CH2MHILL®

2012 Annual Report

Prepared for the City of
West Liberty, Iowa

CH2MHILL®

2012 Annual Report

Prepared for the City of
West Liberty, Iowa

Contents

Exhibits

Executive Summary

CH2M HILL is pleased to present the City of West Liberty with this annual report as an overview of activities related to the West Liberty Wastewater Treatment Facility during 2012. The West Liberty Project is currently in year 22 of operation and year 3 of the current 10-year agreement.

CH2M HILL's leadership and dedication to quality service is evidenced by specific accomplishments found throughout the report. We will discuss specific actions CH2M HILL employees initiated to continue exemplary service to the City of West Liberty.

Our support for the Water Environment Federation, the Iowa Water Environment Association, the Iowa Department of Natural Resourceds (IDNR), and the U.S. Environmental Protection Agency (U.S. EPA) demonstrates our focus on environmental issues in the State of Iowa.

We would like to convey our appreciation to the Mayor, Council, and City officials for their support. CH2M HILL understands the importance of being innovative, resourceful, and flexible partners with our clients in government operations to provide the best solutions for their utility and environmental needs.

CH2M HILL services focus on open communication, honesty, and trust in all areas including contract performance, cost containment, and staff commitment. We sincerely hope this report conveys all the information necessary to give an accurate overview of the day-to-day operations at the West Liberty Wastewater Treatment Facility.

West Liberty Wastewater Treatment Facility

The treatment facility is an extended aeration activated sludge process permitted to treat 1.37 million gallons per day (mgd) average daily flow. The treatment facility is staffed 5 days per week, 8 hours per day and equipped with an automatic dialing alarm system to notify plant personnel of any emergencies during unstaffed hours.

Influent screw pumps

The facility removes on average 99 percent of the pollutants received and produces a high quality effluent similar in appearance to drinking water. Facility processes are operated to produce the highest quality effluent at the lowest possible cost. Odors are rarely a problem and no complaints have been recorded this year.

Exhibit 1 summarizes treatment facility effluent performance.

Exhibit 1
Treatment Facility Effluent Performance

National Pollutant Discharge Elimination System (NPDES) Parameters		
Parameter	Average	Limit
Flow (mgd)	1.20	1.37
5-day carbonaceous biochemical oxygen demand (CBOD) (mg/l)	1.41	25
Total suspended solids (TSS) (mg/l)	3.13	30
Ammonia – N (mg/l)	0.80	3.20 (summer)

As shown in **Exhibit 1**, average daily flow for 2012 was 1.20 mgd or 88 percent of permitted capacity. CBOD was 1.41 mg/l or 5.6 percent of permitted capacity, TSS was 3.13 mg/l or 10.4 percent of permitted capacity, and Ammonia-N was 0.8 mg/l or 25 percent of permitted capacity.

Statistical process control procedures were established to provide continuous compliance with NPDES permit limitations. The sludge retention time, food to microorganism ratio, sludge volume index, and mixed liquor suspended solids concentration are monitored to optimize plant performance.

Exhibit 2 shows the treatment facility removal efficiency for 2012.

Exhibit 2
Annual Treatment Facility Removal Efficiencies

2012 Annual Percent Removal Efficiencies		
Parameter	Average	Efficiency Requirement
5-day CBOD (mg/l)	99.7 percent	85 percent
TSS (mg/l)	99.2 percent	85 percent
Ammonia – N (mg/l)	95.1 percent	No requirement

Exhibit 3 shows treated effluent flow rates for 2012.

Exhibit 3
Effluent Average Daily Treated Flows

2012 Treated Effluent Flow Rates (mgd)		
Month	Average Flow	Maximum Flow
January 2012	1.23	1.76
February 2012	1.34	1.77
March 2012	1.43	1.76
April 2012	1.42	1.8
May 2012	1.37	2.05
June 2012	1.19	1.60
July 2012	1.11	1.41
August 2012	1.14	1.39
September 2012	1.05	2.08
October 2012	1.06	1.46
November 2012	1.00	1.41
December 2012	1.05	1.53

Rain events have a significant impact on flow rates. During high flow rain events, incoming flows can reach 7.0 mgd and disrupt the treatment facility's performance. To alleviate the problems associated with rain events, a portion of the incoming flow is automatically diverted to the storm water retention tank and returned to the treatment facility when incoming flows drop to design parameters.

Exhibit 4 shows influent CBOD concentrations for 2012.

Exhibit 4
Monthly Influent CBOD Concentrations

2012 Influent CBOD Concentrations (mg/l)		
Month	Average CBOD	Maximum CBOD
January 2012	422	668
February 2012	440	555
March 2012	356	510
April 2012	347	506
May 2012	343	445
June 2012	452	780
July 2012	475	675
August 2012	653	1140
September 2012	531	630
October 2012	513	900
November 2012	467	612
December 2012	454	597

Exhibit 5 shows influent TSS concentrations for 2012.

Exhibit 5
Monthly Influent TSS Concentrations

2012 Influent TSS Concentrations (mg/l)		
Month	Average TSS	Maximum TSS
January 2012	391	616
February 2012	410	608
March 2012	337	480
April 2012	386	730
May 2012	310	548
June 2012	413	616
July 2012	562	1116
August 2012	686	1284
September 2012	705	992
October 2012	690	1568
November 2012	516	1116
December 2012	426	720

Staffing Plan

CH2M HILL's project management and staffing has been stable throughout our association with the City of West Liberty. Our Project Manager has access to support from regional and corporate senior leaders and from a vast pool of technical experts available from our Technical Services Group.

Project staff (L-R), Craig Juergens, Chris Gerstbrein, David Clark, Brian Goldesberry and Ken Riley

Exhibit 6
Organizational Chart

With over 200 projects throughout the United States, over 2,200 OM&M professionals, and over 30,000 CH2M HILL employees, we have the resources to provide services under all conditions.

Operations

The biggest factor throughout the year affecting operations has been rain events and loadings above the facility's design capacity. Process alterations have been utilized to address these areas of concern. These alterations included diverting a portion of the incoming flow to the storm water retention tank during high flow rain events and using geotextile tubes to process and store solids. Impact on operations is as follows:

Secondary treatment mechanical aerator motor with gear box

- High flow rain events - Reduces detention time in secondary treatment units and final clarifiers. Reduced detention time leads to reduced performance and treatment efficiencies. High flow rain events are automatically diverted to the storm water retention tank. As the incoming flow drops to design parameters, the storm water retention tank will automatically return flow back through the facility for treatment.
- High influent loadings - Increases sludge production and reduces digester capacity. Increased sludge production results in reduced performance and treatment efficiencies. Increased sludge production is addressed by using geotextile tubes for processing and storing solids. Geotextile tubes increases the facility's solids holding capacity and improves the facility's performance.

Maintenance

Cost control through effective preventive (PM) and corrective maintenance (CM) is a hallmark of our success. Our ability to provide effective maintenance management is well known and can be confirmed by viewing equipment records.

Treated final effluent

CH2M HILL's approach to maintenance involves three functions:

- PM
- CM
- Predictive maintenance (PdM)

We have found that by concentrating on PM and PdM activities, equipment life spans can be protected.

Several PdM activities performed include:

- Infrared scanners
- Vibration analyzers
- Voltage and amperage meters
- Motor testing

Geotextile tubes are used to dewater and store solids

This data is tracked to aid the prediction of possible equipment problems. By taking a proactive maintenance approach, we often are able to prevent breakdowns or the loss of major components. For example, infrared scanners allow us to detect hot spots in electrical equipment that can result from frayed wiring, loose connections, corroded connections, or failing parts. Detecting and repairing these problems, usually at a slight cost, can prevent the total failure of an expensive electrical device.

A computerized maintenance management system (CMMS) is an integral part of the treatment facility. CMMS keeps the staff fully informed of maintenance and repair activities, and tracks performance of proper maintenance to protect the City's capital investment.

All reports can be reviewed on screen or printed, and each can be manipulated to suit the user's needs. These reports can be printed quickly and easily if a question arises concerning a particular piece of equipment or the program in general.

Exhibit 7 shows the monthly work orders generated for 2012.

Exhibit 7
Monthly Work Orders Generated

2012 Work Orders Generated		
Month	Work Orders Generated	Work Orders Completed
January 2012	31	19
February 2012	26	14
March 2012	29	16
April 2012	38	32
May 2012	34	15
June 2012	29	21
July 2012	27	16
August 2012	30	19
September 2012	30	7
October 2012	41	17
November 2012	34	8
December 2012	30	17

Laboratory

The primary objective of the laboratory is to determine compliance with the parameters established in the City's NPDES permit as issued by the State of Iowa. These permit required parameters include:


Laboratory & administration building

- CBOD
- Biochemical oxygen demand (BOD)
- TSS
- Ammonia nitrogen
- pH
- Temperature
- Dissolved oxygen
- Mixed liquor suspended solids (MLSS)
- Settleable solids
- 30-minute settleability
- Acute toxicity

In addition to permit required analysis, CH2M HILL also performs analysis for process control. Process control analysis aids in troubleshooting performance issues and is an indicator of how well the process is performing. Results are used to adjust processes for optimum performance. Process control analysis includes:

- Total kjeldahl nitrogen (TKN)
- Microscopic examination
- Volatile suspended solids
- Total percent solids
- Oil and grease
- Nitrates
- Nitrites

Including process control analysis, more than 6,000 analyses were performed by CH2M HILL staff during 2012. Staff also achieved several other major laboratory accomplishments including:

- Completed U.S. EPA Discharge Monitoring Report-Quality Assurance (DMR-QA) Study in January 2012
- Completed U.S. EPA WP Study in July 2012
- Completed quarterly biosolids analysis per biosolids land application management program. All parameters analyzed were acceptable and well below state and Federal limits
- Completed annual toxicity analysis in June 2012

Sludge transfer pumps

CH2M HILL also provides laboratory services to several smaller communities to meet their wastewater analysis requirements including:

- Atalissa
- Nichols
- Letts
- Conesville
- Columbus Junction
- Maplewood Estates
- Louisa County

The revenue generated from these communities supports our laboratory operations and reduces our laboratory budget requirements, which in turn lowers the City of West Liberty's direct costs.

The following list reflects routine minimum standards for CH2M HILL laboratories:

- Adherence to CH2M HILL's comprehensive quality assurance/quality control program for all permit-required analyses—this includes, but is not limited to, precision and accuracy results and corresponding control charts.
- Chain of custody documentation for all samples entering or leaving the facility—internal or external—which are kept in CH2M HILL bound-and-numbered books.
- A Chemical Hygiene Plan, including Material Safety Data Sheets, for all chemicals and reagents, emergency response, training sign-off sheets, and any site-specific requirements.
- Segregation of existing chemical stock according to chemical compatibility; all chemicals and reagents exceeding the expiration date are discarded according to state and local guidelines.
- Standard operating procedures for all chemical and physical analyses.

Solids Processing

Solids processing is accomplished in three phases at the West Liberty Facility:

- Phase I: Removing or wasting solids from the system
- Phase II: Aerobically digesting of the solids wasted
- Phase III: Dewatering of the aerobically digested solids

Aerobic digestion

Phase I is accomplished through clarification of the treated wastewater. Activated sludge from the secondary treatment system (carrousel oxidation system) is fed to three final clarifiers to clarify the treated wastewater and allow solids to settle. The settled solids are allowed to thicken by gravity in the clarifiers and have a concentration in the range of 0.5 percent to 1 percent solids. The concentrated solids are continuously removed from the clarifiers with 97 percent returned to the secondary treatment system and only 3 percent wasted from the system for digestion and further processing. Wasting is accomplished with positive displacement air-operated diaphragm pumps.

Phase II is accomplished through six aerobic digesters. The aerobic digestion process is an extension of the activated sludge process. Bacteria in the digesters are supplied oxygen and metabolize the organic matter yielding inert products. As the organic supply becomes low, the bacteria enter endogenous decay where internal organic material is used as a food source. In this manner, the bacteria self-destruct reducing the organic content of the solids. Digestion is complete when laboratory analysis indicates the volatile solids and bacteria have been reduced to an acceptable level. The State and Federal Environmental Regulators determine this level.

Phase III is accomplished through chemical addition and dewatering the solids through a gravity belt thickener. Aerobically digested solids are pumped to the gravity belt thickener where two distinct processes occur. The first process is polymer conditioning where organic polyelectrolyte is mixed with the solids to neutralize the electrical charges between the solids and the water to form a floc via an inline vortex flocculant-mixing device. The second process is the gravity drainage where the flocculated solids are gently distributed onto a moving belt. The free water is allowed to separate from the flocculated solids employing the forces of gravity. The free flowing water (filtrate) is collected in a gravity drainage collection pan, which is located directly underneath the woven filtration belt and returned for further processing. The thickened solids leaving the gravity drainage zone will be discharged, aided by plastic doctor blades, and directed to the outlet collection pan of the gravity belt. Typical feed solids concentrations range from 0.5 percent to 1 percent solids with thickened solids in the range of 3.5 percent to 4.5 percent solids. The thickened solids are then pumped to one of two storage tanks or geotextile tubes before being land applied to local agricultural land.

Gravity belt thickener dewaters and thickens digested solids

Land Application Program

Field applicator with flotation tires applies biosolids to agricultural ground for nutrient recycling

CH2M HILL's land application program relies on aerobic digestion and facility management to optimize biosolids application efficiency. Under normal design loadings, the facility is only designed to store biosolids for 3 months because of limited storage capacity; land application is scheduled throughout the year. The processes are managed in the most effective manner to minimize unnecessary cost while providing effective treatment and storage prior to land application. A representative sample is collected weekly to determine compliance with environmental regulations and to determine agronomic application rates. Based on 2012 sample results, the biosolids were classified as Class II, which is considered environmentally beneficial. CH2M HILL's land application program provides several benefits to the land owners that participate in our program. The facility's biosolids make an excellent soil conditioner and are a source of nutrients. The benefits of our land application program are:

- Recycling plant nutrients back into the soil: Primarily nitrogen, phosphorus, potassium, and minerals.
- Lowers commercial fertilizer requirements: Biosolids reduce commercial fertilizer requirements, which reduces the overall cost to land owners.
- Boosting crop yields: Biosolids act as a slow release fertilizer. Nitrogen and other nutrients are released slowly from the organic matter throughout the growing season.
- Improved soil condition: The organic matter in the biosolids improves soil tilth and increases the soil's ability to absorb water and hold nutrients which help reduce erosion and natural runoff.
- Stabilized soil structure: Resulting in benefits of soil physical properties; increased porousness, water movement, root penetration, and soil tilth.

Land owners that participate in our program receive an Agronology Report" at no charge, an Agricultural Application Site Log, and are provided with a copy of Chapter 67 of the Iowa Administrative Code. Land owners are also required to sign a Biosolids Land Application Agreement before land application begins.

The biosolids produced at the West Liberty facility provided an average nutrient value as follows:

- Nitrogen: 27.0 lbs/acre
- Phosphorus: 26.6 lbs/acre
- Potassium: 13.6 lbs/acre

Land application is accomplished with the use of a semi-tractor with trailer and an Ag-Chem Tera-Gator field applicator. The semi-tractor/trailer is used to transport the biosolids out to the fields where the Ag-Chem applicator utilizes a pressurized discharge over a deflector plate for surface application. The application rate for 2012 averaged .79 metric tons/acre with annual totals as follows:

- 595 acres covered
- 3.482 million gallons applied
- 472.1 metric tons applied

Annual reports were prepared and sent to the IDNR and U.S. EPA in January 2013. This report details our land application program and is a regulatory requirement.

West Liberty Foods

The majority of the treatment facility's loadings are derived from West Liberty Foods. They are considered a major industrial contributor and contribute roughly 60 percent of the total loading received at the treatment facility. Because they are a major contributor, the IDNR has established limits on their discharges and requires regular sampling and analysis to determine compliance with permitted limits. A treatment agreement has been established between West Liberty Foods and the City of West Liberty that has set limits for discharges with possible fines for violating these limits.

West Liberty Foods turkey processing facility, West Liberty, Iowa

West Liberty Foods installed pretreatment back in June 2001 to reduce the loadings discharged to the City's treatment facility. Pretreatment was necessary for permit compliance and to prevent overloading the wastewater treatment facility.

Facility Improvements

Facility improvements completed during 2012 included:

- Aerobic digesters – Replaced diffusers in digesters 4 and 5. New diffusers will provide better mixing and reduce electrical usage.
- Screw pumps – Replaced pump motor bearings. Motor will provide reliable service and improved performance.
- Carrousel system aerators – Replaced aerator impellers. New impellers will provide reliable service and improved performance.

Waste activated sludge pumps

- Rotamat screen – Replaced enclosure wooden frame, floor, and siding.
- Biosolids storage tank – Replaced three mixing nozzles. New nozzles will facilitate better mixing and increase efficiencies.
- Facility fencing – Installed a new gate on the east parameter fence. Gate will allow easy access to east grounds and facility outfall structure.

Safety

The West Liberty team continues to build on our exemplary safety record and further develop our onsite health and safety program. We are focused on our goal of Target Zero:

- Zero injuries and illnesses (world class safety)
- Zero adverse impacts (environmental stewardship)
- Zero errors, omissions, and defects (perfect first-time quality)

CH2M HILL places a high priority on safety and provides the necessary equipment and training to comply with Federal and state regulations. This protects project personnel and the general public from injury and CH2M HILL and the City of West Liberty from liability.

During 2012, staff implemented the following as part of our safety iniatives:

- Conducted staff training and reviewed site-specific safety operating procedures
- Fleet vehicle inspections by CH2M HILL Fleet Vehicle Manager
- Safety inspection and audit by CH2M HILL Regional Safety Coordinator
- Updates and revisions to site-specific safety plans

The West Liberty staff have worked 2,737 days without an Occupational Safety and Health Administration (OSHA) reportable incident.

Awards and Certifications

The West Liberty project has won several awards for safety and operational excellence. Awards and certifications earned in 2012 include:

- 2012 National Safety Council Perfect Record Award
- 2012 CH2M HILL Safety Achievement Award
- 2012 Iowa Class B Commercial Driver's License (CDL) Certification – Steve Grgurich
- 2012 Iowa Grade II Wastewater Certification – Chris Gerstbrein

Activated sludge secondary treatment process

Community Involvement

CH2M HILL is a supportive member of every community we serve. We seek opportunities to contribute our time and energy, and where appropriate, supporting funds to community organizations and activities. Our support of community activities and iniatives in West Liberty during 2012 include:

- Membership in the West Liberty Chamber of Commerce
- Active committee member on the Iowa Water Environment Association Biosolids Committee
- Member of the Water Environment Federation
- Member of the National Safety Council
- Donation to the West Liberty American Legion
- Donation to the West Liberty Chamber of Commerce
- Donated time to assist the West Liberty American Legion with bingo at county fair
- Donation time to assist West Liberty American Legion with Memorial Day flag pick-up

Tour given to West Liberty elementary students

Sustainability

At CH2M HILL we are committed to developing substainable business practices. We pledge to develop strategies that enable us to move toward sustainablity while enhancing the value to the citizens of West Liberty. Sustainability efforts in 2012 included the recycling of the following:

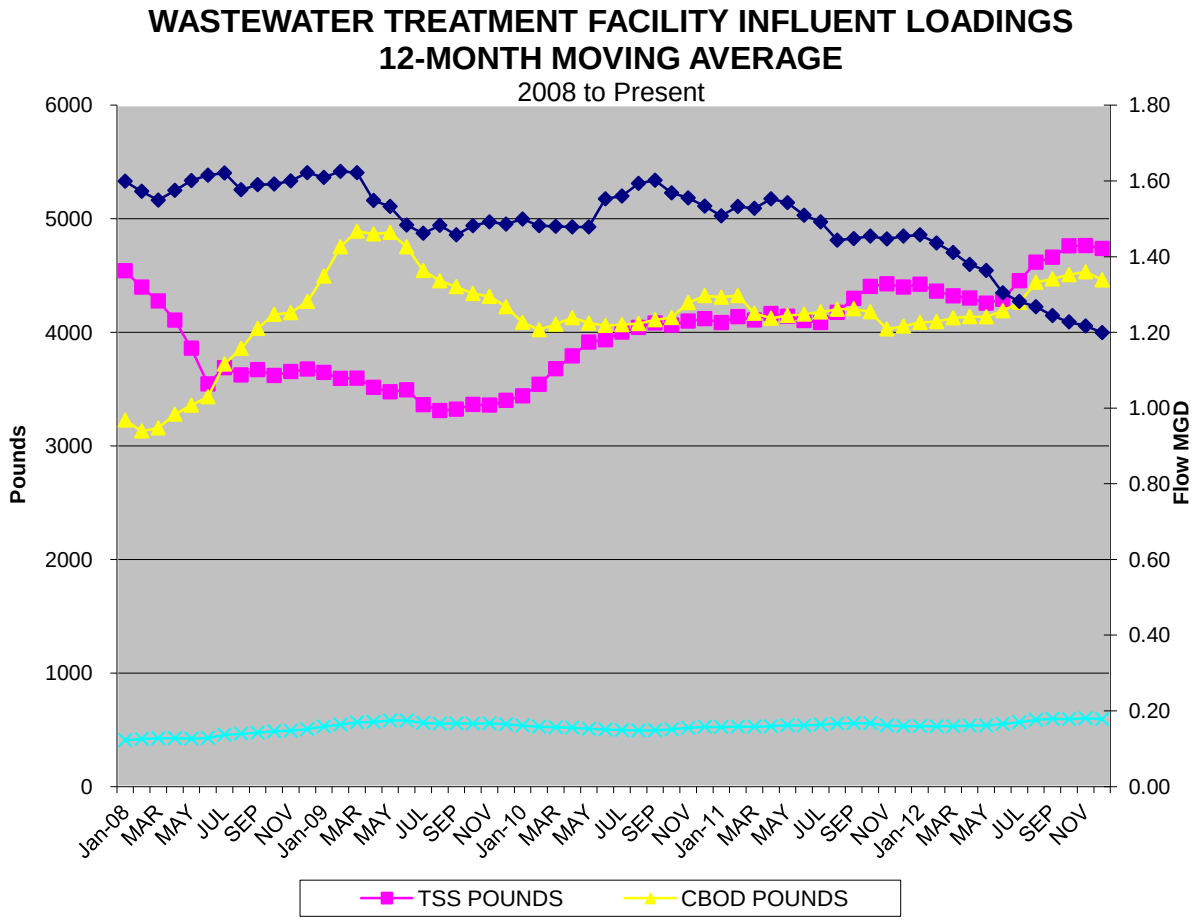
- 4,888 pounds (lbs.) of scrap metal
- 20 lbs. of plastic
- 100 gallons of used oil
- 260 lbs. of paper
- 20 lbs. of electronics
- 472 metric tons of biosolids
- 14.1 million gallons of treated effluent for facility reuse
- 67 percent reduction in carbon footprint associated with polymer consumption

Facility Overview

This section is a facility overview of areas tracked for cost control and process optimization. Overview will cover influent loadings, loadings received from West Liberty Foods, kilowatt usage, polymer usage, and solids mass balance.

Exhibit 8 trends the influent loadings received at the treatment facility.

Exhibit 8
12 Month Moving Average Influent Loadings for CBOD, TSS, TKN, and Flow

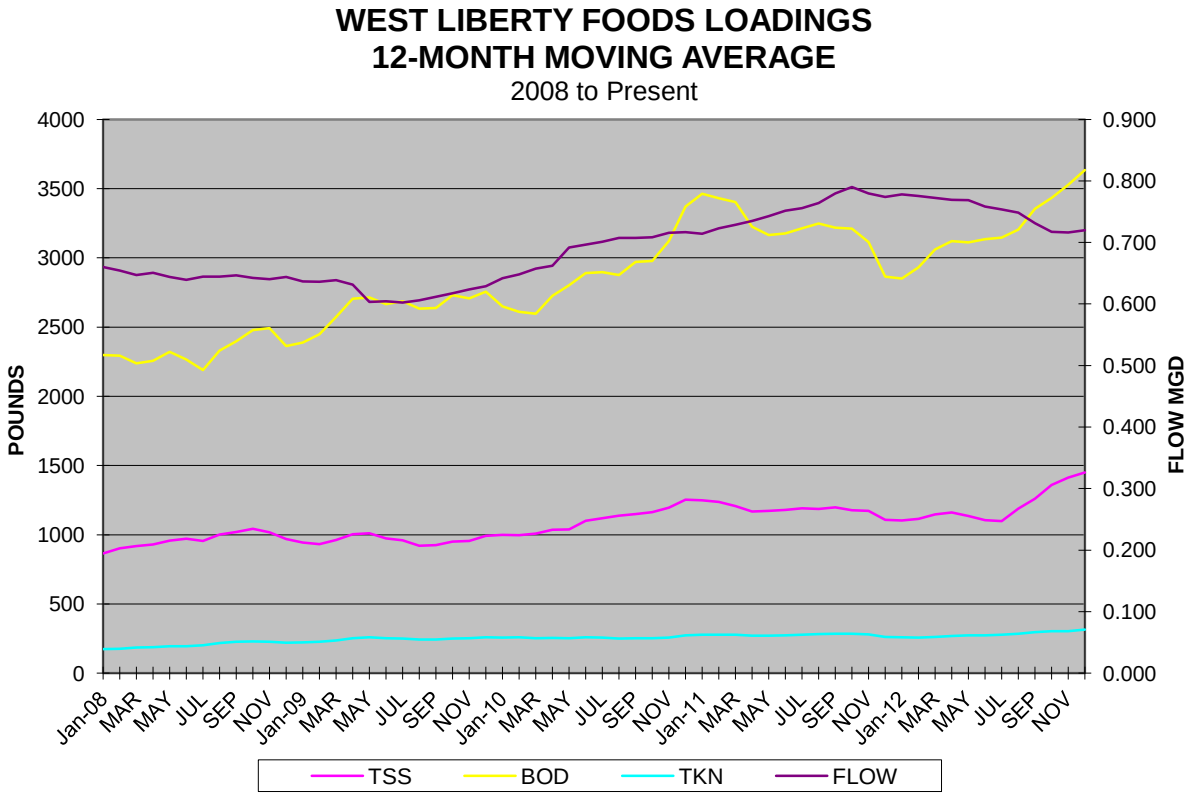


Moving averages smooth the data to form a trend following an indicator. They do not predict direction, but rather define the current direction with a lag. Moving averages lag because they are based on the past. Moving averages are used to define the direction of the trend.

Influent loadings are dependent on West Liberty Foods operation. A large portion of West Liberty's treatment capacity is allocated to West Liberty Foods.

Exhibit 9 trends the loadings received from West Liberty Foods.

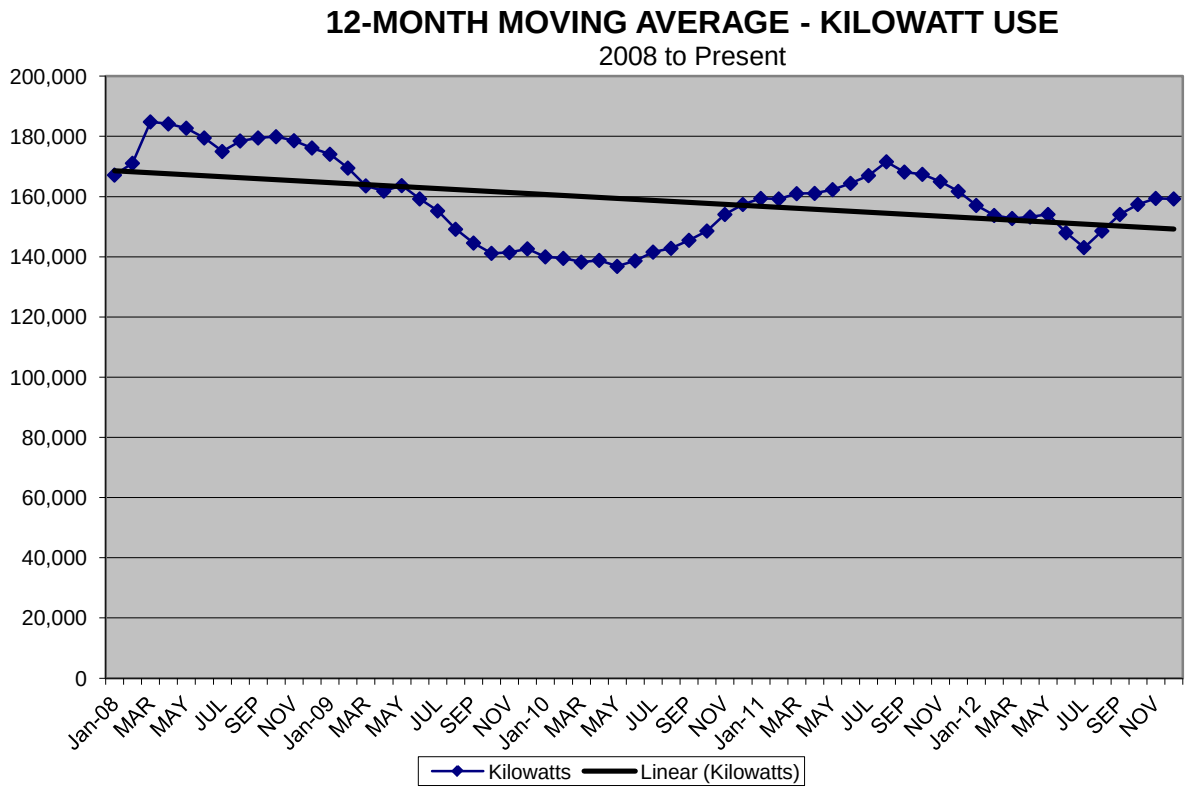
Exhibit 9
12 Month Moving Average Food Loadings for CBOD, TSS, TKN, and Flow



West Liberty Foods loadings are dependent on the efficiency of their pretreatment units and the waste stream treated. Waste streams can vary and include; turkey, beef, and pork.

Exhibit 10 trends the amount of kilowatts used.

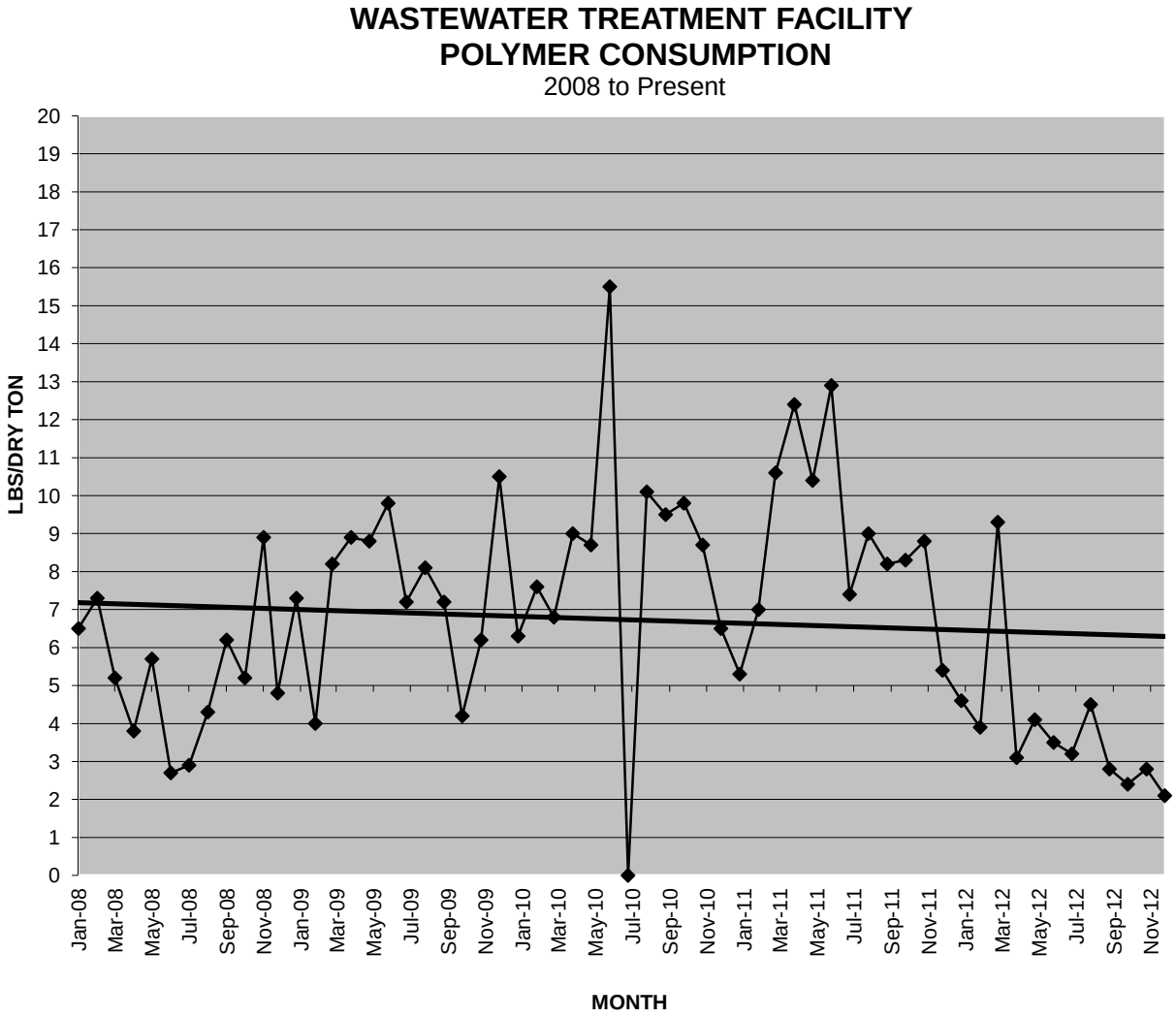
Exhibit 10
12 Month Moving Average Kilowatt Usage



Kilowatt usage is dependent on influent loadings. As the loadings increase so does the demand for more electricity. Decreases in electrical usage can be attributed to reduced loadings and process optimization.

Exhibit 11 trends the amount of polymer used per ton of solids produced.

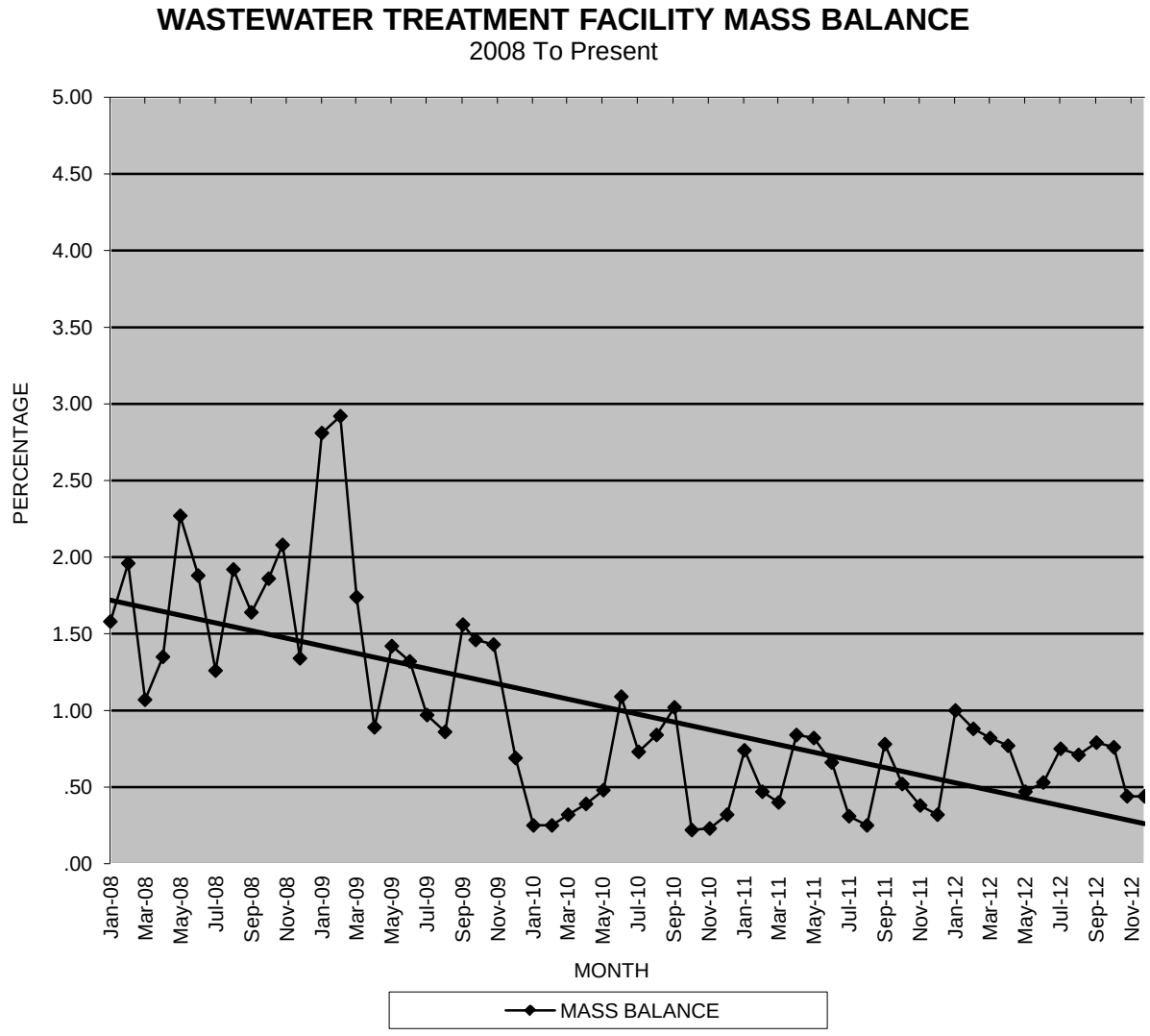
Exhibit 11
Polymer Usage per Ton of Solids Produced



Industry standards indicate polymer additions of up to 10 lbs. of polymer per dry ton of solids produced is considered excellent operational performance. Polymer additions of 10 lbs. to 15 lbs. of polymer per dry ton of solids produced is considered good operational performance and polymer additions greater than 15 lbs. per dry ton of solids produced is considered poor operation. Many factors affect gravity belt performance. It is important to be aware of these factors and keep accurate records for long-term reliable service.

Exhibit 12 trends the balance of solids produced versus solids removed.

Exhibit 12
Solids Mass Balance



A mass balance is an accounting of the material entering the facility and leaving the facility. The concept of a mass balance as related to wastewater treatment is to balance the solids entering the facility and the solids produced during the treatment process. A perfectly balanced system would be 100 percent. All the solids entering the facility and all the solids produced during treatment were removed or balanced. Higher mass balance percentages indicate not enough solids were removed and lower mass balance percentages indicate more solids were removed.

Summary

Whether we are partnering to provide services to a village, a city, a county, or a company, we know our partnerships are built on trust. We are proud and protective of our strong corporate standing, and we are vigilant in maintaining our reputation. The West Liberty project is a shining example of where working together, we have developed and maintained a trusting relationship built on open, honest communications and a dedication to doing the right thing.

Facilities run by CH2M HILL treat more than 1 billion gallons of wastewater and water each day. Our culture uniquely links our personal investment with our job performance and satisfaction, and ensures our commitment to outperform for you.

It is our goal to exceed your expectations. The City of West Liberty will benefit from the partnership with CH2M HILL due to reduced risk, guaranteed performance, and the application of our institutional knowledge gained while working with the City for more than 20 years.

We appreciate the opportunity to serve the City of West Liberty and its citizens. We look forward to our continued partnership for many years to come.

CH2MHILL®