

**BIOSOLIDS PROCESSING CHANGES TAKE
'CONVENTIONAL' WISDOM**

CITY OF LONGMONT, COLORADO

Cal Youngberg, P.E., Water Resources and Environmental Services Manager
Grant Grover, Environmental Project Specialist

ROTHBERG, TAMBURINI AND WINSOR, INC

José Velazquez, P.E., D.E.E. Project Manager
1576 Sherman Street, # 100
Denver, Colorado 80302

ABSTRACT

Over the last few years, the City of Longmont, Colorado wastewater treatment plant (WWTP) has undergone significant changes. Prior to 2002, the WWTP used primary treatment and trickling filter/solids contact with nitrifying trickling filters for the liquid process train and a two-pronged approach to biosolids management. The solids generated in the TF/SC process City's were typically mixed and digested anaerobically, with a significant portion of the primary solids diverted to dewatering and composting at the City-owned aerated static pile facility. They operated a successful Class B, liquid land application program and produced a Class A compost that was used by the City and its citizens. By 2004, the liquid treatment process was converted to an activated sludge system; the compost facility was out of use, replaced by privatized hauling and composting; and the waste secondary solids were anaerobically digested and land-applied by a private operator.

A study of biosolids handling, treatment and reuse alternatives was undertaken for several reasons. First, the liquid stream process had increased biological solids production significantly. Also, the characteristics of the solids changed with the addition of activated sludge. Second, some of the structures currently in use date to the 1950's. Equipment age varies from process to process; however, the City was concerned about the remaining service life, operational capabilities, and overall effectiveness of these items. The operating costs and potential for odor issues in the solids handling system had increased. Finally, the City wants to strive to produce a biosolids product that is of the highest quality and meets all regulatory requirements, can be safely and effectively reused, and represents a resource to the community.

The study addressed not only the technical options available to the City, but also, a market assessment for various products, the perception of the costs of operating a Class A compost facility, and the operational complexity of all systems. This paper will discuss the wide range of alternatives evaluated for upgrading the solids processing facilities at the Longmont WWTP, which included solids thickening, dewatering, aerobic digestion, anaerobic digestion, both conventional mesophilic and temperature/process phased systems; digester pretreatment; chemical stabilization; thermal drying; and various product distribution options. The recommendations and current implementation plan include conventional anaerobic digestion to allow a robust agricultural land application

program. Redundancy and flexibility have been designed in using both technical solutions and management alternatives. Equipment and facilities have back up systems, and the privatized composting option is being maintained. In today's biosolids world, as high-rate, sophisticated treatment processes such as thermal drying and advanced digestion are being used, we will address how the decision making process led to application of the tried and true mesophilic digestion process. The recommendations of the study and current design efforts under way include construction of a single, new mesophilic, anaerobic digester and supporting equipment.

KEYWORDS

Biosolids Management Planning, Master Planning, Thickening, Dewatering, Stabilization, Anaerobic Digestion, Class A Processes, Water Plant Residuals, Product Marketing

OVERVIEW

A study of biosolids handling, treatment and reuse alternatives was undertaken for the City of Longmont, CO for several reasons. First, the liquid stream treatment process had increased biological solids production significantly. Also, the characteristics of the solids changed with the addition of activated sludge. Second, some of the structures in use date to the 1950's. Equipment age varies from process to process; however, the City was concerned about the remaining service life, operational capabilities, and overall effectiveness of these items. The operating costs and potential for odor issues in the solids handling system had increased. Third, the City wished to evaluate if the wastewater facility could accept and process residuals from their water treatment plant(s). Finally, the City strives to produce a biosolids product that is of the highest quality and meets all regulatory requirements, can be safely and effectively reused, and represents a resource to the community.

The study addressed not only the technical options available to the City, but also, a market assessment for various products, the perception of the costs of operating a Class A compost facility, and the operational complexity of all systems. This summary addresses the wide range of alternatives evaluated for upgrading the solids processing facilities at the Longmont WWTP, which included solids thickening, dewatering, aerobic digestion, anaerobic digestion, both conventional mesophilic and temperature/process phased systems; digester pretreatment; chemical stabilization; thermal drying; and various product distribution options.

The recommendations and current implementation plan include conventional anaerobic digestion to allow a robust agricultural land application program. Redundancy and flexibility have been designed in using both technical solutions and management alternatives. Equipment and facilities have back up systems, and the privatized composting option is being maintained. In the future, thermal processing or some other Class A process may be added, depending on regulatory and market drivers. In today's biosolids world, as high-rate, sophisticated treatment processes such as thermal drying and advanced digestion are being used, we will address how the decision making process

led to application of the tried and true mesophilic digestion process. The recommendations of the study and current design efforts under way include construction of a single, new mesophilic, anaerobic digester and supporting equipment.

EXISTING CONDITIONS

The Longmont Wastewater Treatment Plant (WWTP) has a capacity of 14 mgd and employs preliminary treatment, primary clarifiers, activated sludge secondary treatment, nitrifying trickling filters for ammonia removal, and effluent disinfection using ultraviolet radiation. Solids produced at the facility are treated in several physical and biological processes to reduce the volume of material handled, control pathogens, reduce potential for odor production, and to eventually create a reusable product that is beneficial to the City and to the environment. The biosolids processing facilities at the existing plant are summarized in Table 1.

Table 1 Existing Solids Handling Facilities

Unit Process	Condition
Gravity Thickening	The older thickener has been reconditioned. The newer unit was built in 1992. Both units are in good condition.
Dissolved Air Flotation	Constructed in 2003. Unit in excellent condition.
Belt Filter Press Dewatering	The dewatering building was constructed in 1992. Structure is in good condition. One press has been in service since ~1985. The other since 1992. This equipment is in fair condition.
Anaerobic Digestion	Both digesters are from the original construction in the mid-50's. The equipment (mixing, heating, covers) has been recently updated, although one cover once experienced structural failure. This was repaired in 2005. Overall digesters are in poor to fair condition.
Biosolids Storage	Constructed in 2003. Facility is in excellent condition.
Biosolids Composting	Constructed in 1992, taken out of service in 2004 due to operational considerations. Facility is in good condition.

FUTURE CONDITIONS

Solids production for future conditions were estimated using flow and loading projections, solids yields from the new wastewater process, and potential for accepting water treatment residuals from one of the City's water treatment plants (WTP).

Solids production estimates used in the analysis of various alternatives are summarized in Table 2. These estimates are for the raw, unprocessed solids from the primary treatment system (clarifiers) and the activated sludge process (waste activated sludge [WAS]), assuming that water plant solids are processed separately.

Table 2 Current and Projected Plant Flow and Solids Production

Parameter	Current		Build out - 2022	
	Average	Max. Month	Average	Max. Month
Influent flow, MGD	8.16	9.27	14.0	17.0
Primary solids production, lbs/day	6,300	7,200	7,100	8,900
WAS production, lbs/day	9,100	9,900	9,300	11,600
Total Solids Production (Dry tons/day)	7.7	8.6	8.2	10.3

The quality of the solids produced from the existing process, in terms of regulated constituents such as: arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, and zinc, is very high. The actual concentration of these constituents is approximately 3 to 10 times lower than the limit.

If water plant solids are sent to the treatment plant via the existing sewer system, the production of primary solids would increase by approximately 2,200 pounds per day. However, since the water treatment plant (WTP) is operated only during the summer, then this load would only have to be treated during approximately four months (June through September).

EVALUATION OF ALTERNATIVES

A two-step process was used to develop, screen and evaluate processes. First, the range of available options for thickening, dewatering, stabilization and producing a high-quality end-product was developed. This large number of processes was discussed at a workshop with the city staff and consultant. Concurrently, a set of evaluation criteria were developed to address both economic and non-monetary concerns. Using a workshop approach involving the City and Consultant, some processes were screened from further consideration, based on such factors as lack of operating experience, incompatibility with liquid stream processes currently used, and obviously high capital or operating costs. A second, more detailed screening was then performed that included capital and operating cost estimates, preliminary facilities layouts, and a reassessment of non-monetary concerns, including how the end-product could be used.

Figures 1 and 2 show the range of alternatives processes that were considered for the study. Through the screening process, these unit processes were developed into full process trains and then evaluated in greater detail.

THICKENING/DEWATERING

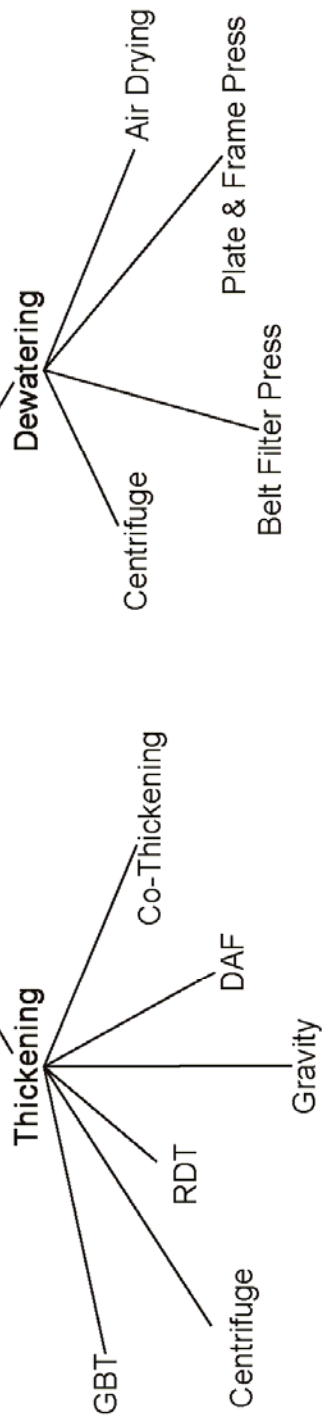


Figure 1 - Thickening & Dewatering Processes

SOLIDS STABILIZATION

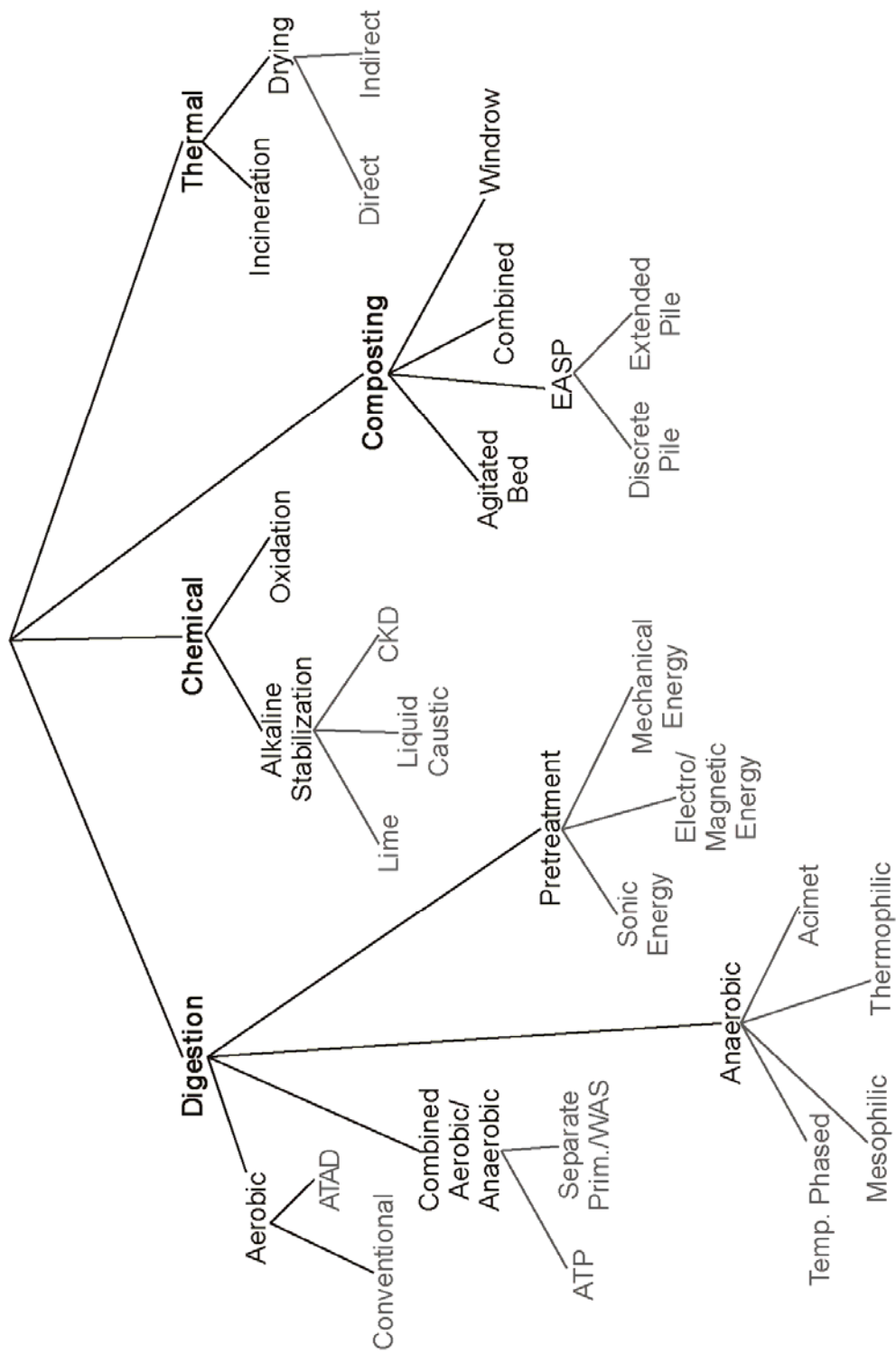


Figure 2 - Stabilization Processes

A present worth and unit cost summary for the range of alternatives considered in greater detail is presented in Table 3 on the following table.

Table 3 Combined Ranking Summary

Ranking @ 70% Non-monetary/ 30% Monetary	Ranking @ 50% Non-monetary/ 50% Monetary	Ranking at 30 % Non-monetary/ 70% Monetary	Estimated Present Worth (\$ 1000's)
Thickening			
1. RDT 2. GBT 3. DAF	1. DAF 2. GBT 3. RDT	1. DAF 2. GBT 3. RDT	Additional DAF: \$2,586 New GBT: \$3,304 New RDT: \$3,450
Dewatering			
1. BFP 2. Centrifuge	1. BFP 2. Centrifuge	1. BFP 2. Centrifuge	Centrifuges: \$ 5,720 BFP: \$ 3,073
Digestion			
1. Conv. Anaerobic External Mix 2. Conv. Anaerobic Internal Mix 3. Egg-Shaped Anaerobic 4. TPAD	1. Conv. Anaerobic External Mix 2. Conv. Anaerobic Internal Mix 3. Egg-Shaped Anaerobic 4. TPAD	1. Conv. Anaerobic External Mix 2. Conv. Anaerobic Internal Mix 3. Egg-Shaped Anaerobic 4. TPAD	Conv. Anaerobic External Mix: \$4,912 Conv. Anaerobic Internal Mix: \$5,151 TPAD: \$5,825 Egg-shaped Anaerobic: \$6,538
PFRP Processes			
1. Direct Drying 2. Indirect Drying 3. Agitated Bed Compost 4. ASP Compost	1. Direct Drying 2. Indirect Drying 3. Agitated Bed Compost 4. ASP Compost	1. Direct Drying 2. Indirect Drying 3. Agitated Bed Compost 4. ASP Compost	Direct Drying: \$10,751 Indirect Drying: \$10,818 Agitated Bed: \$15,815 ASP: \$16,420

PHASED IMPLEMENTATION PLAN

The recommended plan includes immediate implementation of the anaerobic digestion improvements. There are several implementation options for the City of Longmont to consider. Given the many other demands on available capital funds at the City, a phased approach to implementation of the selected management plan is recommended. The most cost-effective “first step” is to proceed with digestion improvements. Subsequent projects should include thickening and dewatering, with the ultimate system to produce a high-quality, highly-marketable product, such as dried pellets or compost to follow. Table 4 presents a summary of these costs and timing of the improvements. Table 5 presents the design criteria and recommended sizing for these systems

Table 4 Summary of Recommendations

Recommended Process	Capital Cost (1000\$)	Priority	Approximate Implementation Date
Thickening: Add one new DAF	1,193	Second	2008
Dewatering: Replace existing older BFP with new unit.	694	Second	2010
Digestion: Install new conventional anaerobic digesters.	3,589 (both units)	First	2006 or as soon as possible
PFRP: Monitor need to provide Class A product. Consider Thermal Drying or privatized composting	5,759	Third	2015 or beyond

Table 5 Design Criteria for Recommended Improvements

Recommended Process	Units	Size	Design Criteria
New Anaerobic Digesters	1	85-ft diameter 27-ft deep	Hydraulic Detention: 20 days Volatile solids loading: 0.1-0.2 lb VSS/cu.ft./day
Thickening: New DAF	1	36-ft diameter	Hydraulic Loading: 0.5-1.0 gpm/sq.ft Solids Loading: 0.5-1.0 lbs/hr/sq. ft
Dewatering: New BFP.	1	1.2 meter	Hydraulic Loading: 70 gpm/meter Solids Loading: 700 lbs/hr/meter

Figure 3 presents the site plan that is recommended for implementation of all phases.

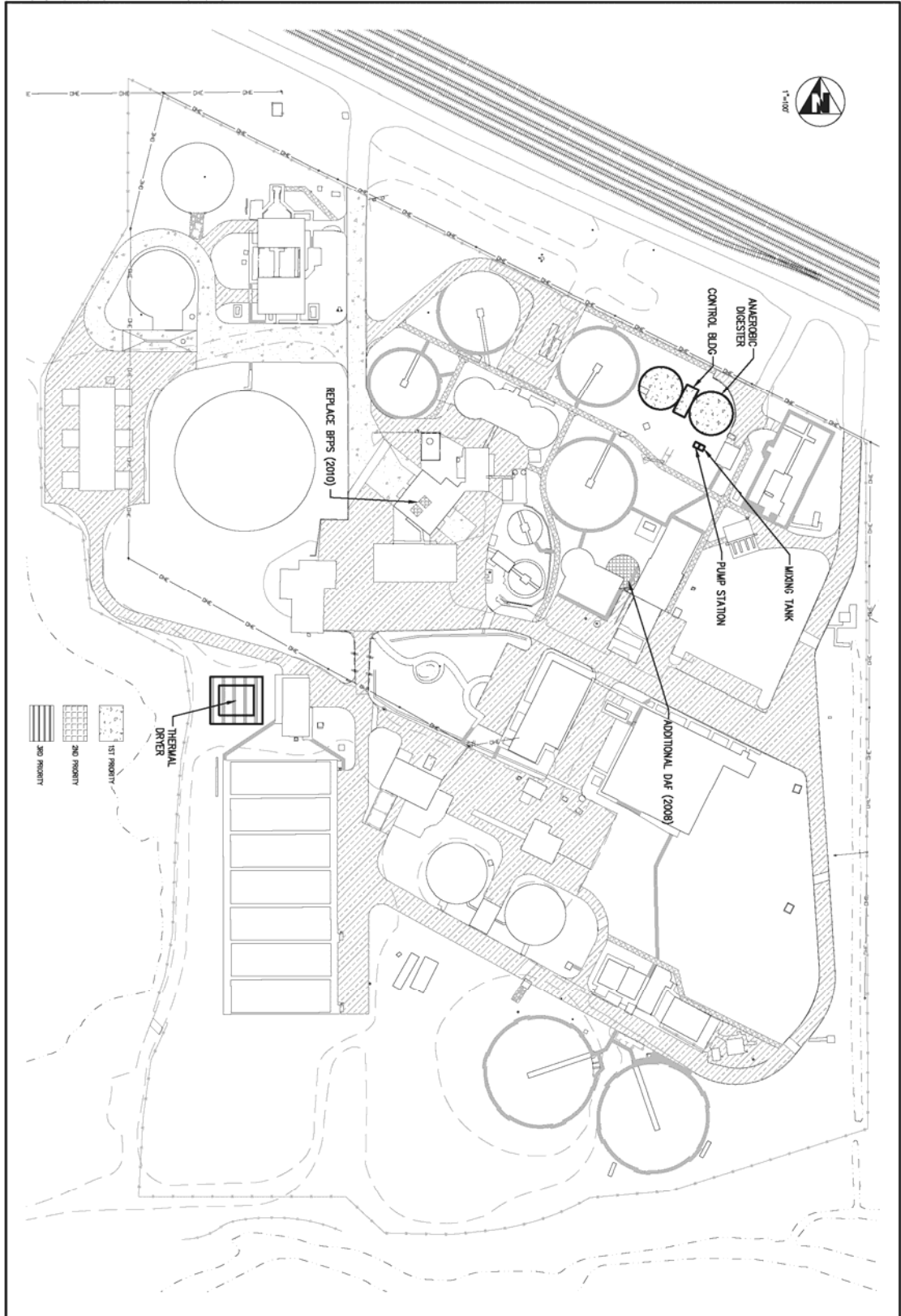


FIGURE 3 Longmont WWTP Biosolids Facility Implementation Plan

At this time it does not appear that water plant residuals from the WTP will be sent to the WWTP. This is based on a comparison of the operating costs associated with storing, removing, and disposing of water plant residuals versus installing a sewer line to the WTP. Based on the design of the new WTP and discussions with City personnel, it is also highly unlikely that other water residuals will be sent to the WWTP. The digesters and other solids handling facilities will have the capability to treat these solids; however, more frequent maintenance and cleaning of the digester tanks will be needed.