INFILTRATOR
water technologies

Commercial High Strength Waste Design

CPOW
Colorado Professionals in Onsite Wastewater

My Background:

- Professional Engineer
- Over 30 years in the decentralized wastewater industry
- Actively involved: Serve on many boards, authored papers, research

This presentation is:

- High Strength Waste Best Practices
- Offers design recommendations and sources

Questions

1. **What is the expected design life of a typical residential system in Colorado?**

   a. 0-5 years
   b. 5-10 years
   c. 10-20 years
   d. Greater than 20 years

Questions

2. What is the expected design life of a typical restaurant system?

a. 0-5 years
b. 5-10 years
c. 10-20 years
d. Greater than 20 years

Questions

What is the most difficult facility type for an onsite wastewater system?

Think about it, we will review at the end of the presentation

Questions

3. For High Strength Waste systems, I design based upon:

a. **Strictly Per code** **Good**
b. **Per code with extra considerations** **Better**
c. **Custom design per facility type** **Best**

Commercial Conundrum

- **IWT provides Design Assistance on commercial HSW projects**
- **We regularly see designers specifying system sizing based upon residential loading rates**
- **What would you recommend?**
- **IWT is in a Precarious position**

Design Decisions

- As designers we tend to think of the critical factors
- But who's decision is it?
- **It is the owner's decision**
- The designer can offer the owner choices

DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

Water Quality Control Commission

REGULATION NO. 43 - ON-SITE WASTEWATER TREATMENT SYSTEM REGULATION

5 CCR 1002-43

151. "Wastewater, high strength" means 1. wastewater from a structure having BOD_5 greater than 300 mg/L; and/or TSS greater than 200 mg/L; and/or fats, oils, and grease greater than 50 mg/L; or, 2. effluent from a septic tank or other pretreatment component (as defined by NSF/ANSI Standard 40 testing protocol) that has BOD_5 greater than 180 mg/L; and/or TSS greater than 80 mg/L; and/or fats, oils, and grease greater than 25 mg/L and is applied to an infiltrative surface.

High strength waste

Many State Codes do not define HSW

- State of Georgia: > 200 mg/l BOD, TSS
- N, P, pH, or other specifics
- HSW = “Abnormal Waste”

Best Definition: HSW is anything other than Residential Waste

KNOW YOUR FACILITY TYPE

Gathering information on influent and effluent requirements

Facility Types

RV Parks - Campgrounds

Schools

Rest Areas

Convenience Stores

Breweries

Wineries

Hospitals – Health Care Facilities

Mobile Home Parks

Shopping Centers

Laundry Mats

Churches

BOD Strength & Restaurant Practices

BOD: 800-1000 mg/L range

Some types of food produced higher BOD

A menu review

- Sauces, sweets, etc.
- Alcohol service
- Grease, practices

Know facility practices

- Single service versus full plate service, or paper
- Ice generation
- Thawing Practices

Sampling of actual facilities

- Take more than one sample just after busy periods

Influent Characteristics & Flow

Resources for determining waste strength:

1. **Literature**
2. **Codes**
3. **Similar Facilities**

Data: Flow data and sampling for strength, inspect the facility for usage habits

Literature: Restaurant BOD Strength

A study performed by Lesikar in 2004 in Texas demonstrated:

- 75% of wastewater samples from 28 different kinds of restaurants were 1400 mg/L or less with an average of 1000 mg/L.

Type of Restaurants	Number of Systems in Group	Average BOD mg/L
Fast Food/Burgers	6	974
Pizza	1	1856
Chinese	4	1364
Mexican	9	1254
American	1	1063
American Buffet	1	792
Steakhouse	2	601
Seafood	3	555

Louisiana Administrative Code

Chapter 15. Sewage Loading Criteria [formerly Chapter 13 Appendix B]

§1501. General Requirements

A. See Note (a)

Place	Loading	Daily Average Flow Gallons per Day	Daily Average BOD_5 Pounds per Day	Design Basis
Apartments		250	0.425	one bedroom
		300	0.52	two bedroom
		400	0.68	three bedroom
Assembly	Note (b)	2	0.0034	per seat
Bowling Alleys (no food service)	Note (b)	75	0.13	per lane
Churches	Note (b)	5	0.0088	per sanctuary seat
Churches (with permitted kitchens)	Note (c)	10	0.017	per sanctuary seat
Country Clubs		50	0.085	per member
Dance Halls	Note (b)	2	0.0034	per person
Drive-In Theaters		5	0.0085	per car space
Factories (no showers)		20	0.051	per employee
Factories (with showers)		35	0.06	per employee

Place	Loading	Daily Average Flow Gallons per Day	Daily Average BOD_5 Pounds per Day	Design Basis
Food Service Operations				
Ordinary Restaurant (not 24 hour)		35	0.12	per seat
24-hour Restaurant		50	0.17	per seat
Banquet Rooms		5	0.017	per seat
Restaurant Along Freeway		100	0.33	per seat
Curb Service (drive-in)		50	0.17	per car space
Bar, Cocktail Lounges, Taverns				
(no food service or very little food service)		25	0.084	per seat
(with regular food service)		35	0.12	per seat
Video Poker Machine		100	0.20	per machine
Fast Food Restaurants		40	0.13	per seat

Place	Loading	Daily Average Flow Gallons per Day	Daily Average BOD_5 Pounds per Day	Design Basis
Hotel/Motel Food Service		45	0.17	per room
Homes/ Mobile Homes in Subdivisions		400	0.68	per dwelling
Individual Homes/Mobile		250	0.425	one bedroom

Hospitals (no resident personnel)	Note (c)	200	0.51	per bed
Institutions (residents)	Note (c)	100	0.25	per person
Municipalities		100	0.17	per person

Place	Loading	Daily Average Flow Gallons per Day	Daily Average BOD_5 Pounds per Day	Design Basis
Mobile Home Parks				
up to 5 trailer spaces		400	0.68	per mobile home space
6 trailer spaces or more		300	0.51	per mobile home space
Motels	Note (b)	100	0.12	per unit
Nursing and Rest Homes	Note (c)	100	0.25	per patient
		100	0.17	per resident employee
Office Buildings		20	0.051	per employee
Recreational Vehicle Dumping Stations				Consult OPH
Recreational Vehicle Parks and Camps		125	0.21	per trailer or tent space
Retail Store		20	0.034	per employee
Schools• • Elementary	Note (c)	15	0.038	per pupil
Schools• High and Junior High	Note (c)	20	0.051	per pupil

Place	Loading	Daily Average Flow Gallons per Day	Daily Average BOD_5 Pounds per Day	Design Basis
Retail Fuel Stations (Located on major highways, etc., and whose primary function is to provide fuel and service to motor vehicles)	Note (d)	250	0.43	per individual vehicle fueling point (up to the first four)
		125	0.21	for each additional individual vehicle fueling point
Shopping Centers (no food service or laundries		0.2	0.00034	per square foot of floor space
Swimming Pool (including employees)		10	0.017	per swimmer
Showers		20	0.04	per shower

Place	Loading	Daily Average Flow Gallons per Day	Daily Average BOD_5 Pounds per Day	Design Basis
Vacation Cottages		50	0.12	per person
Youth and Recreation Camps	Note (c)	50	0.12	per person
Washing Machines		400	1.34	per machine

Louisiana Administrative Code

Title 51, Part XIII, Chapter 15

Place	Loading	Daily Average Flow Gallons per Day	Daily Average BOD_5 Pounds per Day	Design Basis
Food Service Operations				
Ordinary Restaurant (not 24 hour)		35	0.12	per seat
24-hour Restaurant		50	0.17	per seat
Banquet Rooms		5	0.017	per seat
Restaurant Along Freeway		100	0.33	per seat
Curb Service (drive-in)		50	0.17	per car space
Bar, Cocktail Lounges, Taverns				
(no food service or very little food service)		25	0.084	per seat

Colorado Regulation 43

TABLE 6-2 For Design Purposes, the Estimated Daily Wastewater Flow and BOD_5 Load Per Person Unless Otherwise Noted

RESIDENTIAL WASTEWATER	GPD	BOD_5 IN POUNDS PER DAY
Single-family dwellings	75	.20
Auxiliary buildings, by fixture type		
Bath/Shower	14.7	.014
Dishwasher	1.8	.002
Kitchen sink with garbage grinder	5.8	.052
Laundry washer	19.5	.037
Lavatory	8.4	.021
Water closet (toilet)	24.8	.029
Hotels and motels per room	75	.15
Multiple-family dwellings or apartments	75	.20
Boarding and rooming houses (users absent during working hours)	50	.15
Tiny Homes[3], per unit	150	.40
Mobile home	75	.20
Mobile home park per space	300	.80

Possible Design Considerations:

Increase Primary Tank Capacity
Increase Grease Trap Capacity

- “Tanks are cheap insurance”
- Increase frequency of pumping

Increase Drainfield Sizing
Alternate/resting of drainfields
Flow Equalization
Pressure dosing/time dosing - Required
Pretreatment
Outlet filters

HSW

Outlet Filters

USEPA 2002 Soil Loading Rates:

Table 4-3. Suggested hydraulic and organic loading rates for sizing infiltration surfaces

Texture	Structure		Hydraulic loading (gal/ft^2-day)		Organic loading (lb BOD/1000ft^2-day)	
	Shape	Grade	BOD=150	BOD=30	BOD=150	BOD=30
Coarse sand, sand, loamy coarse sand, loamy sand	Single grain	Structureless	0.8	1.6	1.00	0.40
Fine sand, very fine sand, loamy fine sand, loamy very fine sand	Single grain	Structureless	0.4	1.0	0.50	0.25
Coarse sandy loam, sandy loam	Massive	Structureless	0.2	0.6	0.25	0.15
	Platy	Weak	0.2	0.5	0.25	0.13
		Moderate, strong				
	Prismatic, blocky, granular	Weak	0.4	0.7	0.50	0.18
		Moderate, strong	0.6	1.0	0.75	0.25
Fine sandy loam, very fine sandy loam	Massive	Structureless	0.2	0.5	0.25	0.13
	Platy	Weak, mod., strong				
	Prismatic, blocky, granular	Weak	0.2	0.6	0.25	0.15
		Moderate, strong	0.4	0.8	0.50	0.20

Increasing Drainfield Size

- Increased System Size: Spread out the load over more area
- Land Intensive: Large footprint
- Multiple fields are a good option
- Seasonal facilities offer a factor of safety
- In General: high BOD and/or high FOG the soil is not a good medium for treatment

Comparing hydraulic and organic mass loadings for a restaurant wastewater

Given Info:

Design Flow: 600 gpd

BOD: 800 mg/l

Soil: loam, 0.6 gpd/sf loading rate

Hydraulic Loading:

Required Area =

(600 gpd)/(0.6 gpd/sf) = **1,000 sf**

Organic loading: STE: BOD = 150 mg/l

Organic Loading = (150 mg/l)(0.6 gpd/sf)(8.34)
= 7.5 x 10^4 lb BOD/sf/d

Therefore 0.00075 lb BOD/ft2/d is the soils' design organic loading rate

Now compensating for the increased waste strength:

Area=(800 mg/l)(600 gpd)(8.34)/(7.5 x 10-4 lb BOD/sf/d)

= (4.0 lb BOD)/(7.5 x 10-4 lb BOD/sf/d)

= 5337 sf (540% increase)

Restaurant Flows:

114K gpd/month (+/-)

28.5K gpd/week

3,300 gpd on avg

Sat&Sun **6,000 gpd**

The Flow Trap

- Design based upon flow only
- Metering data
  - Monthly average
- Actual Flow ≠ Design Flow

Peak Flow Event Facility

Retention Time: Residential vs Commercial

Residential System:

3 bedroom home, 3 persons (US Census 2.8), 1000 gal tank, actual water usage 50 gpd/person.

Retention time:

(1000 gal)/(150 gpd) = 6.7 days

Retention Time:
Residential vs Commercial

Commercial System

Tank Sizing per CO Code: 48 hours

Retention time: 2 Days

Operations and Maintenance

STRESS THE IMPORTANCE OF O&M TO THE OWNER

DESIGN WITH O&M IN MIND

ACCESS, SAMPLING, SAFETY

HSW Code Leaders

- **MN & WI – Product Review and Registration, Mass loading, Mfg must sign off and O&M required (WI requires 30-30)**
- **GA, CO**
- **NC & WA – Design based upon mass loading**
- **VT, ME**

Division of Environmental Health
Maine Center for Disease Control & Prevention
Department of Health and Human Services
STATE OF MAINE

SUBSURFACE WASTEWATER DISPOSAL RULES

H. ADJUSTMENTS FOR EFFLUENT QUALITY

1. Facilities other than residential, using water records to determine design flows, must also comply with Sections 4(G) and 4(H). (The Minimum Lot Size Law may also apply).

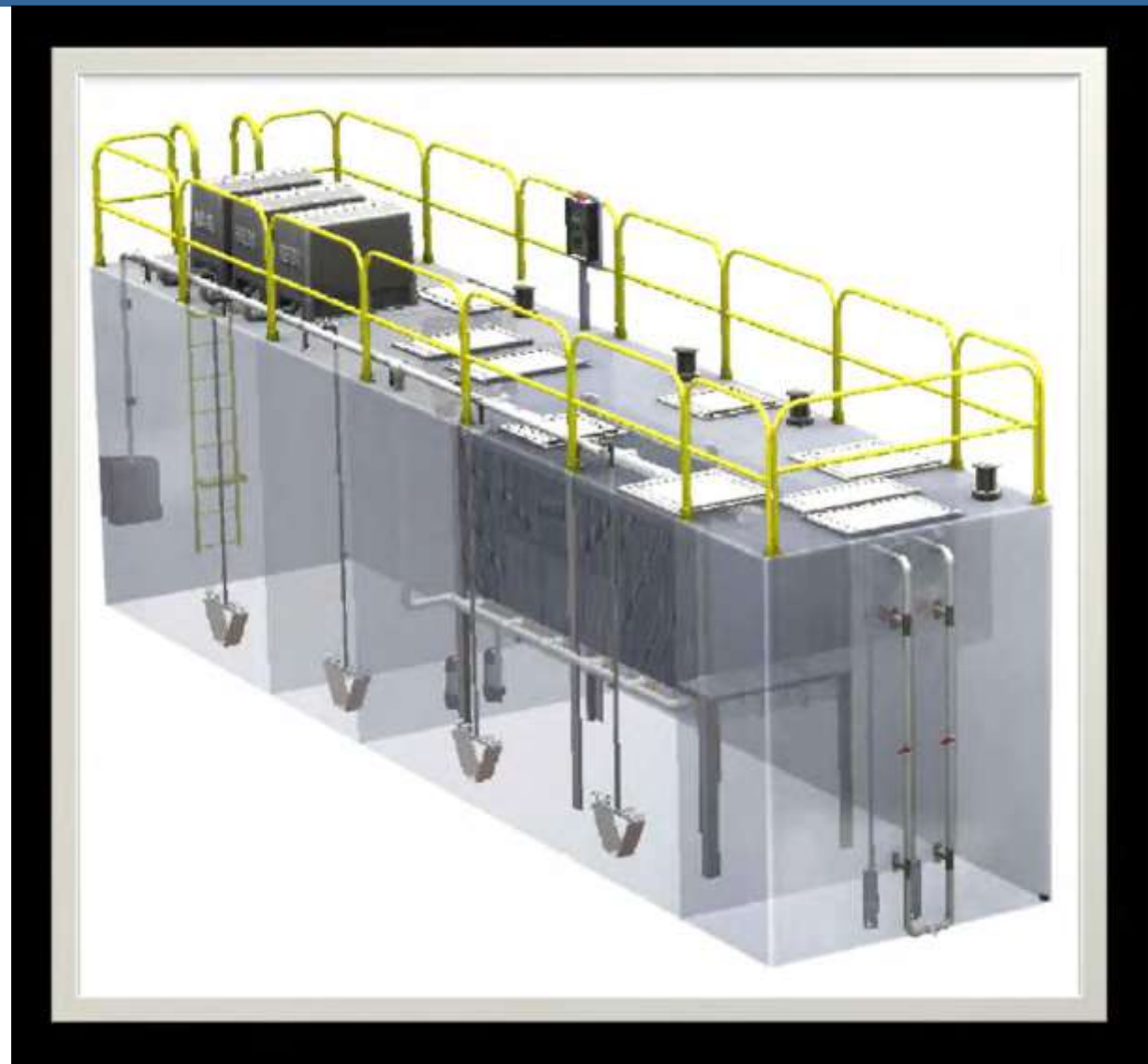
2. Factor: Adjustment for restaurant and commercial/institutional food preparation waste: Disposal areas for restaurants must be increased by 80 percent (multiplied by 1.8) to accommodate the additional organic loading typical of such facilities. This multiplying factor may be decreased by using the following criteria:

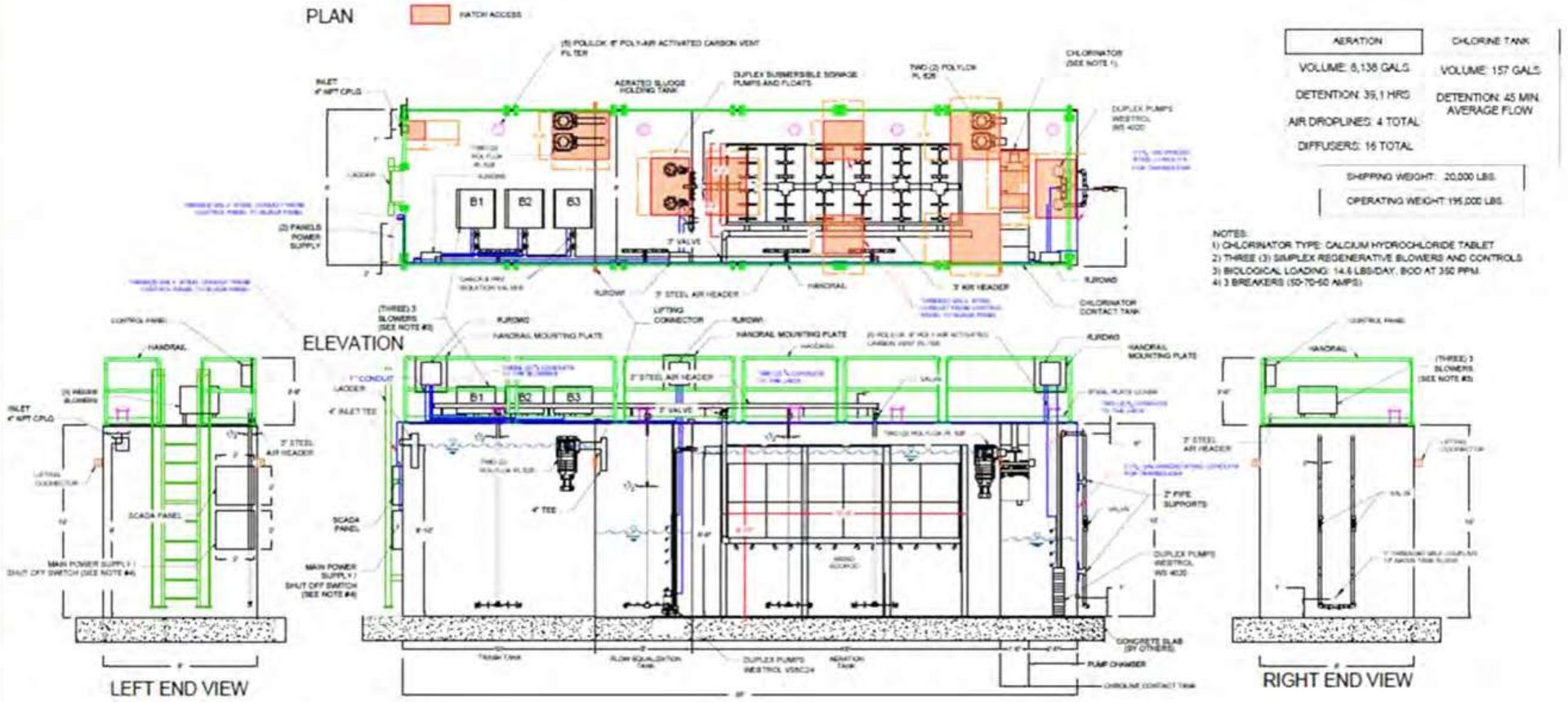
TABLE 4B
ADJUSTMENT FACTOR FOR WASTEWATER STRENGTHS DIFFERENT FROM TYPICAL DOMESTIC WASTEWATER

Strength of wastewater entering the disposal field (BOD5 plus TSS)	Adjustment factor (AF)
30 or less milligrams liter	0.5
52	0.6
82	0.7
122	0.8
175	0.9
240	1.0
320	1.1
420	1.2
530	1.3
660	1.4
810	1.5
985	1.6
1180	1.7
1400	1.8
1645	1.9
2000	2.0

Case Study: O&G Man Camp

Design Flow: 4,999 gpd
WW Strength: 350 mg/L BOD
E600D Ecopod
Treatment to 10/10 (spray)
Primary Tank – 5,000 gal
Flow EQ Tank
Aeration Chamber – 8,500 gal
Chlorination Tank
Pump Tank – 1,500 gal





REV	DATE	REVISION DESCRIPTION	BY
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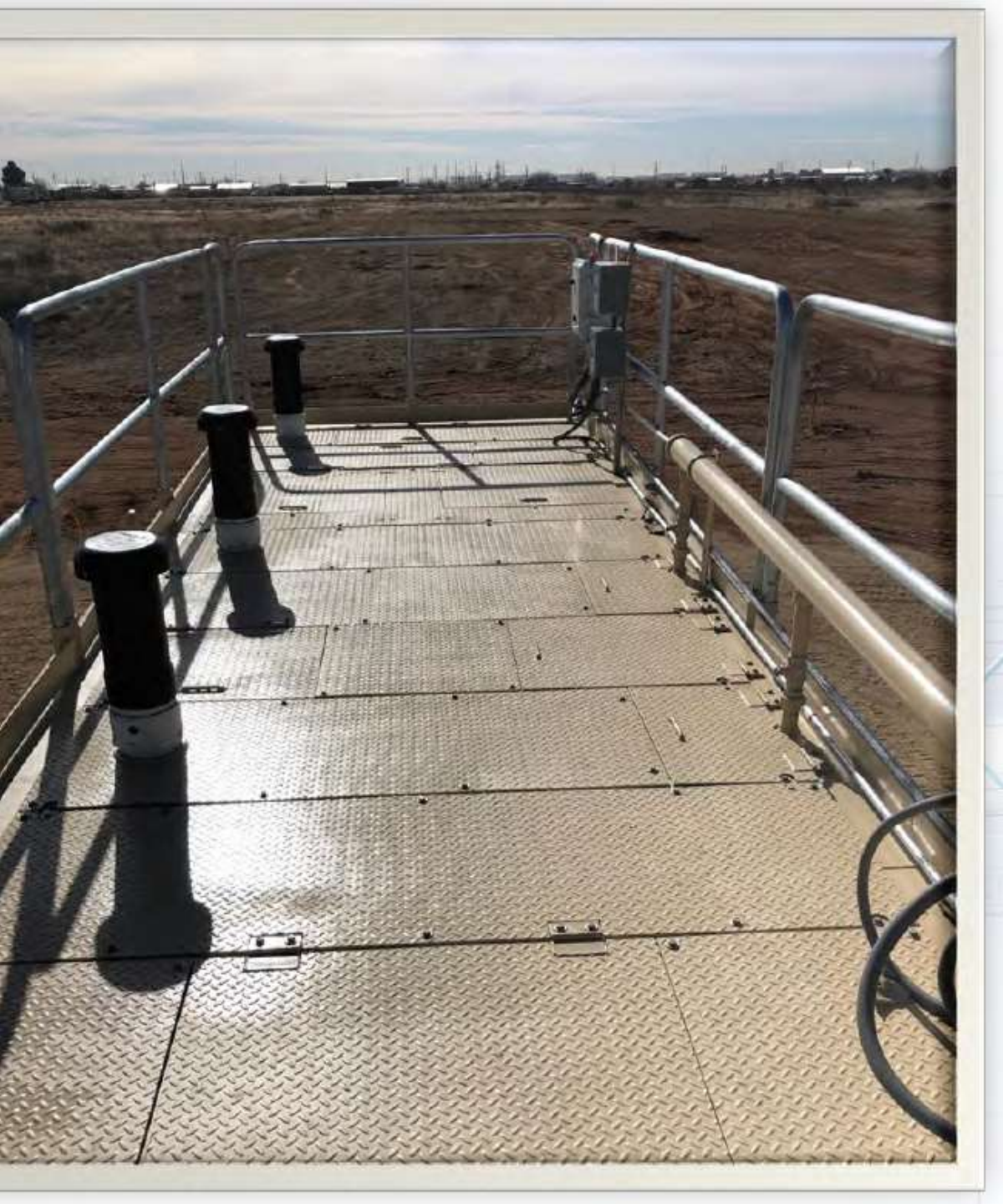
delta

MIDLAND ECOPOD-PLANT
4,999 GPD STP W/ PUMP TANK

PLOT SCALE	DRAWING NUMBER	DRAWN BY	DATE	SHEET	REV
NTS		EDGAR ALVIS	11/07/19	1 OF 1	1

Q:\Technical Resources New\02--ISI_PRODUCTS\25 - Delta Products\PACKAGE PLANTS - STP\MIDLAND ECOPOD-PLANT



Discussion

In your experience what is the most challenging facility type that you had to deal with?

What is the most difficult facility type?

Conclusions:

1. **HSW is complicated, no one-size-fits-all**
2. **It is an owner's decision: Offer options to your client**
3. **O&M, O&M, O&M – design for it, stress the importance to the owner**

Thanks - Questions

Infiltrator High Strength Waste Design recommendations/Best Practices white paper is available

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