




Bacteria TMDLs for Brays Bayou

November 11, 2008



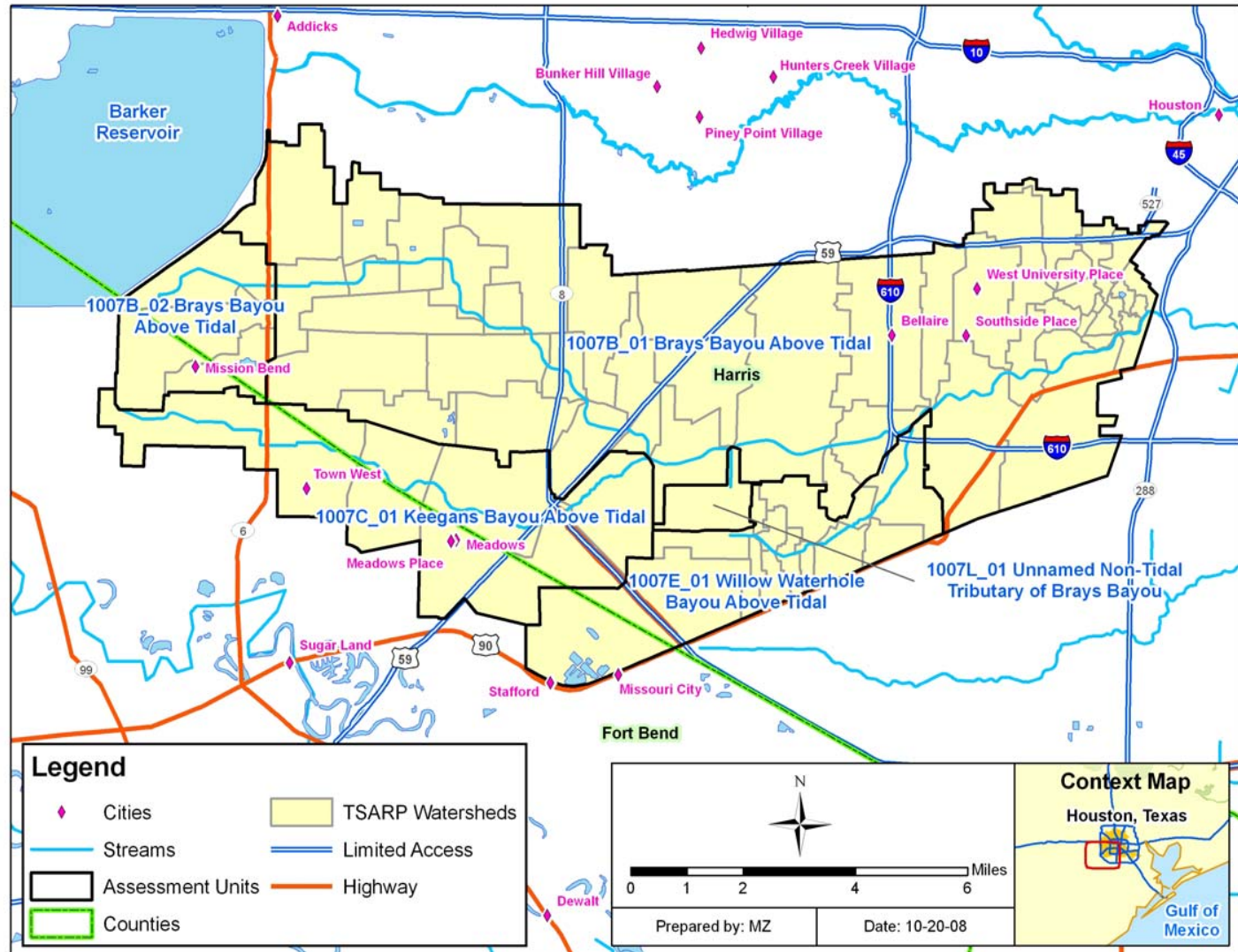
PARSONS

Outline

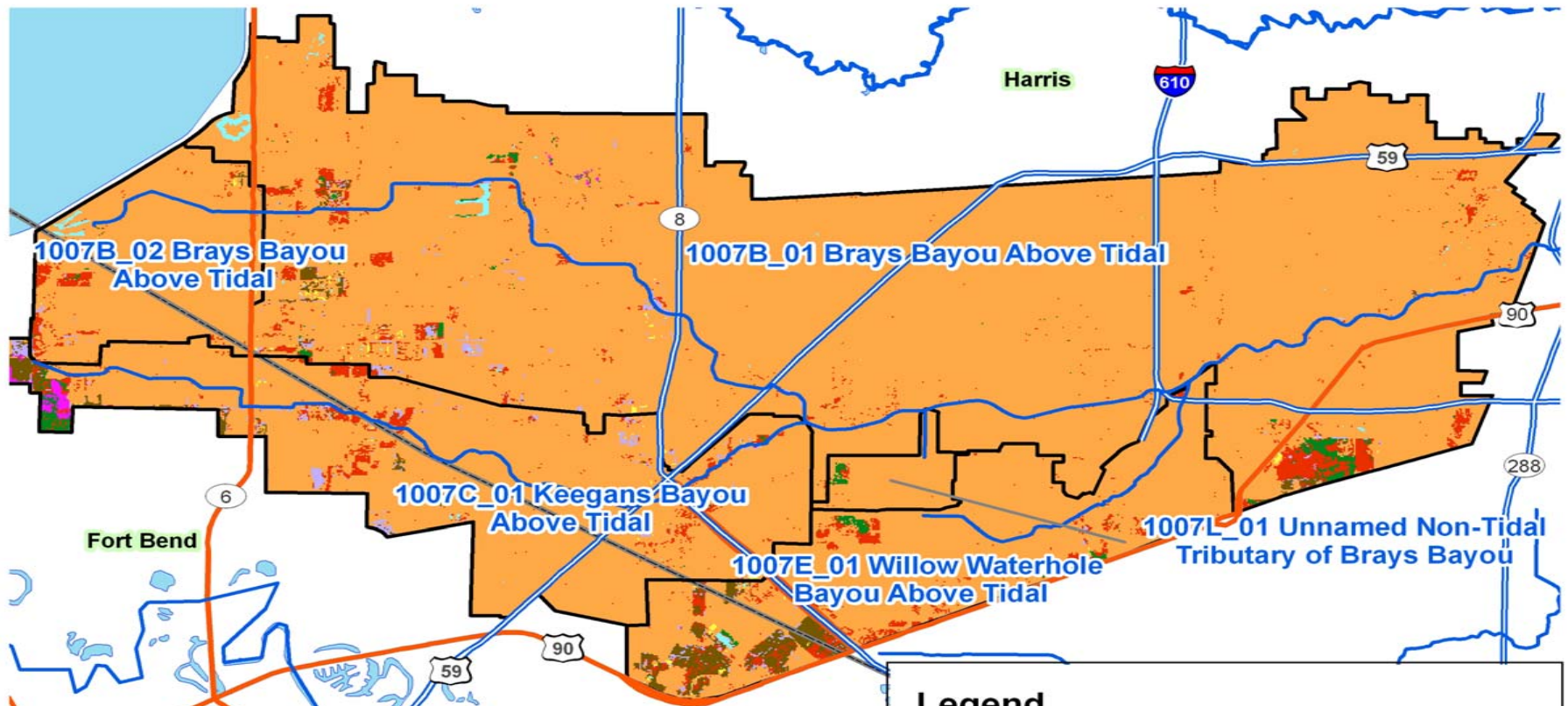
- **Watershed Overview**
 - **Pollutant Source Assessment**
 - **Technical Approach: Load Duration Curves**
 - **TMDL Calculations**
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Brays Bayou Watershed

- ~170 square miles
- Located within 2 counties (Harris, Fort Bend)
- Average Annual Rainfall 47.7 inches (NOAA 2007)

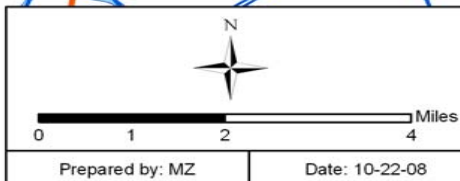


Land Use/Land Cover



Legend

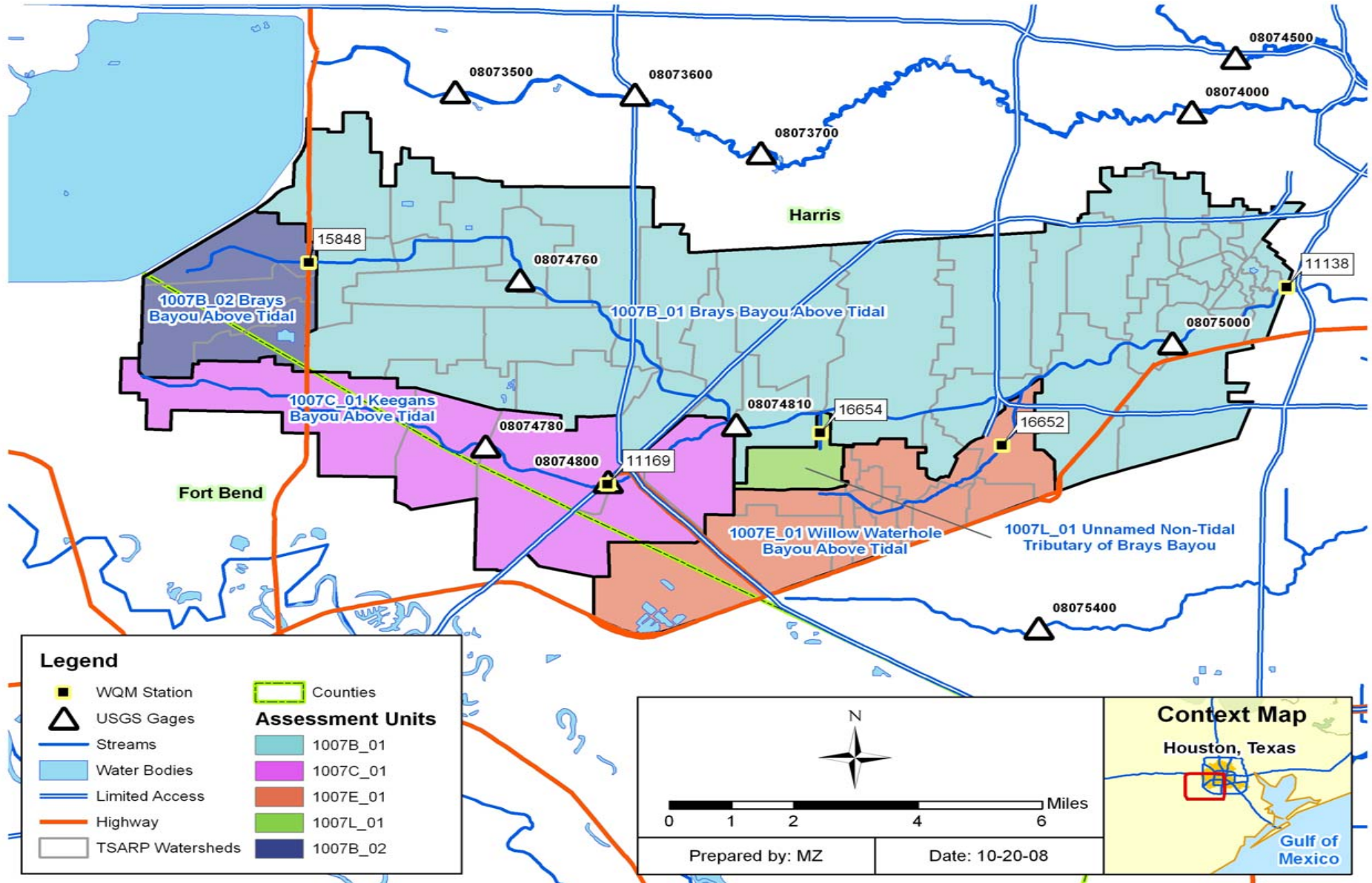
- | | |
|------------------|-------------------|
| Streams | Grassland |
| Assessment Units | Woody Land |
| Counties | Wetland |
| Developed | Bare/Transitional |
| Cultivated Land | Open Water |
| Pasture/Hay | |



303 (d) Listed Assessment Units (2008)

Assessment Unit	Water Body	Description of Assessment Unit Not Supporting Contact Recreation Use
1007B_01	Brays Bayou above Tidal	From 11.5 km upstream of confluence with Houston Ship Channel (Brays Bayou Tidal) to SH6
1007B_02	Brays Bayou above Tidal	From Alief Clodine Road to SH6
1007C_01	Keegans Bayou above Tidal	From Harris County line to confluence with Brays Bayou
1007E_01	Willow Waterhole Bayou above Tidal	Entire Stream
1007L_01	Unnamed Non-Tidal Tributary of Brays Bayou	Entire Perennial Portion of Stream

Water Quality Monitoring Stations

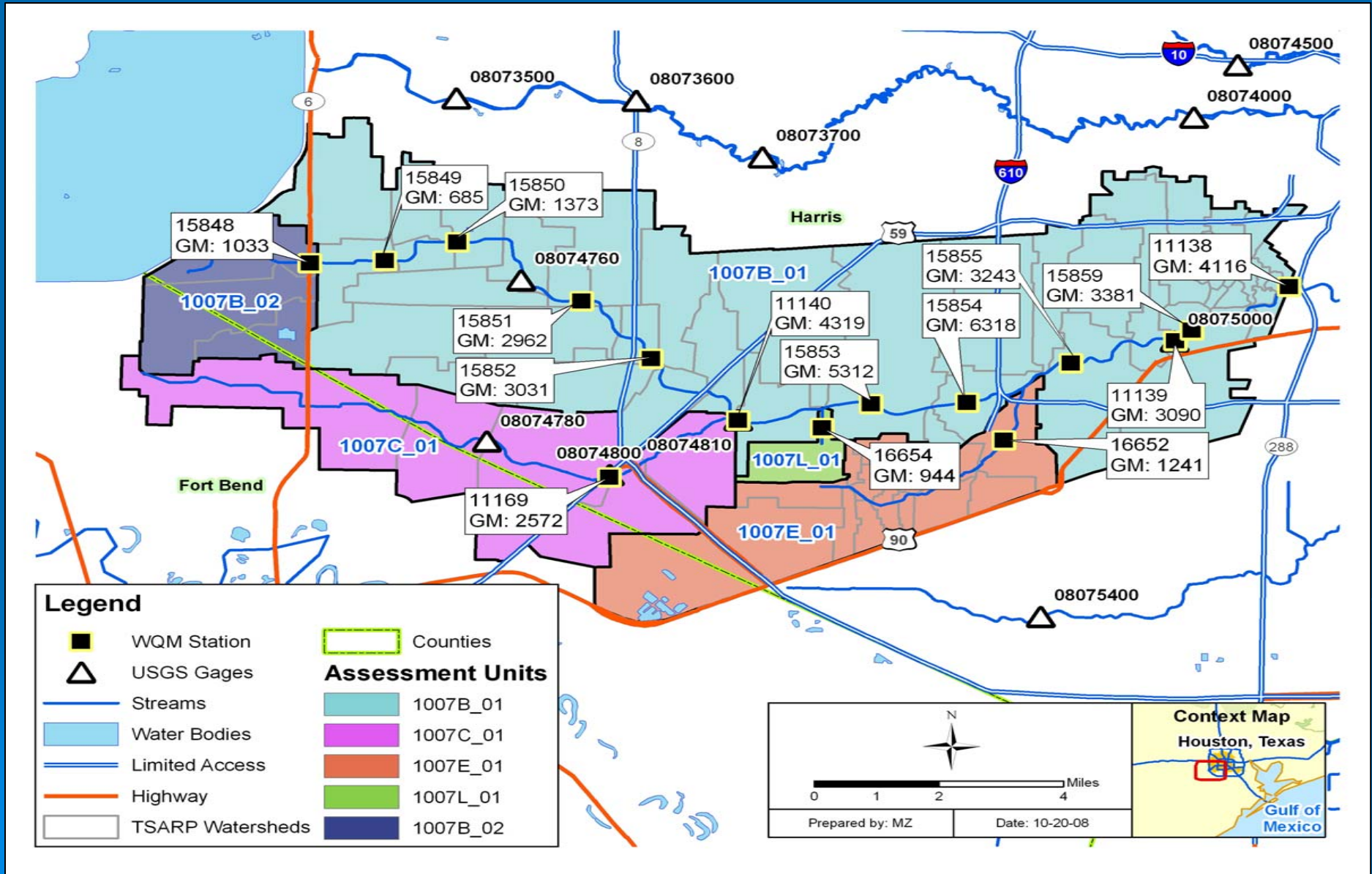


***E. coli* Data for TCEQ Stations from 1996 to 2006**

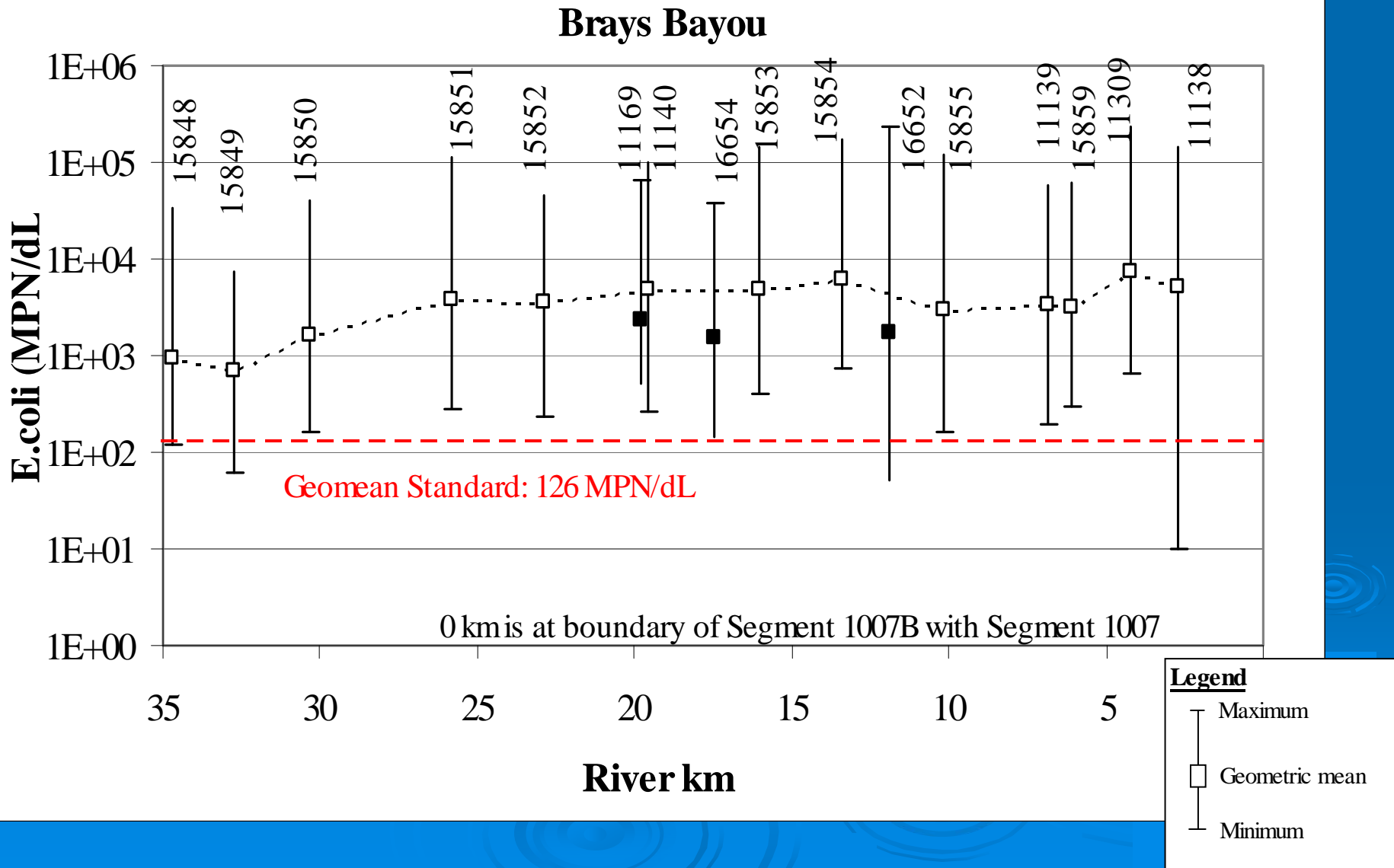
Segment	Station ID	Geometric Mean Concentration	Number of Samples	Number of Samples Exceeding Single Sample Criteria	% of Samples Exceeding
1007B_01	11138	4116	72	70	97%
1007B_02	15848	1033	70	51	73%
1007C_01	11169	2572	56	56	100%
1007E_01	16652	1241	69	50	72%
1007L_01	16654	944	56	43	77%

* Geometric Mean Criteria for *E. coli* is 126 MPN/100mL and Single Sample Criteria is 394 MPN/100mL

Brays Bayou *E. coli* Geomeans



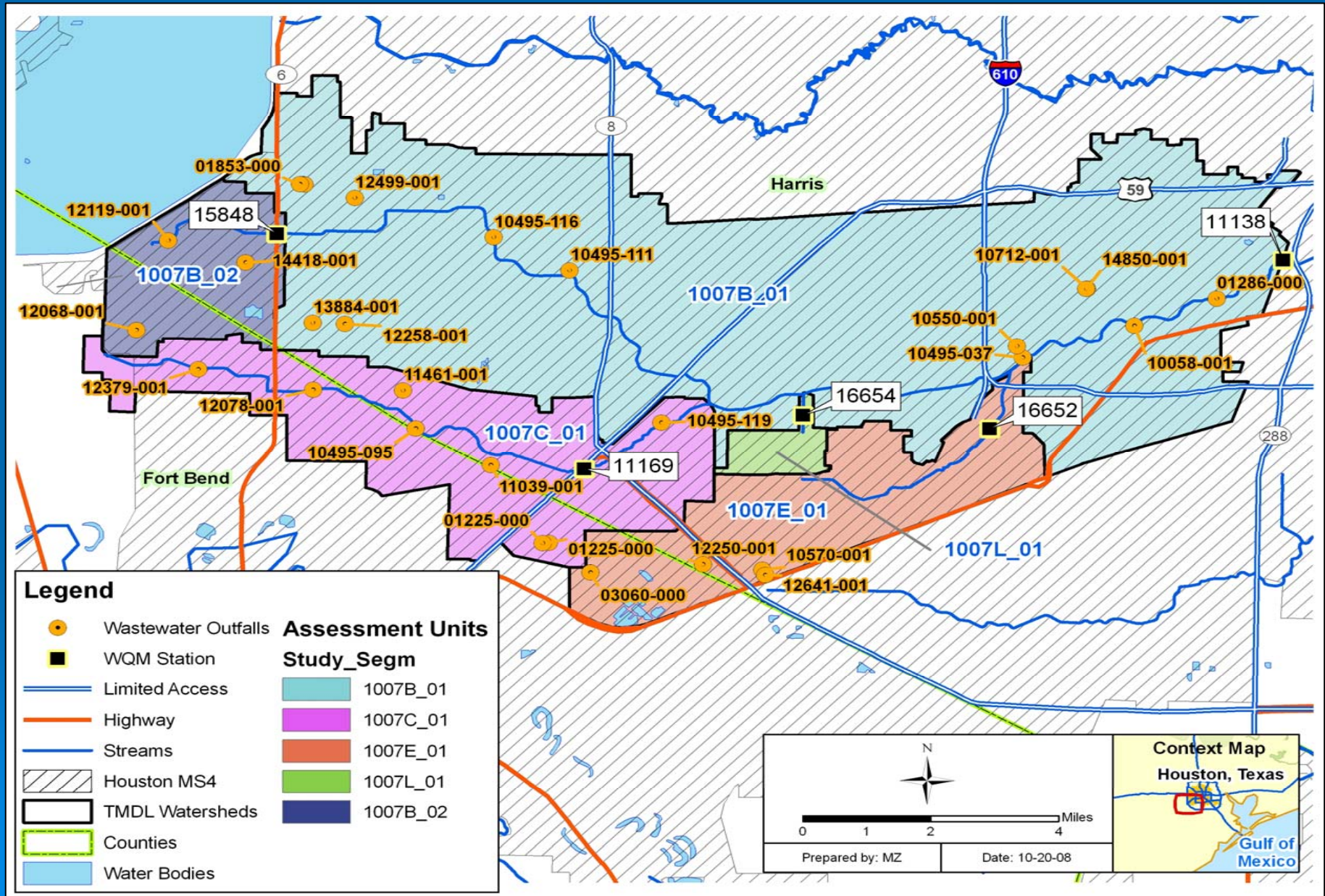
Brays Bayou *E. coli* Longitudinal Profile



Outline

- Watershed Overview
- Pollutant Source Assessment
- Technical Approach: Load Duration Curves
- TMDL Calculations

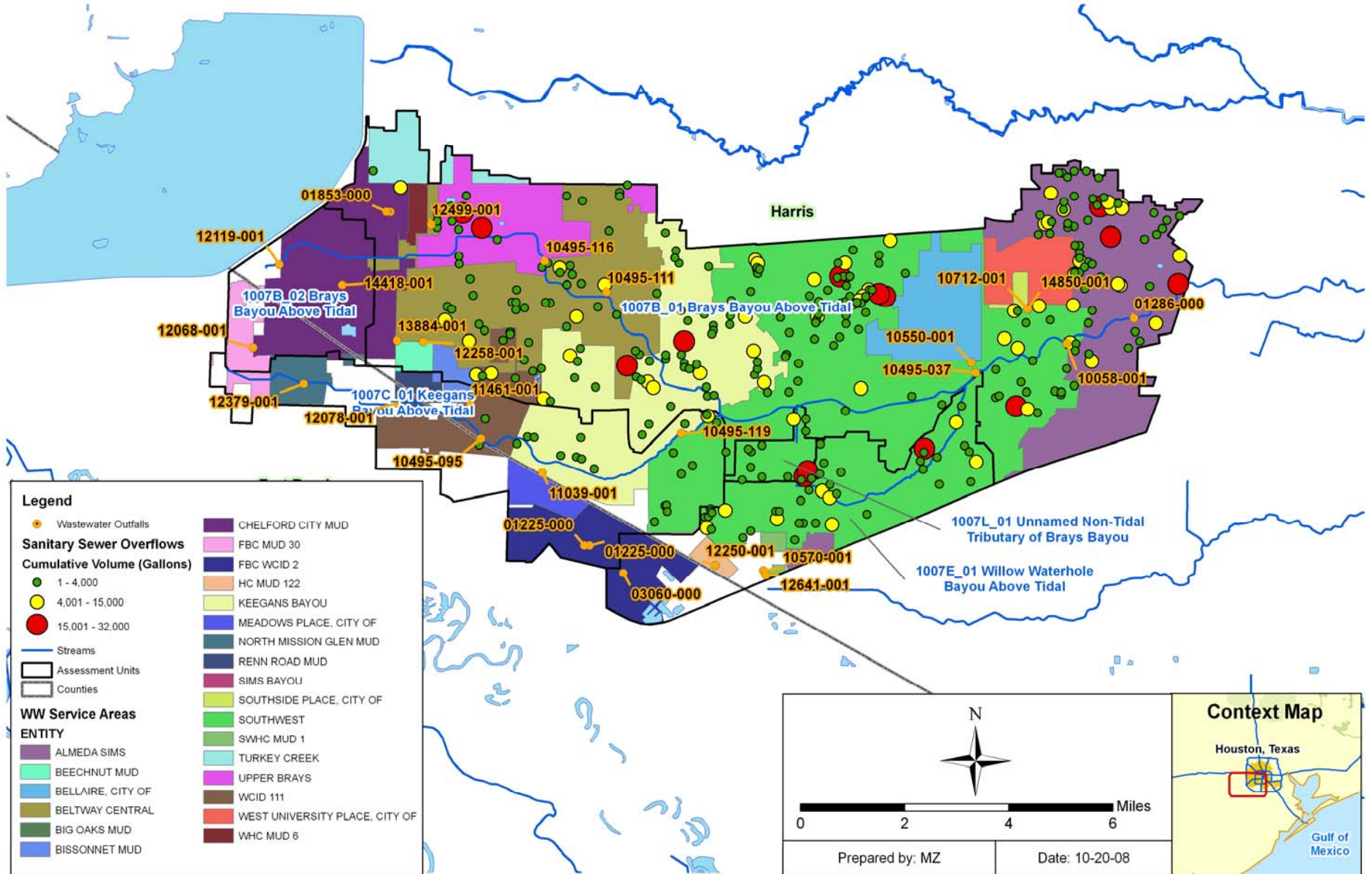
Wastewater Treatment Plants



Summary of TPDES-Permitted Facilities in the Study Area

Assessment Unit	Number of Facilities	Total Permitted Flow (MGD)	Total Average Monthly Flow (MGD)
1007B_01	12	101.9	54.3
1007B_02	3	17.3	4.9
1007C_01	8	36.1	18.9
1007E_01	4	1.3	0.5
1007L_01	0	0	0

Sanitary Sewer Overflows



Permitted Storm Water for WQ0004685000

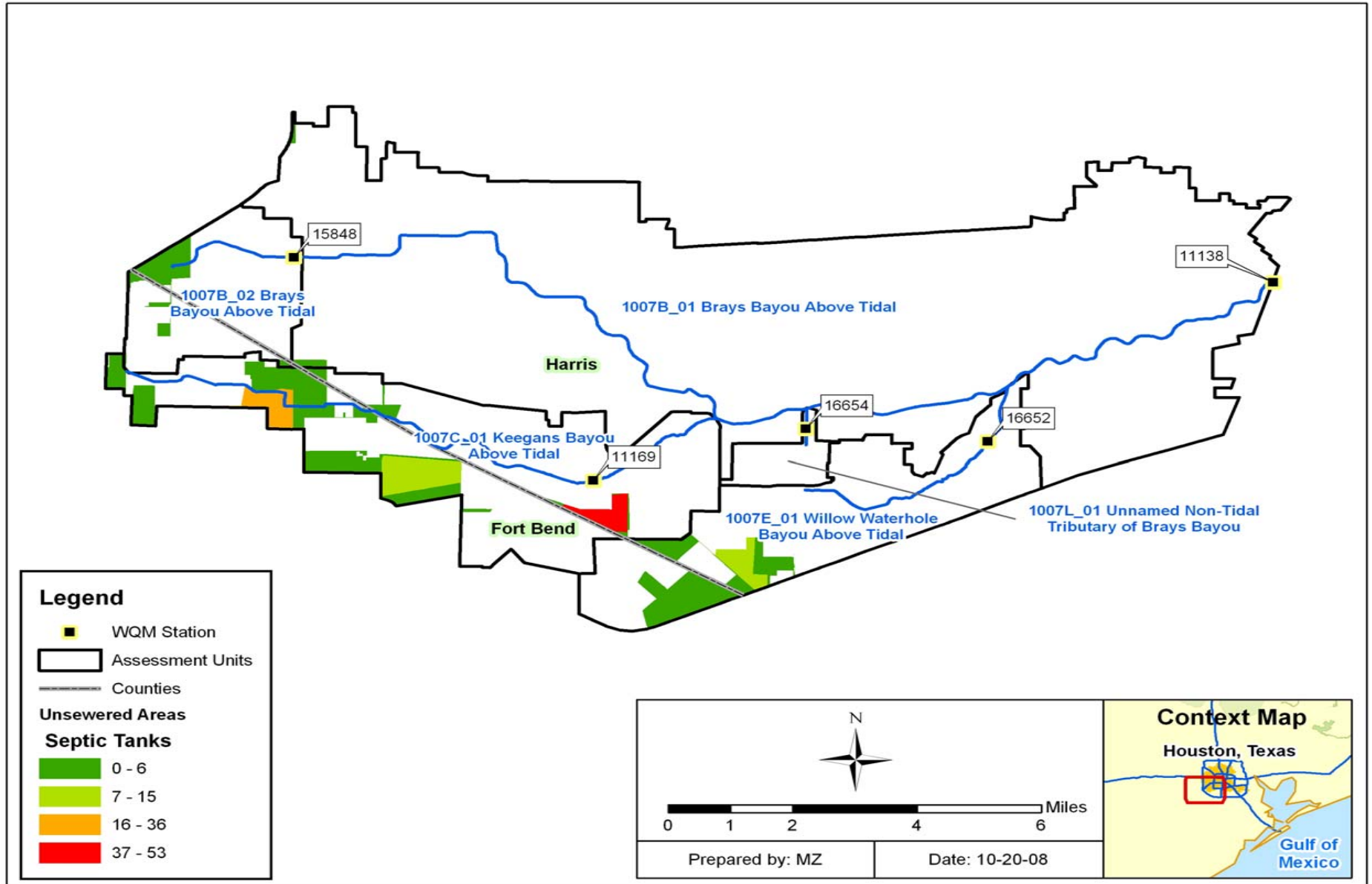
Assessment Unit	Stream Name	Total Area (acres)	Area under MS4 Permit (Acres)	Percent under MS4 Permit
1007B_01	Brays Bayou Above Tidal	42,053	42,053	100%
1007B_02	Brays Bayou Above Tidal	4,354	4,267	98%
1007C_01	Keegans Bayou Above tidal	11,590	11,243	97%
1007E_01	Willow Waterhole Bayou Above Tidal	8,056	8,056	100%
1007L_01	Unnamed Non-Tidal Tributary of Brays Bayou	888	888	100%

Population Projections

Stream Name	Assessment Unit	2005	2035	Increase
Brays Bayou Above Tidal	1007B_01	438,120	498,328	12%
Brays Bayou Above Tidal	1007B_02	31,557	39,361	20%
Keegans Bayou Above Tidal	1007C_01	85,170	97,237	12%
Willow Waterhole Bayou Above Tidal	1007E_01	64,083	71,869	11%
Unnamed Non-Tidal Tributary of Brays Bayou	1007L_01	12,894	13,380	4%

Source: HGAC 2007

On-Site Sewage Facilities




On-Site Sewage Facilities

Assessment Unit	Stream Name	OSSF Estimate using 1990 Census method
1007B_01	Brays Bayou Above Tidal	5
1007B_02	Brays Bayou Above Tidal	1
1007C_01	Keegans Bayou above tidal	120
1007E_01	Willow Waterhole Bayou Above Tidal	19
1007L_01	Unnamed Non-Tidal Tributary of Brays Bayou	0

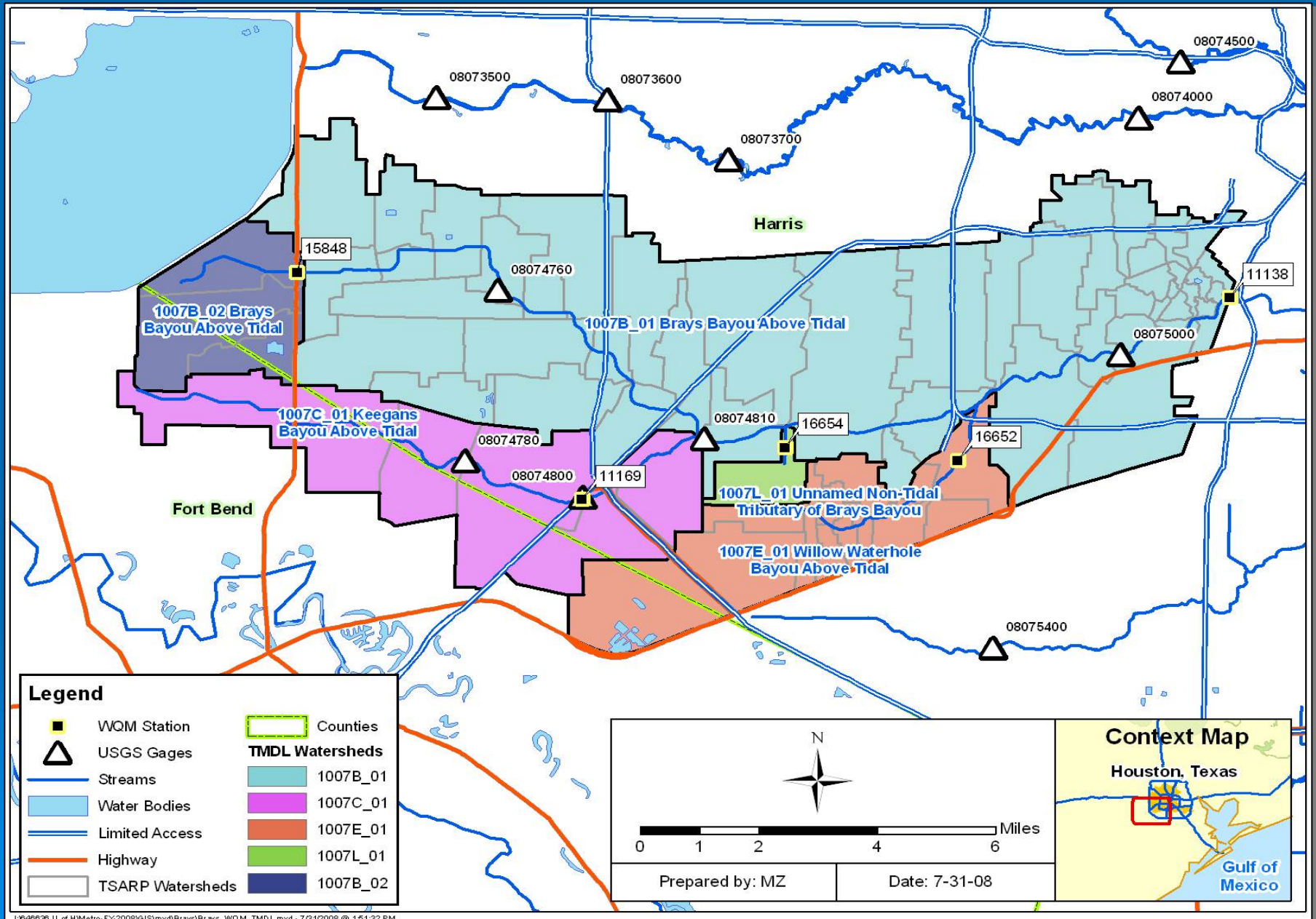
Estimated Number of Pets

Assessment Unit	Stream Name	Dogs	Cats
1007B_01	Brays Bayou Above Tidal	120,874	137,546
1007B_02	Brays Bayou Above Tidal	10,753	12,236
1007C_01	Keegans Bayou above tidal	24,964	28,407
1007E_01	Willow Waterhole Bayou Above Tidal	17,775	20,227
1007L_01	Unnamed Non-Tidal Tributary of Brays Bayou	7,751	8,820

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WQM Stations Targeted for TMDL Development



USGS Gages in the Brays Bayou Watershed

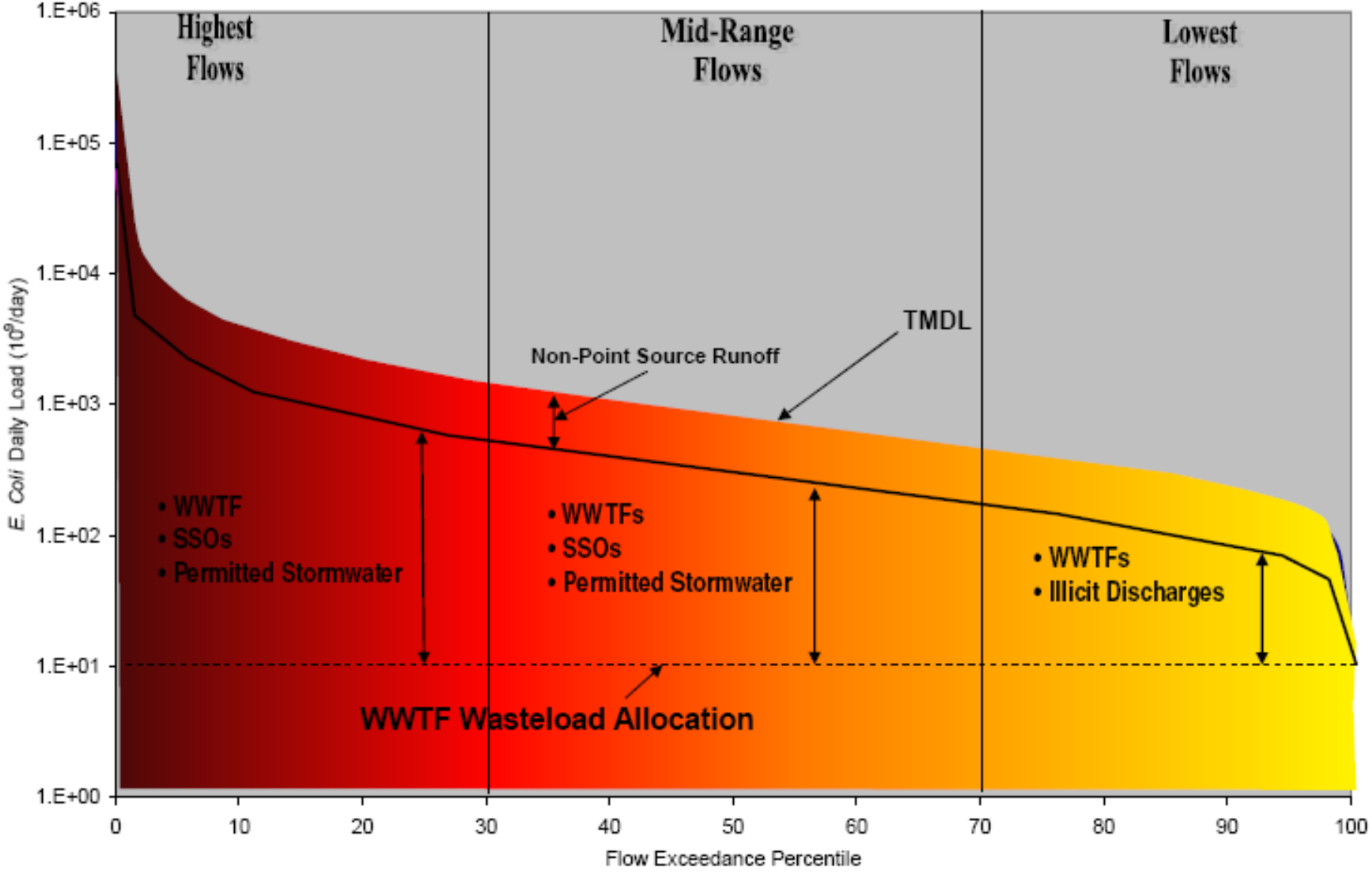
USGS Gage Number	Name	Period of Record	Data Type
8075000	Brays Bayou at South Main St.	5/25/1936 - Present	Discharge (cfs)
		6/8/1988 - Present	Gage Height (ft)
8074810	Brays Bayou at South Gessner Dr.	10/1/2001 - Present	Discharge (cfs)
		5/1/1997 - Present	Gage Height (ft)
8074800	Keegans Bayou at Roark Rd	9/1/1964 - 2/11/2004	Discharge (cfs)
		8/1/1996 - Present	Gage Height (ft)
8074780	Keegans Bayou at Keegan Rd	12/10/1964 - 10/28/1984	Discharge (cfs)
		12/10/1964 - 10/28/2002	Gage Height (ft)
8074760	Brays Bayou at Alief, TX	10/1/2006 - Present	Discharge (cfs)
		9/27/2006 - Present	Gage Height (ft)

* Highlight - USGS gage station used to project flows.

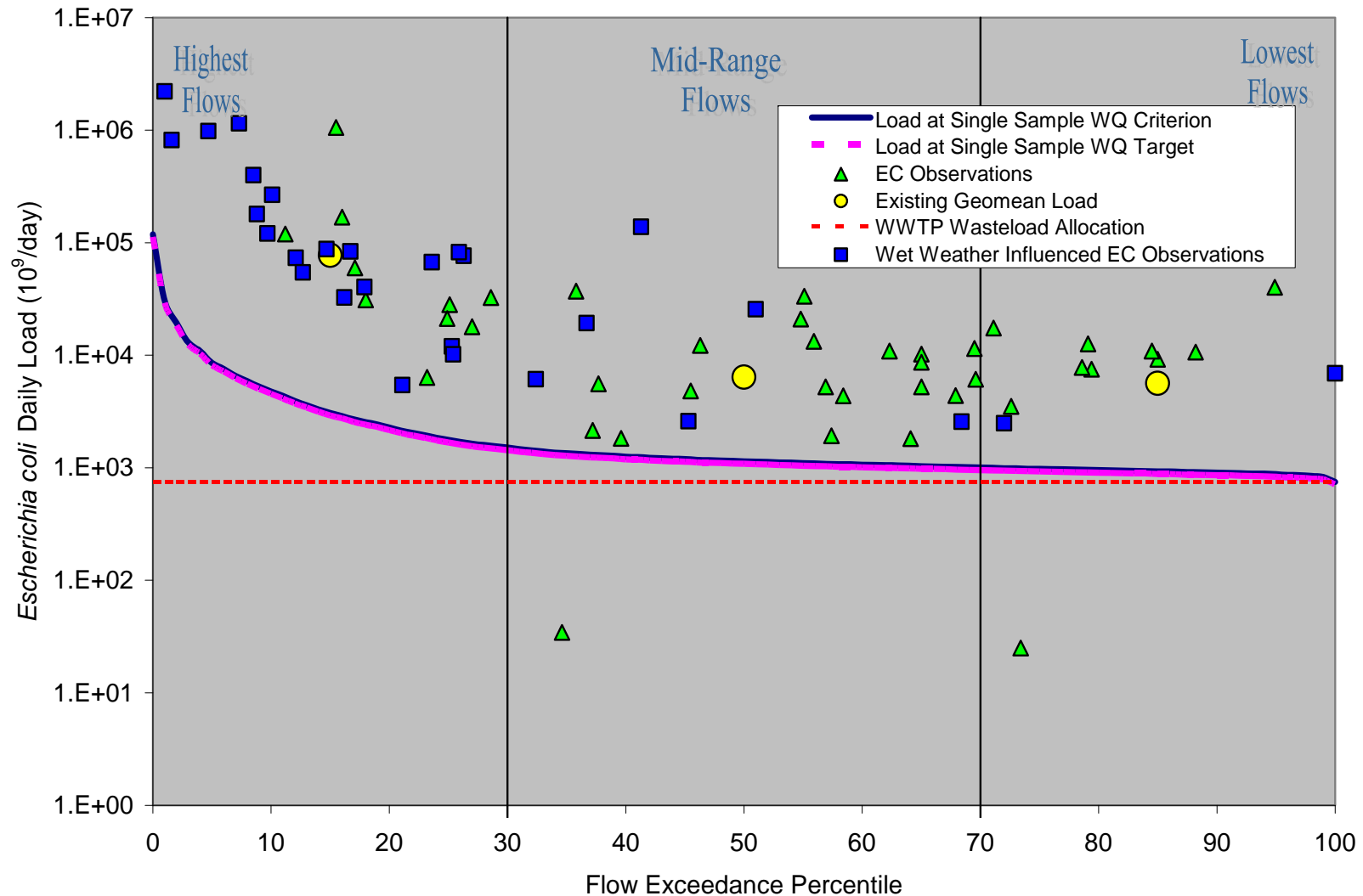
Flow Percentiles

Assessment Unit	1007B_01	1007C_01	1007E_01	1007L_01	1007B_02
Watershed Area (sq. mile)	104.6	18.1	12.6	1.4	6.8
Average Annual Rainfall (inch)	48.4	44.6	52.1	45.8	48.6
Percentile	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)
0	12,341	1,320	1,284	109	599
10	495	48	42	3.5	26
20	236	21	15	1.2	13
30	156	14	6.7	0.5	10
40	130	12	4.0	0.30	8.9
50	118	11	2.9	0.20	8.4
60	110	10	2.2	0.15	8.0
70	104	8.7	1.6	0.11	7.4
80	99	7.6	1.1	0.07	6.5
90	94	2.1	0.70	0.02	1.0
100	78	0	0	0	0

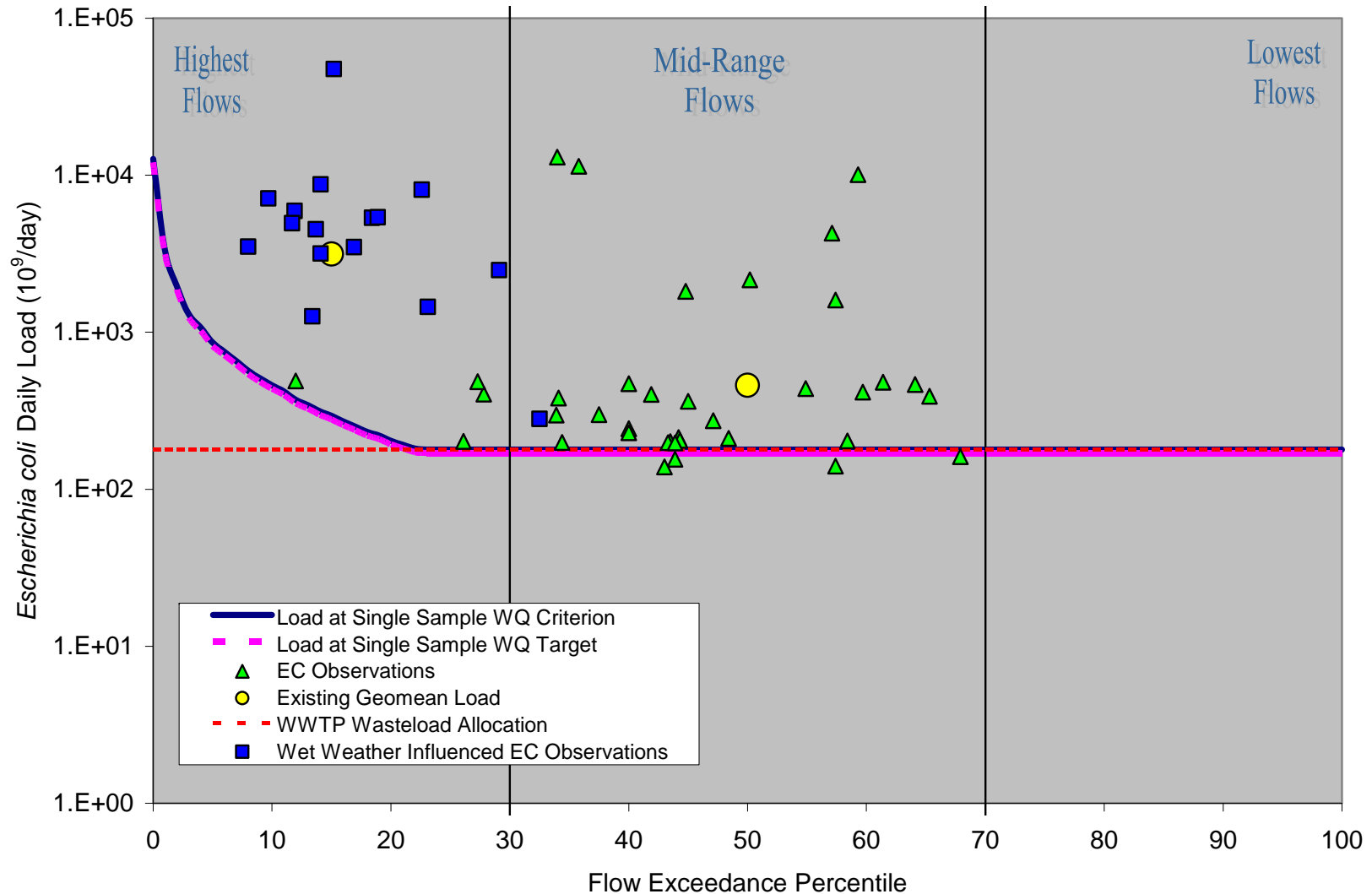
LDC Schematic



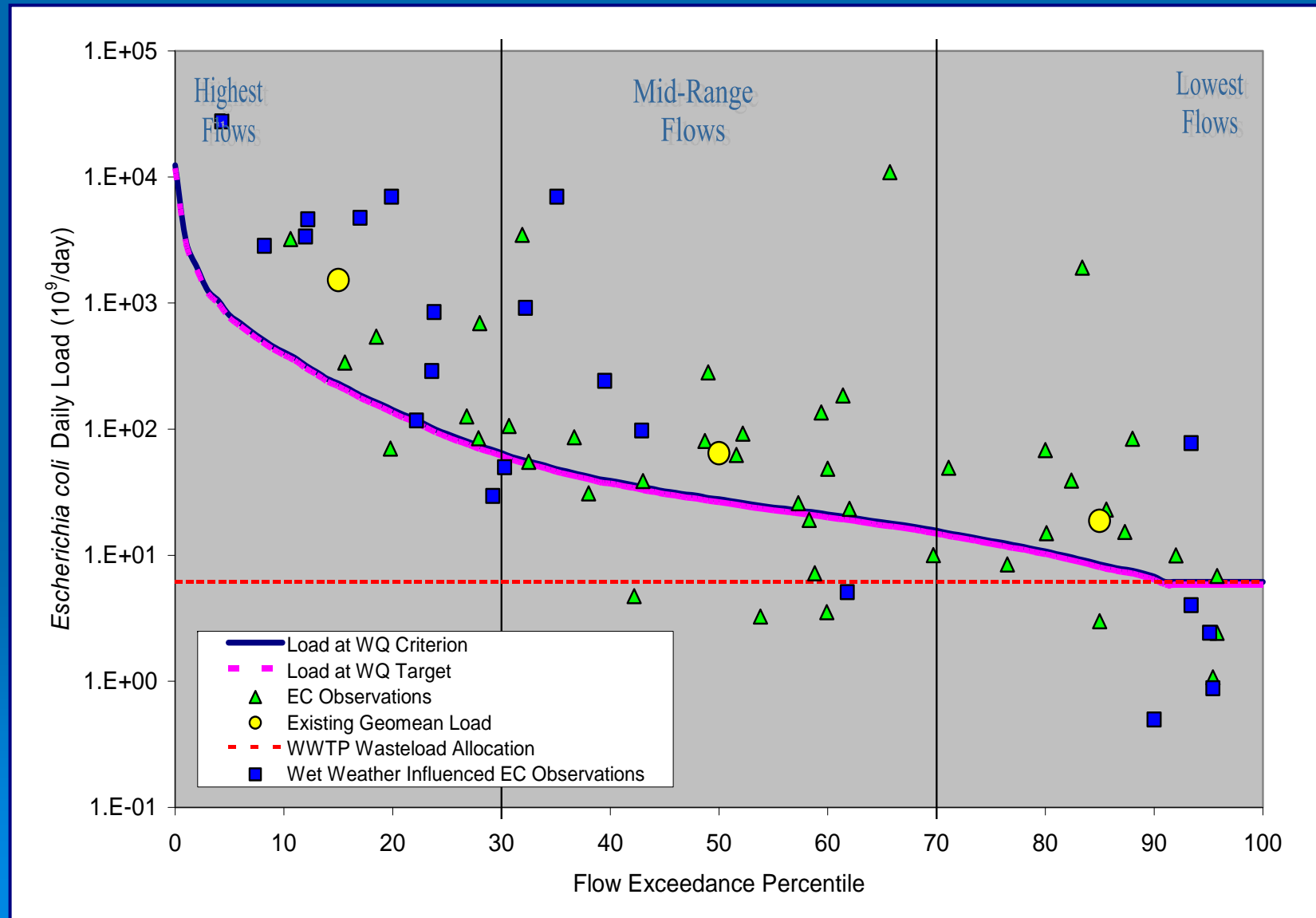
Load Duration Curve for Brays Bayou Above Tidal (1007B_01)



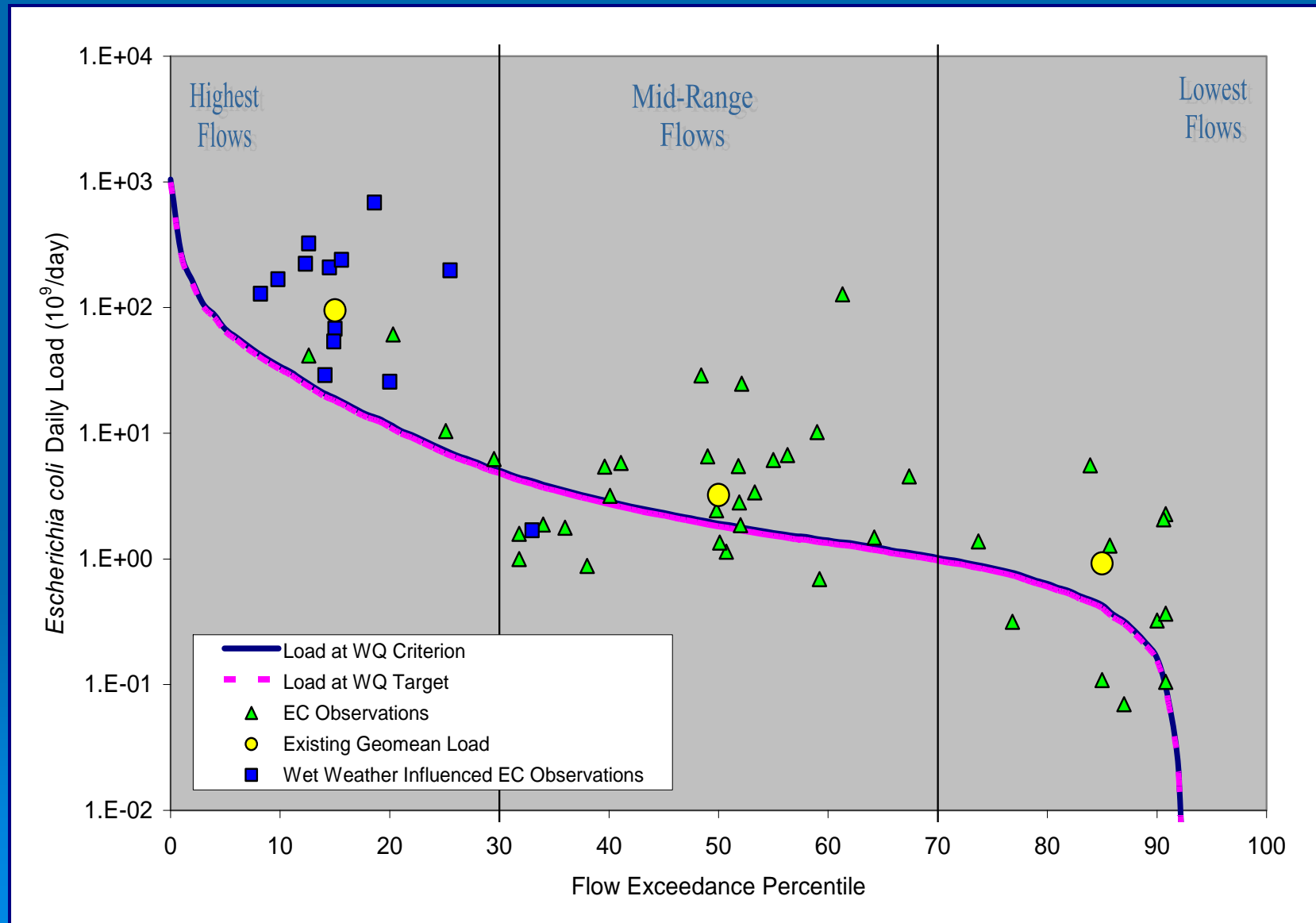
Load Duration Curve for Keegans Bayou Above Tidal (1007C_01)



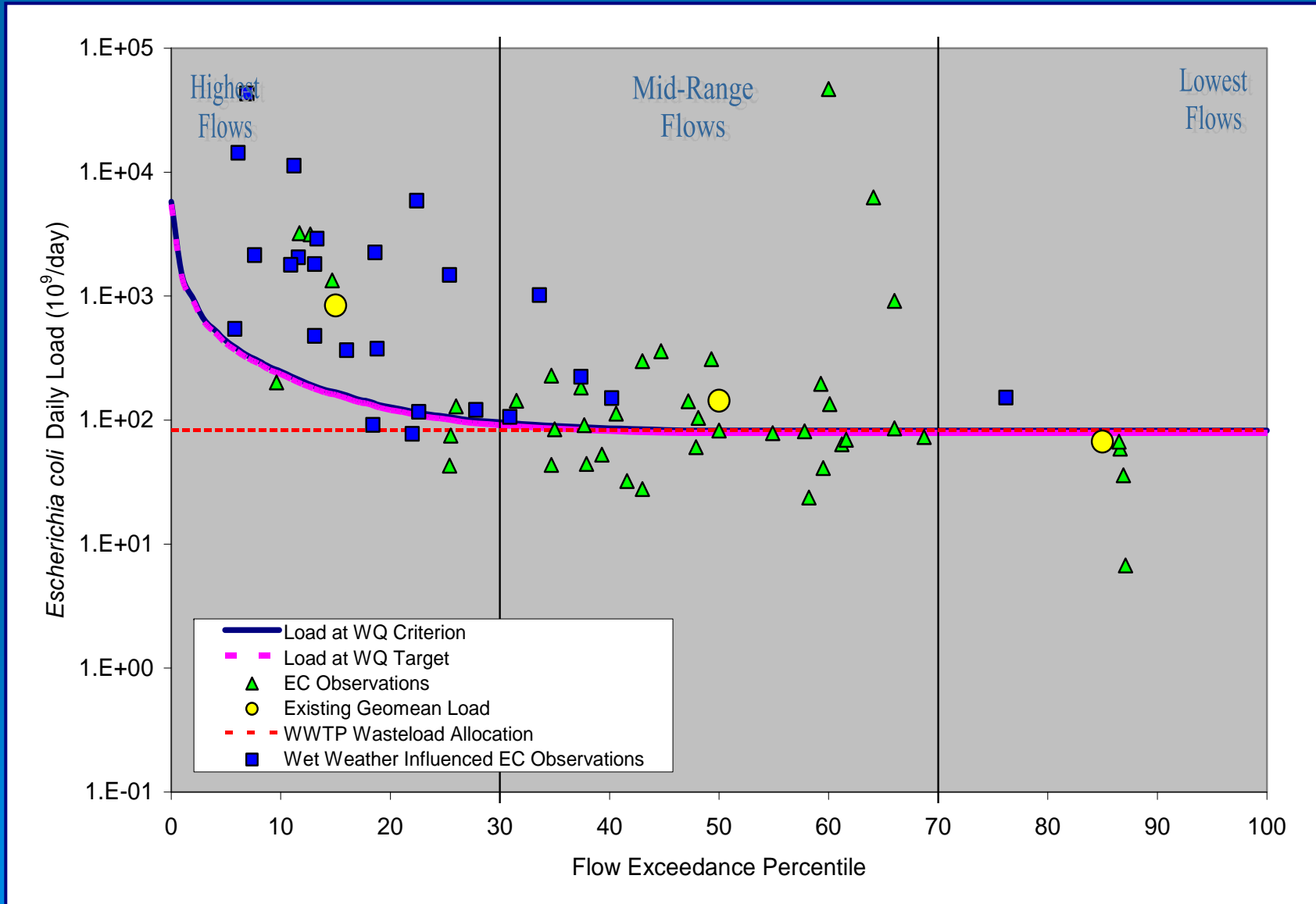
Load Duration Curve for Willow Waterhole (1007E_01)




Load Duration Curve for Unnamed Non-Tidal Tributary of Brays Bayou (1007L_01)



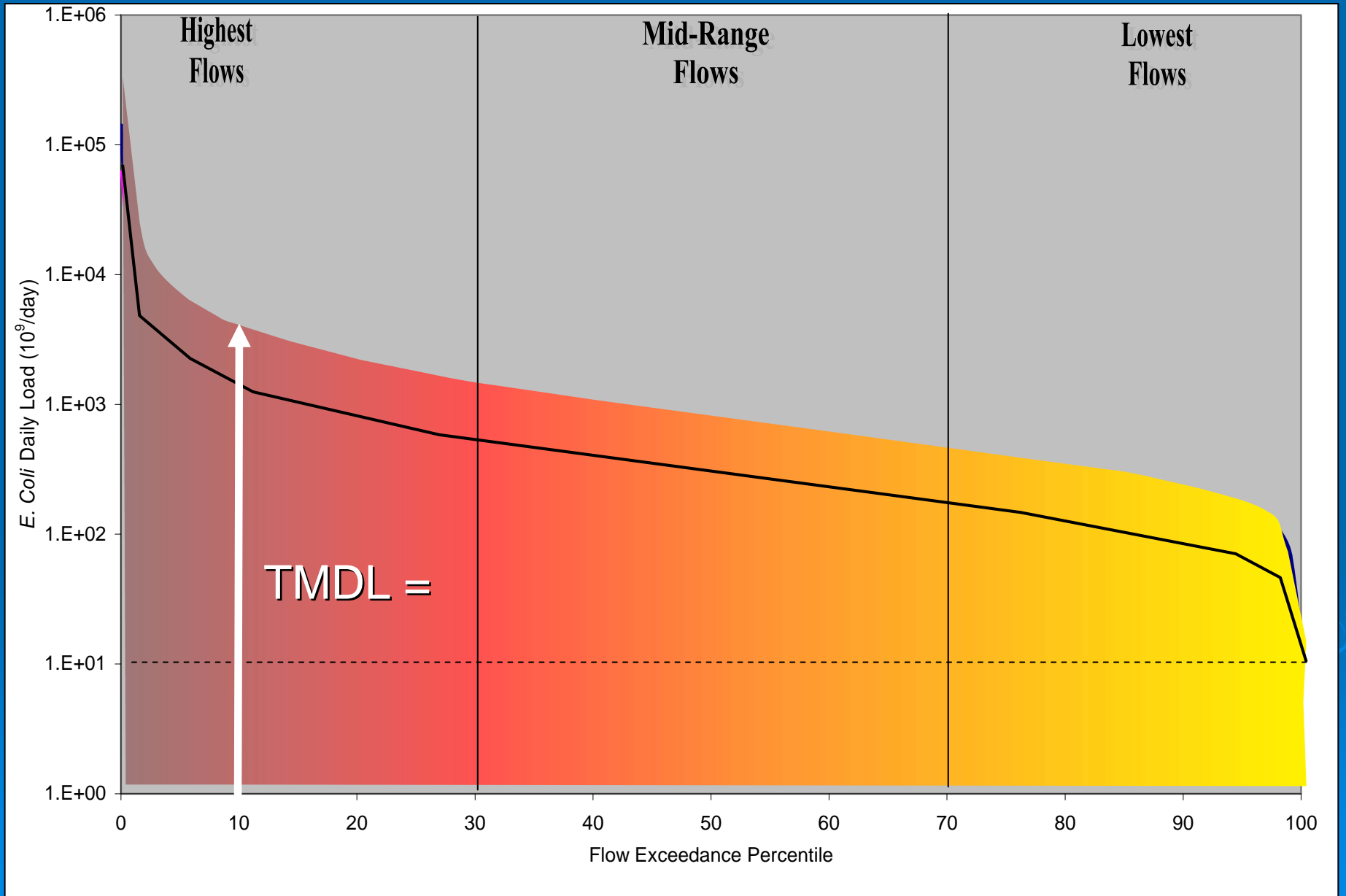
Load Duration Curve for Brays Bayou Above Tidal (1007B_02)



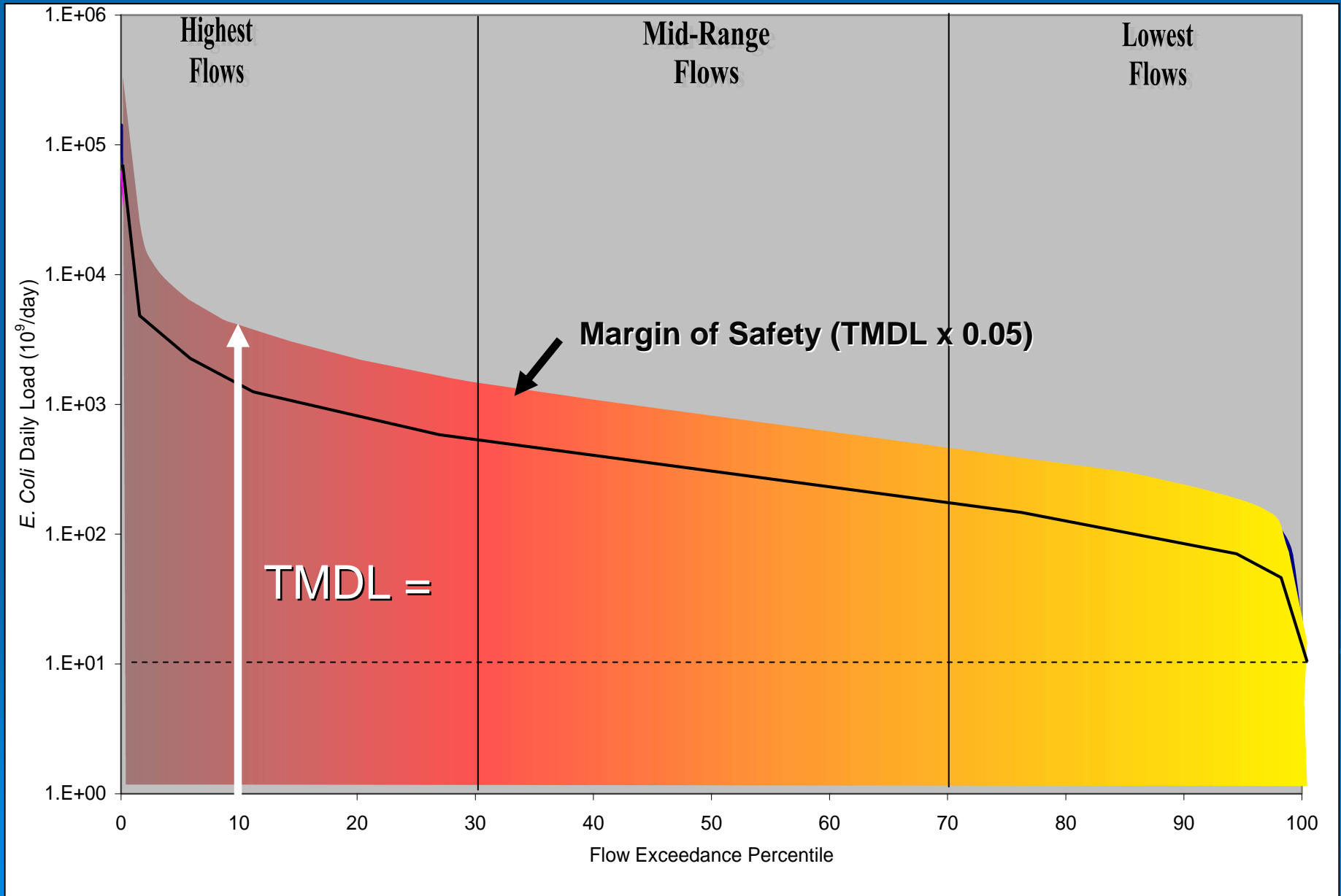
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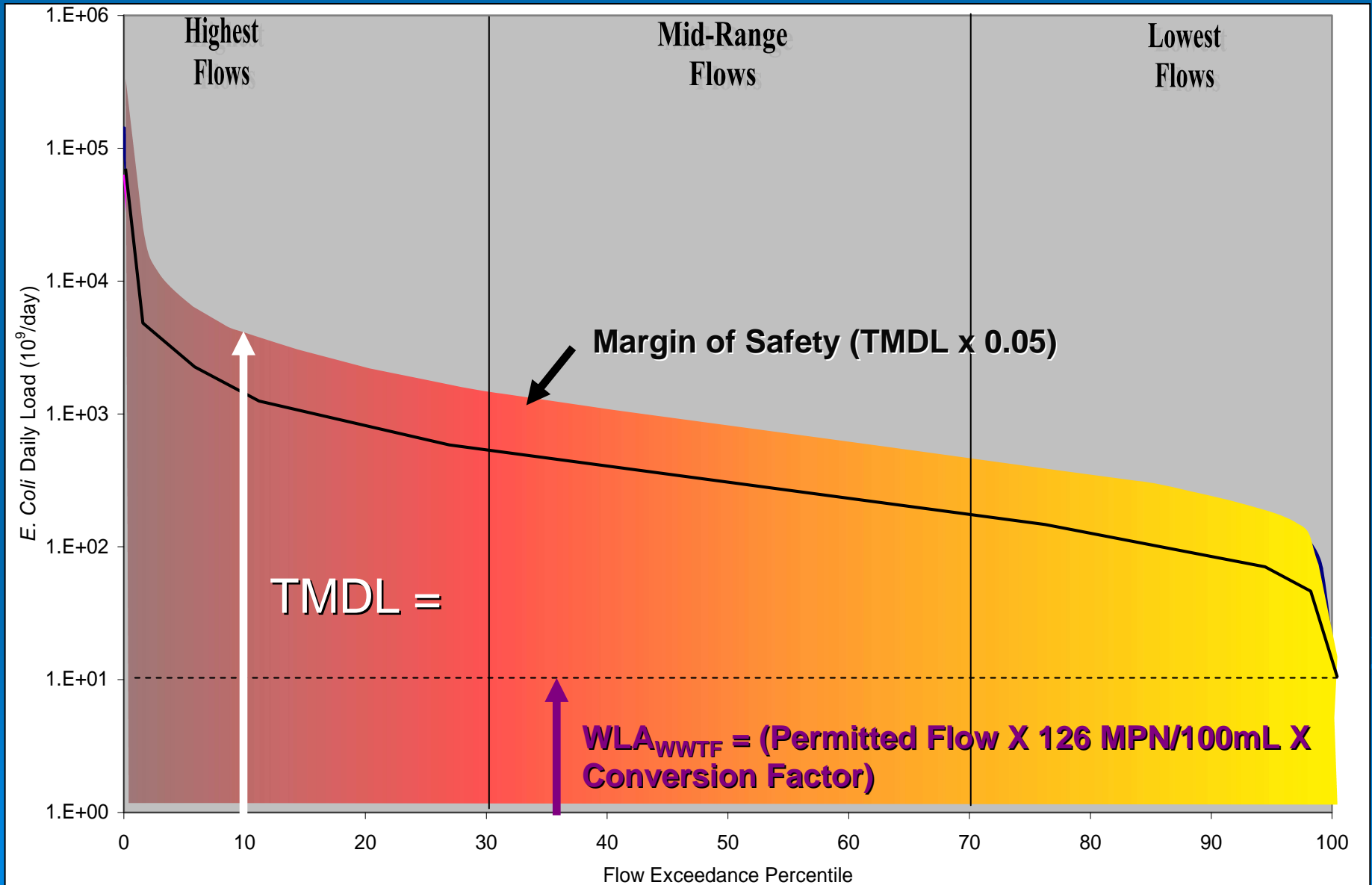
TMDL Calculations



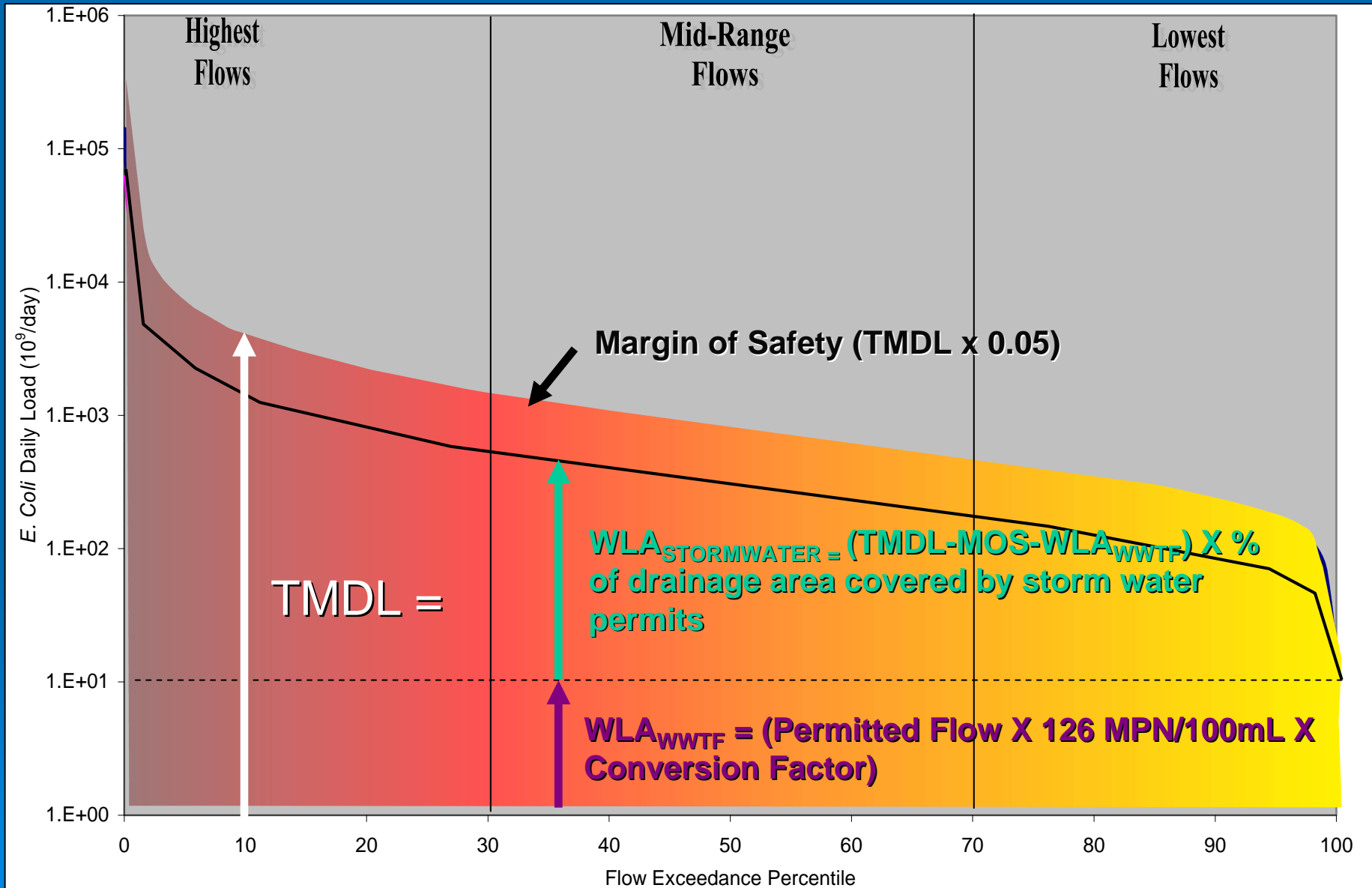
TMDL Calculations



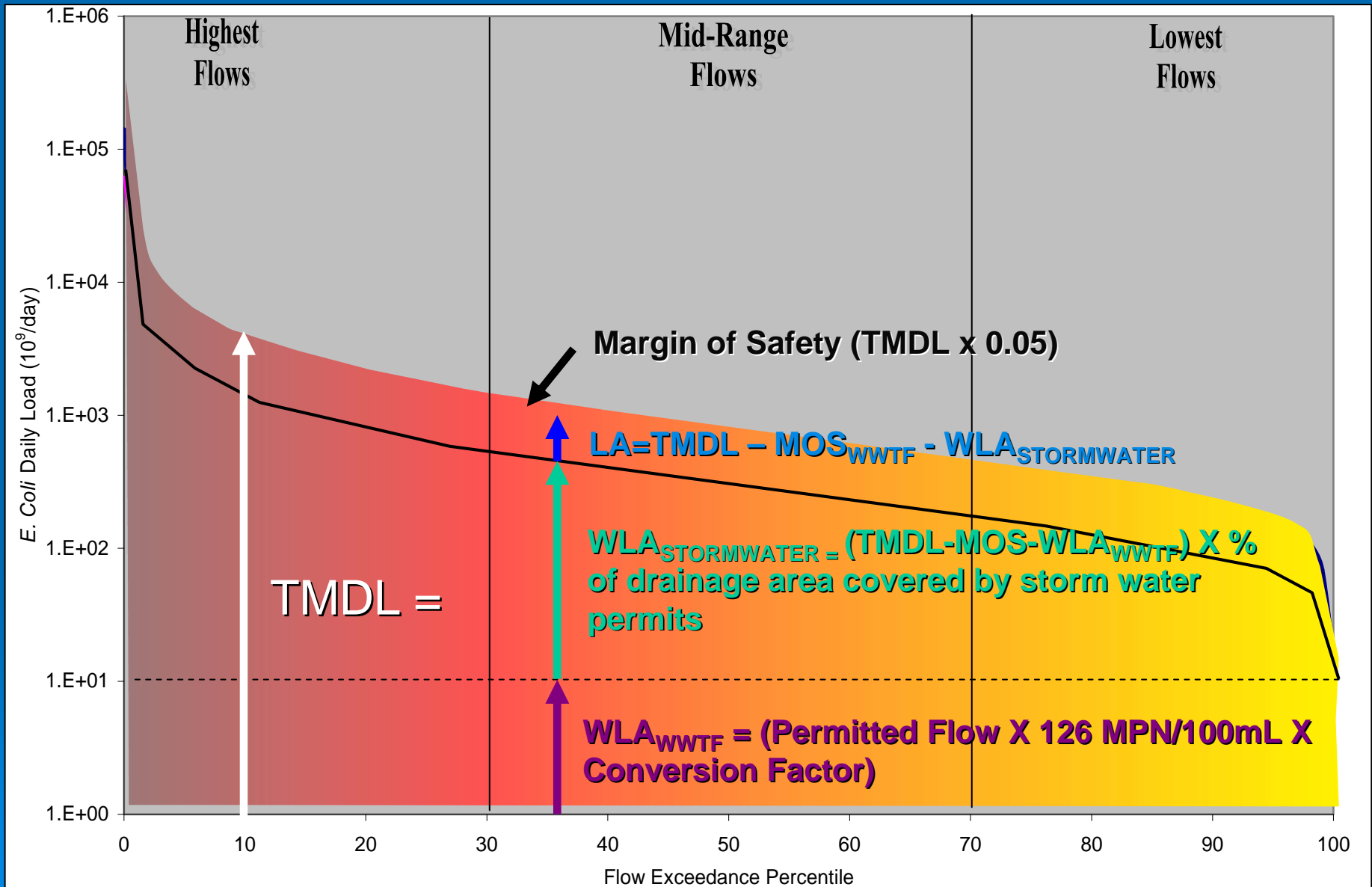
TMDL Calculations



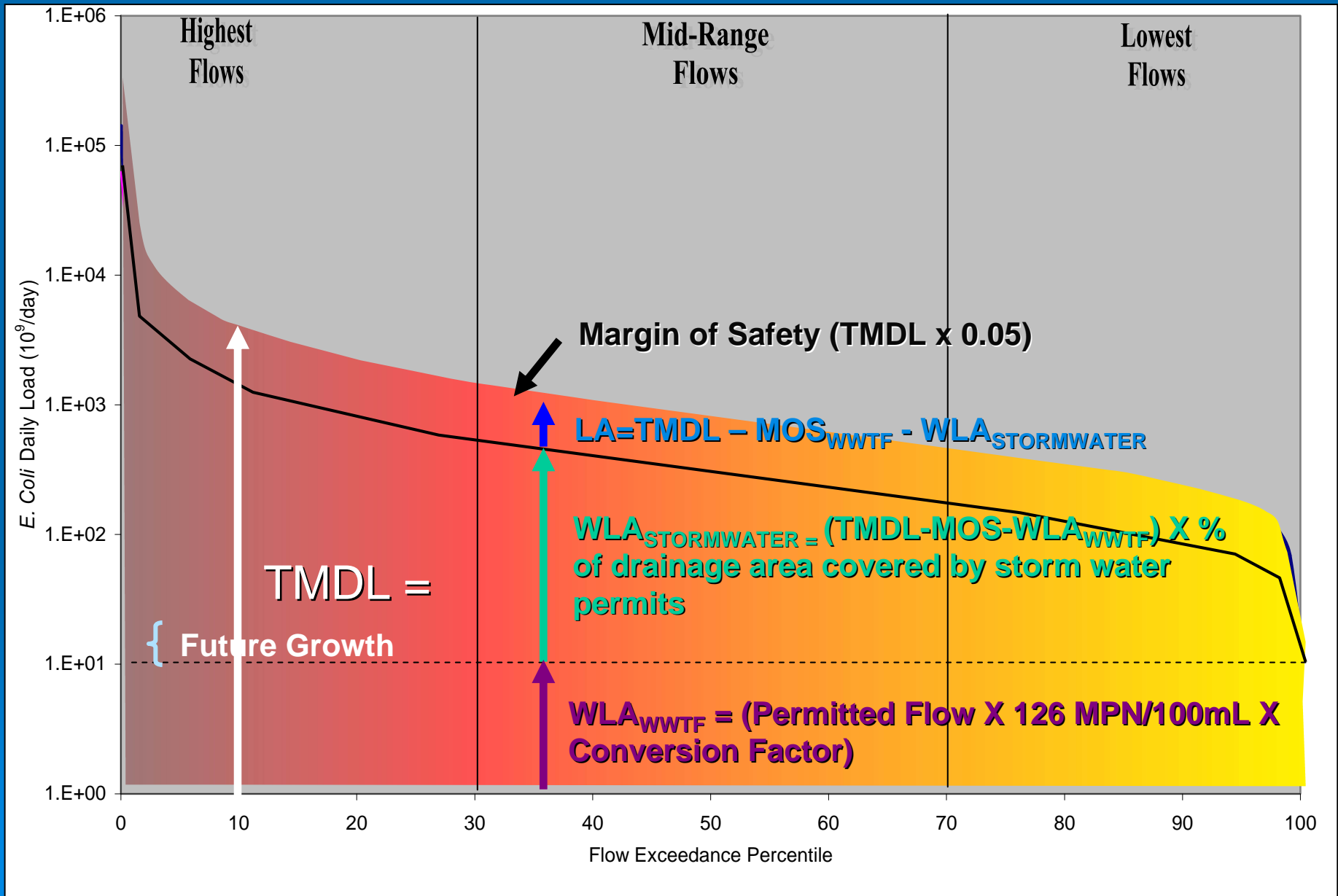
TMDL Calculations



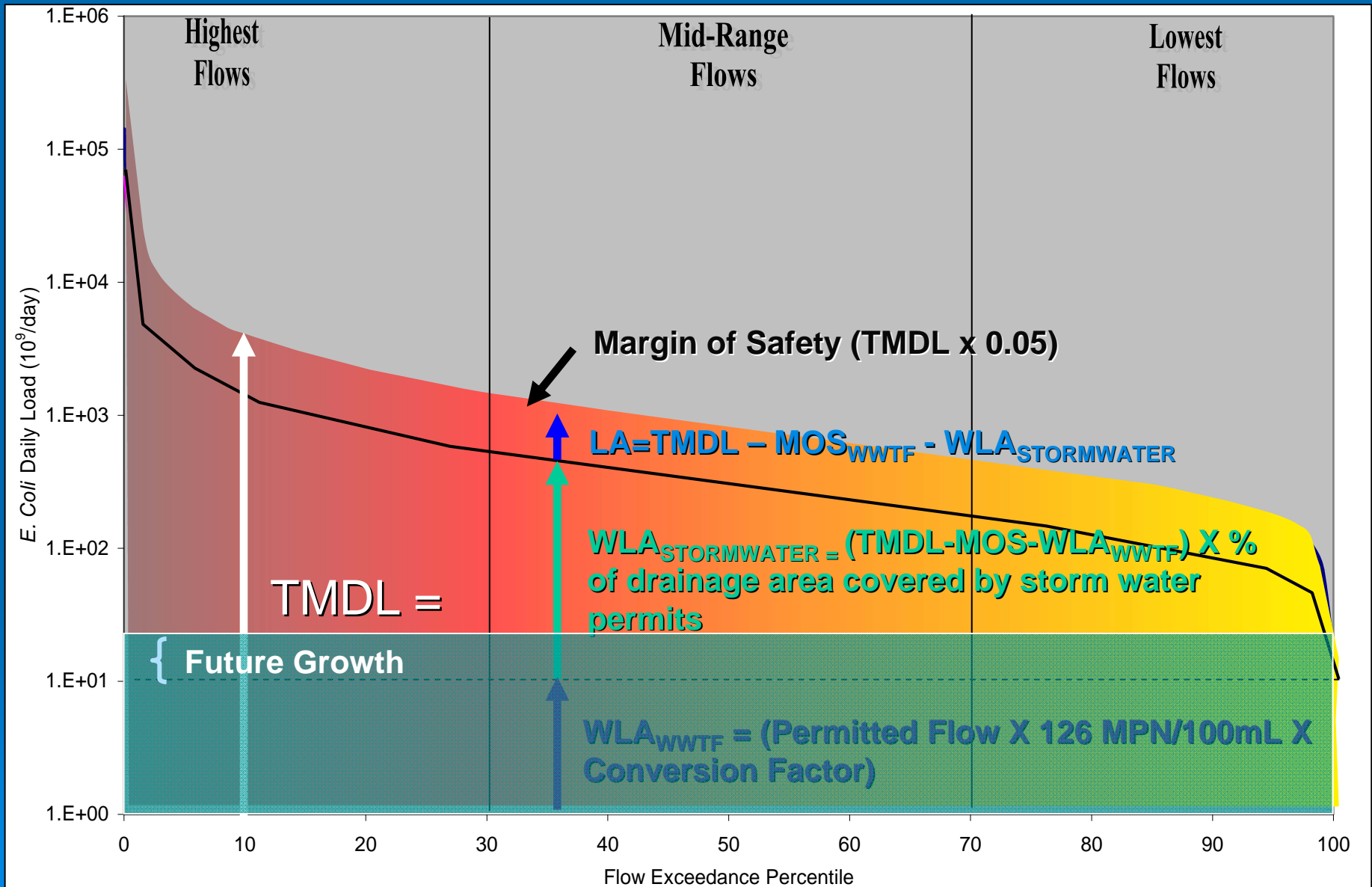
TMDL Calculations



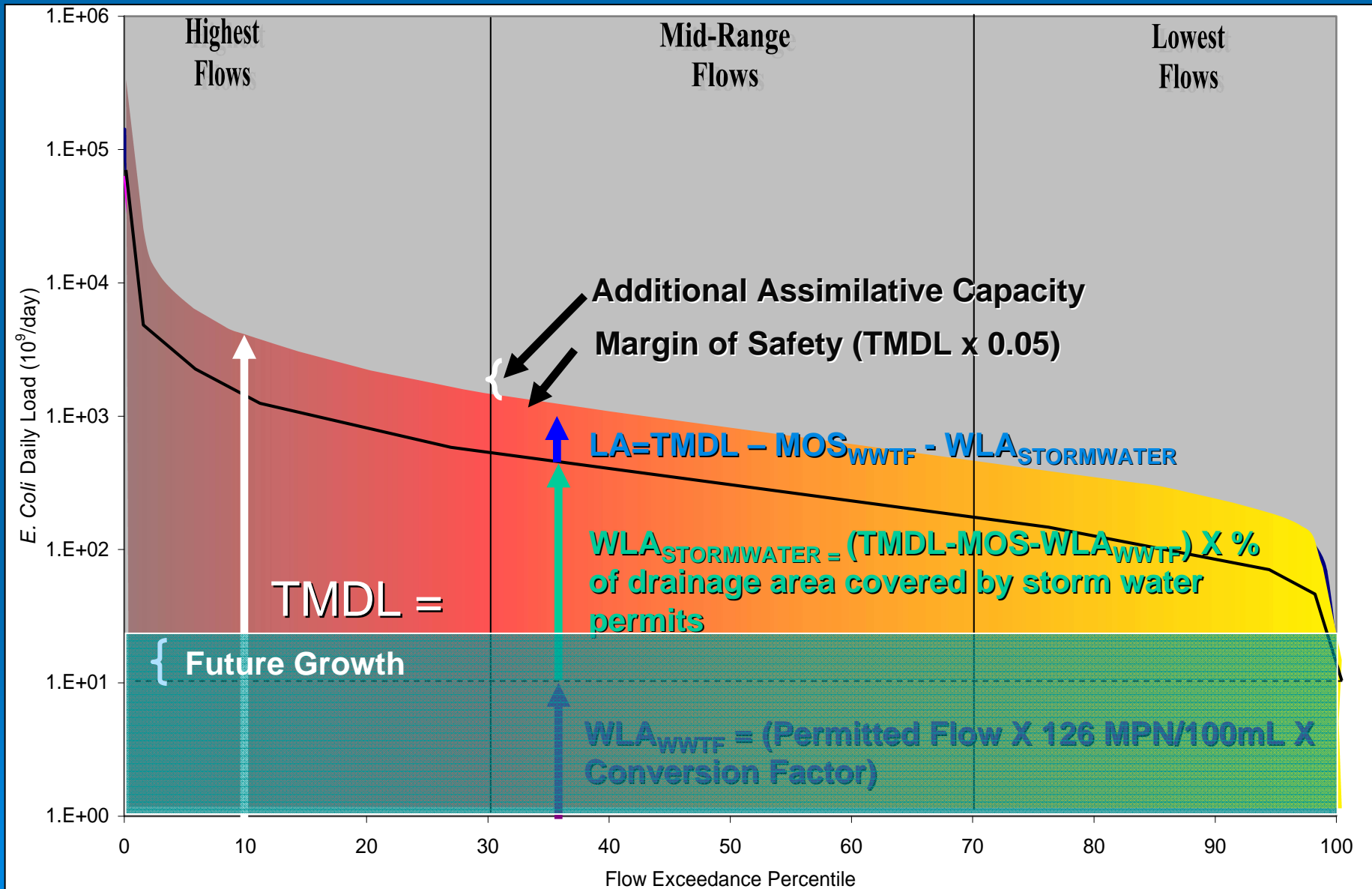
TMDL Calculations



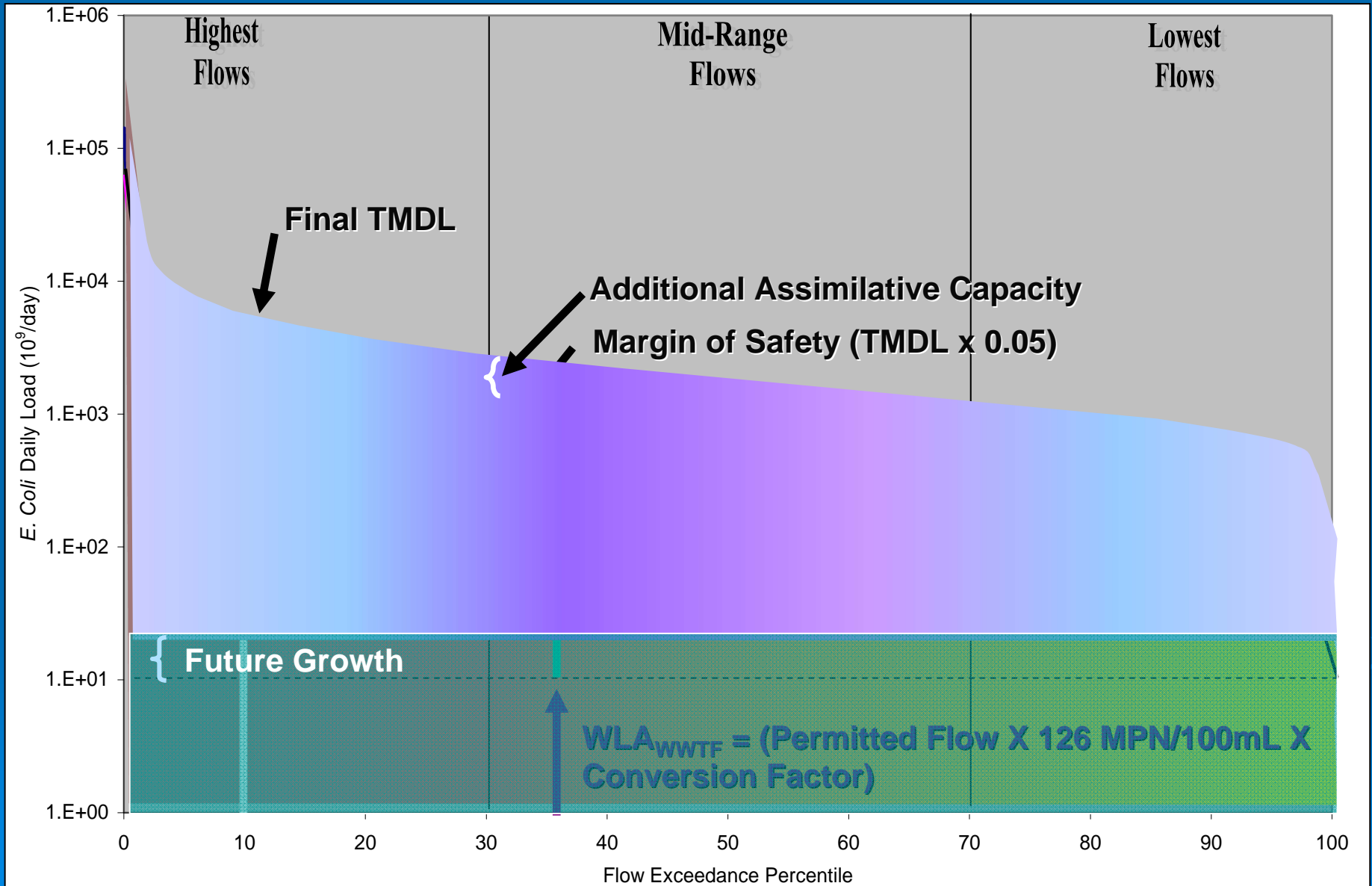
TMDL Calculations



TMDL Calculations



TMDL Calculations



Final TMDL Allocations

Unit	TMDL (MPN/day)	WLA_{WWTF}^a (MPN/day)	$WLA_{STORM\ WATER}$ (MPN/day)	LA (MPN/day)	MOS (MPN/day)
1007B_01	1.83E+12	8.52E+11	8.82E+11	5.76E+11 ^b	9.15E+10
1007B_02	1.32E+11	9.88E+10	2.57E+10	9.01E+08	6.60E+09
1007C_01	2.69E+11	2.01E+11	5.18E+10	1.82E+09	1.34E+10
1007E_01	7.42E+10	6.80E+09	6.15E+10	2.16E+09	3.71E+09
1007L_01	6.09E+09	0	5.79E+09	0	3.04E+08

^a WLA_{WWTF} includes permitted current and future flows for WWTF