

**CITY OF BOULDER
WATER RESOURCES ADVISORY BOARD
INFORMATION ITEM**

MEETING DATE: July 20, 2015

AGENDA TITLE: Information Item – Wastewater Treatment Update

PRESENTERS:

Jeff Arthur, Director of Public Works for Utilities
Chris Douville, Wastewater Treatment Manager
Douglas Sullivan, Acting Principal Engineer

I. PURPOSE

This information item provides an update on the wastewater treatment facility (WWTF) and related programs / projects. The memorandum is organized as follows:

1. Summary of facility status and recent performance
2. Nitrogen Upgrades Project
3. Other noteworthy Capital Improvement Project (CIP) efforts

Later in 2015, WRAB will learn of updates associated with two additional wastewater topics. These items are tentatively scheduled as follows:

- October 19 – **Wastewater Treatment Renewable Energy**. Topics to include cogeneration, solar PV, and energy management initiatives.
- November 16 – **Wastewater Facility Permit Renewal and Regulations Update**. Topics to include Colorado Discharge Permit System (CDPS) effluent permit renewal status, and regulatory updates on important parameters such as copper, arsenic, and temperature.

II. SUMMARY OF FACILITY STATUS AND RECENT PERFORMANCE

The 75th St. wastewater treatment facility (WWTF) is 47 years old yet continues to perform with a high degree of success due in large part to proper and timely investments over the years to address capacity, regulations, and aging infrastructure. 2014 was a so-called baseline year of performance as no construction activities occurred, and no major process or operational modifications were implemented. It is fair to say that 2014 was the best performance year the

WWTF has ever accomplished, based on effluent quality, permit compliance, and resource utilization.

Facility data from the past 18 months (January 2014 through June 2015) is summarized below in Table 1. Effluent quality was excellent during this timeframe, including ammonia removal which was particularly impressive. During this timeframe, there were no effluent concentration violations of the CDPS permit. However, in May 2015 Boulder experienced significant, steady precipitation that resulted in elevated levels of infiltration and inflow (I&I) entering the wastewater collection system. As a result, wastewater flows increased significantly, and a monthly average flow of 26 MGD occurred, which is above our permitted flow limit of 25 MGD.

Table 1 – Effluent quality from January 2014 through June 2015

<i>Parameter</i>	<i>Min</i>	<i>Ave</i>	<i>Max</i>	<i>Notes</i>
Flow (MGD)	9.2	15.6	39.9	Max month limit 25 MGD
cBOD (mg/L)	1	3	8	Monthly permit limit 25 mg/L
TSS (mg/L)	2.0	5.8	21	Monthly permit limit 30 mg/L
NH3 (mg/L)	<0.1	<0.1	0.9	Future permit low limit 1.9 mg/L
NO3 (mg/L)	6.6	14.2	22.9	Future permit low limit 14.7 mg/L
<i>E-Coli</i> (#/100 ml)	1	33*	365	Monthly permit limit 126 / 100ml

* *E-coli* geometric mean is lower than arithmetic average.

Source energy use, and the distribution between grid electricity and renewables, is an important aspect of how treatment goals are achieved. Both reduction of grid energy reliance as well as conservation and using less energy are of high interest for the wastewater treatment program. Table 2 below summarizes the distribution between grid electricity, electricity provided by the city’s 29-year-old cogeneration facility, and electricity provided by the 5-year-old Solar PV facility (owned, operated, and maintained by SunEdison) for the most-recent 12 months.

Table 2 – Electrical power distribution summary, June 2014 through May 2015

<i>Source</i>	<i>Percent</i>	<i>Notes</i>
Solar PV	13	15% during year 1
Cogeneration	18 *	Historically 20-25%
Niwot Substation Grid	15	
Leggett Substation Grid	54	
Grid Subtotal	69	
Renewables Subtotal	31	

* Cogeneration production has been reduced lately due to multiple mechanical, electrical, and control issues resulting in higher than normal downtime.

Another ongoing program at the WWTF is analysis and decisions around asset management and replacement of aging infrastructure. Figure 1 below may provide a useful framework to understand the evolution and age of the various process areas and buildings / subsystems at the WWTF, and how much of the infrastructure is newer versus aged and at or beyond its useful life.

City of Boulder 75th St. WWTF Age of Process Areas and Buildings

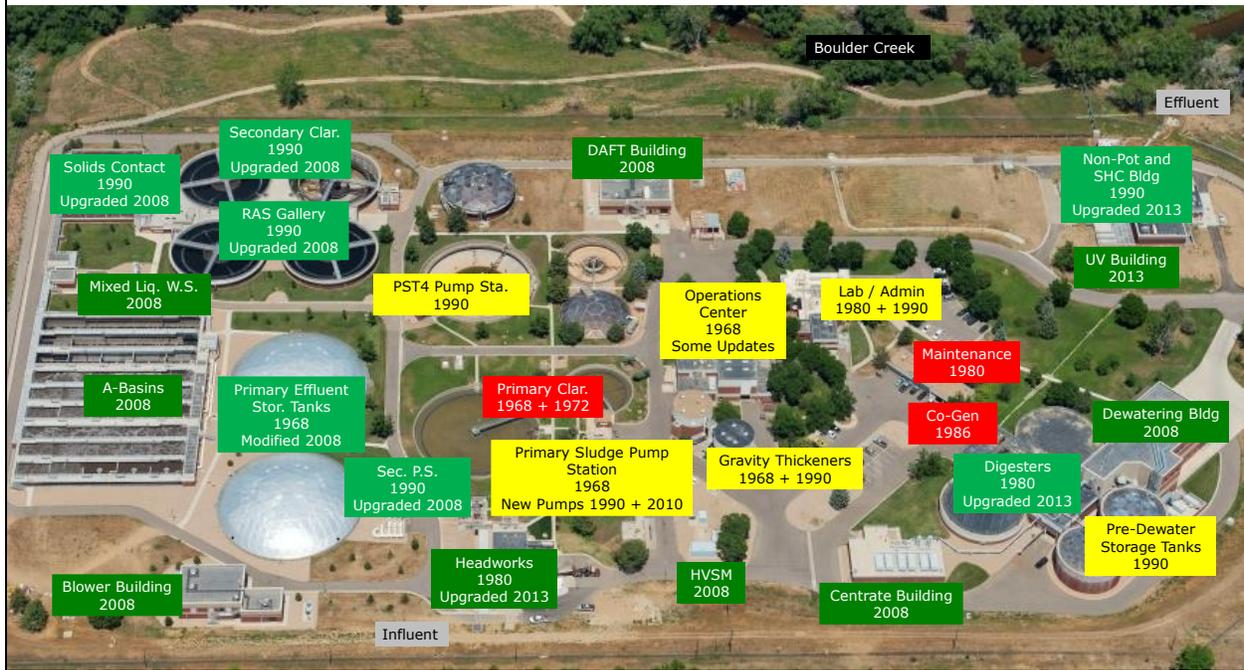


Figure 1 – Age and Status of Process Areas and Buildings

According to the most recent asset management inventory review, which factored into the 2016 CIP budget, the following major capital items budgeted for replacement in the near term:

- 2016 – Pumps - \$150,000 – repair or replacement of top priority pumps
- 2019 – Digester - \$200,000 – design services for new gas storage
- 2020 – Digester - \$2,000,000 – construction of new gas storage facility
- 2020 – Cogeneration - \$185,000 – mechanical overhaul of engines

III. NITROGEN UPGRADES PROJECT

The Nitrogen Upgrades Project (NUP) is the first of three planned projects to meet nutrient regulations for nitrogen and phosphorus. The broad plan for regulatory compliance can be found in the Nutrient Compliance Study, shared with WRAB at the November 2012 meeting as an agenda item. (<https://documents.bouldercolorado.gov/weblink8/0/foi/58033/Row1.aspx>) The main goal of the NUP project is to achieve full compliance with Regulation 85 nitrogen, as well as daily maximum ammonia and nitrate limits that were included in the current CDPS permit (which goes into effect December 1, 2017). It is expected that Regulation 85 limits for nitrogen and phosphorus will be incorporated into the 2016 permit renewal and will include an associated compliance deadline in the 2020-2022 timeframe. As such, the city will achieve nitrogen compliance far in advance of the Regulation 85 effective date. Regulation 85 phosphorus compliance will be addressed in the second of three projects dedicated to phosphorus removal facilities. The phosphorus project is identified in year 2020 of the CIP and has an estimated cost

of \$18,500,000. The final project outlined in the NCS phasing schedule is the project to address Regulation 31 criteria for nitrogen and phosphorus, which are substantially lower / more stringent than Regulation 85.

Carollo Engineers was hired to perform NUP design services for the city, and the design was completed and approved by CDPHE in November 2014. The project includes three main elements, as well as three additional components that help bolster treatment capabilities and operational flexibility. The six project elements are summarized below. Figure 2 includes a site layout showing NUP project elements.

1. **External Carbon Storage and Feed Facility** – a new 30’x50’ single story building to receive, store, and deliver external carbon to the microbiological process to accomplish improved nitrogen removal through enhanced denitrification. Two carbon sources will be utilized – acetic acid, and brewery waste (a water high in sugars referred to as ‘weak wort’).
2. **Aeration Basin Modifications** – structural, mechanical, electrical, and controls upgrades to the existing aeration basins to convert the process from an MLE process to a 4-stage Bardenpho process, to more optimally utilize internal carbon and any supplemental external carbon.
3. **Solids Contact Tank Modifications** – replacement of existing aeration diffusers inside the existing solids contact tanks to enhance final nitrification (ammonia removal) capabilities.
4. **Post Aerobic Digestion Process** – conversion of an existing pre-dewatering sludge storage tank to an aerated process downstream of the anaerobic digesters, where the microbial process will be controlled to encourage nitrification, and potentially simultaneous denitrification, so that the nitrogen load returned to the liquid stream process after dewatering is significantly reduced. Some benefits on dewatering (i.e. reduced polymer requirements) may result as well.
5. **Centrate Control Improvements** – addition of ammonia probes and associated control programming to allow for load-based centrate return to reduce variability in ammonia loading to the main process and enhance the city’s compliance situation with future low ammonia limits.
6. **Primary Clarifier Bypass** – a short pipeline to allow for bypassing some of the facility flow around the primary clarifier process, with the intention of providing more carbon to the activated sludge process to improve nitrogen removal.

Nitrogen Upgrades Project Elements

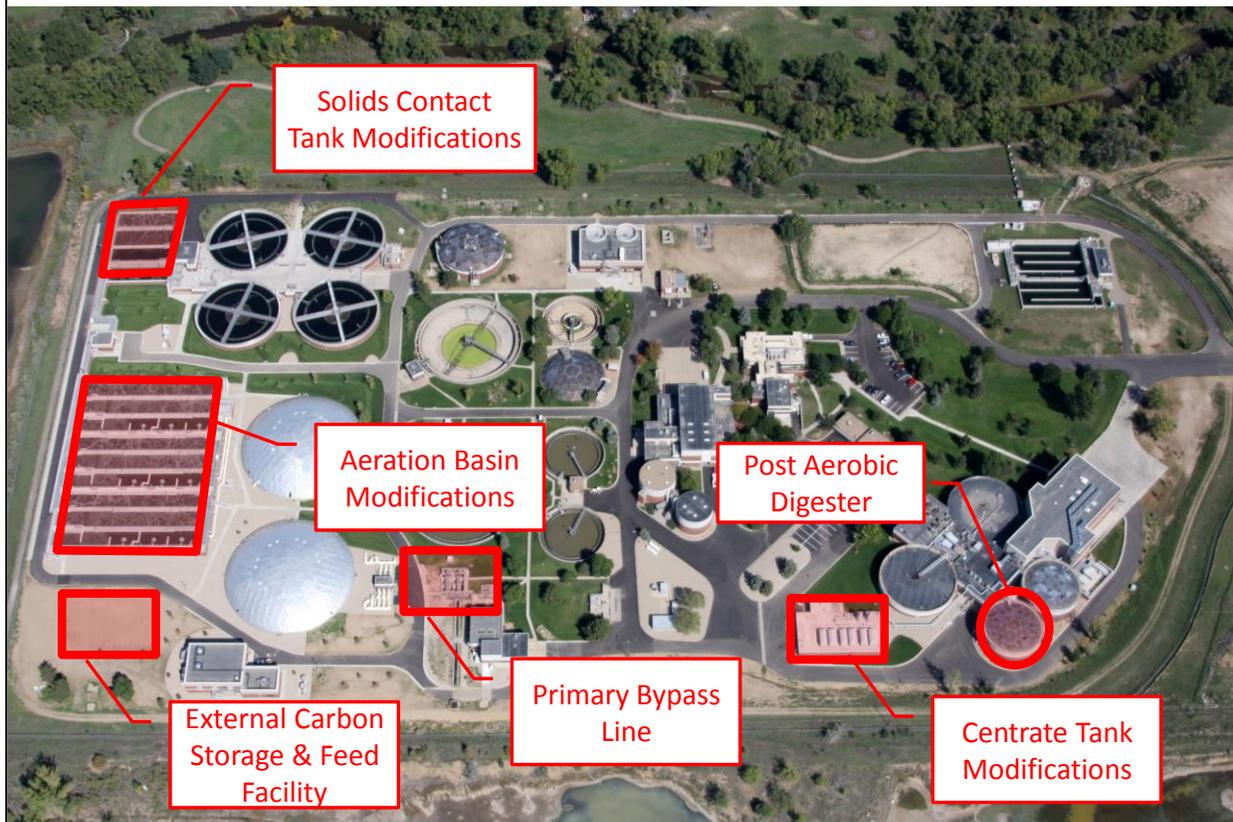


Figure 2 – Key Elements of Nitrogen Upgrades Project

In April 2015, the NUP project was publically bid and subsequently awarded to Aslan Construction, for a bid total of \$4,524,000 (including all six project elements). Currently, the project is going through final approvals with Boulder County. It is anticipated that mobilization and construction will commence in August. The project schedule is projected to be 18 months, which should allow for construction completion near the end of 2016. Funding for construction is partially provided by the Nutrient Management Grant, awarded to the city in 2013. \$900,000 remains in the grant help fund the construction effort.

IV. OTHER NOTEWORTHY CIP EFFORTS

While the Nitrogen Upgrades Project is the main CIP effort occurring at the WWTF for the next few years, several other important capital initiatives are underway in a variety of stages.

IBM LS Project

The IBM Lift Station (LS) is 50 years old, and has been modified / upgraded several times, including the most-recent upgrades project which was completed in 2000. Additionally, CDPHE is requiring that the IBM LS meet current wastewater lift station design criteria for overflow protection. The lift station only has limited emergency storage capability in its current

configuration. The largest vulnerability to the lift station is a rapid or sustained increase in flow due to I&I. Sanitary Sewer Overflows (SSOs) have occurred at the lift station, and the most recent event was September 2013. The city plans to address this deficiency and associated SSOs through I&I reduction efforts (cured-in-place-pipe lining and eliminating cross connections) as well as upgrading the lift station.

The city hired Frachetti Engineering Inc. (FEI) to perform design services for the IBM LS project, and the design was completed and approved by CDPHE in early 2015. The project includes replacement of the three sewage pumps, addition of one standby emergency pump, an increased wetwell volume for additional storage capacity to address overflow protection, and station-wide mechanical / electrical / controls upgrades. The city is currently working through the final construction approval process. The project was bid in June and RN Civil Construction is the apparently low bidder at \$1,564,000. Construction is slated to commence in September.

PAS Improvements Phase 1

In 2013, a Process Automation System (PAS) Strategic Plan was developed to identify and prioritize key projects for the WWTF's essential process automation and control systems (SCADA, PLCs, servers, network, and associated componentry). The plan identified 14 projects organized in priorities of Critical (1 to 2 years), High (3 to 6 years), and Medium (7 to 10 years). The 20-year CIP includes annual funding of approximately \$600,000 for nine of the next 10 years. Several of the critical and high priority projects have been lumped into a single project plan that is scheduled for design in 2015. Carollo Engineers has been given the go-ahead to perform the design services, and construction would follow in late 2015 or early 2016. The 2015 CIP includes funding of approximately \$1,200,000 (including 2014 rollover funds) for the current project. City PAS staff are planning to accomplish several of the identified projects in-house without outside consultant support, and only limited contractor support, to achieve some budget efficiencies.

Electrical System Upgrades and PAS Phase 2

While many of the electrical load centers (LCs) and motor control centers (MCCs) are relatively new, some of them are quite old and beyond their useful life. Five (5) LCs and five (5) MCCs are scheduled to be replaced in year 2017. As such, design for the replacement of this critical electrical equipment will take place in 2016. A design budget of \$120,000 and a construction budget of \$1,200,000 are included in the CIP for 2016 and 2017, respectively.