Case History Addressing Disposable Wipes at a Remote Lift Station

City of Marshfield

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North East Lift Station
North East Lift Station

- 4 Drywell pumps, 26 foot extended pump shafts
- One pump had VFD, others constant speed
- Combined rating 5,000 GPM
- Lift Station built in mid-70’s
- Pumps and controls upgraded 2000
- 10,150 foot-20 inch forcemain
Major Issues with the Lift Station

- Disposable wipes causing plugging
- Floating surface mat of grease and wipes
- Motor and shaft maintenance
- Corrosion and odor at the discharge manhole
- Limited process control
Disposable Wipes
Disposable Wipes
Disposable Wipes at Pump Volute
City’s Approach

- Everything is done on a 5 year plan
- Determined to install a screen
- City’s RFP requested
  - Design and construct a screening system
  - Prepare a long term facilities plan
  - Budgeted $400,000 for improvements
- Hired T&C to do this evaluation
Initial Evaluation

- Agreed to look at other alternatives
- Performed a detail inspection
- Met with City management staff
- Met with the day to day operators
- City met with probable disposal wipe users
Documentation of Issues

- Pump raging-especially during start up
- Pumps not for wastewater
- Debris accumulation in wet well
- Air locking
- Corrosion-wet well and discharge pipe
Documentation of Issues (cont.)

- Low forcemain velocity
- Stray voltage
- Bad environment in wet well
- Water hammer
- Inoperable valves
- Dry well egress/classification
Existing Electrical Panels
Existing Electrical Panels
Existing Pumps
Existing 
Pump Shafts 
and 
Bearings
Existing Flow Meter Valves Not Operable
Existing HVAC
Immediate Needs 0 to 2 Years

- Pump and control for at least 1 pump
- Wet well mixing
- Screening if new pump is not sufficient
- Replace inoperable equipment
- Partial replacement of electrical components
Short Term Needs 2 to 5 Years

- Possibly replace all pumps
- Replace all electrical gear/transformer
- SCADA/Instrumentation replacement
- HVAC and building improvements
- Address all code violations
- Wet well stair
- Pig forcemain
Cost Evaluations - Initial

- Alternates included screens, one new pump and controls, and different combinations
- Cost ranged from $275,000 to $595,000
- Did not address any of the 2-5 year items
- Preliminary decision to eliminated the screen alternates
Cost Evaluations-added 2-5 year Needs-Phase 1

- Replace 2 pumps with VFD’s
- Rebuilt 2 existing pumps with soft starts and relocate motor
- Upgrade the entire electrical system
- Upgrade the dry well building, HVAC, etc.
- Projected costs $1,230,000
- All improvements were part of the Facility Plan
Lift Station Control Recommendations

- Rotate pumps on regular basis-1 to 12 hrs.
- Vary the wet well water level
- Pump down the wet well at end of each pump rotation
- Automate flush cycles and frequency
- Decrease operating wet well depth
- Don’t use existing bar rack
- Controls critical to the solution
Phase 2-Wet Well Improvements

- Painting, HVAC, stairs
- Wet well mixers if needed
- Screening if needed
- Projected cost $485,000 not including screen
Construction Approach

- Pre-bid pumps - $224,000
- Pre-bid electrical and controls - $344,000
- Bid the installation and all other improvements - $337,000
- New transformer by the Utility
First Pump In
Both Pumps In
Cleaning Paint Out
New Pumps
Pump Size
Motor Relocation and Flow Meter
New Entry Doorway
New Switchgear
New Bubbler Tube System
Cable Tray System
Pump Control Matrix

Matrix Duration: 12.0 HR
Duration Accumulated: 3.8 HR

Pump-Down Speed: 100.0 %

Stage No. 1
- Pump No. 1: On
- Start: 8.25 FT
- Stop: 3.35 FT

Stage No. 2
- Pump No. 2: On
- Start: 9.25 FT
- Stop: 7.50 FT

Stage No. 3
- Pump No. 3: On
- Start: 11.50 FT
- Stop: 7.00 FT

Stage No. 4
- Pump No. 4: On
- Start: 12.00 FT
- Stop: 8.00 FT

Matrix Alternation Select: Auto

Working Ramp Control
- Wetwell Level: Minimum 3.75 FT, Maximum 7.75 FT
- Pump Speed: Minimum 75.0 %, Maximum 100.0 %
System Flushing

<table>
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<tr>
<th>Day</th>
<th>Flush 1</th>
<th>Flush 2</th>
<th>Flush 3</th>
<th>Flush 4</th>
<th>AFD Speed</th>
<th>Pumps used to Flush</th>
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<td>24:00</td>
<td>24:00</td>
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<td>24:00</td>
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Plant Monitoring Screen
Results

- Since start up, no plugging
- Eliminated wet well mat
- Significantly reduced the H2S at the discharge
- Greatly reduced alarms and call ins
- Final costs $1,025,000
H₂S Improvements

H$_2$S Improvements
H$_2$S Improvements
Questions and Comments