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Improved Wastewater Treatment

Las Vegas, Honduras



April 25, 2008 Final Presentation

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Agenda

- 1. Project Background**
- 2. Imhoff Tanks**
- 3. Wastewater Quality**
- 4. CEPT**
- 5. Options for
Expansion**
- 6. Recommendations**

Background

- City of Las Vegas: 17,400 Population
- Wastewater Treatment Facility Built in 1992
- Approximately 3,600 People Connected to Treatment
- No Facility Maintenance in 15 Years
- Las Vegas Interested in Expansion

Research Focus

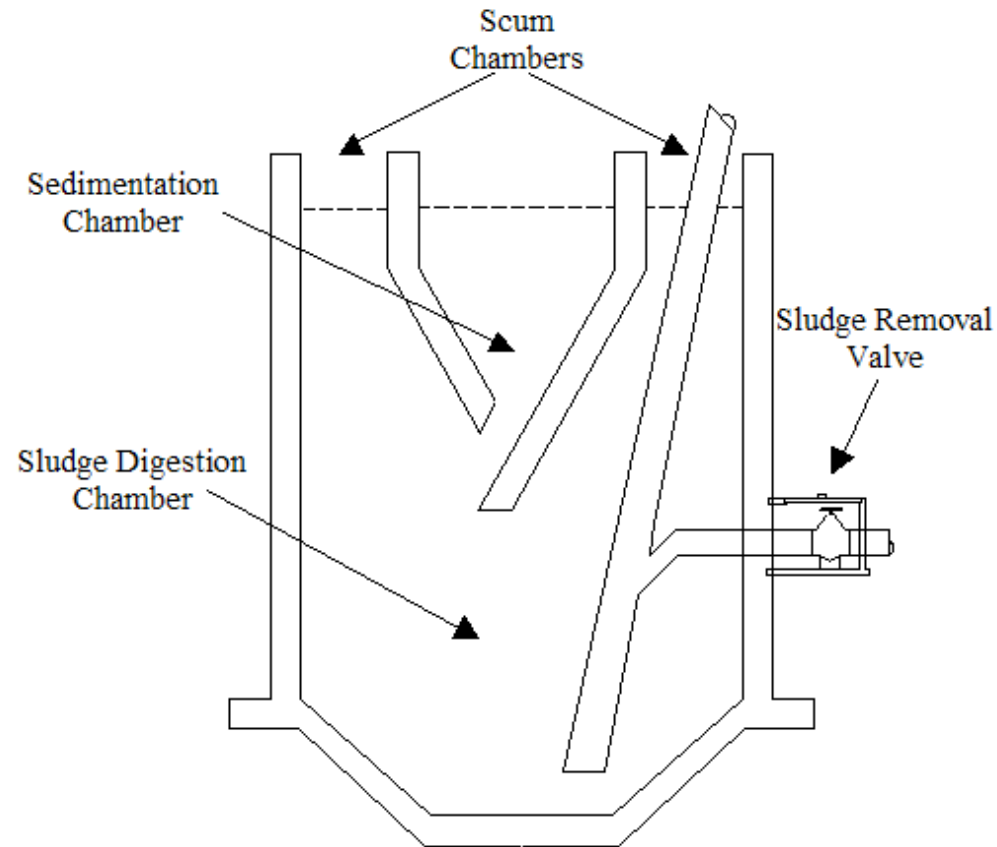
Anne

- Imhoff Tank Improvements Using CEPT
- Prevalence and State of Repair of Imhoff Tanks in Honduras

Matt

- Existing Conditions
- Maintenance
- System Expansion

Imhoff Tank Cross Section



Wastewater Quality

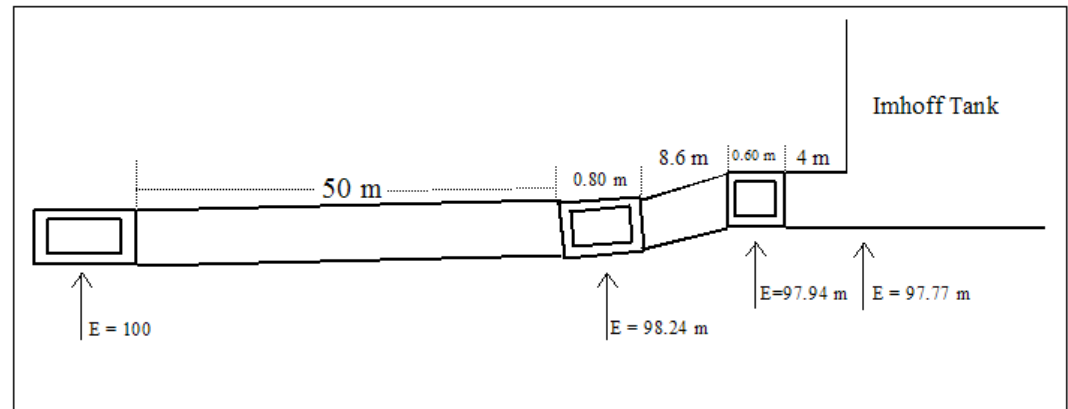
<u>Flow</u>			
Flow	180 m ³ /hr	Res. Time	30 minutes
Per Capita	1,000 L/day		
<u>Removal Efficiencies</u>			
Characteristic	Influent	Effluent	Percent
TSS	190 mg/L	140 mg/L	-26%
BOD	150 mg/L	120 mg/L	-19%
COD	320 mg/L	260 mg/L	-19%
Total Coliforms	500x10 ⁶	1800x10 ⁶	+260%

Chemically Enhanced Primary Treatment (CEPT)

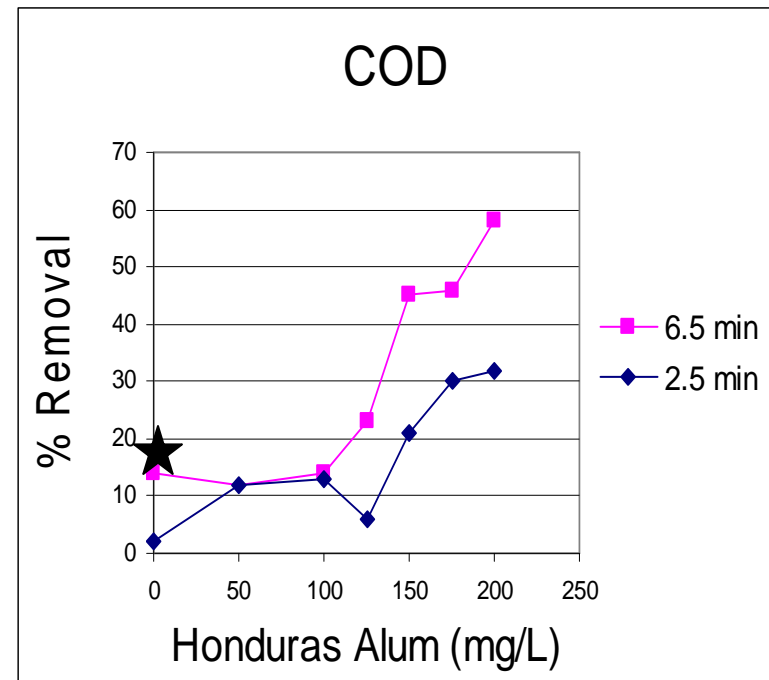
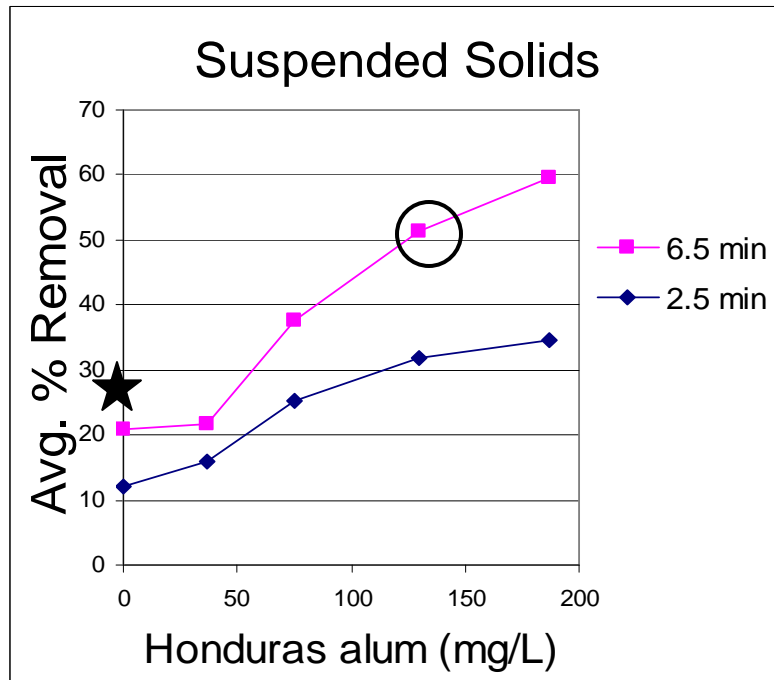
- 1) Availability of Local Coagulants
- 2) Dosage of Coagulant and Cost
- 3) Potential TSS and COD Removal
- 4) Additional Sludge Production
- 5) Feasibility of Chemical Injection

CEPT: Bench Scale Testing

- Local Coagulant:
Solid Alum
 $\text{Al}_2(\text{SO}_4)_3 \cdot 14\text{H}_2\text{O}$
- Mixing Regime:
100 rpm 30 sec
- Settling: 2.5 min &
6.5 min



Jar Testing Results



TSS_{Las Vegas}: 190 mg/L
Regulation: 100 mg/L

COD_{Las Vegas}: 320 mg/L
Regulation: 200 mg/L

CEPT Pilot Test

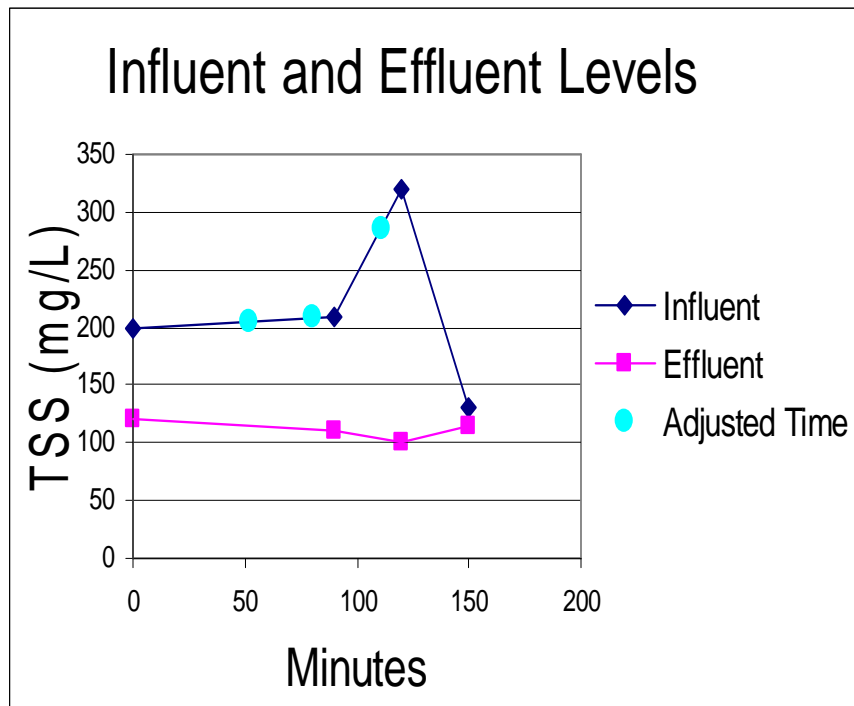


Duration: 1.5 hours



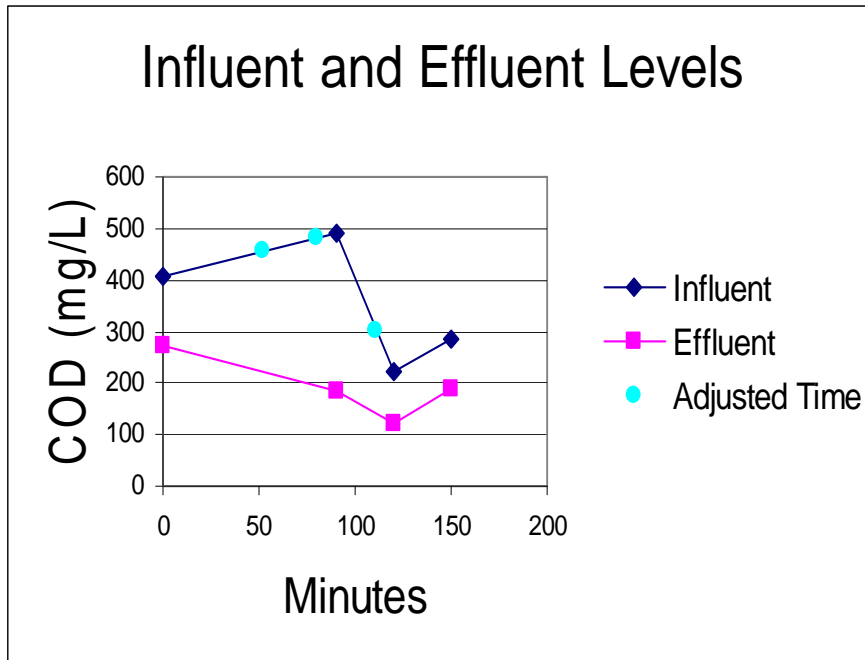
Dosage: 150 mg/L

Pilot Test Results: TSS



Influent (Time Adjusted)	Effluent	% Removal	Avg. % Removal
206	110	47	53
209	100	52	
286	115	60	

Pilot Test Results: COD



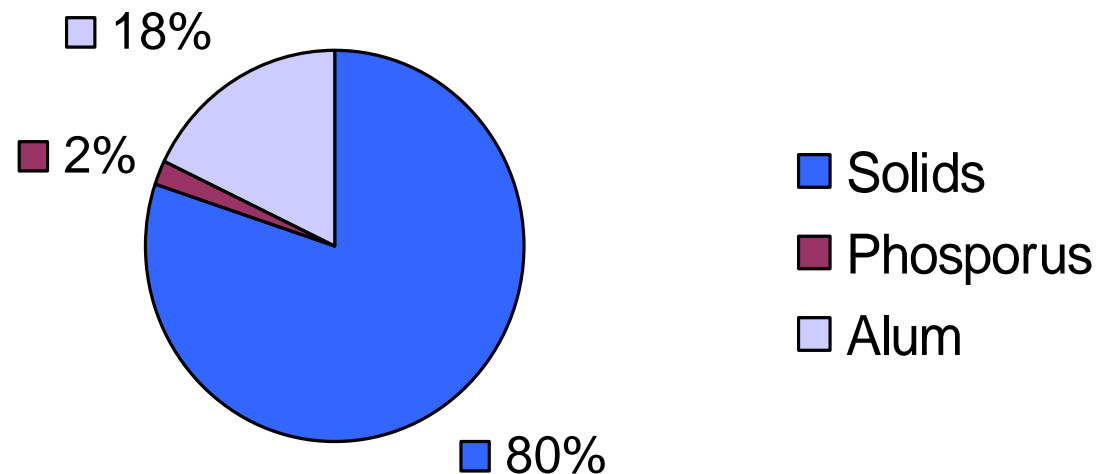
Influent (Time Adjusted)	Effluent	% Removal	Avg. % Removal
456	185	59	57
484	120	75	
302	187	38	

Sludge

Without Maintenance
(26% TSS Removal):
184 kg/day

With Maintenance
(40% TSS Removal):
283 kg/day

CEPT Sludge Production
(53% TSS Removal):
469 kg/day



Cost

$10 \text{ Lempira/kg} * 180 \text{ m}^3/\text{h} * 18 \text{ h/day} * 1000 \text{ L/m}^3 * 150 \text{ mg/L} * 1\text{kg}/1,000,000\text{mg} =$

4,860 Lempira/day

\$243/day

CEPT Conclusions

- 1) Coagulants: Limited Selection
- 2) Dosage & Cost: 150 mg/L ~ \$250/day
- 3) Removal: TSS = 53% ; COD = 38%
- 4) Sludge Production: Manageable
- 5) Injection Feasibility: Difficult

**Recommended to Las Vegas to Focus on Maintenance
and Water Conservation**

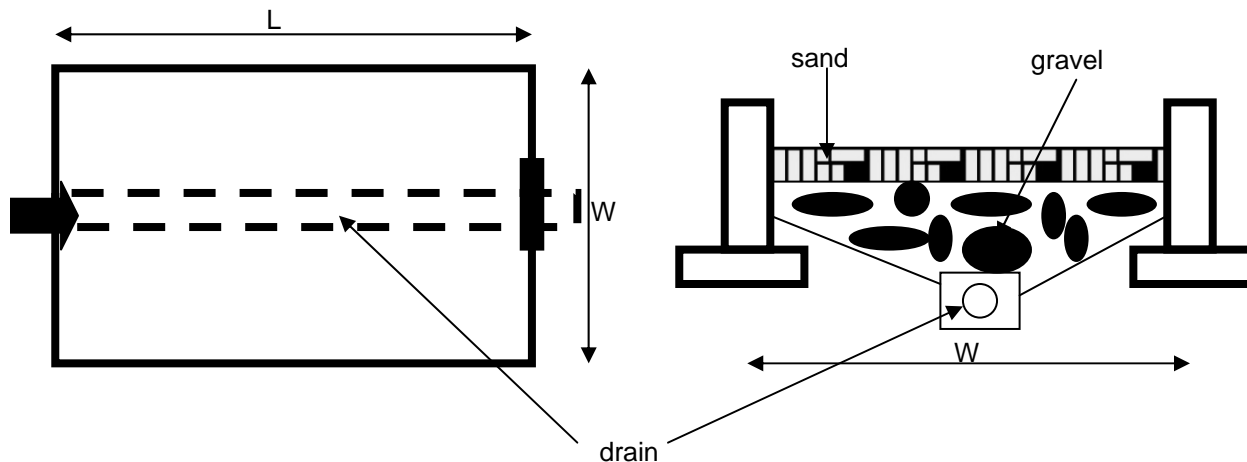
Maintenance

<u>Removal Efficiencies</u>			
	Influent	Effluent	Percent
TSS	200 mg/L	120 mg/L	-40%
COD	410 mg/L	270 mg/L	-34%

Tank Maintenance

Control Gates

Improved Flow Distribution

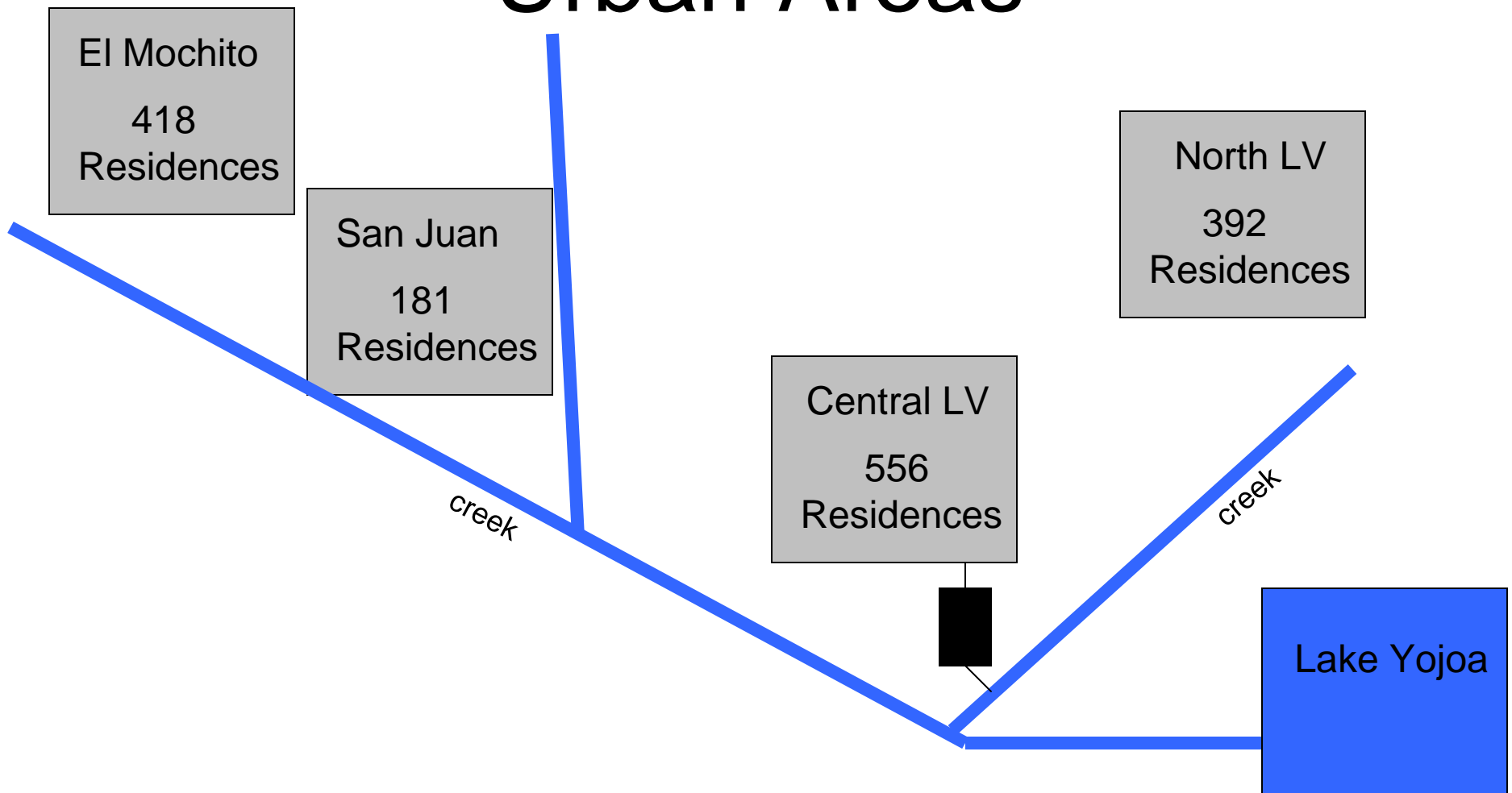


Sludge Drying Bed

8m x 18 m Single Bed

47m³ Sludge (Semi-Annual)

Urban Areas



Treatment Goals and Limitations

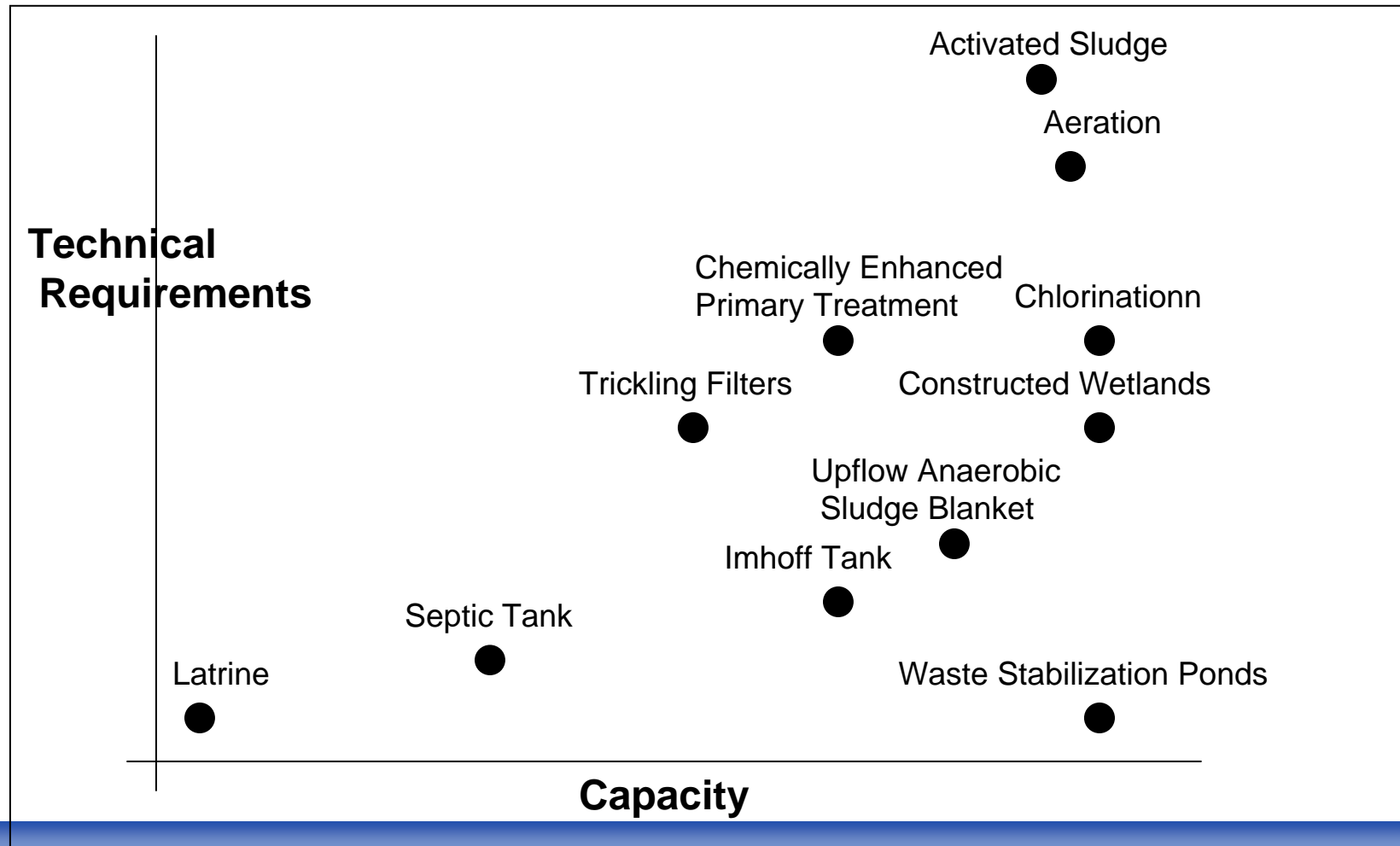
Goals

- **National Effluent Standards**
 - BOD, Pathogens, Nitrogen, Phosphorus etc.
- **SANAA Recommendations**
 - Pathogens and Solids
- **Site Specific Needs**
 - Solids

Limitations

- **Land**
 - Limited Open Space
- **Technical Expertise**
 - Lack of Engineers
- **Budget**
 - Limited O&M Money
- **Planning Horizon**
 - Municipal Changeover

Options



Tanks and Maturation Ponds

Flow Tank Size

Central Las Vegas

Existing +1 Tank
Reduced No Expansion

El Mochito

Existing 12.1m x 4.0m (2)
Reduced 6.1m x 2.0m (2)

North Las Vegas

Existing 11.6m x 3.8m (2)
Reduced 5.8m x 2.0m (2)

San Juan

Existing 11.6m x 3.8m (2)
Reduced 5.8m x 2.0m (2)

Flow Pond Size

Central Las Vegas

Existing 21,000 m²
Reduced 5,000 m²

El Mochito

Existing 19,000 m²
Reduced 5,000 m²

San Juan

Existing 8,000 m²
Reduced 2,000 m²

North Las Vegas

Existing 17,000 m²
Reduced 4,000 m²

Recommendations

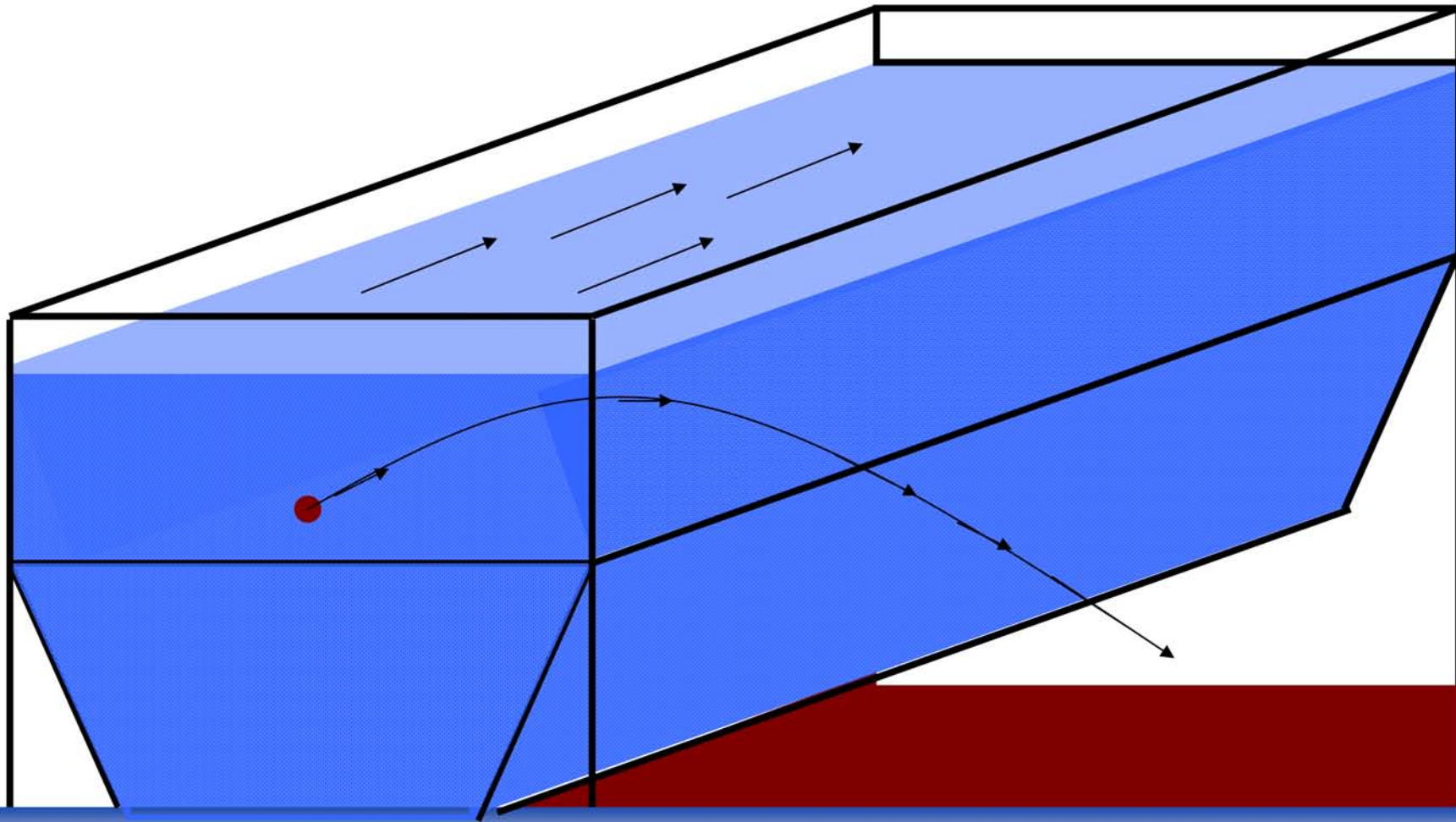
- **Conservation**
 - Less wastewater much better treatment
- **Maintenance**
 - Operator
 - Sludge Drying Bed
- **Expanded Treatment**
 - Sedimentation Tank (Imhoff)
 - Maturation Pond if Needed
 - Appropriate Sizing

Thank You

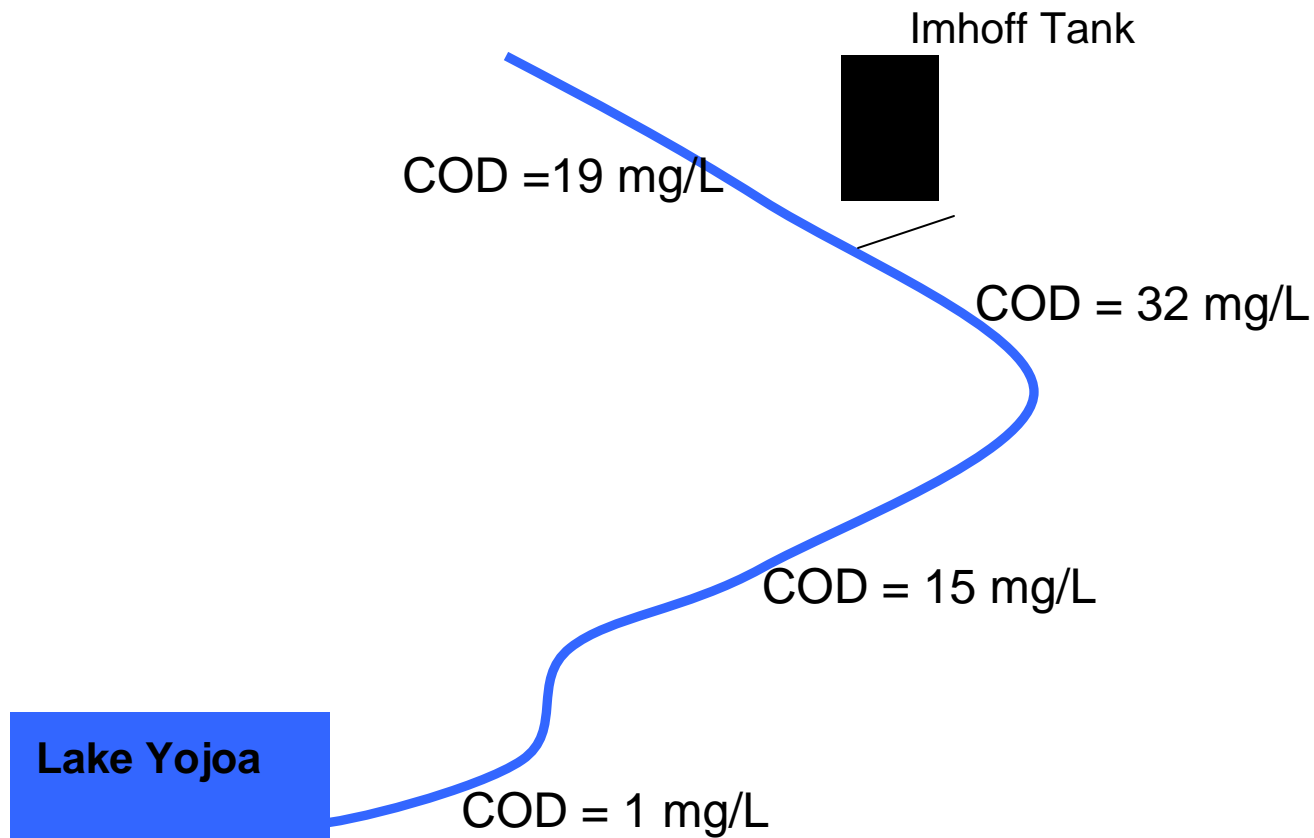
Pilot Test Results

Period	Time	Flow (m ³ /h)	COD (mg/L)		TSS (mg/L)	
			Influent	Effluent	Influent	Effluent
1	10:30 am	169.2	407	272	200	120
2	12:00 pm	156.2	493	185	210	110
3	12:30 pm	149.8	221	120	320	100
4	1:00 pm	153.0	286	187	130	115

Imhoff Tank Physics



Existing Free Treatment



Waste Stabilization Ponds

<u>Flow</u>	<u>Pond Size</u>
Facultative Pond	
Existing	314,000 m ²
Reduced	78,000 m ²
Maturation Pond	
Existing	54,000 m ²
Reduced	13,000 m ²

