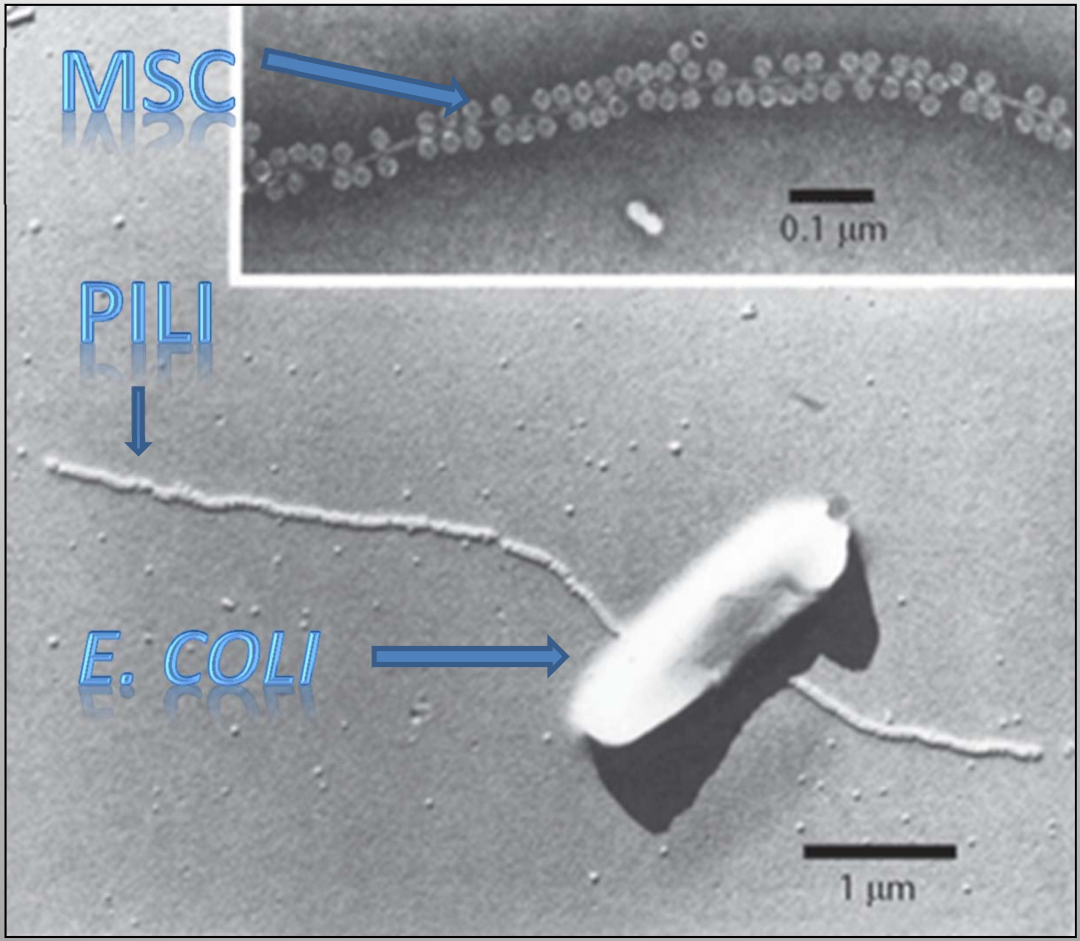
MSC in the NSSP



CDR Kevin R. Calci
Gulf Coast Seafood Laboratory
US Food & Drug Administration

Expanded Use of MSC:

-**Wastewater Treatment Plant Efficiency**

-Shoreline Survey

Expanded Use of MSC:

-Wastewater Treatment Plant Efficiency

-**Shoreline Survey**

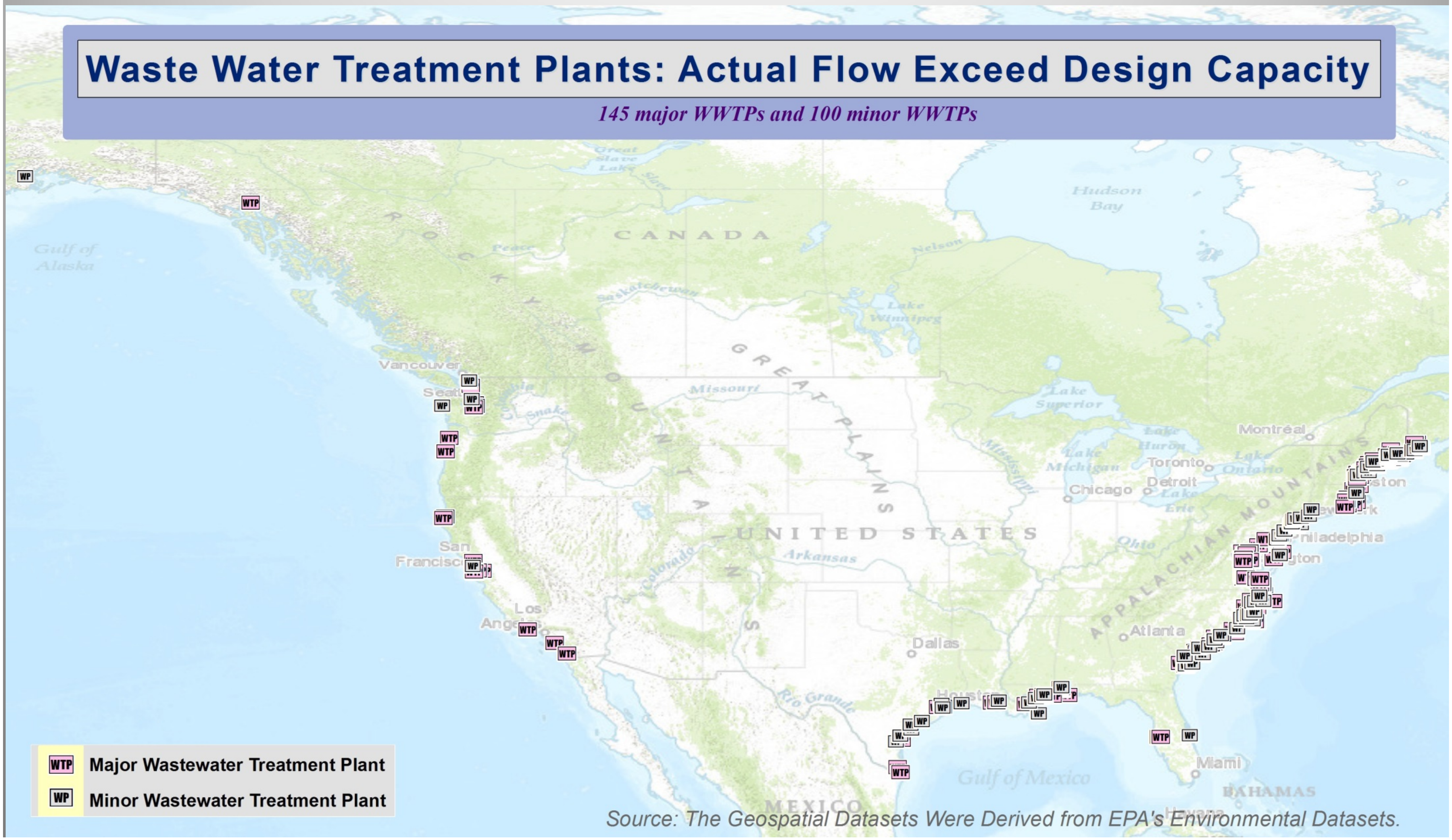
Male-Specific Coliphage Ecology

- **Raw Sewage**
  - 10^{4-5} PFU/100ml
- **Treated Sewage**
  - 10^{2-3} PFU/100ml
- **Animal Sources**
  - Horses, hogs, chickens
    - 1700 horses to equal a 1 MGD WWTP

Sizing up the Problem

The Good News:

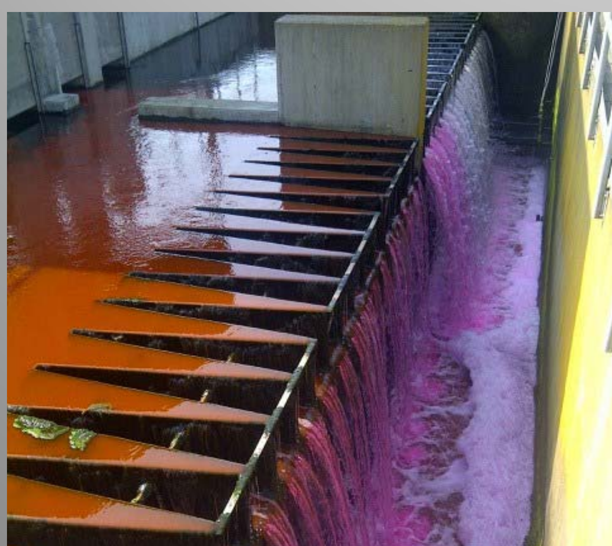
only 31% of the 779 wwtp exceed design capacity



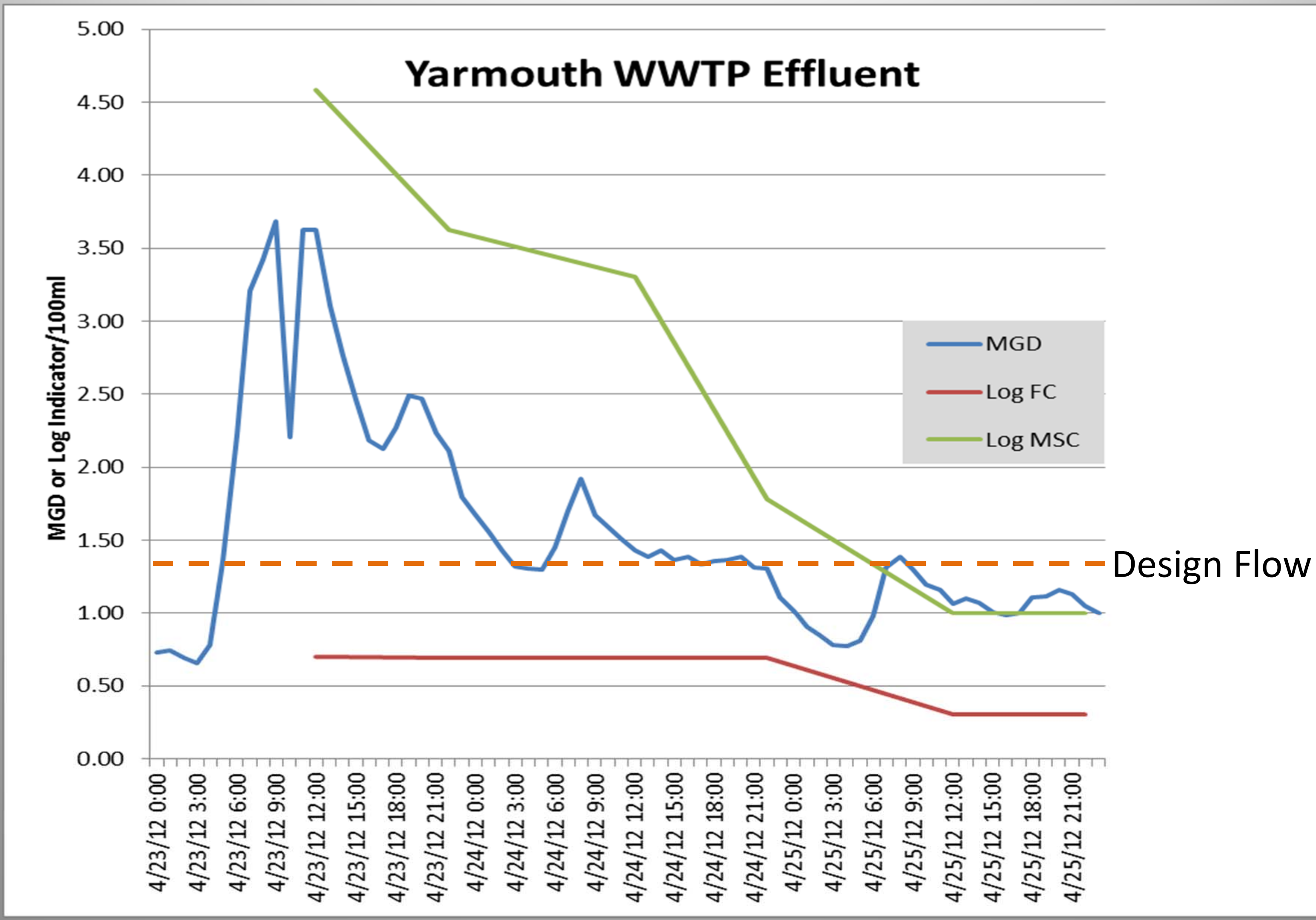
WWTP Efficiency:
How well are they doing?

FDA/State WWTP Studies

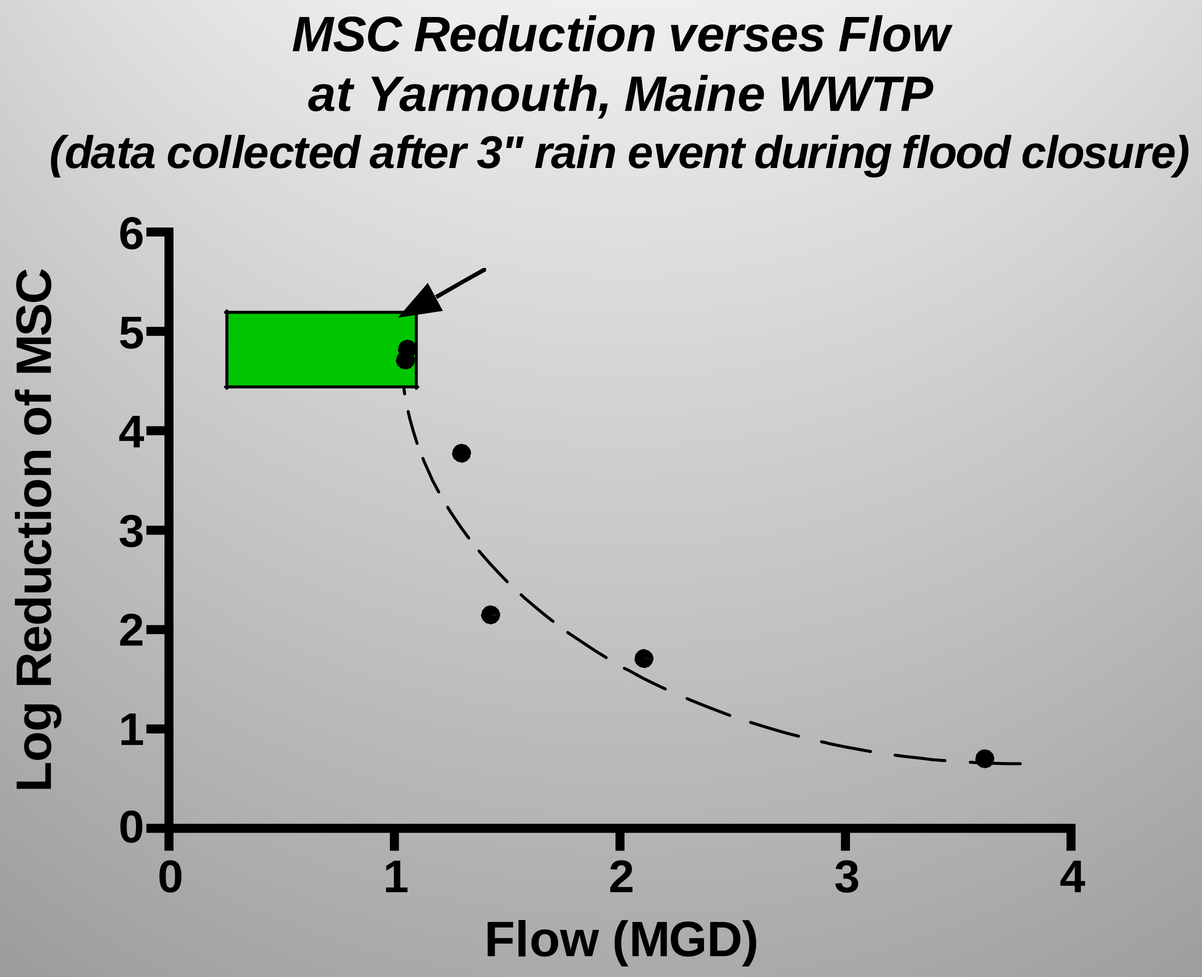
- 39 mechanical wwtp’s
- Ranged from Primary to Tertiary treatment
- No disinfection, chlorination or UV
- **ME**, **NH**, MA, **RI**, **CT**, **VA**, **AL**, MS, CA, **OR**, **WA**
- 7 wwtp-dye dispersion-shellfish sentinel studies



Capturing an Upset Condition



MSC Reduction in Response to Flow



A Glimpse at More DATA to Come

Disclaimer

This information is provided solely for the purpose of this MSC Informational Meeting; it has not been formally disseminated by FDA, Health Canada, Canadian Food Inspection Agency or Environment Canada. It does not and should not be construed to represent any agency determination or policy.

Norovirus in Bivalve Molluscan Shellfish Food Safety Risk Assessment

- This risk assessment was commissioned as a collaborative effort between the United States Food and Drug Administration, Health Canada, the Canadian Food Inspection Agency and Environment Canada
- Assessment objectives include: **quantitatively** evaluating impact of selected factors on the risk of becoming ill with norovirus from consumption of (oysters), assessing impact of preventive practices and controls, and informing food safety objectives if possible

Risk Assessment Key Input: Data on Wastewater Treatment (DRAFT)

- **A meta-analysis was completed in order to build the quantitative risk model. Data for NoV & MSC concentration in raw and treated wastewater was collected.**
  - Data sources: refereed scientific literature (43 papers), as well as original data from the US FDA and Canadian agencies
  - Data selection: using systematic selection criteria
  - Data focus: NoV I or NoV II in influent and effluent, and MSC if NoV I or NoV II data are available for that WWTP
  - Method used: Bayesian inference model considering; censored data, random effects for influent level and log reduction among WWTPs, seasonal effect and correlations between log-reduction of NoV and MSC

Meta-analysis Draft Results: Influent concentrations

- **Influent concentration estimates representing the population of WWTPs**
  - **Average over WWTPs and months**

	Estimate	CI 95%	
NoV I, influent (log_{10} gc/l)	1.5	0.4	2.4
NoV II, influent (log_{10} gc/l)	3.9	3.5	4.3
MSC, influent (log_{10} PFU/l)	6.2	6.1	6.4

Correlation coefficients: WWTP to WWTP
DRAFT Results

	Influent NoV I (log_{10} gc/l)	Influent NoV II (log_{10} gc/l)	Influent MSC (log_{10} PFU/l)	Log reduction NoV I (log_{10} gc/l)	Log reduction NoV II (log_{10} gc/l)
Influent NoV II (log_{10} gc/l)	**0.7 (0.3; 0.9)**				
Influent MSC (log_{10} PFU/l)	0.3 (-0.2; 0.6)	**0.4 (0.1; 0.7)**			
Log reduction NoV I (log_{10} gc/l)	-0.1 (-0.7; 0.7)	-0.2 (-0.8; 0.6)	-0.1 (-0.5; 0.5)		
Log reduction NoV II (log_{10} gc/l)	-0.3 (-0.6; 0.1)	**-0.5 (-0.8; -0.2)**	-0.3 (-0.6; 0.1)	0.5 (-0.2; 0.8)	
Log reduction MSC (log_{10} PFU/l)	-0.3 (-0.6; 0.2)	**-0.5 (-0.8; -0.1)**	-0.2 (-0.5; 0.1)	0.5 (-0.2; 0.8)	**0.8 (0.6; 0.9)**

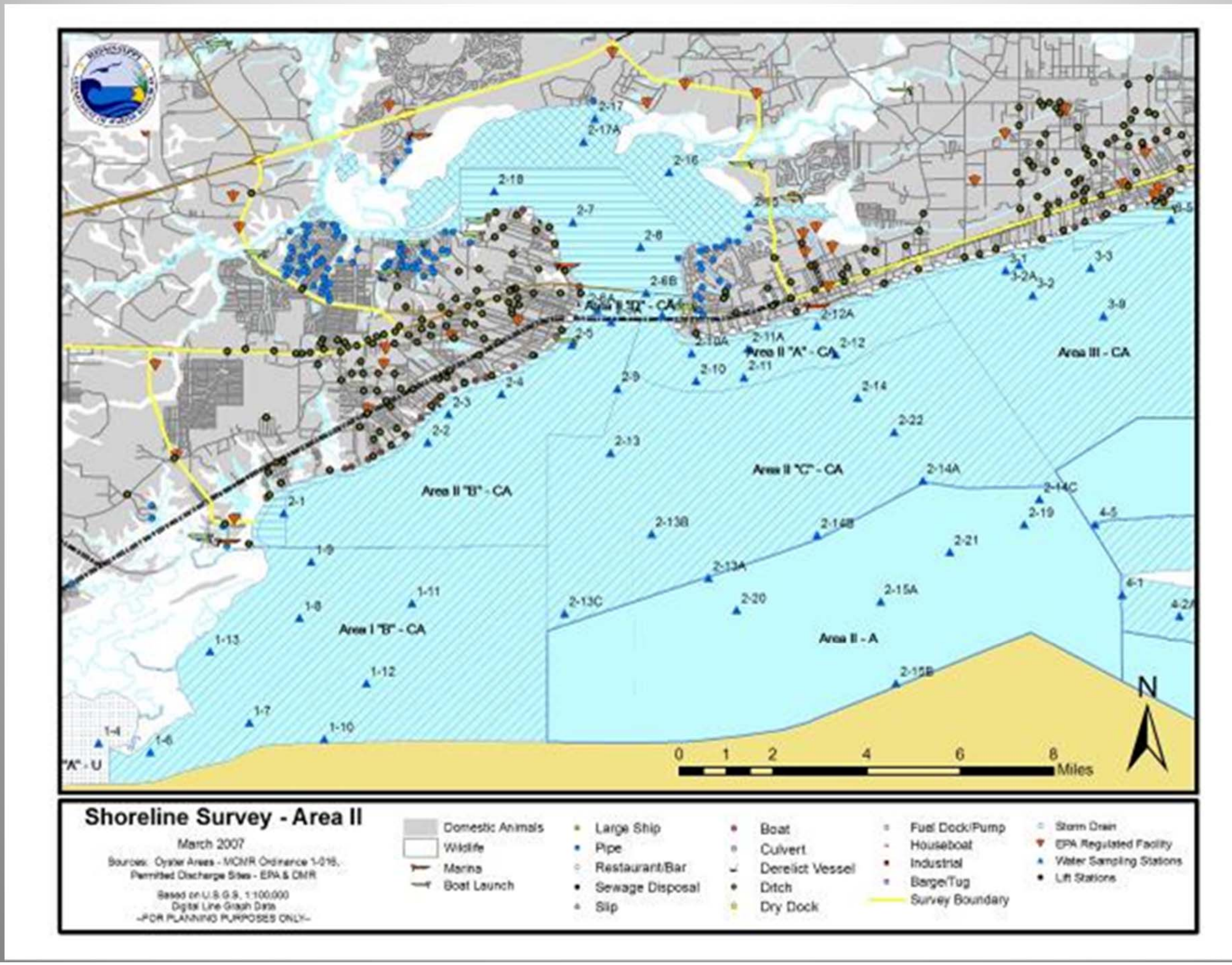
How to interpret this table:

A WWTP that provides (on average) a high log reduction for MSC, provides (on average) a high log reduction for NoV II

Estimate of average Log reduction as a function of WWTP *DRAFT Results*

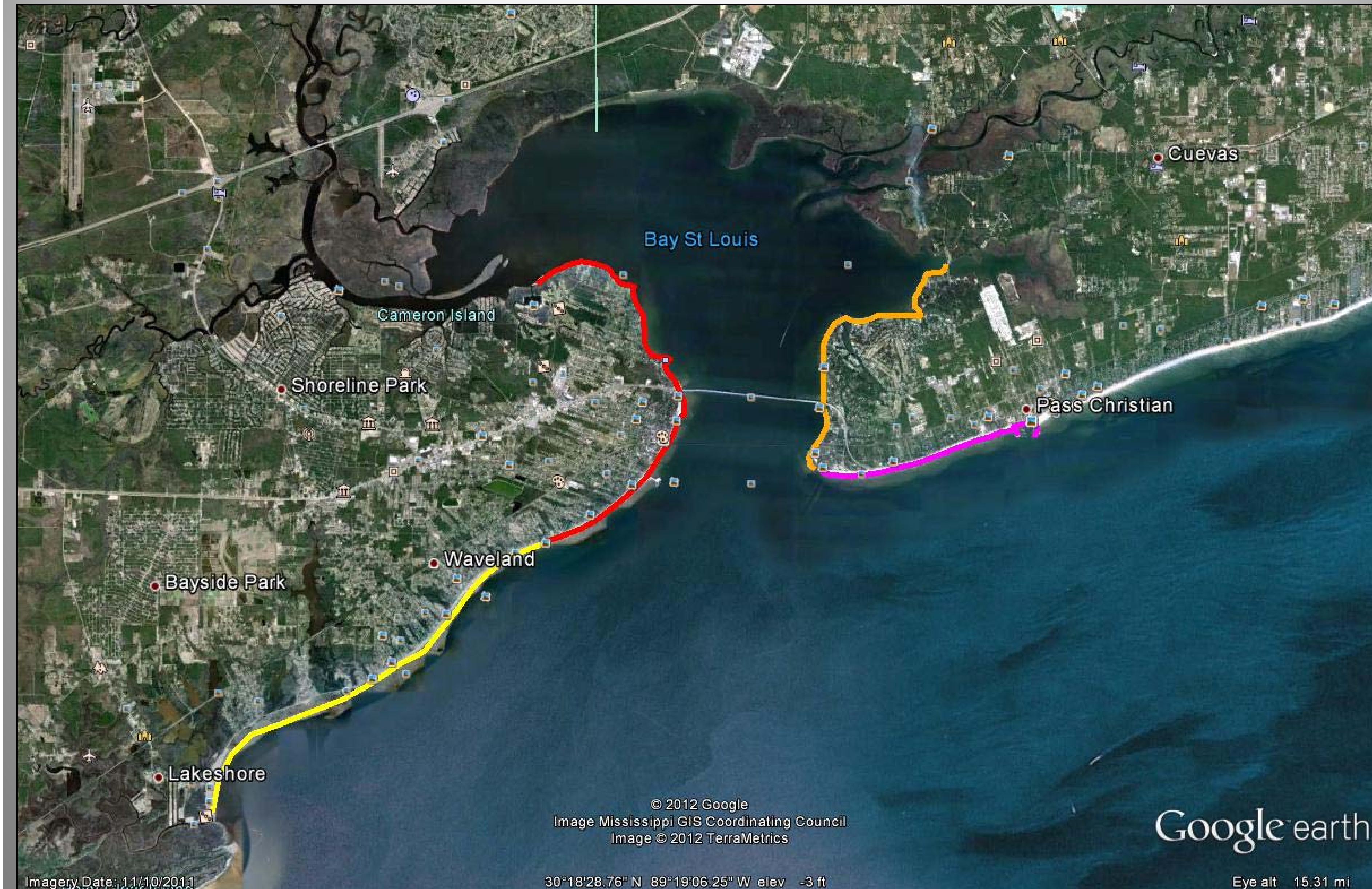
	Disinfection	WWTP type	Estimate	CI 95%	
Mechanical	None	NoV I (log_{10} gc/l)	-2.2	-3.7	-0.8
		NoV II (log_{10} gc/l)	-2.5	-3.4	-1.6
		MSC (log_{10} PFU/l)	-2.4	-2.9	-1.9
	Chlorine	NoV I (log_{10} gc/l)	-2.4	-3.9	-1.1
		NoV II (log_{10} gc/l)	-2.7	-3.6	-1.9
		MSC (log_{10} PFU/l)	-2.9	-3.4	-2.4
	UV	NoV I (log_{10} gc/l)	-3.0	-4.6	-1.5
		NoV II (log_{10} gc/l)	-3.3	-4.4	-2.3
		MSC (log_{10} PFU/l)	-4.3	-4.9	-3.7

MSC Use in Shoreline Surveys



What's the Game Plan

Shoreline Survey Teams



Water Sample for the Laboratory

Shoreline Survey Water Samples

Sample #	Site Name	Date	Time	FC/100ml	EC/100ml	MSC/100ml
1	WS-1	1/10/2012	10:45	140	140	9.9
2	WS-2	1/10/2012	11:14	1665	1660	300
3	WS-3	1/10/2012	11:26	155	145	10
4	WS-5	1/10/2012	11:45	625	620	9.9
5	WS-6	1/10/2012	11:58	380	365	9.9
6	ES-2	1/11/2012	8:50	60	50	9.9
7	ES-5	1/11/2012	9:00	28	18	9.9
8	ES-8	1/11/2012	9:28	320	310	9.9
9	ESS-9	1/11/2012	9:55	300	290	9.9
10	WS-1A	1/11/2012	8:45	175	170	9.9
11	WS-2A	1/11/2012	9:10	3950	3700	280
12	WS-3A	1/11/2012	9:28	1070	1035	10
13	WS-4A	1/11/2012	9:58	485	455	340
14	WS-4.1	1/11/2012	10:29	290	275	9.9
15	WS-4.2	1/11/2012	10:55	0.9	0.9	9.9
16	WS-5A	1/11/2012	11:48	535	485	20
17	WS-6A	1/11/2012	ND	1035	1010	9.9
18	WS-7	1/11/2012	12:57	116	115	9.9
19	WS-8	1/11/2012	13:08	28	28	9.9
20	WS-10	1/11/2012	13:20	18	18	9.9
21	WS-11	1/11/2012	13:30	15	13	9.9
22	WS-12	1/11/2012	13:40	4	4	9.9
23	WS-13	1/11/2012	13:50	2900	2900	9.9
24	WS-14	1/11/2012	14:51	4	4	9.9
25	WS-16	1/11/2012	15:23	0.9	0.9	9.9
26	WS-17	1/11/2012	15:43	5	5	9.9
27	WS-18	1/11/2012	15:53	106	104	9.9
28	E-11	1/11/2012	ND	7	7	9.9
29	E-12	1/11/2012	ND	9	8	9.9
30	ES-14	1/11/2012	ND	275	260	9.9
31	ES-15	1/11/2012	ND	235	232	9.9
32	ES-16	1/11/2012	ND	134	122	9.9
33	ES-44	1/11/2012	ND	8	8	9.9
34	ES-46	1/11/2012	ND	445	430	9.9
35	ES-47	1/11/2012	ND	0.9	0.9	9.9
36	WS-11	1/11/2012	11:30	55	55	30
37	SWS-9	1/11/2012	10:15	430	430	100
38	SWS-12	1/11/2012	12:02	170	165	30
39	SWS-15	1/11/2012	12:43	24	24	9.9
40	SWS-16	1/11/2012	13:10	285	285	9.9
41	WS-1.1	1/12/2012	11:05	17500	17000	510
42	WS-2.1	1/12/2012	11:15	26	25	9.9
43	WS-2B	1/12/2012	10:30	11850	11850	670
44	WS-6.1	1/12/2012	9:21	78	76	9.9
45	WS-6.2	1/12/2012	9:43	230	155	9.9
46	WS-6.3	1/12/2012	10:02	15	11	9.9
47	WS-6B	1/12/2012	11:29	550	520	9.9
48	ES-61	1/12/2012	ND	7	6	9.9
49	ES-67	1/12/2012	ND	0.9	0.9	9.9
50	ES-71	1/12/2012	ND	27800	27800	9.9
51	SS-5	1/12/2012	10:21	38	32	9.9
52	WS-15A	1/12/2012	12:35	50	50	9.9
53	WS-16A	1/12/2012	12:15	3	3	9.9
54	SS-6	1/12/2012	11:10	24	20	9.9
55	SS-1	1/12/2012	9:07	17	17	9.9
56	SS-7	1/12/2012	11:33	92	86	9.9
57	IPJ	1/12/2012	ND	ND	ND	ND
58	SS-8	1/12/2012	15:17	720	680	9.9
59	SS-10	1/12/2012	15:32	160	150	9.9
60	SS-11	1/12/2012	15:52	6	6	9.9
61	SS-12	1/12/2012	16:04	39	38	9.9
62	SS-13	1/12/2012	16:20	1045	1000	9.9
63	HP-51	1/13/2012	11:43	120	120	9.9
64	HP-52	1/13/2012	12:41	0.9	0.9	9.9
65	WS-1.5	1/13/2012	14:10	50	49	10
66	WS-1.4	1/13/2012	14:55	29	29	9.9
67	WS-1.6	1/13/2012	14:25	0.9	0.9	9.9
68	WS-1.3	1/13/2012	13:40	43	41	10
69	WS-1.2	1/13/2012	12:53	114	106	9.9
70	WS-2.1A	1/13/2012	12:05	46	45	9.9
71	WS-1B	1/13/2012	11:35	13	12	9.9
72	WS-2C	1/13/2012	11:40	265	265	540
73	WS-1.1A	1/13/2012	12:20	157	155	170
74	BSW-16	1/13/2012	13:45	0.9	0.9	9.9
75	BSW-1	1/13/2012	12:46	220	150	19.9
76	BSW-2	1/13/2012	12:59	82	68	9.9
77	BSW-3	1/13/2012	ND	180	180	9.9
78	WS golf course pond	1/15/2012	19:00	0.9	0.9	9.9
79	Pond overflow stream	1/15/2012	19:15	785	690	9.9
80	WS PVC pipe	1/16/2012	9:26	79	79	9.9
81	WS parking lot pond	1/16/2012	9:37	65	65	9.9
82	WS parking lot 2	1/16/2012	9:43	23	23	9.9
83	WS downstream from weir	1/16/2012	9:55	355	345	9.9
84	WS baseball upgrade of lift	1/16/2012	10:19	65	65	9.9
85	Baseline River	1/16/2012	12:30	20	20	9.9
86	WS west fork Joes Bayou	1/16/2012	10:51	310	310	180
87	WS East Fork Joes Bayou	1/16/2012	11:05	95	95	9.9
88	WS-2D	1/16/2012	9:00	625	615	10
89	WS golf course pond A	1/16/2012	9:21	18	18	9.9
90	Diamondhead WWTP outfall	1/16/2012	13:00	70	65	9.9
91	Culvert @ Joe's Bayou & Blue Meadow Rd	1/18/2012	9:13	900	900	30
92	West fork of Joe's Bayou	1/18/2012	14:25	405	400	150
93	Culvert near school crossing	1/18/2012	8:55	105	105	9.9
94	East fork of the West fork Joe's Bayou	1/18/2012	9:44	7300	7300	3060
95	E fork of W fork of W fork (sandy delta)	1/18/2012	8:20	4700	4700	9.9
96	WS Joe's Bayou (between casino and RV)	1/18/2012		27	24	60
97	Pass Christian Effluent	1/19/2012	14:05	0.49	0.49	9.9
98	Waveland Influent	1/19/2012	11:48	6500000	6500000	142000
99	Pass Christian Influent	1/19/2012	14:20	3000000	3000000	134800
100	Pass Christian Effluent Prechlorinated	1/19/2012	14:13	11250	11200	400
101	Waveland Effluent post UV	1/19/2012	11:25	140	140	9.9
102	Waveland Effluent pre UV	1/19/2012	11:32	14100	14100	1730

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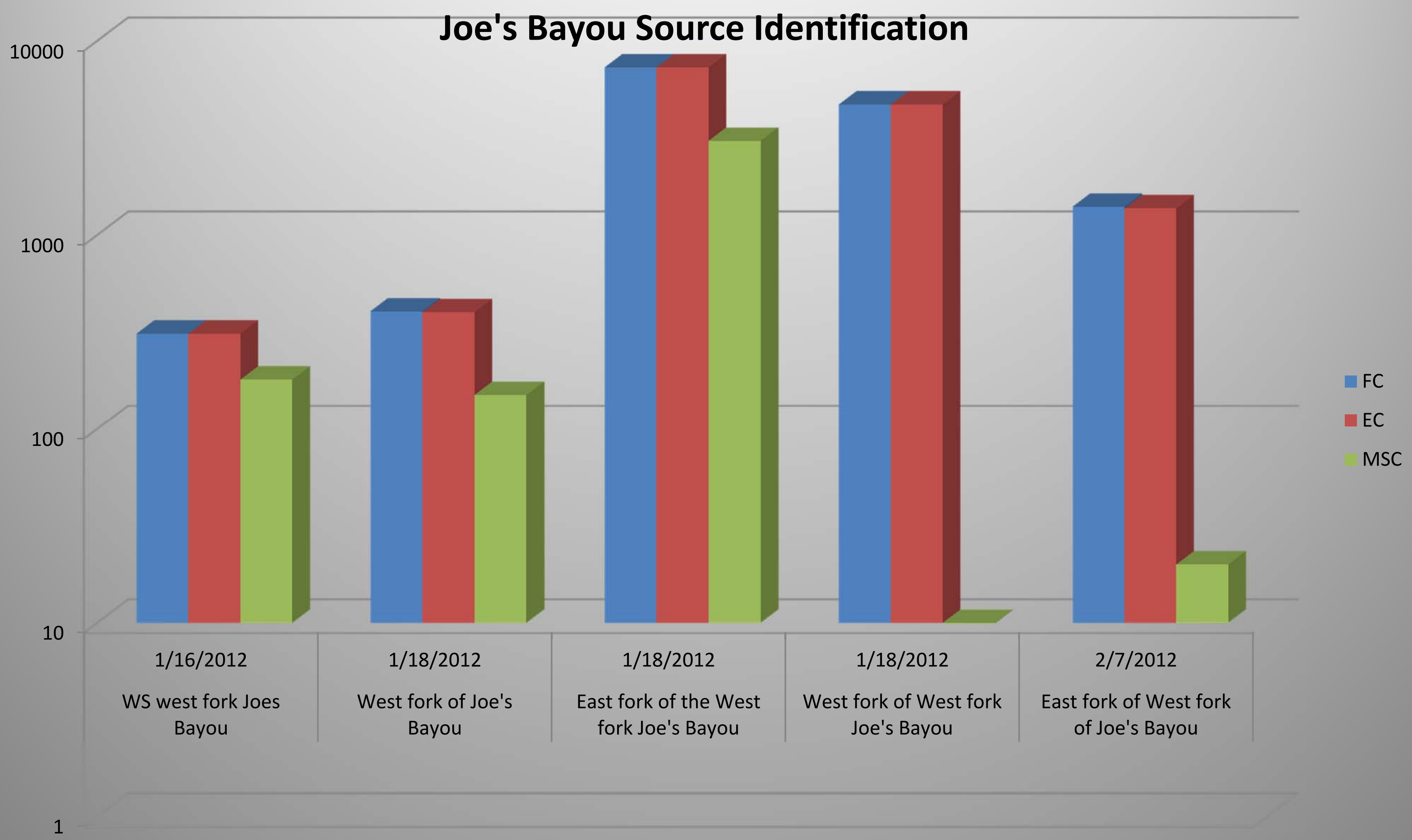
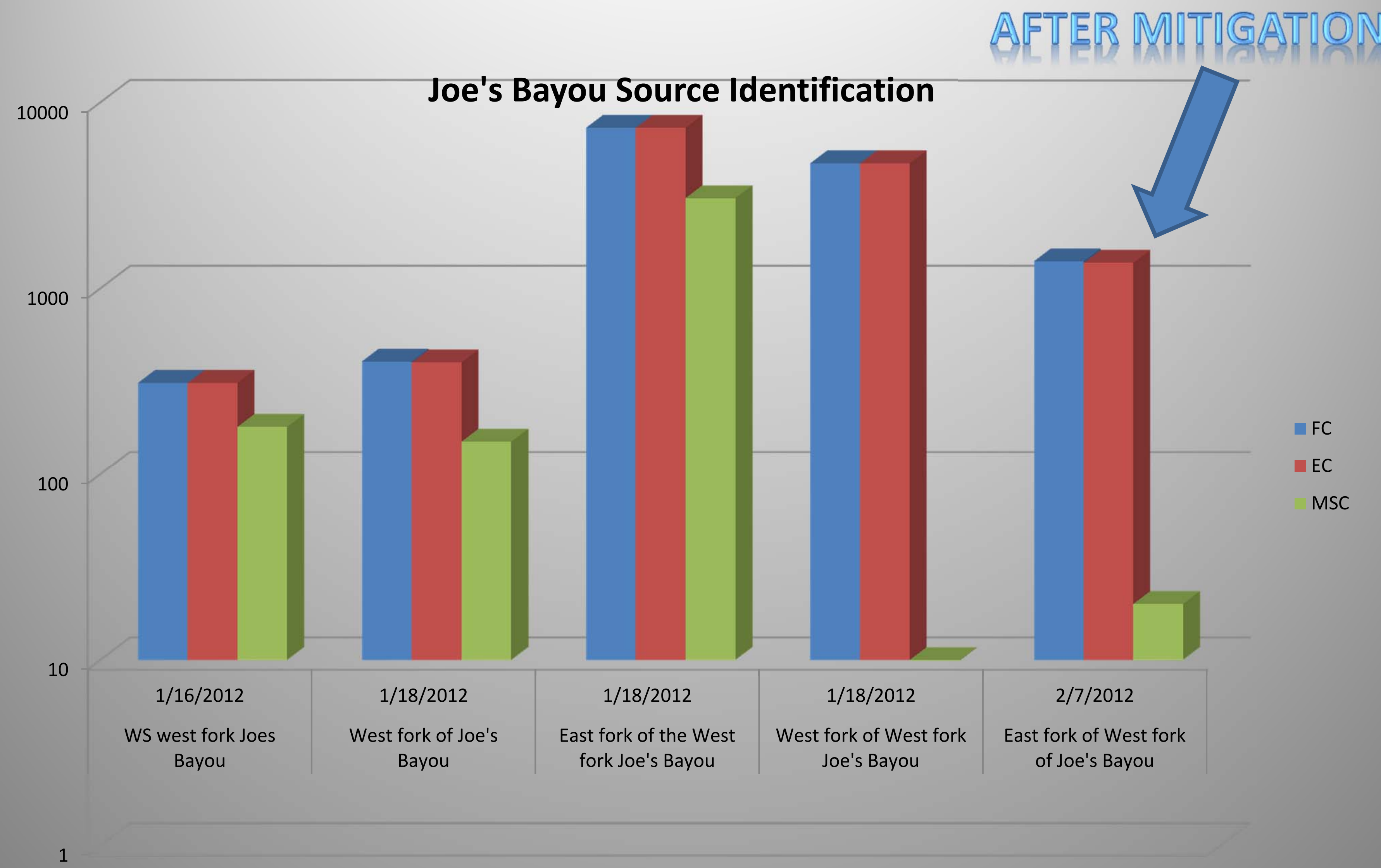
Indicator Profiles



Indicator Profiles



FDA/State Shoreline Surveys

- East Greenwich, RI- cross connections
- Empire, LA- failing septic tanks
- Bristol, RI- overflowing manhole in woods
- Pawcatuck River, RI- cross-connections
- Coos Bay, OR- 62 shoreline sources; <10 MSC
- Morro Bay, CA- very little shoreline contribution
- Tomales Bay, CA- Possible seeps from evaporation pond and failing septic tanks
- Bay St. Louis, MS- failing lift station and malfunctioning air-trap

Summary of WWTP Efficiency Use

- When a conditional management plan around a WWTP is developed, MSC would more accurately define viral pathogens reduction efficiency of the plant than the bacterial fecal indicators.

Summary of Shoreline Survey Use

- Shoreline surveys are very large investment in time and money. Get more bang for your buck, by adding a column of data on the spreadsheet. Indicator profiles will suggest where mitigation should occur to prevent municipal sewage from entering into the watershed.

Questions??