PLANNING AND DESIGNING TRANSFER STATION AND MATERIALS RECOVERY FACILITIES TO SUPPORT ZERO WASTE INITIATIVES

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ABSTRACT

Zero Waste initiatives, which seek to maximize solid waste materials recovery and minimize disposal of materials into landfills (i.e., maximize landfill diversion), are at an all-time high. These days, “Zero Waste” is in the vocabulary of nearly every state, municipality and governmental agency, along with stated goals to increase recycling.

Achieving maximum landfill diversion requires significant commitment and efforts at many levels. Public and private participation, on the parts of individuals as well as businesses, are essential. It is evident that this commitment and these efforts are in place in many locations throughout the U.S., leading to the profound growth in landfill diversion regulations and Zero Waste initiatives.

HISTORY

The Clean Air Act of 1963 and its significant amendments, the creation of the EPA in 1970, and the passage of the Resource Conservation and Recovery Act (RCRA) in 1976 have transformed the solid waste industry.

During the same general time frame as the passage of the original Clean Air Act, the public’s awareness and concern for the environment led to the “Environmental Movement”, a significant, driving political force. Helping launch the Environmental Movement was Rachel Carson’s 1962 New York Time’s bestselling book, *Silent Spring*. Although, not directly related to solid waste, this book opened a previously non-existent public conversation on environmental concerns and the effect human behavior can have on the world we live in.

The next significant event that helped institutionalize the Environment - and make it something policy makers would start (and continue) to pay attention to - was the first Earth Day on April 22, 1970. Earth Day 1970 achieved a rare political alignment, enlisting support from Republicans and Democrats, and people from all walks of life and social persuasion.

The success of this first Earth Day was no doubt an influencing factor leading to the passage of the significant 1970 amendments that strengthened the Clean Air Act. In addition, the Environmental Movement began to gain unprecedented momentum that in a few years would lead to the passage of the RCRA, which included Subtitle D that specifically addressed the design, operations and closure of landfills. As a result of Subtitle D, hundreds of landfills closed rather than comply with Subtitle D requirements.

A consequence of these widespread landfill closures was the perception that the United States was “running out” of landfill capacity. The icon for this publicly perceived “crisis” became the Mobro 4000, a barge that made headlines for hauling more than 3,000 tons of trash from New York to Belize and then back again.

The 1987 Mobro 4000 incident was widely cited by environmentalists and the media as emblematic of the “solid-waste disposal crisis” in the United States due to a shortage of landfill space. It triggered much national public discussion about waste disposal, and has been credited as a contributing factor to recycling rate increases in the late 1980’s and after.

The combination of all of these factors - heightened environmental consciousness, perception of shortage of landfill space, and increased costs for landfill disposal resulting from Subtitle D requirements - prompted many states and municipalities to initiate recycling regulations.

Typically, early recycling programs had modest goals. However, over time, and in response to increased public interest, states and jurisdictions have expanded their recycling goals. Zero Waste initiatives are the latest attempt to capture the public and political will to maximize diversion and recycling.

THE RECYCLING INDUSTRY

Most communities began with simple residential "curbside" recycling programs that included glass bottles, tin and aluminum cans and newspaper. However as the benefits of landfill diversion and recycling became clearer, these programs were expanded over time to add more and more commodities. Another contribution to the growth of recycling was the rise of commodities markets which started to expand and stabilize, creating a demand for materials.

Eventually the practical limits of being able to add more and more compartments on collection vehicles limited any further ability to expand collection services for recyclables. The obvious efficiency of collecting mixed (commingled) recyclable materials created the need to innovate on the processing side. This led to the development of the sophisticated sorting technology that exists today. This current technology has enabled, among other things, "single stream" residential collection and processing to become a reality.

As single stream collection and processing have matured, the amount of targeted materials diverted from landfills has risen significantly. Many municipalities have adequate collection and processing for source separated recyclable materials from residential and sometimes commercial sources. However, the amount of these materials generated by the residential sector is generally limited to approximately 20% of the total waste stream.

Many other materials that have intrinsic value cannot be processed in a single stream or other type of conventional materials recovery facility. As a result, other strategies and processes for diverting these additional materials from landfills have become common.

Strategies that have gained momentum include: accepting food waste for composting; processing commercial waste to recover recyclables in a mixed waste ("dirty") MRF; improved specialty MRF's for increased recovery of C&D materials; and preparation of feedstock for energy-from-waste conversion technologies.

THE ROLE OF THE TRANSFER STATION

As landfills closed and population grew rapidly starting in the 1960's, transfer stations became vital components of many solid waste systems.

Early transfer stations were designed strictly to receive waste from collection trucks and self haulers and then transfer that waste to larger vehicles for transportation to landfills.

The tipping floor area required for the simple dump and load operation was comparatively small, and early transfer stations were often designed for "direct dump" or had receiving pits to facilitate the dumping process.

The majority of these early transfer stations have served their communities or businesses well for many years. However, as population has continued to increase, demand for more transfer station space has increased proportionately. Adding to this is the need to incorporate additional space to handle waste material unloading and staging from many different types of generators.

In addition, the most strategic locations for additional recovery processes are often transfer stations. A large portion of non-residential source-separated materials are collected and taken to transfer stations, in many cases destined for disposal into landfills. Placing operations to recover those materials at the location where they are already received is often the most efficient and cost-effective solution.

Adding processes and services at an existing transfer station enables the operator to more highly utilize existing infrastructure and staff. For instance, source separation is effective in diverting certain waste stream portions, including C&D, green waste and food waste. When these materials are received at transfer stations, segregating and staging them require tipping floor space that may already exist and the existing loading equipment, staff and infrastructure can be utilized to transfer them to recyclers or to energy conversion facilities.

Fortunately, many transfer stations have adequate site space to accommodate expansion if needed. In addition, recovery operations can typically be added within the limits of existing facility operating permits or with minor permitting revisions, whereas permitting a new facility could be lengthy and costly.

On the negative side, as operations and services need to be added, existing transfer stations are often too small and improperly configured to accommodate the necessary operational changes. The archaic direct dump and pit designs are especially ineffective and unsafe for added recovery operations.

Achieving maximum diversion typically requires providing additional public services including convenient and safe recycling and household hazardous waste drop-off centers. While these services are typically not conducted within transfer stations, they are often located at transfer station sites, further complicating site traffic flow and safety.

CONCLUSIONS

Zero Waste initiatives and the desire to recycle are here to stay. As jurisdictions continue to develop new policies and strategies for recycling more materials, additional tipping floor space and improved operational flow will become essential.

To meet the demands, transfer stations will no longer be single-purpose facilities and will need to transform into multi-functional solid waste processing facilities. This situation is exaggerated for municipalities that have adopted Zero Waste initiatives.

As a result, many municipalities have been or will be forced to modify, expand or add new facilities to meet their needs. The ability to successfully modify existing transfer and recovery facilities will significantly affect how much of the total waste stream can be diverted and recycled and the ultimate success of Zero Waste initiatives.

CASE STUDIES

This paper discusses three examples of existing solid waste processing facilities that have undergone transformation or have developed a Master Site Plan and capital improvement schedule. In all three cases, the objectives have been to undergo transformation in order to provide additional operations to achieve increased landfill diversion goals and to move their communities toward achieving Zero Waste initiatives.

The knowledge gained from these experiences will hopefully provide a model for planning and designing facilities that are necessary to make progress towards achieving a Zero Waste initiative. The goal is to provide insight and strategies transferable to operators facing similar challenges to help them transform their existing transfer stations to meet their future solid waste processing needs related to Zero Waste initiatives.

Case Study #1
Shoreway Center for the Environment, South Bayside Waste Management Authority, San Carlos, CA (SBWMA)

Background: SBWMA operates as a special district responsible for managing recycling and solid waste services for 12 jurisdictions in San Francisco. Established in 1982, SBWMA has continued to develop a solid waste system that progressively responds to public demand and new regulations to promote more diversion from landfills.

Built in 1982 the original transfer station is situated on a 10 acre site located halfway between San Francisco and San Jose. Prior to the improvements discussed herein, the Transfer Station was a 58,000 sq ft building that included a large commercial tipping floor, a small self-haul tipping area, and four loading ports. In the early 90's SBWMA started collection services for recyclables and yard waste for residents in each of its member jurisdictions. These services consisted of dual-stream collection (separate compartments for fibers and containers) and yard waste on a bi-weekly basis. To process the dual stream recyclables, equipment was installed in an existing 48,000 sq ft building adjacent to the transfer station site. As SBWMA continued to add programs, new operations were added to the site. This included a public drop-off for recyclables, an e-waste drop off and an area for segregated construction debris.

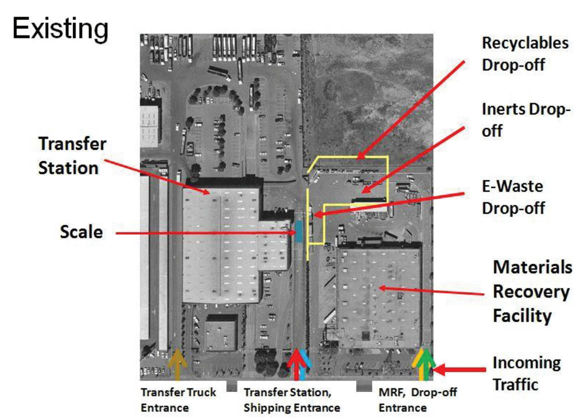

FIGURE 1. EXISTING SBWMA FACILITIES

The primary access road to the inbound scale was located between the two operations, requiring all traffic to use one access road. Both commercial collection and general public vehicles travelled in two lanes to one scale house. The single entrance in the middle of the site caused several undesirable traffic and circulation conflicts that created some significant safety problems and operational inefficiencies. The situation was aggravated by the fact that many new services were added that increased customer traffic.

In 2005, with the goal of increasing participation and therefore recovery/diversion, the Authority made the decision to convert to single-stream collection. This, in turn, created the need to convert the MRF to single-stream processing. The new processing system would need to be designed for an anticipated increase in volume plus the ability to process clean commercial materials. As a result, substantial changes to the MRF would be required.

The Authority also wanted to enlarge the self-haul tipping floor because its small size created an unsafe and inefficient operation that provided little opportunity for recovery of self-haul materials. This need for a significant capital improvement presented a fortuitous opportunity to consider other pressing needs, such as overall operational efficiency, employee and customer safety, more efficient traffic circulation, and better material handling.

In order to satisfy its commitment to its community as a center for environmental education and a symbol of waste reduction, recycling, and improving our environment as a way of life the Authority sought to construct an educational center with viewing gallery and to gain as a minimum, LEED Silver certification.

Completed Improvement: The existing MRF building was demolished and replaced with a new 71,000 sq ft MRF building. This size and configuration provided sufficient building area for the proposed single-stream and clean commercial MRF system, including staging for the increased volume of collected materials.

1. **New MRF**
   Increased processing efficiency
2. **Expanded Transfer Station**
   Increased public access
3. **Education Center**
   Public learning resource, viewing areas
4. **Scale Plaza**
   Increased capacity
5. **Public Recycling Center**
   More convenient access
6. **New Bridge Access**
   Provides new access for commercial vehicles
7. **New Visitor Parking**
   Welcoming amenity

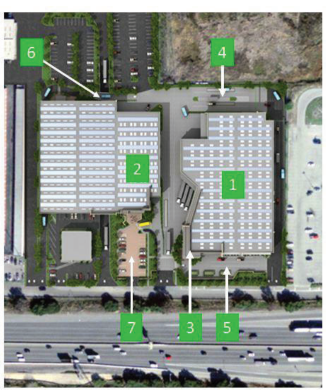

FIGURE 2. NEW S.E.C. FACILITY

The existing 12,000 sq ft self-haul portion of the Transfer Station building was removed and replaced with a 21,000 sq ft building addition. This increased building area doubled the number of unloading stalls from six to 12 and provided a significant increase in material staging capacity. In addition, customer safety and the ability to recover self-haul materials were significantly increased.

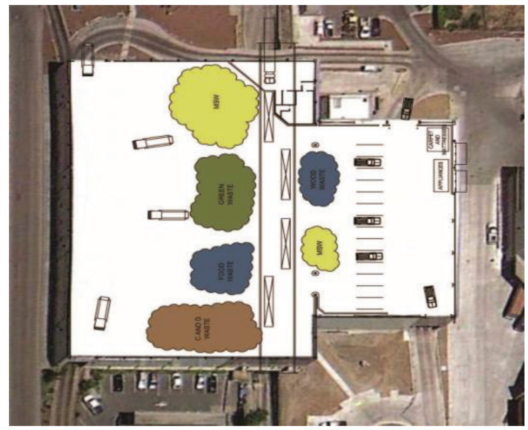

FIGURE 3. NEW TRANSFER STATION FLOOR PLAN

Other improvements include a relocated recyclables and E-waste drop-off in front of the MRF near the street – another significant increase in customer safety as well as convenience. As a result, those customers using only these services will not need to drive to the back of the site, thus eliminating unnecessary traffic and congestion.

A new Education and Environmental Center was also provided for the Authority to conduct tours and provide educational events for schools or other civic organizations. In addition, satisfying the Authority's commitment that the facility serve as a symbol of environmental soundness, the facility received LEED Gold certification.

Diversion Data: The improved facility and new processing system has produced the following increases in recovery/diversion:

- Converting to single stream residential collection resulted in a 29.5% increase in recyclables that were processed in the new MRF.
- Weekly residential pickup of organics resulted in 29.4% increase in recoverable materials over the previous year.

- Additional floor space provided by the transfer station expansion resulted in an additional recovery of wood, metals, OCC and used carpets from C/D waste.

The following is a comparison of the amount of materials recovered between the original and the improved facilities:

Waste/ Stream	**2006**	**2011-12**
Residential SS	32,000 tpy	41,000 tpy
Organics (green + food wastes)	88,000 tpy	102,000 tpy
C/D waste	18,300 tpy	38,200 tpy
Total	138,300 tpy	181,200 tpy

In summary, after one full year of operating the new Shoreway Environmental Center, SBWMA has increased recycling by 31% or about 43,000 tpy. The Authority expects this number to increase as new programs and services mature.

FIGURE 4. NEW S.E.C. MRF AND EDUCATION CENTER

Case Study #2
Tacoma Recycling and Transfer Station, City of Tacoma, WA

Background: The City of Tacoma provides a full range of solid waste services. For many years this included operating a landfill centrally located on a 200-acre parcel within the City limits. In 1990 they opened a large public drop-off center for recyclable materials at the entrance to the landfill. Although the City provided full collection services, they also had a program whereby residences and businesses could dump at the landfill at reduced rates. Because of the large amount of self-haul customers using the landfill, the City constructed two small direct-dump transfer stations at the landfill. Customers could unload waste directly into trailers that would transport the waste to the landfill working face.

In the early 1990's in an effort to preserve landfill space and to recover energy from waste, the City constructed a plant to make refuse derived fuel (RDF). The RDF would be burned in the City-owned Municipal Light Utility Plant. The RDF plant accepted primarily residential wastes and turned them into a fluff RDF. Recognizing that in the near future they may need to haul waste to disposal sites outside the region, the City constructed a 15,000 sq ft transfer station for transporting City-collected municipal waste to select disposal sites. Curbside recyclables were collected and delivered to a privately owned and operated MRF. In 1999, the City discontinued operation of the RDF plant.

As the City continued transitioning from operating its own landfill and began transporting more materials off site, the different buildings on the site were modified for the various operations. A compactor was added to the transfer station. The RDF building was used to receive and grind yard debris and wood waste, and the public transfer stations were provided sufficient unloading stalls for self haulers. This material was then taken to the larger transfer station to be compacted and transported to distant landfills.

The Tacoma Recycling and Transfer Station receives and transfers approximately 215,000 tons per year. Population growth, increased services and the need to increase operational efficiency prompted the need for additional transfer station capacity. To satisfy this need, the City initially intended to build a small addition to their existing transfer station.

FIGURE 5. TACOMA SOLID WASTE FACILITIES 2009

The City's waste composition identified the potential to recover significant quantities of materials from three waste streams:

- Self Haul –75,000 TPY received. Of that amount, it was determined that:
    - 28,000 TPY were recoverable (wood, OCC, metals, plastic, etc.)
    - 6,000 TPY of organic materials were compostable
- Commercial compactors – 30,000 TPY received. Of that amount, it was determined that:
    - 4,500 TPY were recoverable
    - 5,400 TPY were compostable
- Roll-off bins– 36,500 TPY received. Of that amount, it was determined that:
    - 20,000 TPY were recoverable
    - 2,600 TPY were compostable

After examining these different waste streams, the City determined that at least 10% of the incoming materials (approximately 20,000 TPY) could be recovered with minimal floor sorting efforts. In addition, long-term increases could be realized with the installation of mechanized sorting equipment.

As a result of this analysis, the City decided to build a new, larger transfer station to provide space to stage and recover materials and provide for a future processing system. The larger building would allow the City to consolidate and improve operations, reducing the need to double handle materials and optimizing the labor force.

Completed Improvements: The new Tacoma Recycling and Transfer Station is a 75,000 sq ft building and provides eight commercial and 18 self-haul unloading stalls plus a significant material staging capacity. The larger tip floor area provides space for spotters to screen customer loads and direct those that contain larger quantities of recyclable materials to an area for floor sorters to recover. In addition, space is available for a future C&D/mixed waste processing line.

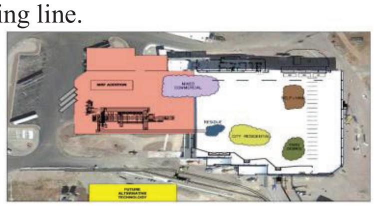

FIGURE 6. TRTS FLOOR PLAN & FUTURE MRF

Diversion Data: Since operating the new facility, the City has recognized the potential to recover large amounts of wood, metal and other recyclables. To date they have begun to recover materials from the tip floor under a pilot project approach and are currently evaluating the best methods to increase recovery including new equipment.

FIGURE 7. NEW TRANSFER STATION FACILITY

Case Study #3
Redding Transfer and Recycling Facility, City of Redding, CA

Background: The Redding Transfer and Recycling Facility (RTRS) was constructed in 1996 and receives, processes and transfers approximately 110,000 tons per year, broken down as follows:

- Source-separated residential single-stream recyclables – 12,000 TPY
- Residential yard waste for composting – 16,000 TPY
- MSW received and transferred to landfill – 80,000 TPY
- HHW, Miscellaneous – 2,000 TPY

The facility has been adequate to handle the needs of the City for the past 15 years. However, due to a number of factors, including higher waste volumes, increased public usage, new programs and additional services, the City was slowly outgrowing the facilities as designed.

Problematic and inefficient operations included:

- Insufficient tipping floor space for maneuvering and unloading of commercial and self-haul vehicles for peak times.
- Insufficient queuing for public drop-off of recyclables and household hazardous waste.

- Insufficient tipping/staging area for MRF infeed.
- Insufficient bale storage and shipping dock.

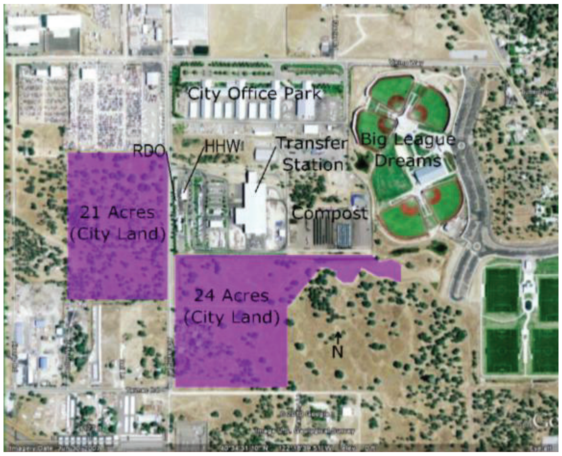

FIGURE 8. EXISTING RTRS

As the City contemplated making investments in the facility, they decided to prepare a Master Site Plan and Capital Improvement Plan for needed improvements to address current deficiencies as well as provide for additional future services and expansion. This included increase receiving and processing capability and adding new recycling services.

Planned Improvements: To achieve the targeted operational increases, the following improvements are planned:

- Construct a new hauling yard on the 10-acre City parcel across from the RTRS facility.
- Construct a 5,100 sq ft addition to the tipping floor to provide for additional unloading and transfer capabilities.
- Construct a 12,500 sq ft addition to the tipping floor to provide additional receiving and staging for incoming recyclable materials to the MRF processing system.
- Construct a 5,500 sq ft extension to the bale storage area and add a truck dock.
- Construct a new public drop-off area, including areas for recyclables, HHW and a re-use center in the area previously used for collection truck parking .
- Install new equipment for both single stream and commercial waste processing
- Provide an area for a future alternative technology project.

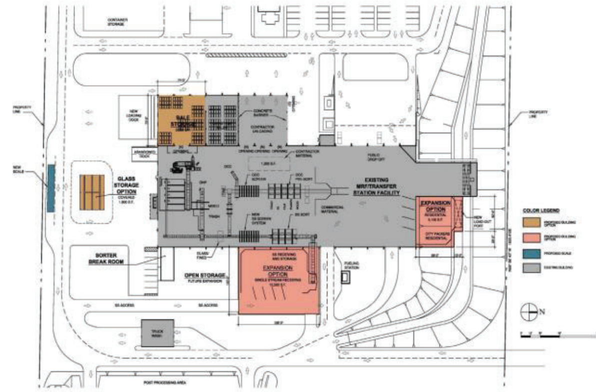

FIGURE 9. REDDING FACILITY MASTER PLAN

Diversion Data: The planned improvements to the facility and processing system are projected to produce the following increases in recovery/diversion:

- 3,800 TPY from C&D waste stream
- 10,000 TPY from commercial waste stream
- 6,000 TPY from self-haul waste stream
- 5,600 TPY of food and green waste

The total projected increase in diversion is 25,400 TPY, or 23% of the total waste stream. Since the City landfill has only about 20 years of remaining capacity the site master plan also shows where a future alternative technology could be constructed.