

# Solon Springs, WI WWTF Case Study Achieving Affordable Compliance

Michael C. Stoffel, PE  
Senior Project Manager

# The Background

Regional Stabilization Pond System

Primary (2), Secondary, Seepage Cell (2)

Village of Solon Springs (Village)

Upper St. Croix Lake Sanitary District (USCLSD)

Collection and Treatment

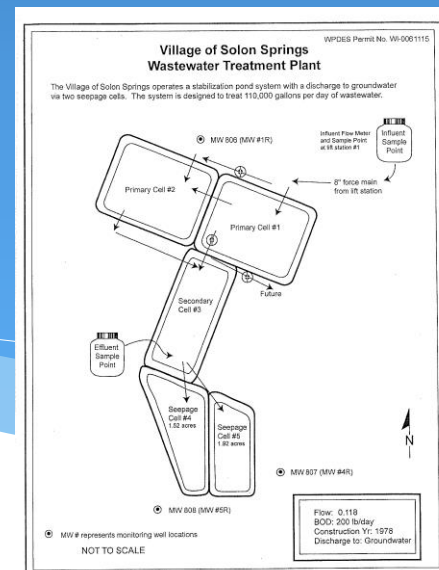
Town of Gordon Sanitary District (Gordon)

Treatment Only

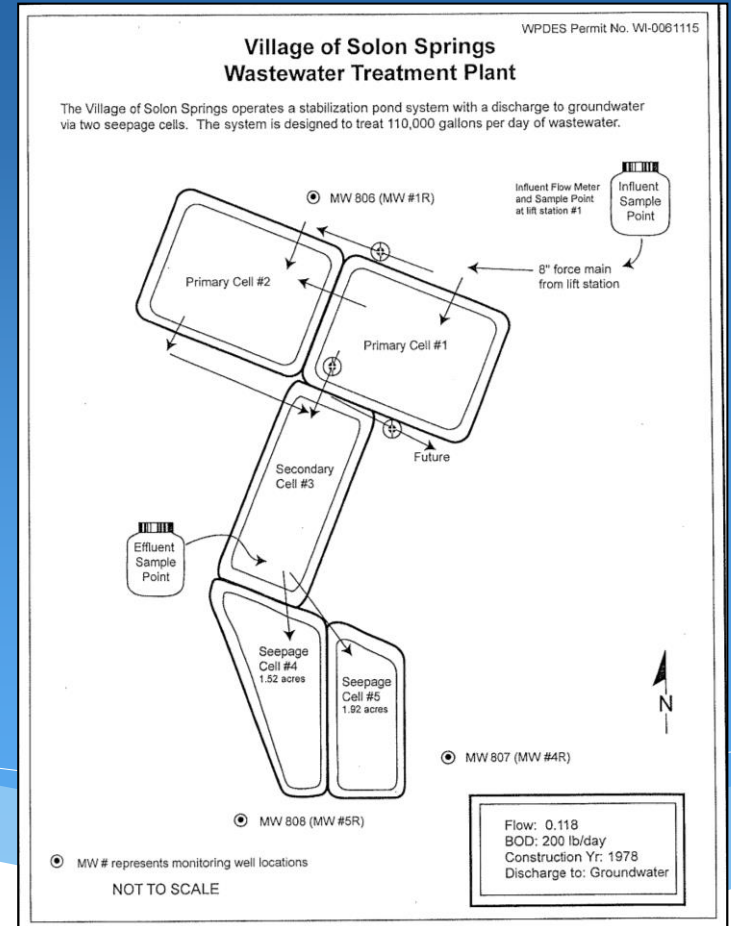
Constructed 1978

Private Wells

St. Croix Lake Significance



# The Background



# The Issues

1978 Clay Lined Ponds – Turtles, Muskrats, Gophers, Moles  
Nonfunctional Control Structures – Valves, Gates  
180 Day Storage Capacity  
Primary Forcemain Breaks & Leaks  
Flow Metering  
WPDES Permit 10 mg/L Nitrogen  
User Rates





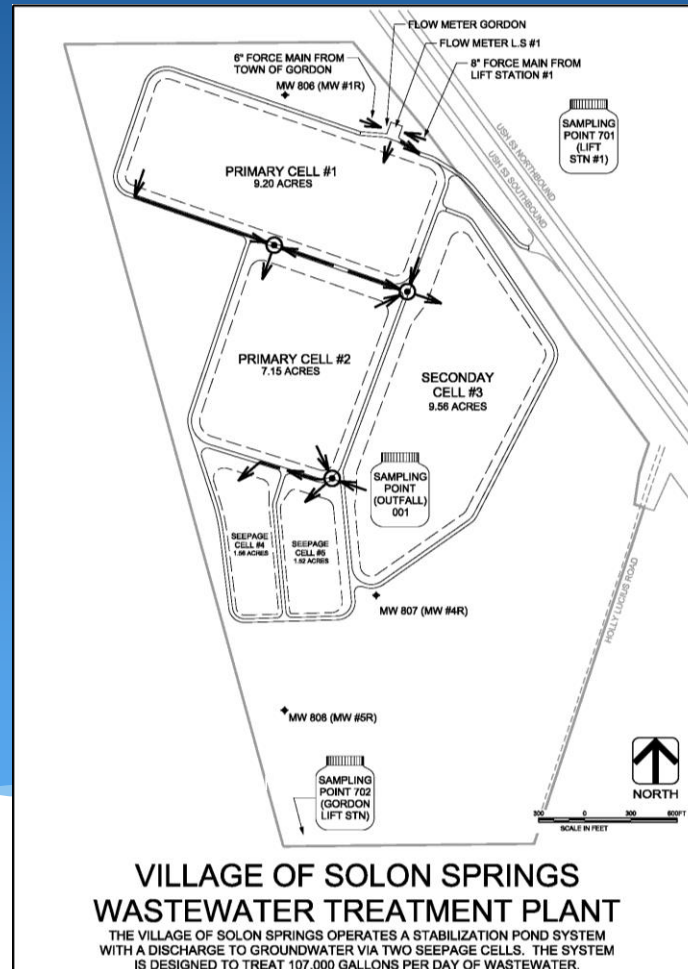
# Compliance - WWTF

Facility Planning Evaluated Alternatives to Meet 10 mg/L N  
Stabilization Pond Expansion Preferred Alternative  
300 days storage  
Warm weather discharge  
Passive vs Mechanical Treatment  
Synthetically Lined Ponds  
New Control Valves and PVC Piping



Image Source: Google Earth Pro

# Compliance - WWTF



# Compliance - WWTF

Facility Planning Evaluated Alternatives to Meet 10 mg/L N  
Stabilization Pond Expansion Preferred Alternative  
300 days storage  
Warm weather discharge  
Passive vs Mechanical Treatment  
Synthetically Lined Ponds  
New Control Valves and PVC Piping  
Seepage Cell Dispersion  
Influent Flow Metering  
Effluent Flow Metering



Image Source: Google Earth Pro



# Compliance - Collection

Primary Forcemain Replacement  
Labor Day 2009 Major Failure  
Influent Flow Metering - USCLSD





# Affordable - Funding

US Army Corps Section 154 Environmental Funding (USACE)

\$1.18 M Grant (2009 and 2010 Appropriation)

US Dept. of Agriculture Rural Development (USDA-RD)

\$1.54 M Low Interest Loan

\$727 K Grant

WI Dept. of Natural Resources Clean Water Fund (CWF)

Low Interest Loan – Not Used

# Affordable – User Rates

Existing User Rates did not cover expenses

Village General Fund Subsidized

No Short Lived Assets or Replacement Funds

3 Contributors (Village, USCLSD, Gordon)

Portions of USCLSD unmetered

Existing meter system unreliable

Village Commercial Rates not based on flow

# Affordable – User Rates

Addressed Operation and Maintenance Expense Costs

Village General vs Sewer Utility

Treatment vs Collection

Identified Short Lived Assets reserve needs

# Affordable – User Rates

## Operating and Maintenance Expenses and Short Lived Assets Village of Solon Springs Date Prepared: February 2010

The USDA requires that the following two tables be included in the Preliminary Engineering Report for the proposed project. The Operating and Maintenance Expenses table includes expenses based on the Villages recent budget and the Replacement Reserve tab

O&M Expense Item	Total Cost	Percent Utility	Amount	% of Cost Treatment	Amount Treatment	% of Cost Collection	Amount Collection
Salaries Operators	\$ 66,250.00	40%	\$ 26,500.00	50%	\$ 13,250.00	50%	\$ 13,250.00
Salaries Clerk/Treasurer	\$ 38,200.00	30%	\$ 11,460.00	50%	\$ 5,730.00	50%	\$ 5,730.00
Benefits Operators	\$ 29,740.00	40%	\$ 11,896.00	50%	\$ 5,948.00	50%	\$ 5,948.00
Benefits Clerk/Treasurer	\$ 17,150.00	30%	\$ 5,145.00	50%	\$ 2,572.50	50%	\$ 2,572.50
Insurance	\$ 22,000.00	50%	\$ 11,000.00	54%	\$ 5,940.00	48%	\$ 5,060.00
Utilities Internet, phone, elec etc..	\$ 6,200.00	100%	\$ 6,200.00	50%	\$ 3,100.00	50%	\$ 3,100.00
Supplies	\$ 3,450.00	100%	\$ 3,450.00	50%	\$ 1,725.00	50%	\$ 1,725.00
Repairs/Maintenance	\$ 14,850.00	100%	\$ 14,850.00	50%	\$ 7,425.00	50%	\$ 7,425.00
Other Transportation	\$ 1,200.00	100%	\$ 1,200.00	50%	\$ 600.00	50%	\$ 600.00
Administrative/Office Office Supplies & Exp.	\$ 1,000.00	100%	\$ 1,000.00	50%	\$ 500.00	50%	\$ 500.00
Contract Services Audit/Sewer Assistance	\$ 25,000.00	100%	\$ 25,000.00	50%	\$ 12,500.00	50%	\$ 12,500.00
<b>Total O&amp;M*</b>			<b>\$ 117,701.00</b>		<b>\$ 59,290.50</b>		<b>\$ 58,410.50</b>

\*Less Interest & Depreciation

Reserve Years	Description	Replacement Cost	Percent Utility	Annual Reserve	% of Cost Treatment	Amount Treatment	% of Cost Collection	Amount Collection
5	Shop Computer Equipment	\$ 5,000.00	100%	\$ 1,000.00	50%	\$ 500.00	50%	\$ 500.00
5	Office Computer Equipment	\$ 5,000.00	50%	\$ 500.00	50%	\$ 250.00	50%	\$ 250.00
10	Flow Meter w/Solar (3)	\$ 30,000.00	100%	\$ 3,000.00	67%	\$ 2,000.00	33%	\$ 1,000.00
5	Flow Meter Software	\$ 1,500.00	100%	\$ 300.00	67%	\$ 200.00	33%	\$ 100.00
6	1 Ton F450	\$ 45,000.00	50%	\$ 3,750.00	50%	\$ 1,875.00	50%	\$ 1,875.00
10	Mower	\$ 10,000.00	100%	\$ 1,000.00	100%	\$ 1,000.00	0%	\$ -
10	Safety Boat	\$ 3,000.00	100%	\$ 300.00	100%	\$ 300.00	0%	\$ -
10	SCADA System	\$ 50,000.00	100%	\$ 5,000.00	33%	\$ 1,650.00	67%	\$ 3,350.00
5	SCADA Software	\$ 2,500.00	100%	\$ 500.00	33%	\$ 165.00	67%	\$ 335.00
5	Radios/Phones	\$ 6,000.00	100%	\$ 1,200.00	50%	\$ 600.00	50%	\$ 600.00
10	Lift Station Controls	\$ 10,000.00	100%	\$ 1,000.00	0%	\$ -	100%	\$ 1,000.00
20	Lift Station Valves/Equipment	\$ 60,000.00	100%	\$ 3,000.00	0%	\$ -	100%	\$ 3,000.00
10	Lift Station Pumps (6)	\$ 60,000.00	100%	\$ 6,000.00	0%	\$ -	100%	\$ 6,000.00
15	Generators (3)	\$ 60,000.00	100%	\$ 4,000.00	0%	\$ -	100%	\$ 4,000.00
10	Sewer Jetter w/Camera	\$ 40,000.00	100%	\$ 4,000.00	20%	\$ 800.00	80%	\$ 3,200.00
<b>Total Replacement Reserve - Short Lived Assets</b>				<b>\$ 34,550.00</b>		<b>\$ 9,340.00</b>		<b>\$ 25,210.00</b>



# Affordable – User Rates

Addressed Operation and Maintenance Expense Costs

Village General vs Sewer Utility

Treatment vs Collection

Identified Short Lived Assets reserve needs

Identified System replacement reserve needs

Long Term Debt repayment

Tabulated historic flows of the three partners

Developed Flow Proportional 3-year Average User Rates

# Affordable – User Rates

	Community	Solon Springs	USCLSD	Gordon	Total
<b>CURRENT CUSTOMERS (EDUs) BASIS</b>					
Percentage of Total EDUs	60.15%	29.12%	8.73%	100%	
Percentage of Total - Collection Obligation	60.15%	31.96%	7.90%	100%	
Percentage of Total - Treatment Obligation	60.15%	29.12%	8.73%	100%	
<b>DESIGN CUSTOMERS (EDUs) BASIS</b>					
Percentage of Total EDUs	60.73%	28.49%	10.78%	100%	
Percentage of Total - Collection Obligation	60.73%	31.93%	7.30%	100%	
Percentage of Total - Treatment Obligation	60.73%	28.49%	10.78%	100%	
<b>FLOW BASIS ANNUAL 2007</b>					
Percentage of Total Flow	18,182,244	6,386,324	2,006,122	26,584,690	
Percentage of Total Flow - Collection System	68.43%	24.10%	7.55%	100%	
Percentage of Total Flow - Collection System	74.02%	25.98%	0.00%	100%	
<b>FLOW BASIS ANNUAL 2008</b>					
Percentage of Total Flow	18,900,825	6,916,871	2,160,986	28,078,685	
Percentage of Total Flow	67.81%	24.69%	7.71%	100%	
Percentage of Total Flow - Collection System	73.26%	28.14%	0.00%	100%	
<b>FLOW BASIS ANNUAL 2009</b>					
Percentage of Total Flow	25,160,597	6,220,688	2,160,424	33,537,889	
Percentage of Total Flow	74.87%	18.94%	6.49%	100%	
Percentage of Total Flow - Collection System	80.98%	19.94%	0.00%	100%	
<b>FLOW BASIS ANNUAL 2010</b>					
Percentage of Total Flow	22,284,681	6,885,087	2,316,262	31,486,030	
Percentage of Total Flow	70.78%	21.88%	7.26%	100%	
Percentage of Total Flow - Collection System	76.40%	23.60%	0.00%	100%	
<b>FLOW BASIS ANNUAL 2011</b>					
Percentage of Total Flow	19,244,394	6,585,110	2,344,496	28,174,000	
Percentage of Total Flow	68.36%	23.31%	8.33%	100%	
Percentage of Total Flow - Collection System	74.53%	25.43%	0.00%	100%	
<b>FLOW BASIS ANNUAL 2012</b>					
Percentage of Total Flow	21,011,408	6,413,672	2,287,520	29,712,600	
Percentage of Total Flow	70.69%	21.69%	7.73%	100%	
Percentage of Total Flow - Collection System	76.61%	23.39%	0.00%	100%	
<b>Annual Operation &amp; Maintenance (see applicable worksheets)</b>					
Wastewater Collection System	\$	63,940		\$	63,940
Wastewater Treatment System	\$	42,460		\$	42,460
Total Annual Operation & Maintenance Costs	\$	106,400		\$	106,400
<b>Annual Replacement Reserve - Short Lived Assets (see applicable worksheet)</b>					
Wastewater Collection System	\$	18,472		\$	18,472
Wastewater Treatment System	\$	8,712		\$	8,712
Total Annual Replacement Reserve Costs	\$	27,183		\$	27,183
<b>Financing</b>					
TOTAL PROJECT COST		\$3,380,000			
USDA C Grant		\$1,682,000			
USDA RD Loan		\$1,541,000			
USDA RD Grant		\$177,000			
		\$0			
<b>DEBT Summary</b>					
USDA 2011 Loan Collection System (13.28%)	40)	2,500%	\$204,632.38	\$	204,632
USDA 2011 Loan Treatment System (86.72%)	40)	2,500%	1,336,367.82	\$	1,336,368
<b>Total Debt</b>			\$1,541,000.00	\$	1,541,000
<b>Annual PIU Payments</b>					
USDA 2011 Loan Collection System (13.28%)			\$9,384.21	\$	9,384
USDA 2011 Loan Treatment System (86.72%)			\$54,765.78	\$	54,766
<b>Total Annual PIU Payments (Including 10 yr Debt Service)</b>			\$63,137.98	\$	63,138

<b>Total Debt</b>		\$1,541,000.00	\$	1,541,000
<b>Annual PIU Payments</b>				
USDA 2011 Loan Collection System (13.28%)		\$9,384.21	\$	9,384
USDA 2011 Loan Treatment System (86.72%)		\$54,765.78	\$	54,766
<b>Total Annual PIU Payments (Including 10 yr Debt Service)</b>		\$63,137.98	\$	63,138
<b>GWLF Loan Payback</b>				
Total USDA 2011 Loan Collection System (13.28%) Payback	\$	335,269	\$	-
Total USDA 2011 Loan Treatment System (86.72%) Payback	\$	2,180,150	\$	-
Total Loan 3 Payback	\$	-	\$	-
Total Loan 4 Payback	\$	-	\$	-
<b>Total Payback</b>	\$	2,525,519	\$	-
<b>Annual Estimated Costs per Community Flow Basis 2018</b>				
<b>Treatment Costs</b>				
Operation & Maintenance	\$	28,638	\$	8,845
Annual Replacement Reserves	\$	8,168	\$	2,605
USDA Debt Service	\$	38,765	\$	11,970
<b>Total Annual Treatment Cost</b>	\$	75,569	\$	22,720
<b>Treatment Cost per 1000 Gallons of Flow</b>	\$	3,3069	\$	3,3069
<b>Collection System Costs</b>				
Operation & Maintenance (45.51% Joint Flow Proportional)	\$	57,073	\$	5,867
Annual Replacement Reserves (45.51% Joint Flow Proportional)	\$	16,488	\$	1,680
USDA 2011 Loan Debt Service (2017 Flow Proportional)	\$	6,433	\$	1,973
<b>Total Annual Collection System Cost</b>	\$	79,994	\$	18,820
<b>Collection System Cost per 1000 Gallons</b>	\$	3,8884	\$	1,973
<b>Total Cost per 1000 Gallons</b>	\$	6,8993	\$	5,4742
<b>Annual Estimated Treatment Costs per Community Flow Basis 2011</b>				
<b>Treatment Costs</b>				
Operation & Maintenance	\$	27,659	\$	9,431
Annual Replacement Reserves	\$	5,965	\$	2,021
USDA Debt Service	\$	37,430	\$	14,763
<b>Total Annual Treatment Cost</b>	\$	71,054	\$	26,215
<b>Treatment Cost per 1000 Gallons of Flow</b>	\$	3,6917	\$	3,6917
<b>Collection System Costs</b>				
Operation & Maintenance (45.51% Joint Flow Proportional)	\$	66,521	\$	7,360
Annual Replacement Reserves (45.51% Joint Flow Proportional)	\$	16,324	\$	2,136
USDA 2011 Loan Debt Service (2011 Flow Proportional)	\$	6,323	\$	1,953
<b>Total Annual Collection System Cost</b>	\$	79,187	\$	11,449
<b>Collection System Cost per 1000 Gallons</b>	\$	4,1117	\$	7,712
<b>Total Cost per 1000 Gallons</b>	\$	7,8934	\$	5,4669
<b>Annual Estimated Treatment Costs per Community Flow Basis 2012</b>				
<b>Treatment Costs</b>				
Operation & Maintenance	\$	28,602	\$	8,731
Annual Replacement Reserves	\$	6,188	\$	2,180
USDA Debt Service	\$	38,707	\$	11,811
<b>Total Annual Treatment Cost</b>	\$	73,497	\$	22,422
<b>Treatment Cost per 1000 Gallons of Flow</b>	\$	3,4965	\$	3,4965
<b>Collection System Costs</b>				
Operation & Maintenance (45.51% Joint Flow Proportional)	\$	57,135	\$	6,806
Annual Replacement Reserves (45.51% Joint Flow Proportional)	\$	16,506	\$	1,968
USDA 2011 Loan Debt Service (2012 Flow Proportional)	\$	6,433	\$	1,961
<b>Total Annual Collection System Cost</b>	\$	80,084	\$	10,735
<b>Collection System Cost per 1000 Gallons</b>	\$	3,9184	\$	1,973
<b>Total Cost per 1000 Gallons</b>	\$	7,3969	\$	5,4697
<b>3 Year Average (2010-2012) by Flow per 1000 Gallons</b>				
	\$7.33	\$5.17	\$3.50	
<b>Average Total Cost over the Last 3 Years (2010-2012)</b>	\$152,408.72	\$34,200.22	\$9,111.37	
<b>3 Year Average per EDU</b>	\$98.60	\$32.88	\$20.82	
<b>3 Year Average Flow</b>	20,846.961	6,619.616	2,316.423	

# Affordable – User Rates

Addressed Operation and Maintenance Expense Costs

Village General vs Sewer Utility

Treatment vs Collection

Identified Short Lived Assets reserve needs

Identified System replacement reserve needs

Long Term Debt repayment

Tabulated historic flows of the three partners

Developed Flow Proportional 3-year Average User Rates

Facilitated Partner User Rate discussions

Developed Village Flow Based Commercial estimates

# Affordable – User Rates

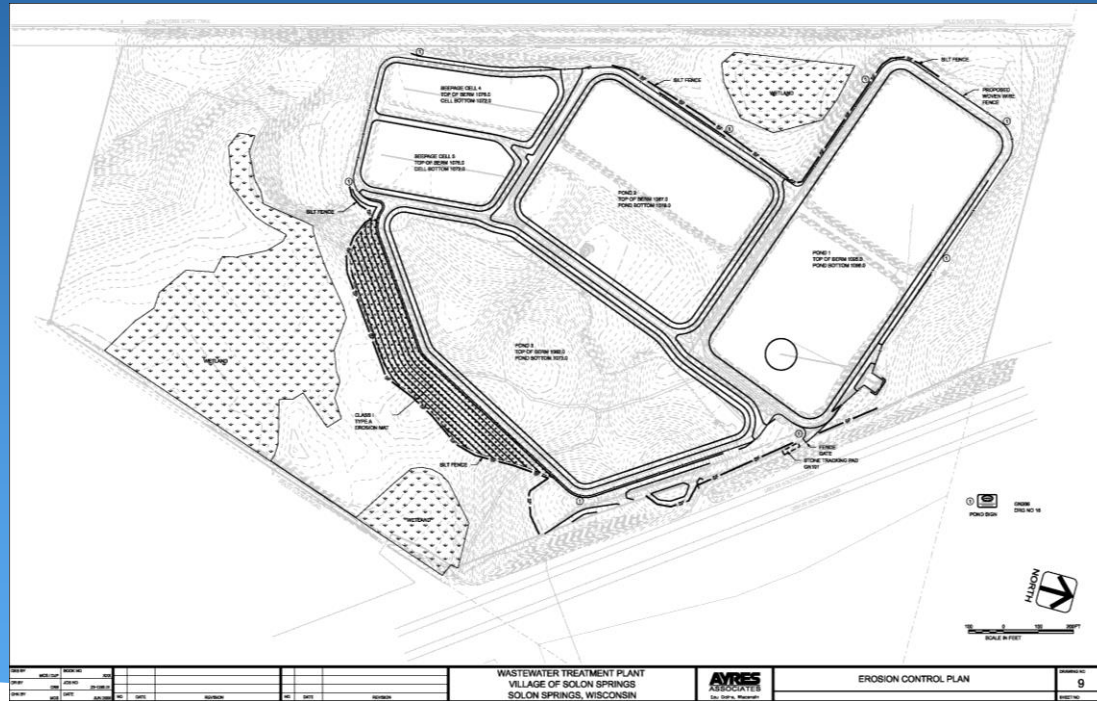
**TABLE 1 UNIT DETERMINATION**

	<b>Classification</b>	<b>Unit Value</b>
1	Single Resident	One Unit
2	Duplex	Two Units
3	Apartments	One Unit per apartment
4	General Retail Business Small (1 Fixture)	1.2 Units
5	General Retail Business Medium (2 – 6 Fixtures)	2 Units
6	General Retail Business Large (7 or More Fixtures)	3.5
7	Non-Profit Organization w/Kitchen	1.5 Units
8	Non-Profit Organization w/o Kitchen	1.2 Units
9	Hardware/Parts Store (2 or Less Fixtures)	1.2 Units
10	Hardware/Parts Store (2-4 Fixtures)	1.7 Units
11	Hardware/Parts Store (5 or More Fixtures)	3.4 Units
12	Bank	One Unit per 4000 Square Feet
13	General Office Building	One Unit per 1800 Square Feet
14	Truck Repair/Garage (4 or Less Bays)	1.2 Units
15	Truck Repair/Garage (5 or More Bays)	3 Units
16	Grocery Store	One Unit per 1500 Square Feet
17	General Industry	One Unit per 3000 Square Feet
18	Restaurant with Bar	One Unit per 400 Square Feet
19	Restaurant	One Unit per 600 Square Feet
20	County Park w/ Facilities	One Unit per 2.5 Acres
21	Gas Station or Service Station (8 Pumps or Less)	3 Units
22	Gas Station or Service Station (9 Pumps or More)	5 Units
23	Mobile Home Park	One Unit per Trailer
24	Motel	One unit per 4 rooms
25	Laundromat	One Unit per 1.4 Washers
26	Campground	One Unit per 7 Sites
27	School District (PK-12)	One Unit per 8 Students/Emp
28	Vacant Facility	1.2 Units
29	Salon	1.2 Units per 2 Stations
30	Fire Hall	2 Units



# Affordable – Construction

## Balanced Earthwork



# Affordable – Construction

Synthetic Liner  
30 mil PVC



# Affordable – Construction

Wave Protection





# Affordable – Construction

Trenchless Alternatives

Directional Drill

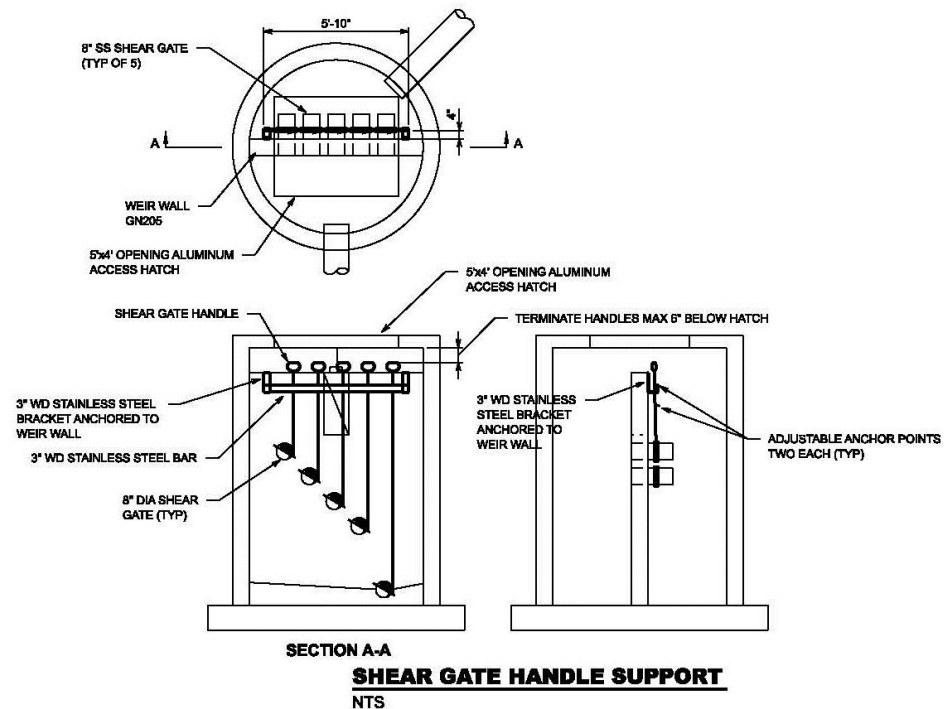
Fusible PVC





# Affordable – Construction

Control Structures  
Conventional  
Materials  
Maintenance  
Friendly



# Affordable – Construction

## Flow Metering



# Achieving

Substantial Completion Fall 2012

Fall 2013 Discharge

Results

Limits

BOD

4 mg/L

50 mg/L (ES)

Nitrite/Nitrate

2.4 mg/L

10 mg/L (ES)

Chloride

68 mg/L

250 mg/L (ES)

Ammonia

0.5 mg/L

4.1 mg/L (PAL)

Organic N

2.4 mg/L

2.8 mg/L (PAL)

TDS

237 mg/L

450 mg/L (PAL)

Accurate Flow Metering for Billing and Inflow and Infiltration

# Achieving Affordable Compliance

Complete Facility Planning  
Funding Grants and Loans  
User Rate Review and Update  
Public Meeting Facilitation  
Conventional Design Alternatives  
Passive Operation and Maintenance





# Achieving Affordable Compliance

Contract Documents and Administration  
Construction Staking and Inspection  
Funding Administration  
Record Drawings  
Operation and Maintenance Manuals  
Capacity, Management, Operation and Maintenance (CMOM)



# Achieving Affordable Compliance

## Questions?

Michael C. Stoffel, PE  
Ayres Associates  
715.834.3161

StoffelM@AyresAssociates.com  
[www.AyresAssociates.com](http://www.AyresAssociates.com)

