# City of Louisville

## *Wastewater Treatment Facility*

*1601 Empire Road*
*Louisville, Colorado 80027*
*303-335-4780*

*Louisville Wastewater Treatment Facility: Includes from L-R Pump building, Administration Building, Lab building and Centrifuge Building. A storage lagoon is in the foreground.*

## HISTORY OF LOUISVILLE WASTEWATER TREATMENT PLANT

The Louisville Wastewater Treatment Plant (WWTP) is located in eastern Boulder County on the east side of Louisville. The facility discharges into Coal Creek, which is approximately ¼ mile east of the plant. The initial WWTP was constructed in 1952 and consisted of a settling pond followed by an aerated lagoon. Growth within the City was very slow for a number of years and the plant was not expanded until 1965. At that time, an Extended Aeration Activated Sludge plant (Race Track) was added along with chlorination to provide a higher degree of treatment.

To meet continuing growth, a four-cell lagoon system was added in 1973. During that period, the effluent from the Race Track process discharged into the lagoon system during high flows or for irrigation use. Two additional lagoons were added in 1978 to meet demand. In the early 1980's the City grew substantially. By 1982, the plant was experiencing over loaded conditions and required a more effective way of treating sewage. A 900,000-gallon per day Extended Aeration, Activated Sludge treatment plant was constructed to meet growing demand.

Soon after the 1982 expansion, the WWTP had many difficulties meeting its discharge permit limits. The treatment processes were once again approaching their design capacity.

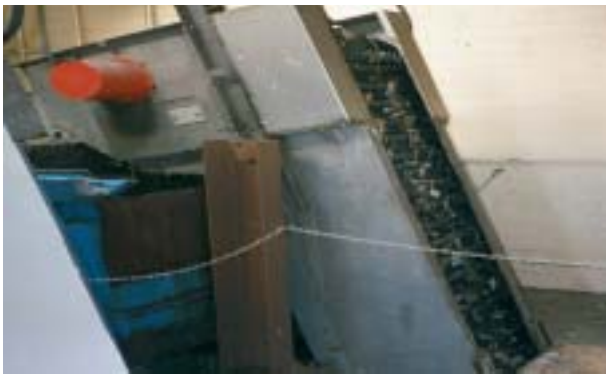
In 1986, construction of a new clarifier, aeration basin, and chlorine contact tank was necessary to address the increased hydraulic and organic loadings. A laboratory was also added in 1986 to assist operators in controlling the various treatment processes and for monitoring regulatory pollutant limits. The most recent plant expansion was completed in 1999. An administration building was added along with a secondary clarifier, new pump building, ultra-violet disinfection system, and upgrade of the aeration system. A 400 KW diesel powered generator was purchased to ensure continual electrical power supply to equipment. Programmable logic controllers (PLCs) were also added along with new computer Supervisory Control and Data Acquisition (SCADA) software to operate automatic control devices on vital process equipment.

## OVERVIEW OF TREATMENT PROCESSES

The City of Louisville's WWTP utilizes various equipment, concrete basins and "Bugs" to treat raw sewage that comes from homes and businesses within the City. The raw sewage gravity flows through a network of pipes, which discharges into the treatment plant. Next, screening equipment removes rags, sticks, and other trash found in the sewage. After passing through a grit chamber and flow measuring device, the raw sewage flows into an aeration basin. The critical treatment process begins in the aeration basin were the raw sewage comes in contact with activated sludge. Activated sludge is mostly water, 99.7% by volume, but it also contains a sludge biomass that is light brown in color with a musty odor.

The term "activated" means that the sludge particles are teeming with bacteria, fungi, protozoa, and other microorganisms (Bugs). These "Bugs" decompose organic material found in sewage and in doing so consume oxygen. The oxygen needs of the "Bugs" are met by blowing compressed air into the aeration tanks.

*Raw Sewage flows into the aeration basin where air is introduced for mixing and supplying oxygen to microorganisms for decomposition of organic matter. The secondary clarifier (center tank) provides solids/liquid separation. Solids are pumped back to the aeration basin and supernatant flows by gravity to the ultra-violet disinfection equipment.*



*The Bar Screen, located in the headworks building, removes heavy debris such as rags, sticks, and plastic items that are discharged into the sewer system. Removal of this material protects other plant equipment from damage.*

Activated sludge then flows from the aeration basin into the secondary clarifiers where the sludge containing "Bugs" and solids settle to the bottom. This separation of material produces clear water or effluent. The effluent then flows throught the ultra-violet system where harmful bacteria is removed by the ultra-violet light. The effluent is then discharged to Coal Creek.

To control the biological process and maintain a healthy "Bug" population, a portion of the solids that settle to the bottom of the clarifier are wasted to a digester tank for further treatment.

The process sequence for the Louisville Wastewater Treatment Plant consists of preliminary treatment (Bar Screens, Grit Chamber, flow meter), Aeration Basin with activated sludge, secondary clarification, and Ultra-violet disinfection. Solids that are removed from the activated sludge process are stabilized in the Aerobic Digester, and thickened in the Gravity Thickener basin or pumped into the Drum thickener equipment. Sludge is then removed from the digester (@2.5% solids) and pumped to a Centrifuge for further dewatering (to 11% solids). The Biosolids (treated sludge) are placed on 3 acres of an asphalt surface were they are aerated and mixed daily in windrows by a front end loader equipped with a mechanical auger/aerator attachment. After the biosolids meet EPA requirements for Class "A" biosolids, they are ready for distribution.

## PRELIMINARY TREATMENT

Household and industrial/commercial wastewater from the City of Louisville's sewer collection system enters the Headworks building via a 27" clay pipeline. The raw wastewater is screened by two automatic bar screens that remove rags, sticks, and other debris which could damage downstream equipment or interfere with treatment. The screened wastewater then flows through a grit removal channel. The grit channel allows heavier sand, gravel, and other particles to settle out while the organic materials remain suspended in the wastewater and are carried on. Grit removal is necessary to protect moving mechanical equipment from abrasion and abnormal wear and to reduce the quantity of inorganic solids in the process basins. The gritty material is pumped out of the channel and disposed of in the landfill. Pretreated wastewater then passes through a Parshall Flume and flow-measuring device on its way to the aeration basin.

## SECONDARY TREATMENT

The secondary treatment is an extended aeration, activated sludge process which consists of one 2.1 million gallon aeration basin with two secondary clarifiers, two centrifugal aeration blowers, three return activated sludge pumps (RAS), and one progressive cavity pump for waste activated sludge (WAS). The purpose of the secondary process is to provide optimum environment for microorganisms to flourish and reproduce where they can breakdown and digest the organic material in the raw wastewater.

Raw sewage from the primary process flows by gravity into the aeration basin supplying food to the microorganisms ("Bugs"). The aeration basin must be mixed and the "Bugs" supplied with oxygen to survive; a 200 Hp Centrifugal blower that forces air into the tank accomplishes this. The activated sludge in the aeration basin is also called mixed liquor, which is a combination of water, solids, and "Bugs." After the

*The progressive cavity pumps are used to transfer waste sludge solids from the secondary clarifiers to the digester and Drum thickener equipment.*

*The multi-stage centrifugal blowers deliver compressed air to the aeration and digester basins. Two 200 hp electric motors drive the blowers which pump air to the aeration basin while another two 250 hp motors supply air to the digester.*

mixed liquor is treated for many hours in the aeration basin, the mixed liquor flows into a splitter box where the flows are split between the two secondary clarifiers.

The clarifier units provide for the liquid-solids separation of the mixed liquor. The upper portion of the clarifier contains clear effluent which gravity flows to the ultra-violet disinfection system where pathogenic (disease causing) bacteria and viruses ("Bad Bugs") are destroyed. The heavier sludge solids, which settle to the bottom of the clarifier, are pumped back (RAS) to the aeration basin for continued treatment of incoming raw wastewater by the microorganisms. In order to control the activated sludge process, excess sludge from the bottom of the clarifiers (WAS) is removed daily by a wasting pump. These solids are pumped into the aerobic digester for further treatment.

## EFFLUENT DISCHARGE

After passing through the Ultra-violet disinfection system, the final effluent or finished product from the treatment processes is used in different ways. Most of the effluent is discharged to Coal Creek, helping to maintain aquatic life and habitat in the stream. Effluent is also reused in the treatment plant for irrigation of vegitated areas and lubrication of pump seals.

After additional disinfection, a portion of the effluent (reuse water) is pumped to the Louisville Sports Complex and discharged into a holding pond. From there the reuse water is used to irrigate the ballfields and surrounding trees and native grasses. Reuse water contains valuable nutrients and soluble metals that improve plant growth and soil structure.

## SOLIDS HANDLING/BIOSOLIDS PROCESS

Sludge removed from the secondary clarifiers (WAS), that is not returned to the aeration basin is pumped to the aerobic digester for further treatment and stabilization. The microorganisms in the digester basin consume organic material, which produces byproducts of carbon dioxide, water, and inorganic and organic compounds.

The thickener basin concentrates solids by removing excess water through the use of gravity. The solids from the thickener are pumped to a centrifuge dewatering machine were additional water is removed. After dewatering the solids, they are placed on a three acre asphalt drying pad were the biosolids treatment process begins.

The biosolids are formed into windrows, which are aerated and mixed daily by mechanical equipment called an auger/aerator. Aeration by the auger/aerator speeds up the biological activity by adding oxygen and helps dry out the solids. Once the biosolids reach a moisture level between 45% to 50% they are stacked into a larger pile for composting. During the composting process, temperatures are elevated to 50 to 55 degrees Celsius for several weeks. This temperature range is critical in killing bacteria and viruses that maybe present in the biosolids. The final step in the biosolids process involves sampling and lab analysis of the biosolids. After the biosolids meet or exceed the EPA regulations and requirements for Class "A" biosolids, they are reused by the City in landscape projects and made available to local residents and businesses for use in gardens, lawns and other landscaping projects.

*Digester: Solids that have settled to the bottom of the secondary clarifiers are pumped or wasted to the digester basin for further treatment and stabilization. The digestion basin includes a gravity thickener unit which is located in the center of the basin.*

*After the Digester sludge is dewatered in the centrifuge, they are applied on 3 acres of asphalt surface where they are mixed and aerated daily with a front end loader and auger attachment. This aeration and mixing process reduces water and eliminates harmful bacteria producing Class "A" biosolids.*

## ADMINISTRATION AND LAB BUILDINGS

The administration building contains the office of the Plant Superintendent, Chief Plant Operator, and the Industrial Pretreatment Specialist. A combined break room/meeting area and locker room/shower facility are also located within the administration building.

The laboratory building houses the operator's office area and computer room which controls, monitors, and records daily functions and activities through out the WWTP. Maintenance records are stored in computer files and are checked weekly for routine maintenance work that must be performed to ensure that various plant equipment is running efficiently and reliably. An integrated alarm system alerts operators 24 hours per day of any vital equipment failure or process variance from normal conditions.

The lab area is used to perform analysis of sludge, influent, and effluent samples for process control. Certified operators perform tests, in order to ensure compliance with EPA and State Health Department's stringent discharge permit regulations for Coal Creek. Proper analysis is also important in achieving cost-effective and environmentally safe effluent discharged from the Wastewater treatment plant.

## INDUSTRIAL PRETREATMENT PROGRAM

The City's Industrial Pretreatment Program (IPP) was initially approved by the Environmental Protection Agency in 1983. The IPP has gone through numerous changes to comply with new requirements and regulations over the years. Presently, the IPP consists of a coordinator, who is also the WWTP Superintendent, and a Pretreatment Specialist. Their primary duties consist of regulating and monitoring all industrial and commercial businesses located within city limits of Louisville. Permitted industries are sampled on a regular basis to verify compliance with local and federal pretreatment regulations. Currently, there are four companies in the City that are defined as Categorical dischargers and are permitted through the IPP. All new commercial and industrial businesses in the City are inspected before they can discharge from their facilities. The Pretreatment Specialist performs annual inspections of regulated businesses and also inspects restaurant grease interceptors on a quarterly basis to make sure the restaurants are maintaining their interceptors.

Stringent discharge limits imposed on industrial and commercial businesses are required to protect the general public and City employees as well as the sewer collection system, wastewater treatment processes and equipment. Other benefits of a Pretreatment Program include: protecting the receiving stream (Coal Creek) from industrial pollutants that may pass through the WWTP, reducing the chance of illegal dumping of hazardous or toxic wastes into the sanitary sewer system, and protection of the City's biosolids from contamination by industrial wastes.

*The Laboratory building contains equipment and chemicals used by the operators to perform various laboratory analyses. Daily sample collection and testing is required for monitoring and controlling the biological process at the Wastewater Treatment Plant. Extensive laboratory analysis is also required for the effluent reuse program and biosolids composting process.*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