td>
<td>Higher</td>
</tr>
</tbody>
</table>

### Factors to Consider:
- Distance to landfill
- Types of waste hauled
- Size of trailer
- Price of fuel
- Purchase price of trailer
Transfer Trailer Tarps

- Tarps come in a variety of styles
  - Manually operated or power-operated
  - Single piece or sections
  - Deployed from the side or along length of trailer
- Manual tarps are lower cost, but require more time to deploy - decision may depend on how many loads per day or haul
Transfer Trailer Tarps (continued)

Driver Using Pole to Close Tarp

Source: Mountain Tarps website

Source: Roll-Rite website
Personnel
The number of personnel used at a station will vary greatly based on the style of the transfer station and the amount of waste processed. Typical positions include:

- Oversight/Administration
- Site Supervisor
- Equipment Operators
- Transfer Drivers
- Scale House Attendants / Cashiers
- Laborers
Oversight/Administration

- Typically, this position is filled by either the City’s Solid Waste Director or the Public Utilities Director
- Works under very little direction, direct supervisor for other positions
- Responsible for the overall performance of program, oversees all operations and procedures, identifies areas where improvement is needed
- Represents the program at meetings, hearings, conferences, etc.

Site Supervisor

- Hires, supervises, counsels and instructs transfer station employees, provides routine training when needed
- Oversees and designs all schedules and plans for transfer station
- Identifies and implements methods to improve production
Personnel (Continued)

Transfer Tractor Drivers

- Drives tractor truck from transfer station to landfill and may operate compactor, if applicable
- May act as back-up equipment operator
- Inspects, cleans, maintains and services vehicle
- Detects needed repairs to prevent safety hazards
- Monitors and records mileage by documenting odometer readings before and after driving vehicle

Equipment Operators

- Operates heavy equipment safely and efficiently
- Inspects, cleans, services and makes minor repairs to equipment
- Works with site workers when not operating equipment
- May act as back-up transfer driver
Scale House Attendants / Cashiers

- Weighs vehicles entering the transfer station, records tonnage data
- Responsible for collecting fees, managing payments and recording charges
- Answers questions and handles complaints regarding transfer station
- Works to improve operations by decreasing turnaround times, notifying Site Supervisor of special loads entering station and streamlining work processes

Site Workers / Laborers

- Performs daily tasks as instructed by Site Supervisor or Crew Leader
- Cleans and maintains transfer station and equipment used
- Inspects waste received for any unacceptable materials or items
- Works safely and notifies Site Supervisor of any safety hazard observed
Personnel Training

- Additional personnel at TS facilities allows for the separation of responsibilities and training requirements
- Personnel training requirements include the following:
  - First aid
  - Fire safety
  - Personal protection equipment
  - Haz Comm (Right-to-know)
  - Detecting prohibited materials
  - Emergency action plan
  - Bloodborne pathogens
  - Lock-out/tag-out
  - Heat exhaustion & stroke
  - Recordkeeping & reporting
  - Equipment O&M
  - Litter control
  - Confined space
Waste Hauling Approaches
Waste Hauling

- Waste hauling approaches for transferring waste from the TS to the landfill include:
  - Public services by the jurisdiction using leased or jurisdiction-owned equipment
  - Private services through a contact for services
    - Formal procurement process is recommended to ensure that best value contract is available
    - Transfer station equipment can be leased or owned by either the jurisdiction or the private hauler
## Waste Hauling Approaches - Contracting with Private Hauler

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- May be less susceptible to public interference</td>
<td>- Additional profit margin and administrative costs</td>
</tr>
<tr>
<td>- Competition can increase system efficiency</td>
<td>- Potential for inflated costs due to dependence on one contractor</td>
</tr>
<tr>
<td>- More flexibility in management structure</td>
<td>- Accountability may be lost</td>
</tr>
<tr>
<td>- Can involve less strain on municipal budget</td>
<td>- Lack of qualified contractors may lead to poorer service quality</td>
</tr>
<tr>
<td>- Fiscal and administrative consistency due to contracted amounts</td>
<td></td>
</tr>
<tr>
<td>- Larger firms may be able to obtain unit price advantage</td>
<td></td>
</tr>
</tbody>
</table>

R. W. Beck, Inc.
Private contracting can take several different forms:

- The private sector contractor provides all waste hauling equipment and staffing necessary

- Government purchases all necessary hauling equipment and provides the land and operating staff for the collection stations
Citizens’ Collection Station and Transfer Station Considerations
Both CCSs and TSs follow similar practices regarding:

- Limiting off-site impacts
  - Dust, Odor, Litter, Noise, Visual Impacts

- Health and safety
  - Employee Training
  - Waste Acceptance and Prohibited Material
  - Personal Protection Equipment
  - Safe Work Environment
  - Operations In the Event of an Emergency
Limiting Off-Site Impacts
Limiting Off Site Impacts

- It is important for transfer stations and citizens’ collection stations to be good neighbors

- Potential concerns
  - Dust
  - Odor
  - Litter
  - Noise
  - Visual Impacts
Good Neighbor Policy

- Solid waste transfer stations will receive complaints
  - Always respond in a professional manner
  - Respond promptly to address citizen complaints
  - Keep a log to document efforts
  - Advise appropriate authorities (i.e., your boss) of particularly sensitive complaints
  - Be honest and straightforward about how you will respond
Dust can be a health issue inside the transfer station and a nuisance to neighbors.

- If access roads are unpaved, a water source must be provided to keep dust down.
- Proper ventilation is the appropriate engineering control to protect workers from dust.
- Misting systems can keep dust down.
  - Important to keep misting systems in proper repair.
- Dust may be more of a problem in dry times of year.
- May need to operate a “bag house” to collect dust.
- Adequate buffer can reduce dust complaints.
Neighbors often very sensitive to odors

- Odor control methods
- Keep facility clean and wash floors regularly
- Move waste on a first-in/first-out basis
- Dump “smelly” loads directly into trailers (e.g., packing house waste or grocery store compactors)

- Misting systems can disperse an odor control agent
- Misting system can be at waste handling area and at property boundary
- Adequate buffer can reduce odor complaints
Noise

- Operate machinery correctly
- Make sure operating hours are appropriate for surrounding neighborhoods
- Conduct operations within an enclosed building or use earthen berms to deflect noise
- Do not allow haulers to slam tailgates or drop containers
Visual Impacts

- Pick up litter right away
- Use vegetation to screen operations from surrounding properties
- Conduct operations within a building
- Design facility to “fit in” with surroundings
- Orient operations away from sensitive areas (i.e., away from homes or nearby highways)
- Maintain odor control measures (often, if they can’t smell you, they won’t see you)
Litter

- Daily pick-up litter at facility and on any right away leading to facility and coordinate with DOT efforts
- Post signs notifying haulers of requirement to contain loads
- Use litter fences for wind blown litter
- Move waste into trailers quickly
- Require haulers caught littering to pick-up material
- Charge a higher tip fee for un-tarped loads
Health and Safety
Health and Safety

- Responsibilities for Health and Safety include:
  - Employee Training
  - Waste Acceptance and Prohibited Material
  - Personal Protection Equipment
  - Safe Work Environment
  - Operations In the Event of an Emergency
Responsibility for Health and Safety

- Employers must provide a safe work environment
- Employees are required to comply with safety rules (employer is responsible for enforcing safety rules)
- Facility users must be made aware of safety rules through signs, handouts and clear instructions
- Spirit of cooperation should be encouraged between supervisors, employees and facility users
- Unsafe work conditions should be reported immediately and remedied
Employee Training

- Conduct initial safety orientation and training for new employees before they begin work
  - Facility should have a written health and safety plan
  - Employees should be able to courteously advise facility users of any safety requirements
- Conduct on-going safety meetings monthly (at minimum)

- First Aid
- Fire safety
- Haz Comm (Right-to-know)
- Detecting prohibited materials (and response)
- Recordkeeping
- Personal protection equipment
- Equipment O&M
- Emergency action plans
- Bloodborne pathogens
- Confined space
- Lock-out/tag-out
- Heat exhaustion & stroke
- Reporting
- Litter control
Waste Acceptance and Prohibited Material

- Unloading should be confined to as small an area as possible
- An attendant should monitor incoming loads
- Any prohibited materials should be returned to the transporter or generator
- Attendant must be trained to identify of what is acceptable and what is prohibited
- Need to have procedures for handling prohibited waste

- **Prohibited waste may include:**
  - Hazardous waste
    - Ignitable, corrosive, reactive and toxic
  - Compressed gas cylinders
  - Bulk liquids
  - Freon containing refrigerators and air conditioners
  - Biomedical waste and sharps (needles)
  - Asbestos
  - Any material that may affect compliance
Personal Protection Equipment (PPE)

- Employer must conduct job hazard analysis to determine what PPE is necessary
- PPE should be provided to employee for free
- Employees must be trained on PPE care and use
- OSHA standards for use must be followed
- Typical PPE
  - Boots (steel toe & puncture resistant)
  - Gloves
  - Eye protection
  - Hard hat
  - Visibility vests
  - Hearing protections
Safe Work Environment

- Housekeeping - pick up “trip-and-fall” hazards
- Walking surfaces can be slick from leachate or rain
- Clean tipping floor daily and wash once a week
- Proper safety equipment and machine guarding should be maintained (fix broken doors, handrails, lights, etc.)
- Use signs to instruct to workers and customers
- Make sure to have adequate lighting
- May need dust control and adequate ventilation
- Keeping facility clean promotes a safe attitude
- Conduct daily facility and equipment inspections
Operations in the Event of An Emergency

- Employees must be trained on recognizing and responding to emergencies
- Employees must be trained to know what they can handle and when to evacuate
- Emergency notification procedures - if in doubt call 911
- When evacuating facility, all employees must go to “rallying point”
- Potential emergencies to prepare for include:
  - Fire or explosion
  - Release of gas
  - Chemical spill
  - Diesel or hydraulic spill
  - Customer injury
  - Traffic accident
Site Signage

Comprehensive signage program must consider the following:

- Design fundamentals
  - Inventory
  - Layout/legibility
  - Color schemes
  - Type selection/visual images
  - Uniformity
- Viewing specifications
  - Placement
  - Distance
  - Height
- Signage maintenance plan
Minimum signage should include:

- Facility name
- Tipping fees
- Materials accepted, including recycling
- Prohibited materials
- Hours of operation
- Directions to material drop-off locations within the site (tipping floor, recycling, etc.)
- Locations of alternate disposal sites, if applicable
- Owner and/or operator with contact information
- Emergency phone numbers for fire, police and medical assistance
Project Financing
Project Financing

- Projects can be financed solely by the public sector or private sector, or a combination of the two.
- Publicly owned facilities can often take advantage of lower costs of capital.
- Partnering with the private sector can take advantage of industry expertise to increase the efficiency of operations.
Public private partnership opportunities include:

- Publically owned, privately operated facility (City of Georgetown, City of Houston)
- Publically owned land, privately owned and operated facility (Blanco County)
- Privately owned and operated with a long-term disposal contract with the public entity (El Paso material recovery facility)
- Publically owned and operated transfer station with privately operated hauling operation (City of Killeen)
If a community’s analysis leads to it undertaking some responsibility for infrastructure costs, there are several alternative financing options:

- Pay-as-you-go financing
- Debt financing
- Grant-in-aid financing
- Reserve fund financing
Pay-As-You-Go Financing

- Capital items are purchased out of current year funds as they are available through tax and fee collection.

- When capital expenses exceed spending capacity, the capital items must wait until the following fiscal year for purchase.
**Pay-As-You-Go Financing**

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Avoids the added costs of interest payments</td>
<td>- It is possible that the purchase of very large capital items may be put off indefinitely</td>
</tr>
<tr>
<td>- When capital expenses exceed spending capacity, the capital items must wait until the following fiscal year for purchase</td>
<td>- It could be argued that large capital items with useful lives of several decades should be financed over time so that new or future residents also pay for the benefits they receive</td>
</tr>
<tr>
<td>- This low debt burden may enhance the community’s credit rating</td>
<td></td>
</tr>
</tbody>
</table>
Debt Financing

- Money is borrowed from an outside lender with the promise to return the principal, in addition to an agreed-upon interest percentage.

- A variety of instruments are available which vary based on
  - Terms of maturity (short vs. long term)
  - Basis of repayment (e.g., general obligation and revenue bonds)
### Debt Financing

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- It may be the only way to finance very large capital items in a timely manner</td>
<td>- Increased cost because of interest charges on debt</td>
</tr>
<tr>
<td>- Those who benefit over time for services and facilities will also pay toward their costs</td>
<td>- May impact credit rating or ability to secure future debt</td>
</tr>
</tbody>
</table>
Grants-In-Aid

- Grants-in-aid:
  - Federal or state grants-in-aid can significantly reduce costs
  - Opportunities vary from year to year
  - Funding resources include:
    - *The Catalog of Federal Domestic Assistance* (available in hardcopy at federal libraries and online)
    - TCEQ Regional Solid Waste Grants Program
Reserve Fund Financing

- Reserve Fund Financing is the government equivalent of a savings account for capital item acquisition

  - A portion of current revenues is invested each year in order to accumulate sufficient funds to purchase equipment, land, vehicles or other items

\[
\text{Reserve Fund Total} = \text{Annual Investment} \times (1 + \text{Compound Interest Rate})^{\text{# of Years} - 1}
\]

Compound Interest Rate
Estimating Capital and Annual Operating Costs
Capital and operating costs for a TS can vary considerably and are dependant on site-specific characteristics.

- Small transfer stations (<40,000 tons per year) can have capital costs ranging from $500,000 to $3M.
- Additional costs include the purchase of trailers, transfer tractors and other rolling stock.
- The remaining presentation focuses on the capital and operating costs of CCS facilities.
Estimating Capital and Annual Operating Costs for a CCS

- It is highly recommended that a community develop a cost estimate prior to hiring a construction contractor to create a “benchmark” for comparison
  - Benchmark can be used to determine if the private sector’s bids are excessively high
  - Benchmark can also create a sense of competition among bidders
CCS Facility Expenditures

- Costs to consider include:
  - Capital costs
    - Land costs
    - Waste collection and hauling equipment
  - Operating costs
    - Salaries
    - Equipment maintenance
    - Utilities
    - Fuel costs
CCS Capital Costs

- Capital costs will vary depending on:
  - Site design
  - Regional market for land
  - Regional market for waste collection equipment

- Must consider the impact of the purchase and operation of the equipment in compliance with Texas and federal regulations as some equipment may have restrictions
CCS Capital Costs

- **Land Costs**
  - Price of land varies with land conditions, location and market activity
  - Site preparation costs vary depending on the character and location of the proposed site
    - Costs can be reduced if natural topography allows for a natural trash drop-off point with sufficient grade separation
- **Ground covering treatments include:**
  - Crushed Rock (lowest cost)
  - Asphalt
  - Concrete (highest cost)
Waste Collection and Hauling Equipment

- Includes the purchase of:
  - Dumpsters
  - Roll-off containers
  - Compactors
  - Roll-off trucks

The costs increase as the range of services increase

- For example, if brush grinding is included as part of the CCS services, wood chippers need to be purchased
• Operating costs can include:
  • Salary and fringe for drivers, administrators, collection station attendants
  • Equipment maintenance
  • Utility costs
  • Vehicle operating expenses such as insurance, fuel and contracted service fees
  • Depreciation expenses (if applicable)
    • Based on capital cost of item and effective useful life
Example CCS Budget
Assumptions considered in this CCS budget include:

- **Materials Accepted:** MSW
- **Throughput:** 200 tons of material per month
- **Load-Out Frequency:** 9 times per month per container
- **Equipment Needs:** 4 roll-off containers and 1 stationary compactor
- **Grade Separation:** Poured concrete z-wall
- **Personnel:** Staffed by 1 attendant at $12.50 per hour plus benefits (with 25 percent added to account for back-up)
- **Hauling Distance:** 15 miles
- **Attendant Building:** Pre-fabricated building
- **Disposal Costs:** $25 per ton
### CCS Capital Costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Capital Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Costs</strong></td>
<td></td>
</tr>
<tr>
<td>Cut/Fill for Ramp and Pad</td>
<td>$ 9,000</td>
</tr>
<tr>
<td>General Site Grading</td>
<td>$ 4,000</td>
</tr>
<tr>
<td>Concrete Retaining Wall</td>
<td>$ 30,600</td>
</tr>
<tr>
<td>Concrete Pad for Roll-Off Boxes</td>
<td>$ 7,400</td>
</tr>
<tr>
<td>Gravel Paving for Drives and as Asphalt Base</td>
<td>$ 8,960</td>
</tr>
<tr>
<td>Asphalt Paving</td>
<td>$ 18,225</td>
</tr>
<tr>
<td>Attendant Building and Utilities</td>
<td>$ 8,000</td>
</tr>
<tr>
<td>Concrete Pad for Attendant Building</td>
<td>$ 333</td>
</tr>
<tr>
<td>Chain Link Fence with Gates</td>
<td>$ 20,200</td>
</tr>
<tr>
<td>Pavement Marking</td>
<td>$ 400</td>
</tr>
<tr>
<td>Signage</td>
<td>$ 400</td>
</tr>
<tr>
<td>Erosion &amp; Sediment Control</td>
<td>$ 1,000</td>
</tr>
<tr>
<td>Security Lighting</td>
<td>$ 1,500</td>
</tr>
<tr>
<td><strong>Construction Subtotal</strong></td>
<td>$ 110,018</td>
</tr>
<tr>
<td><strong>Cost of Capital</strong></td>
<td>5 %</td>
</tr>
<tr>
<td><strong>Term (Years)</strong></td>
<td>15</td>
</tr>
<tr>
<td><strong>Annualized Construction Subtotal</strong></td>
<td>$ 10,599</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Capital Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment Costs</strong></td>
<td></td>
</tr>
<tr>
<td>Compactor and Receiving Unit (1)</td>
<td>$ 20,000</td>
</tr>
<tr>
<td>Roll-Offs (4)</td>
<td>$ 14,000</td>
</tr>
<tr>
<td>Small Tractor</td>
<td>$ 60,000</td>
</tr>
<tr>
<td><strong>Equipment Subtotal</strong></td>
<td>$ 94,000</td>
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<tr>
<td><strong>Cost of Capital</strong></td>
<td>5 %</td>
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<tr>
<td><strong>Term (years)</strong></td>
<td>7</td>
</tr>
<tr>
<td><strong>Annualized Equipment Subtotal</strong></td>
<td>$ 16,245</td>
</tr>
</tbody>
</table>

Note: Assumes internal engineering and construction management staff utilized. Additional costs apply if these are outsourced.
### Example CCS Budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capital Expenses</strong></td>
<td></td>
</tr>
<tr>
<td>Annualized Construction Subtotal</td>
<td>$10,599</td>
</tr>
<tr>
<td>Annualized Equipment Subtotal</td>
<td>$16,245</td>
</tr>
<tr>
<td><strong>O&amp;M Expenses</strong></td>
<td></td>
</tr>
<tr>
<td>Hauling Costs</td>
<td>$156,600</td>
</tr>
<tr>
<td>Disposal Costs</td>
<td>$60,000</td>
</tr>
<tr>
<td>Employee Salaries and Benefits</td>
<td>$45,500</td>
</tr>
<tr>
<td>Equipment O&amp;M</td>
<td>$5,000</td>
</tr>
<tr>
<td>Utilities</td>
<td>$10,000</td>
</tr>
<tr>
<td>Other O&amp;M and Site Costs</td>
<td>$10,000</td>
</tr>
<tr>
<td><strong>Annual Expenditures Total</strong></td>
<td>$313,944</td>
</tr>
</tbody>
</table>

- Additional items to consider include:
  - TS Budget would have additional line items
  - Decrease of illegal dumping may help to offset revenue requirement by decreasing associated program expenses
  - $313,944 must be recovered for revenue sources
Revenue Collection
Revenue collection must be considered no matter how effective a community is in minimizing expenses

Options include:

- User fees (pay-as-you-throw programs)
- Monthly waste utility charges
- Rolling costs into a general ad valorem tax levy
- Revenue gained from recyclables (not as predictable)
Revenue Collection Options

- Communities often use a combination of these options
- Some key decisions regarding a balance of these options include
  - Who should pay for rural waste collection and disposal?
  - Is the financing mechanism publicly acceptable?
  - Is the financing mechanism financially feasible?
  - Are the administrative requirements too burdensome?
  - Are the likely impacts of the financing mechanism acceptable?
Revenue Collection Options

Who should pay for rural waste collection and disposal?

- The answer depends, in a large part, on what the community hopes to accomplish with the new facilities
  - If it is simply providing an affordable and convenient alternative waste collection service for rural citizens, then those who utilize the service should pay
  - If the emphasis is to stop or drastically reduce illegal dumping, then the community may want “all” residents to pay for services
Revenue Collection Options

Is the financing mechanism publicly acceptable?

- Some financing approaches may not be able to garner sufficient elected-official support to be viable

- Another factor is whether the public will accept the finance mechanism if it is “voluntary” in nature
  - Counties and other public entities such as river authorities and water districts have the legal authority to require use of solid waste services and to impose general taxation countywide (if they desire)
Revenue Collection Options

Is the financing mechanism financially feasible?

- The funding source should ideally be stable and reliable over time
  - Property taxes and user fees are also susceptible to revenue losses due to economic downturns or rate changes
- Stabilization can be achieved through diversification of revenue sources
- Texas also allows counties to fund solid waste programs as a utility which could collect fees on a monthly basis
Revenue Collection Options

Are the administrative requirements too burdensome?

- Collection of user fees can increase administrative overhead costs

- Each jurisdiction should carefully review the administrative cost burdens associated with various revenue collection options
Are the likely impacts of the financing mechanism acceptable?

- Relates back to “who should pay” and “what is the purpose of your program”
  - Although pay-as-you-throw programs can present an incentive to recycle, they can also increase illegal dumping activities
  - A mandatory tax could be imposed for all residents and a specific user fee could be structured for households that generate more waste
One of the most important factors that shapes a community’s revenue collection decision is the amount of revenue they will expect to generate.

Revenues generated from pay-as-you-throw and monthly utility fees can be calculated as follows:

\[
\text{Revenue} = \text{Participation \%} \times \text{No. of Participants} \times 52 \times \text{Waste Amount} \times \text{Cost}
\]

The percentage of households participating in a voluntary system can be determined using a MSW survey.
Sources

- R. W. Beck staff
  - Scott Pasternak, Karl Hufnagel, David Gregory, Seth Cunningham, Dave Yanke

- External Reference Materials
  - U.S. EPA’s Decision Maker's Guide to Solid Waste Management, Volume II (Chapter 4)

- Other primary and secondary research
Questions?

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