Replacement of Rotating Biological Contactor System with Sequenced Aeration System

Village of Hinckley Wastewater Treatment Facility Expansion

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Background

Village of Hinckley

- Located in DeKalb County Along Route 30, West of Aurora (~50 Miles West of Chicago)
- Population ~2,070
Existing WWTF

- Originally Constructed in 1974
- Upgraded in 2001

Key Components:
- Sludge Drying Beds
- Sludge Holding Tank
- Headworks & Raw Sewage Pump Station
- Primary Clarifiers
- Aerobic Digesters
- 3 Rotating Biological Contactors (RBCs)
- Secondary Clarifiers and Solids Contact Tank
- Final Clarifier
Existing Facility Status

Outdated and Unreliable Process Equipment

Numerous Effluent Violations: Ammonium, BOD, TSS

Flows regularly exceeding WWTF capacity (DAF = 0.2 MGD)

2010 – WWTF on Illinois Pollution Control Board’s Critical Review List

USEPA Administrative Order – Compliance by End of 2014
Existing Facility Status

WWTF Average Daily 3-Month Low Flow
Village of Hinckley, DeKalb County, Illinois

- > 100% Capacity - Restricted Status
- 80% to 100% Capacity - Critical Review Status
- <= 80% Capacity
- Average Daily Flow

Year:
Project Goals

Expansion: 0.2 MGD to 0.5 MGD Design Average Flow

Convert Failing Rotating Biological Contactor (RBC) Process to Suspended Growth Activated Sludge Process with Nutrient Removal

Expand Screening and Pumping Capabilities

Meet New Seasonal Disinfection Requirements

Improve Biosolids Treatment and Handling
Project Details - Treatment

Demolition of Existing RBC’s and Associated Primary Clarifiers, Secondary Clarifiers, and Solids Contact Tank

New Activated Sludge Process Manufactured by Aero-Mod, Inc.

- Bio-P Fermentation Zone
- Anaerobic Selector
- 3-Stage Controlled Aeration
- Clarifiers
- Aerobic Digesters
- Internal RAS & WAS
Aeration System
Sequential Oxidation Biological Nutrient Removal (BNR)

- Bio-P Fermentation, Anaerobic Selector, 3-Stage Controlled Aeration
- Each Step Carried Out in Separate Tanks
- Sequential Aeration to Minimize Energy Usage
- Automatic Solids Wasting to Aerobic Digesters
Slide Rail Diffusers

- Lightweight PVC Assembly
- Individual Isolation and Air Control
- Support Provided by Stainless Steel Guide Rail
- Easy Removal
Aeration System

Clarifiers

- Rectangular Design
- Rapid Removal of Solids Through Automatically Timed Airlifts
- Effluent Flow Regulation
- No Electrical Components
- No Moving Parts Below Water Surface
- Minimal Maintenance
Aeration System

Additional Highlights:

• Modified Typical System Design to Reuse Existing Clarifier and Digesters
• Common Wall Construction
• Energy Efficient
Modifications to Headworks and Raw Sewage Pump Station

- Mechanical Screen – Center-Flow
- Replace Raw Sewage Pumps and RAS Pump and Add VFD’s
- Electrical and Controls Upgrades
Mechanical Screen

- Center-Flow Screen
- Solids Collected on Continuous Belt that Conveys Solids to Wash Compactor
- No Submerged Drive Components
- Design Reused Existing Influent Channel at WWTF
- Winterized with Heat Traced and Insulated Components
Additional Project Details

New UV Disinfection and Effluent Parshall Flume

Modifications to Existing Aerobic Digesters

Reused Existing Structures and Processes for Supplemental Biosolids Dewatering and Storage

New Biosolids Dewatering Building
Biosolids Dewatering

Dewatering Building

- Belt Filter Press with Sludge Feed Pump, Polymer Feed System, and Cake Pump
- Indoor Sludge Storage Area
- Chemical Feed System for Chemical Phosphorus Removal
- Non-Potable Water System
- Houses Blowers and Compressor System for Aero-Mod Activated Sludge System
Construction Challenges

RBC No. 3 Failure

RBC No. 1, Stage 2 Failure

Maintain Treatment Throughout Construction

- Phased Demolition & Equipment/Treatment Startups
- Bypass Pumping
Construction Challenges

Switchover from Existing RBC System to Aero-Mod System
Process Optimization

- Operational Changes and Control Adjustments to Optimize BNR
- RAS Cycle Timing (On/Off) Adjustments
- Aeration Cycle Timing Adjustments
- Winter Mode
- Ongoing Coordination with and Support from Manufacturer
Effluent Results

TOTAL SUSPENDED SOLIDS

- Concentration (mg/L)
- Monthly Average
- Permit Limit - Monthly Average

Key Events:
- USEPA Administrative Order Issued
- Aero-Mod System Online
Effluent Results

NITROGEN, AMMONIA TOTAL

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Monthly Average

Permit Limit - Monthly Average

USEPA Administrative Order Issued

Aero-Mod System Online
Effluent Results

BOD-5

CONCENTRATION (mg/L)

Jan-08 Apr-08 Jul-08 Oct-08 Jan-09 Apr-09 Jul-09 Oct-09 Jan-10 Apr-10 Jul-10 Oct-10 Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13 Apr-13 Jul-13 Oct-13 Jan-14 Apr-14 Jul-14 Oct-14

USEPA Administrative Order Issued

Aero-Mod System Online

52 Wheeler Road, Sugar Grove, IL 60554 ~ (630) 466-6700 tel ~ (630) 466-6701 fax ~ www.eeiweb.com
TOTAL NITROGEN (AFTER AERO-MOD SWITCHOVER)

- Y-axis: Concentration (mg/L)
- X-axis: Months from Jun-14 to Dec-14
- Data points show the concentration of total nitrogen from June to December 2014.
TOTAL PHOSPHORUS (AFTER AERO-MOD SWITCHOVER)

- **CONCENTRATION (mg/L)**
- **Jul-14** to **Nov-14**
- **Total Phosphorus**
- **NPDES Permit Limit**

Graph showing the concentration of total phosphorus from July to November 2014, with the NPDES Permit Limit marked as a horizontal line.
Project Summary

- Complete Design Eng. (10/12)
- USEPA Administrative Order (5/13)
- Construction Start (7/13)
- USEPA AO Compliance Date (12/14)
- Facilities Plan Report Complete (3/11)
- Bid Opening (4/13)
- Executed IEPA Loan (6/13)
- Contract Completion Date, Substantial Completion, and Open House (10/14)
Project Summary

Project Construction Cost ➔ Funded Through IEPA Low Interest Loan

- Original Budget: $4,600,000
- Actual Cost: $4,800,000 +/−
- Construction Contract C.O.’s @ 1.5%

Project Team

- Owner: Village of Hinckley
- Contract Operations: Test, Inc.
- General Contractor: Whittaker Construction & Excavating, Inc.
- Engineer: EEI
Q&A