## Nederland Wastewater Treatment Facility

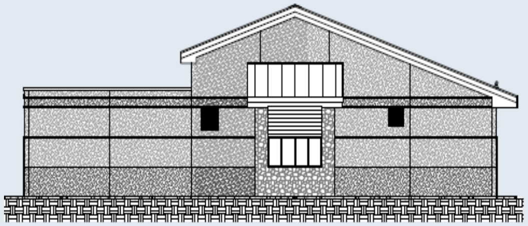

**Figure 1:** West elevation*

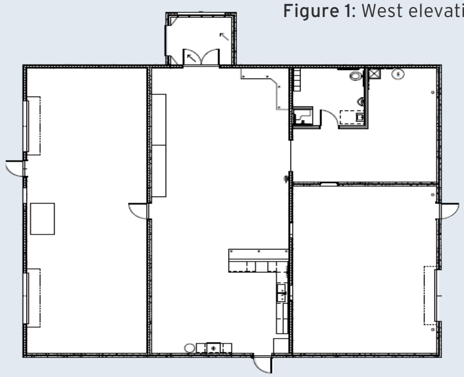

**Figure 2:** Floor plan*

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|---|---|
| **Project Type:** | Wastewater treatment facility |
| **Project Budget:** | $3.5M |
| **Project Size:** | 3,990 sf |
| **Completion:** | Spring 2012 |

**Project Team:**

| | |
|---|---|
| Project Architect: | Aller Lingle Massey Architects |
| Civil Engineer: | The Engineering Company |
| Electrical Engineer: | Russ Sasakura Engineering |
| Mechanical Engineer: | CD Engineering |

**GEO High Performance Consultant (HPC)**

Ambient Energy

*Drawings courtesy of Aller Lingle Massey Architects

## new thinking saves energy

### high performance goals

Seek as many energy efficiency measures as possible in order to reduce the town's energy cost burden.

### project description

The small town of Nederland, CO (pop. 1400) and the adjacent Barker reservoir are within the Middle Boulder Creek watershed. In addition to being a water supply for the town and the adjoining communities, including Boulder, the reservoir is also a recreational area. To help mitigate concerns about the quality of water flowing into the reservoir and downstream, Nederland is constructing a new 3,990 sq ft wastewater treatment facility. This facility will reside on the northwest (upstream) end of Barker Reservoir and be capable of treating 0.25 million gallons of wastewater per day (MGD).

### a pathway to energy efficiency

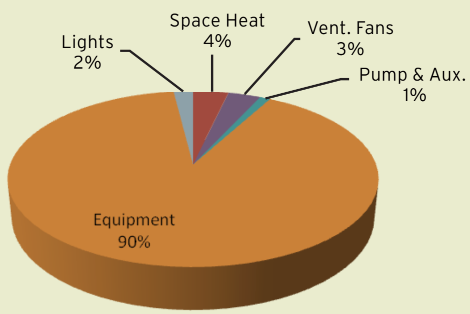
In small towns, facility energy savings can significantly impact operating budgets. At the early conceptual stages of this project, energy efficient strategies became a priority for the project team and town officials. With the assistance of the GEO consultant, an energy analysis for the project identified that nearly 90% of the building's energy use and cost ($112,000/year) was due to process equipment. A typical approach for a project of this size and scope would be to follow a traditional "this is the way it has always been done" path to the specifying of this equipment. However, armed with the results of the energy analysis, the project team embraced a new approach that started with a research effort focused on more efficient waste water treatment equipment.

As a result of this research, high speed turbine blowers were selected in place of the originally designed standard centrifugal and positive displacement (PD) blowers. Compared to the original design, the turbine blower for the digester is expected to save a minimum of 15% of the energy used annually and have a simple payback of three years. The turbine blower for the sequencing batch reactor (SBR) has a payback of just over one year. The combination of this equipment accounts for more than 60% of the overall electric load of the facility. By selecting high efficiency blowers, a minimum 14% electrical energy savings is expected annually.

The headworks room is where wastewater first enters the treatment facility. This first stage of treatment, by code, requires twelve continuous air changes per hour for safe operations and occupancy. As a result, the makeup air unit normally would require supplemental heating, placing a significant energy load on the building. However, with this facility, the project team was able to design a heat recovery system with recovery coils around the discharges pipes of the high horsepower turbine blowers. The recovered heat from these coils is then transferred to the makeup air unit, nearly eliminating the need for heating in these rooms.

Additional support by the GEO consultant helped to further optimize the energy efficiency of this wastewater treatment facility. This included incentive research, recommendations to reduce heating setpoints, and participation in conceptual design meetings with the owner and project team. All together, this process resulted in an estimated annual energy savings for the project of at least $13,000 per year. The energy analysis, short payback, and ongoing energy savings made it a simple decision for town officials to support the high performance features of this project.

**Nederland WWTF Energy Use**




This chart, from the GEO consultant's energy analysis, quantifies and categorizes the energy use in the treatment facility by system. The graphic showed the project team and town officials illustrated to the project team and town officials that focusing on efficient process equipment would have a significant impact on energy use and cost.

## high performance design features

- Energy efficient blowers with air bearings in lieu of standard blowers with grease bearings.
- Gas-fired radiant burners for energy efficient spot heating to keep pipes from freezing replaced conventional propeller driven convective heaters.
- Walls insulated to the levels required by ASHRAE 90.1-2004 to reduce heating energy costs.
- Heat recovery from turbine blowers to further reduce energy consumption.
- Winter heating setpoint reduced to 45 degrees F from the originally planned 55 degrees F to minimize energy use.
- Cooling system eliminated in order to reduce peak electricity consumption.
- Building footprint was minimized to avoid heating extra square footage and to save on construction costs.
- Photovoltaic system investigated pending the terms of a power purchase agreement.
- Separate facilities for treatment and administration enable customizing and economizing the ventilation supply for each based on their specific needs and code requirements.

## payback analysis

While there were some up front costs associated with purchasing the higher efficiency process equipment, the payback period was very short and the enhanced equipment was a valuable investment. The analysis below details the cost-effectiveness of the proposed high efficiency blowers.

### digester blower payback

- Original design (positive displacement blowers): 70 hp, 52 kW, at a cost of $106,000 (two blowers).
- Re-design for energy efficiency (high speed blowers utilizing air bearings): 50 hp, 37 kW, at a cost of $172,000 (two blowers).
- Despite the higher initial cost, energy analysis showed a 2.5 year payback for both blowers, with an annual energy savings of 891,891 kBtu per year.

### sequencing batch reactor blower payback

- Original design (positive displacement blowers): 34 hp, 27 kW, at a cost of $70,000 (two blowers).
- Re-design for energy efficiency (high speed blowers utilizing air bearings): 26 hp, 19 kW, at a cost of $76,000 (two blowers).
- Despite the higher initial cost, energy analysis showed a 1.1 year payback for both blowers, with an annual energy savings of 178,378 kBtu per year.