City of Leadwood
Wastewater System
Engineering Report

DRAFT

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Background

The purpose of this report is to describe the City of Leadwood's wastewater system (System ID Number MO-0104256) and recommend needed improvements.

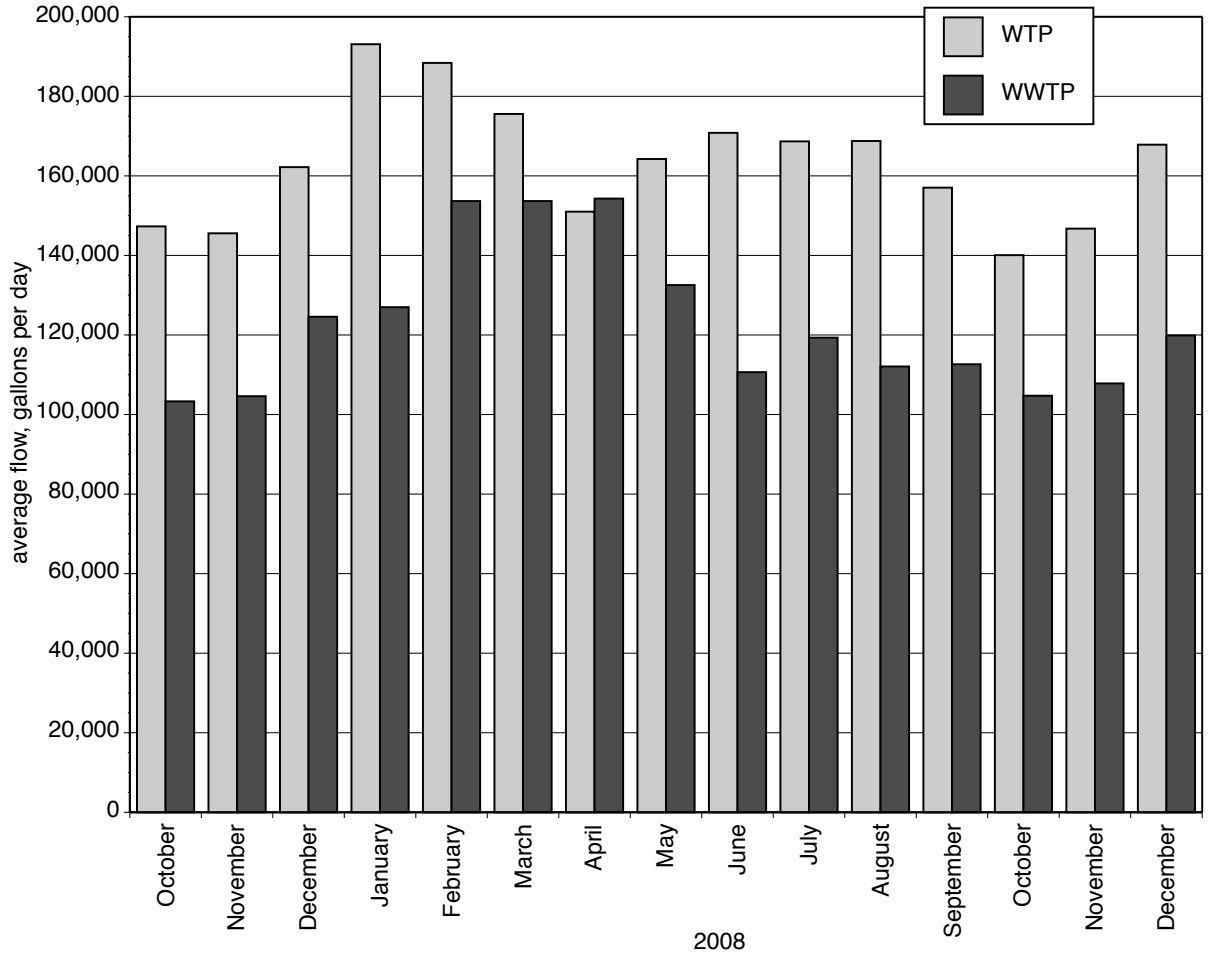
Population and Wastewater Flows

Leadwood has a stable population of 1,247 people. Wastewater is primarily from residential sources. There are no major industrial sources or unusual commercial sources.

From limited data available on raw wastewater quality, BOD averages 327 mg/l; TSS averages 200 mg/l. (The number for BOD may be slightly high, as one of only four data points was 551 mg/l.)

Flow rate averages 120,000 gpd. Reviewing 15 months of flow data for both the water and wastewater systems, the peak months for drinking water usage were January, February, and March. The peak months for wastewater flow were February, March, and April.

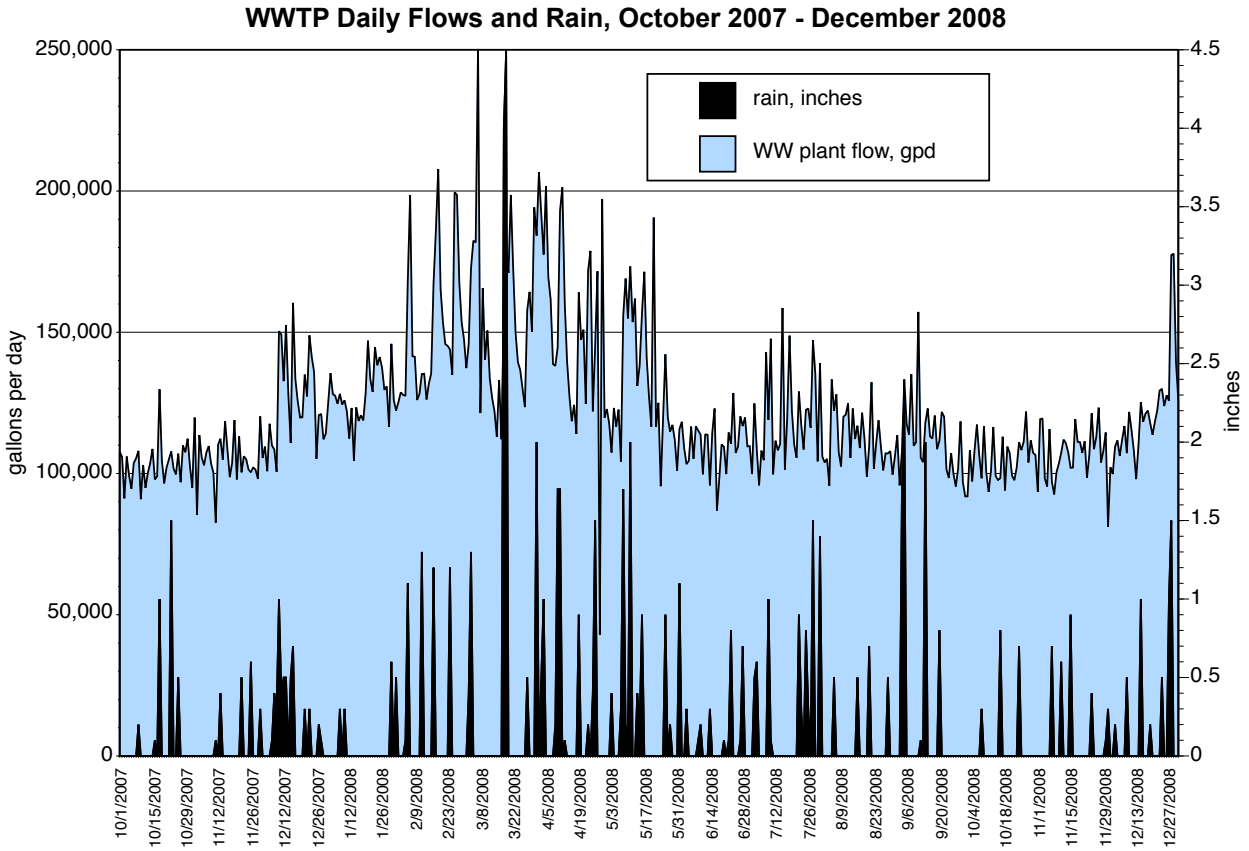
Peak flows in winter are due to the fact that Leadwood's water system is presently unmetered. Since there is no financial incentive to conserve water, residents tend to leave their water running to avoid frozen pipes. In addition to wasting water, this places a higher load on the wastewater treatment plant during cold weather. This, in conjunction with spring rains, can cause the wastewater plant to exceed its capacity. The City is seeking funding for installation of meters on all drinking water service connections.



Existing Collection System

Inflow and Infiltration

All rain and plant flow data from October 2007 through December 2008 is shown in the graph below. During the period January to May, 2008, plant flows were high and fluctuated significantly. The 180,000 gpd design capacity of the wastewater treatment plant was exceeded on twenty occasions in the late winter/early spring.



The City of Leadwood continues to work on the control of inflow and infiltration throughout the collection system.

In 2008, a surface inspection of the entire wastewater collection system was conducted. Sanitary sewer system maps were updated and field-verified to ensure that they are current and complete. A twenty-foot-wide path was cleared along each sewer right-of-way.

Each manhole was checked for faulty covers, cracks, or other evidence of potential sources of inflow. After inspection and cleaning, manhole covers were tagged with green paint. Overall, no major problems were found.

All 26 lift stations were pumped out and cleaned twice in 2008--once in the spring and again in the fall. Debris, rocks, and balls were found in some of the lift stations. Staff reports a resultant decrease in pump problems at lift stations.

Smoke testing in conjunction with MRWA identified fifteen to twenty household connections in need of repair. All of these repairs were made. They City needs to purchase its own smoke testing equipment in the future. Additionally, the purchase of a closed-circuit television camera system designed for sewer line inspection would enable the City to further investigate the condition of the collection system.

Existing Treatment Facilities

Leadwood's wastewater treatment process consists of a single oxidation ditch and UV disinfection. No pretreatment is provided, so a significant amount of debris and grit enters the plant. At a minimum, bar screens are needed to collect the largest materials. Grit removal would provide further protection for pumps.

Average daily wastewater flow is 120,000 gallons, and treatment plant nominal capacity is 150,000 gallons per day. Maximum capacity is 180,000 gallons per day.

Since there is only one treatment train, it cannot be shut down for any reason at all. Therefore the basin cannot be drained and cleaned, nor can any part of the treatment train undergo major maintenance.

A modern, parallel treatment train would provide duplicity, increase effluent quality, and effectively double peak flow treatment capacity.

The disinfected effluent is discharged into an unnamed tributary to Big River. The City is able to routinely meet its permitted effluent limitations, which are as follows:

BOD_5: 45 mg/l weekly average; 30 mg/l monthly average
TSS: 45 mg/l weekly average; 30 mg/l monthly average
Fecal Coliform: 1,000/100ml daily maximum; 400 /100ml monthly average

Sludge

Sludge is stored in a single aerated holding tank and is land-applied when the tank is full. Design sludge production is 24 dry tons per year, however, actual sludge production has been calculated as 42 dry tons per year (400,000 gallons at 2.5% dry solids).

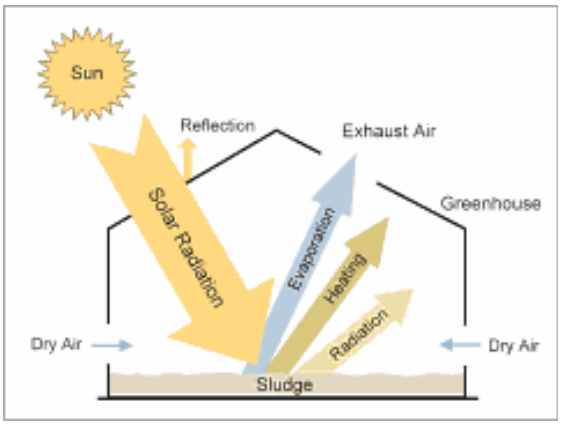
Three- to four-thousand gallons of waste activated sludge are pumped into the 52,000-gallon aerated sludge storage basin twice a week, for an average of 1,000 gallons per day. This basin is operated as an aerobic sludge digester. The sludge is constantly aerated and mixed by diffused aeration, except for when it is allowed to settle every ten days so that the supernatant can be decanted back to the head of the plant.

The City of Leadwood does not own any equipment capable of hauling sludge. About four times per year, a contract hauler collects, hauls, and applies the sludge to approximately 25 acres of hay fields and pasture. Each hauling session may consist of up to fifty 2,000-gallon truckloads, for an annual total of up to 400,000 gallons (1,520,000 liters). Optimally, the City should have its own vehicle capable of hauling sludge.

At the time of hauling, sludge is tested for percent dry solids. Typically, the sludge contains approximately 25 grams of dry solids/liter (2.5% dry solids). Thus, the 400,000 gallons per year represent 41.8 tons of dry solids per year, which is applied at a rate of approximately 1.67 dry tons/acre.

A second sludge basin dedicated to thickening would increase sludge storage capacity and operational flexibility. It would also enable plant operators to settle and age the sludge more thoroughly, thereby increasing solids content, reducing hauling costs, and improving the specific oxygen uptake rate (SOUR).

It is reported that solar sludge drying beds may dry sludge to 85% solids (~80% reduction in volume). A solar sludge dryer is similar to a greenhouse with sensors to monitor temperature, humidity, and moisture content of the sludge, and a programmable logic controller to control fans and louvers. In order to mix the sludge and promote uniform drying, a mechanical mole roams the floor and tills the sludge. Additionally, a solar-powered radiant floor heating system would serve to accelerate the drying process.



Solar sludge drying beds are not commonplace in the US, but they are currently in service in Europe. Using the energy of the sun in Germany, they operate with a minimal amount of electricity.

The City of Leadwood should construct a pilot solar sludge drying bed to determine its effectiveness.

Recommended Improvements

Collection System

To improve the ability to inspect the collection system, the City needs to purchase smoke testing equipment and a video camera system.

Opinion of Probable Cost: $15,000

Pretreatment

Pretreatment should be provided in the form of a bar screen and a grit chamber in order to remove large solids and heavier material at the front end of the plant.

Opinion of Probable Cost: $100,000

Second Treatment Train

A modern package treatment plant in parallel with the existing treatment train is proposed.

Opinion of Probable Cost: $2,500,000

Sludge Management

The City has a critical need for a truck capable of hauling about 4,000 gallons of sludge.

Opinion of Probable Cost: $75,000

In order to maximize operational flexibility and reduce hauling costs, another sludge holding basin dedicated to thickening is needed.

Opinion of Probable Cost: $200,000

Design and construction of a modest solar sludge drying bed should be pursued.

Opinion of Probable Cost: $50,000

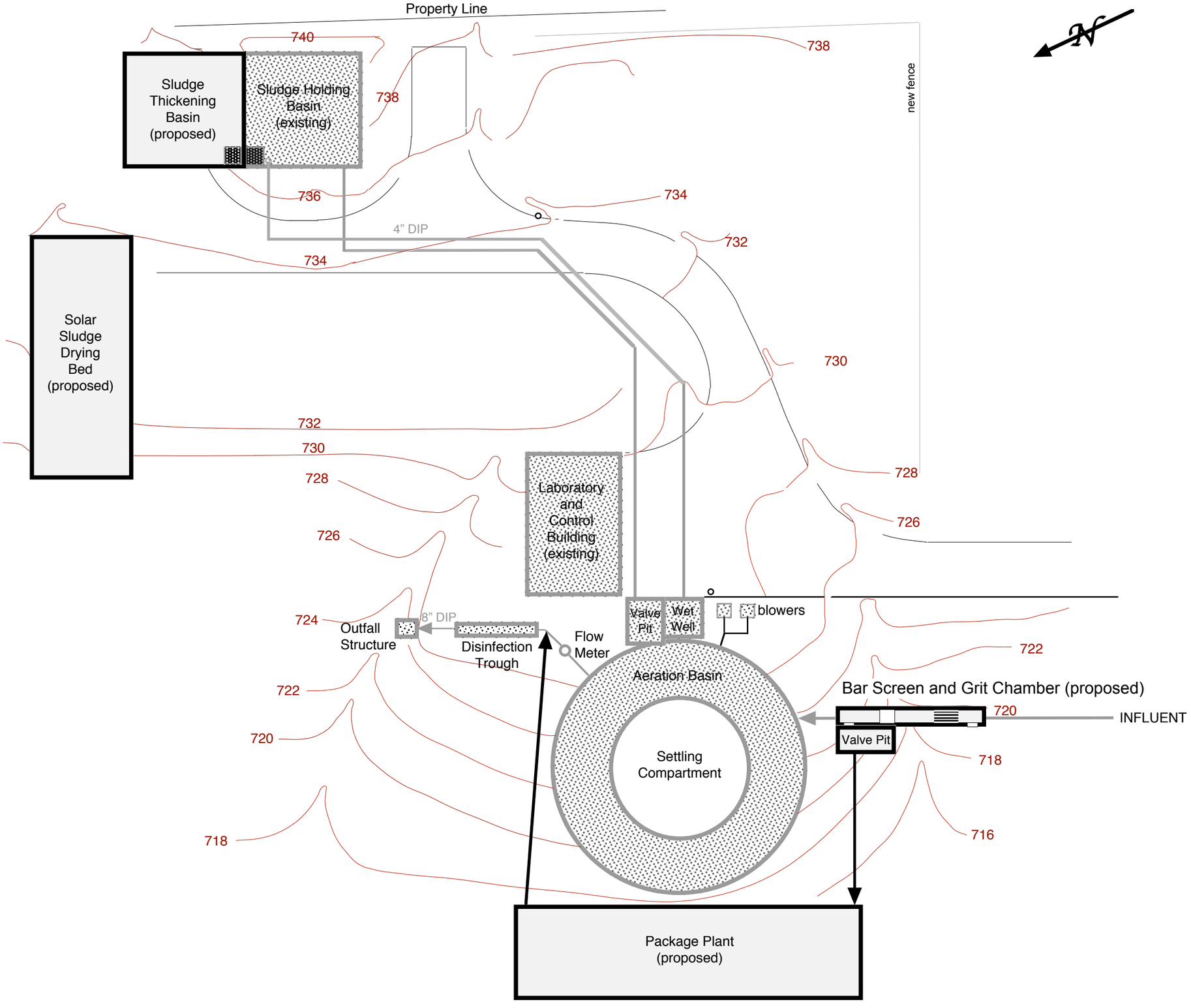
Backup Power Supply

The wastewater treatment plant should have a diesel generator that will enable the plant to perform its basic functions in case of an extended power outage.

Opinion of Probable Cost: $50,000

Conclusions

The City of Leadwood's wastewater treatment facility is in need of improvements with regard to pre-treatment (bar screens, grit removal), a second treatment train, sludge management, and a backup power supply. The total cost of these improvements is estimated to be $2,990,000.



City of Leadwood
Wastewater Treatment Plant Modifications

Leadwood, MO

SITE PLAN

Designed by: TOC
Drawn by: TOC
Checked by: JOC
Date: May, 2009

No.	Date	Revision	By

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