




Bacteria TMDLs for Halls Bayou

November 10, 2008



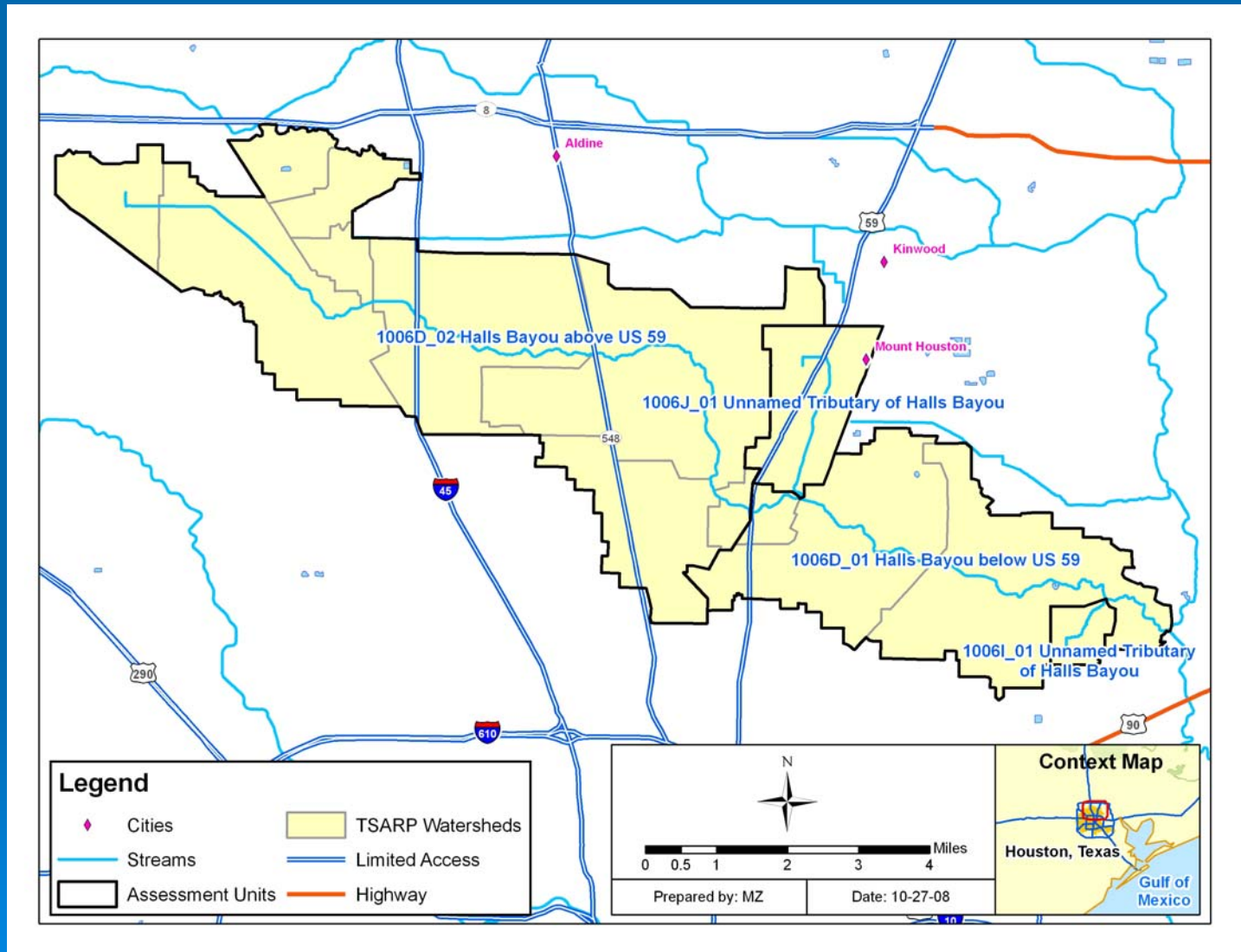
PARSONS

Outline

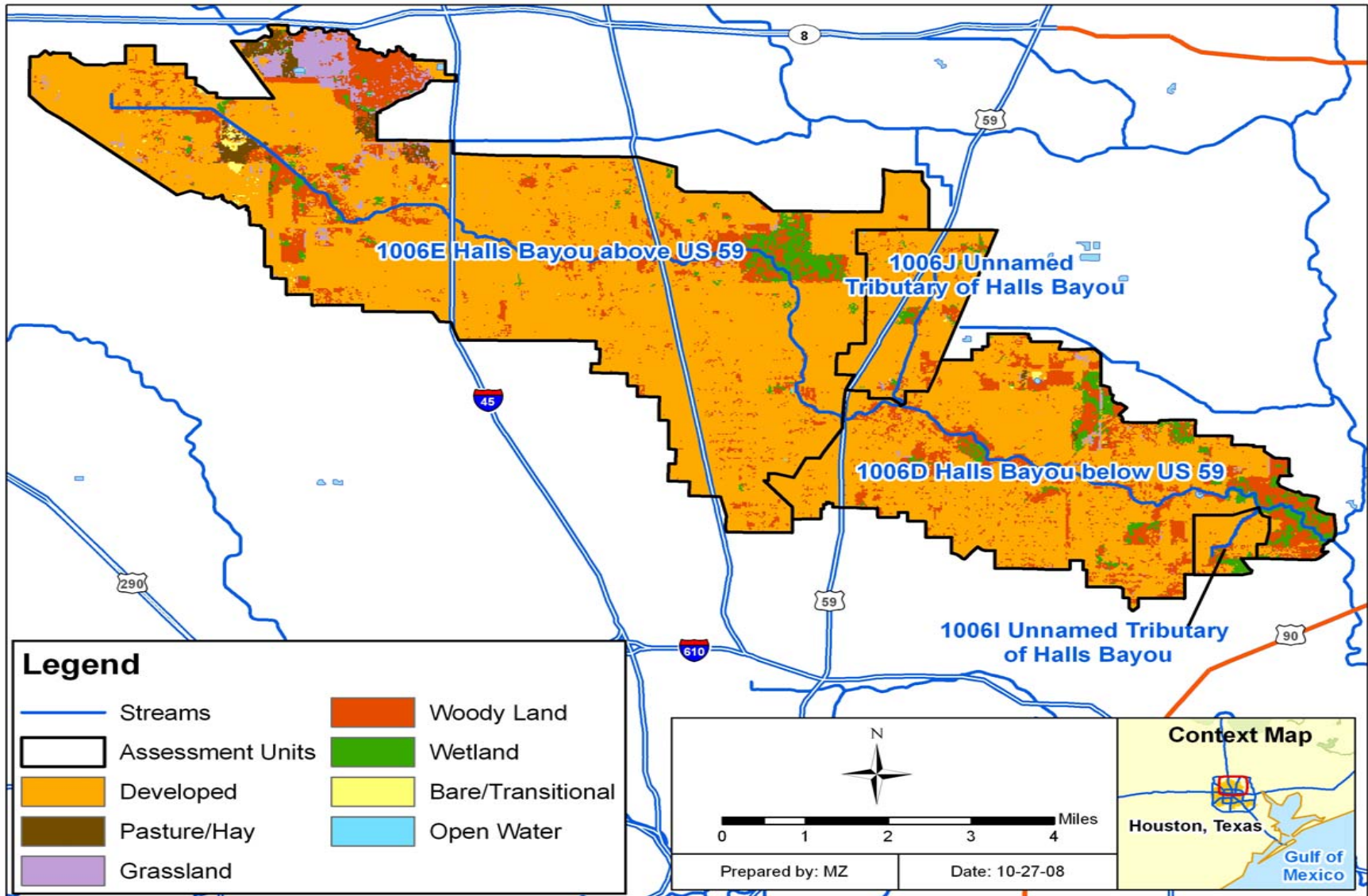
- **Watershed Overview**
 - **Pollutant Source Assessment**
 - **Technical Approach: Load Duration Curves**
 - **TMDL Calculations**
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Halls Bayou Watershed

- ~20 square miles
- Located within 2 counties (Houston, Harris)
- Average Annual Rainfall 49.8 inches ((NOAA 2007))



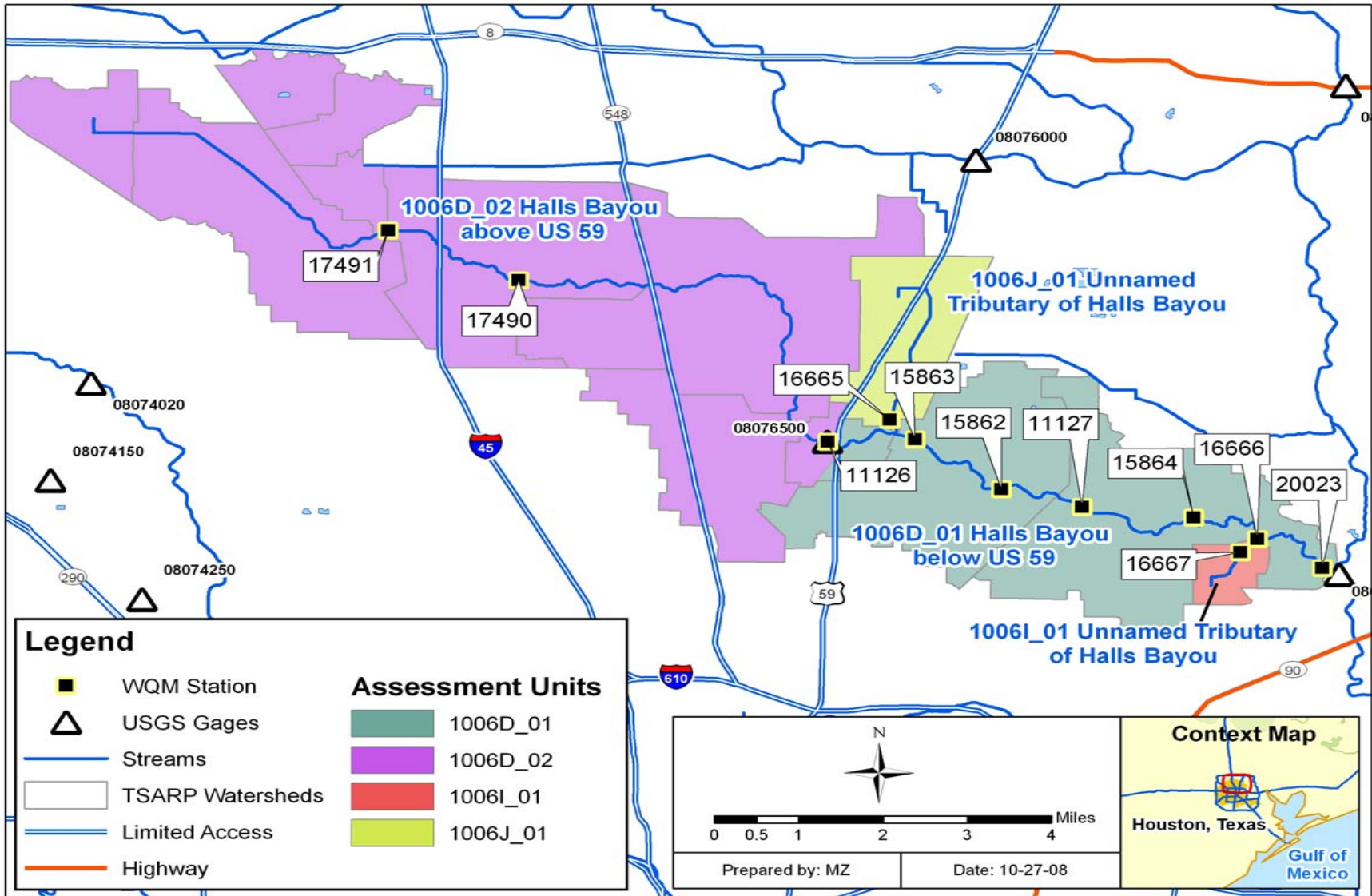
Land Use/Land Cover



303 (d) Listed Assessment Units (2008)

Segment	Water Body	Description of Assessment Unit Not Supporting Contact Recreation Use
1006D_01	Halls Bayou below US 59	Halls Bayou 1 mi. upstream of Confluence w/ Green's Bayou (downstream of Station 16666)
1006D_02	Halls Bayou above US 59	Halls Bayou at Jensen Dr. in Houston
1006I_01	Unnamed Tributary of Halls Bayou	Trib of Halls at Talton Dr. near Monterrey Ln.
1006J_01	Unnamed Tributary of Halls Bayou	Trib of Halls Bayou at Langley Road in North Houston

Water Quality Stations

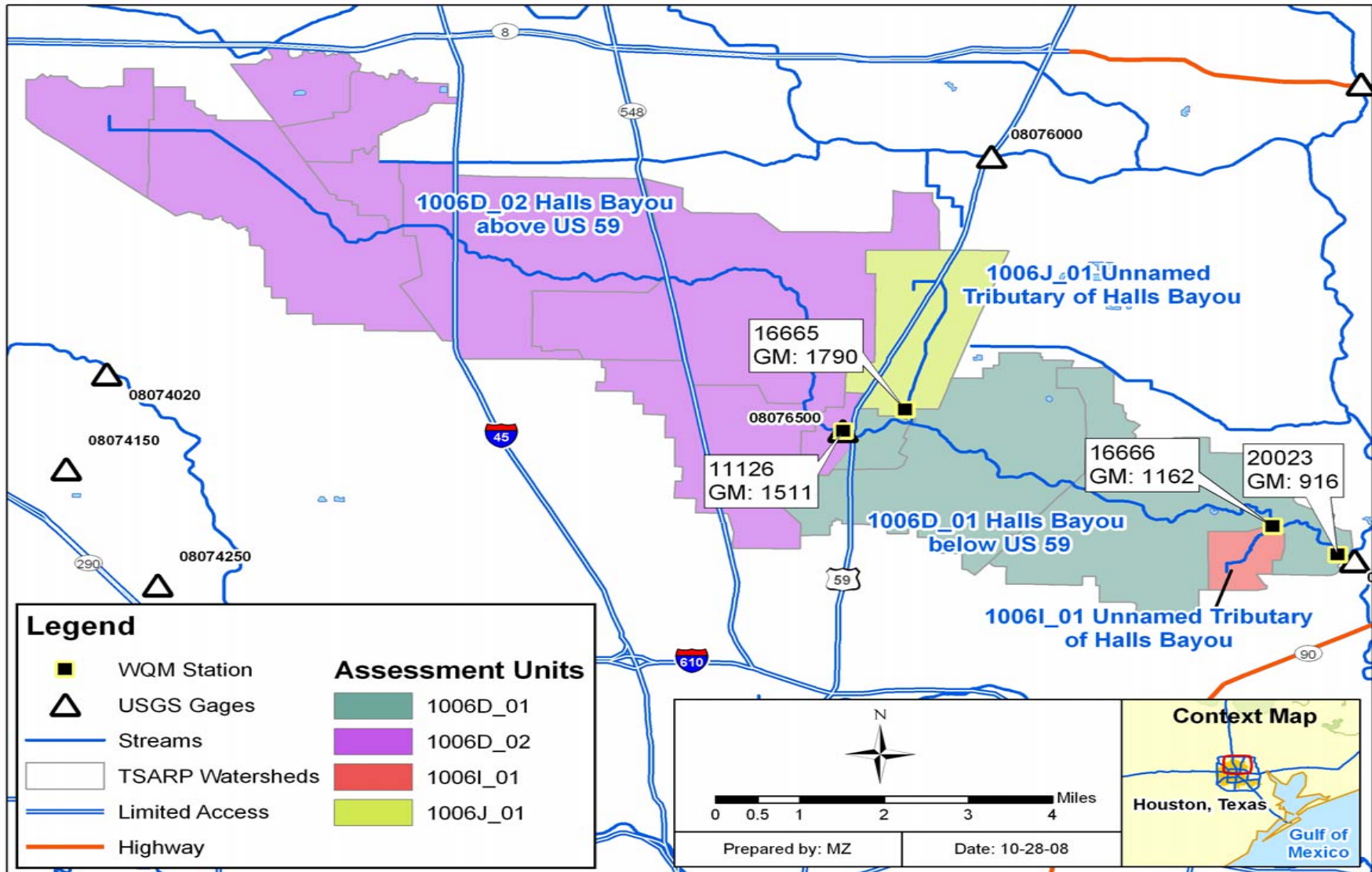


***E. coli* Data for TCEQ Stations from 1996 to 2006**

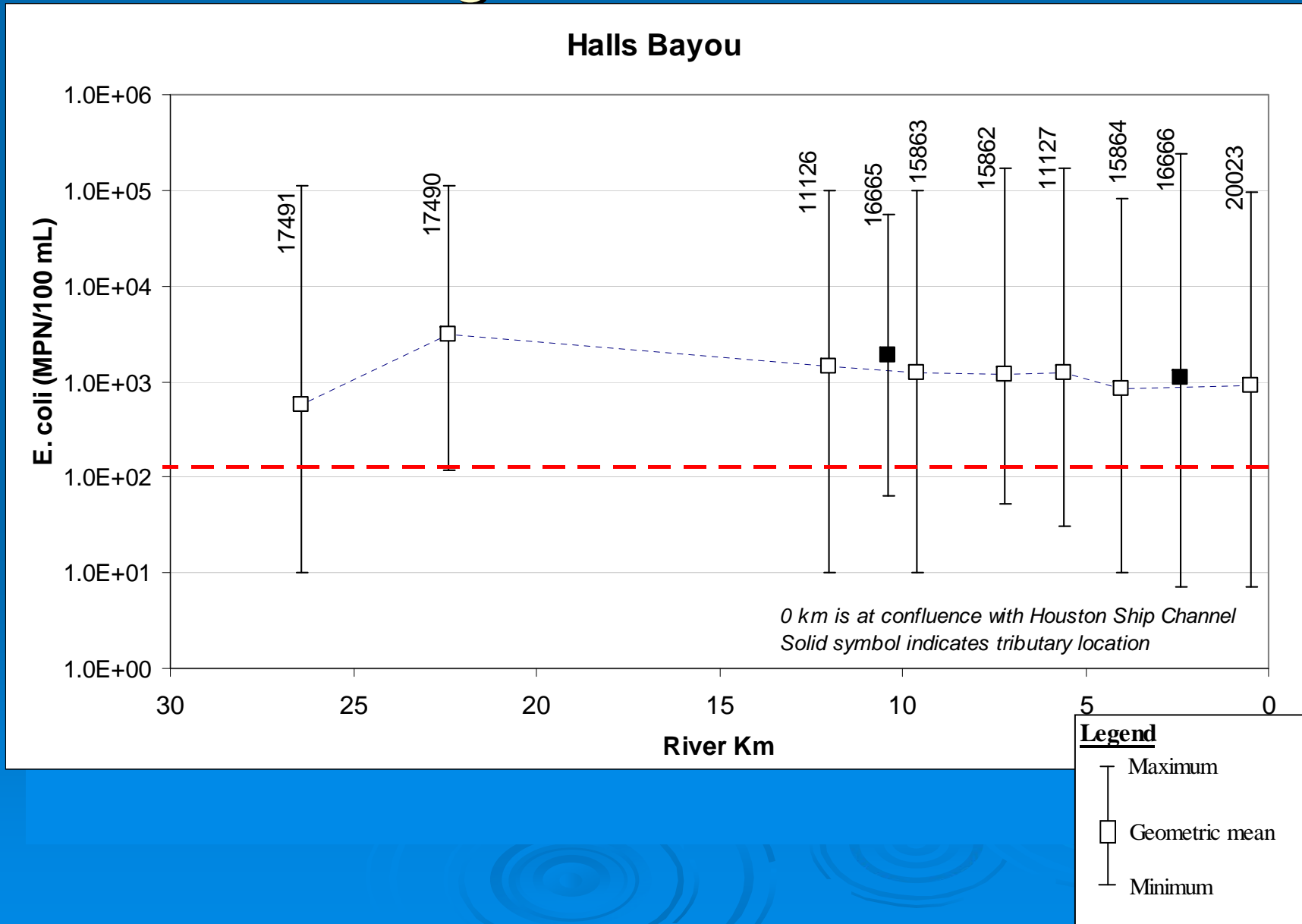
Assessment Unit	Station ID	Geometric Mean Concentration	Number of Samples	Number of Samples Exceeding Single Sample Criteria	% of Samples Exceeding
1006D_01	20023	916	17	10	59%
1006D_02	11126	1511	61	49	80%
1006I_01	16666	1162	78	62	79%
1006J_01	16665	1790	80	70	88%

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

Halls Bayou *E. coli* Geomeans



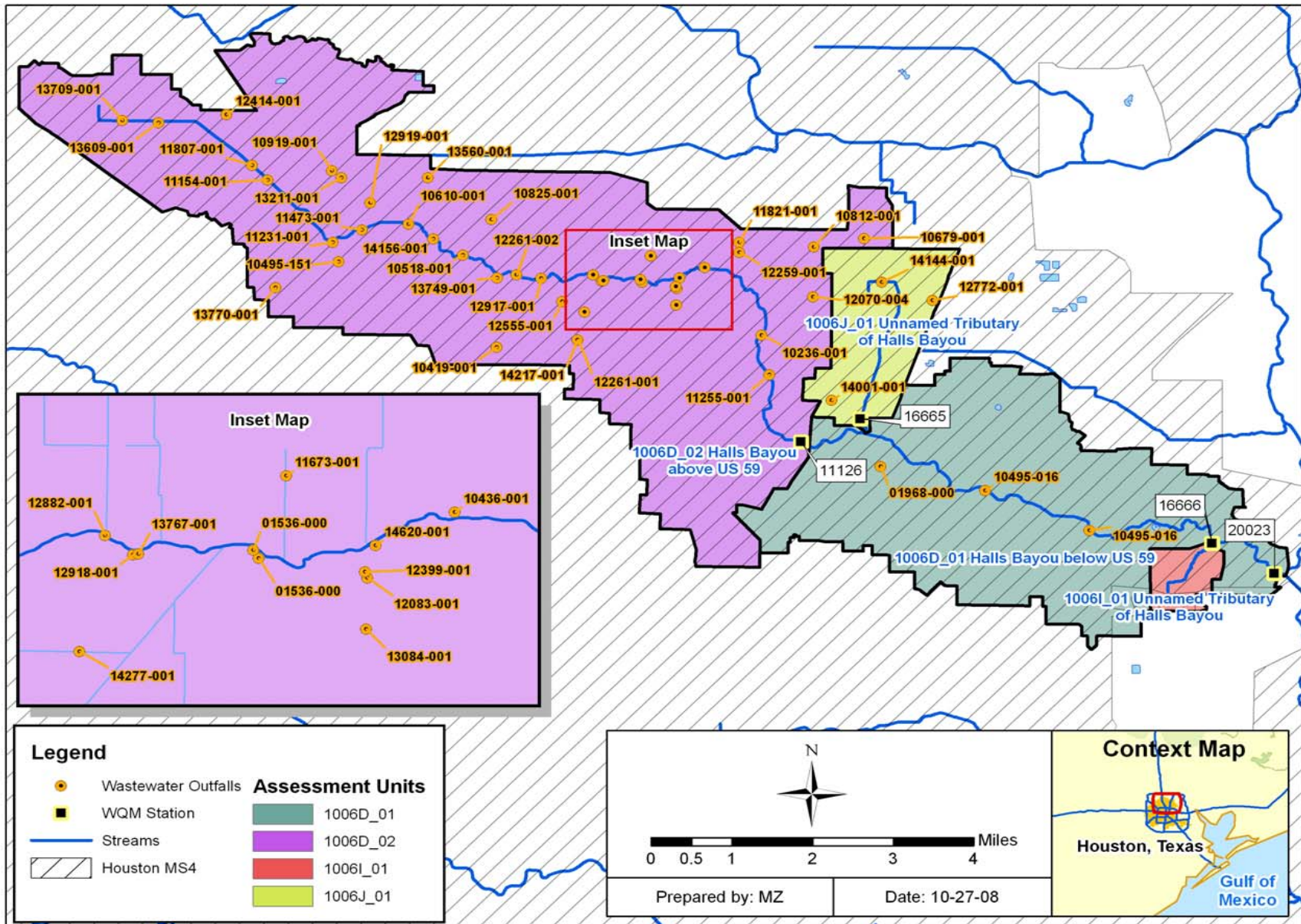
Halls Bayou *E. coli* Longitudinal Profile



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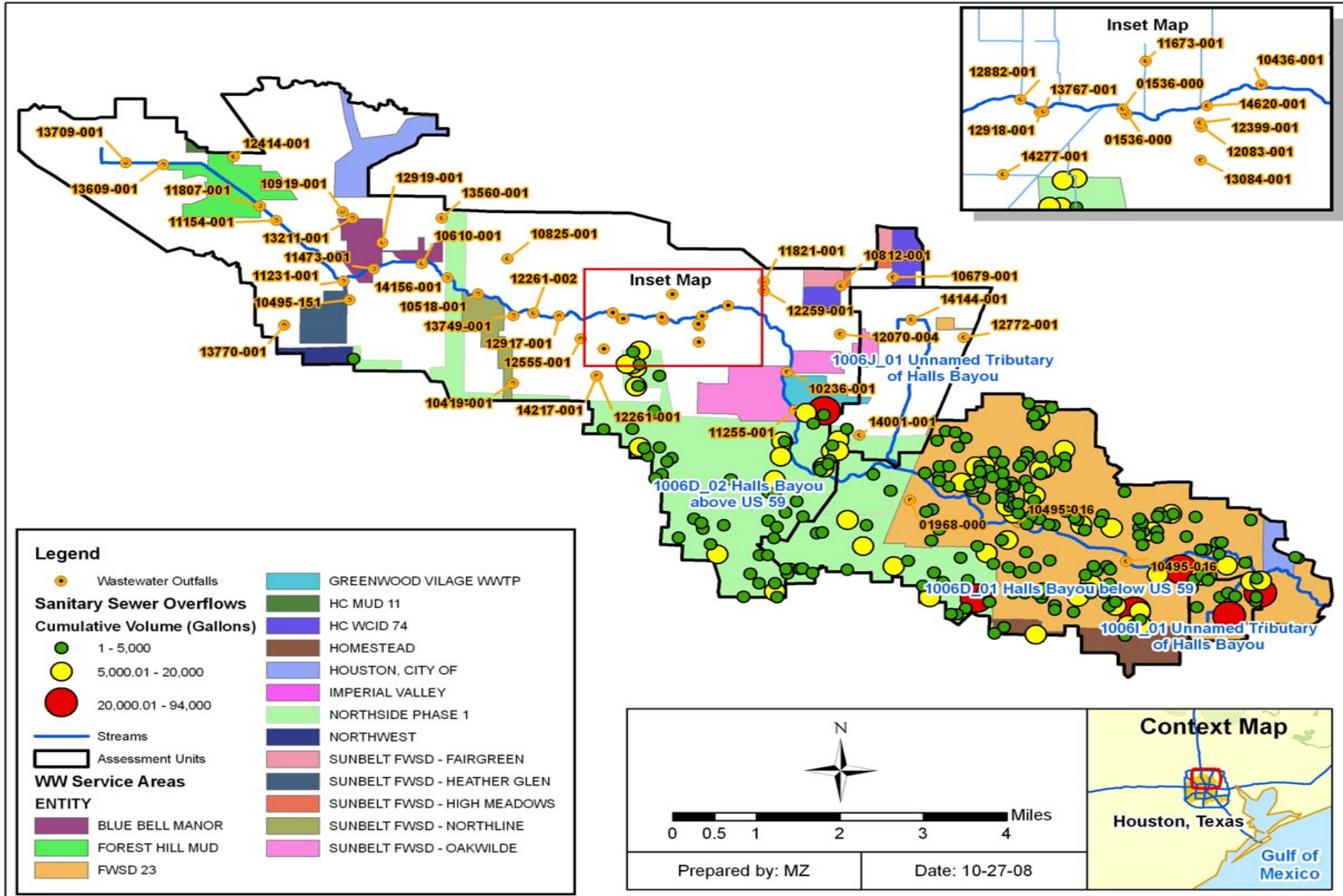
Wastewater Treatment Plants



Summary of TPDES-Permitted Facilities in the Study Area

Assessment Unit	Number of Facilities	Total Permitted Flow (MGD)	Total Average Monthly Flow (MGD)
1006D_01	2	7.1	3.82
1006D_02	42	10.65	5.09
1006D_02	0	0	0
1006J_01	3	0.133	0.023

Sanitary Sewer Overflows



Permitted Stormwater For WQ0004685000

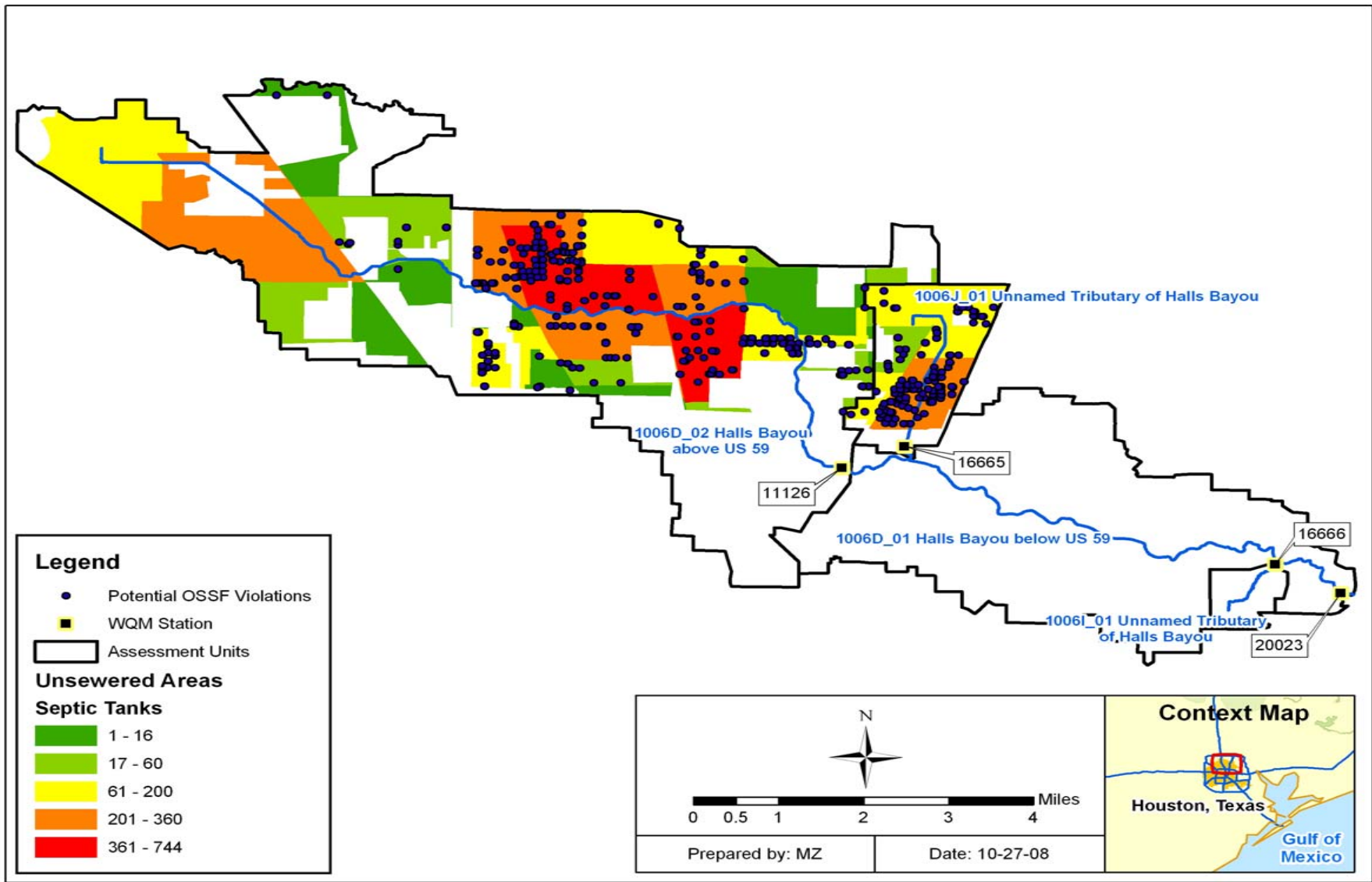
Segment	Stream Name	Total Area (acres)	Area under MS4 Permit (Acres)	Percent of Watershed under MS4 Jurisdiction
1006D_01	Halls Bayou below US 59	8,182	8,007	98%
1006D_02	Halls Bayou above US 59	18,090	18,090	100%
1006I_01	Unnamed Tributary of Halls Bayou	452	376	83%
1006J_01	Unnamed Tributary of Halls Bayou	1,839	1,839	100%

Population Projections

Stream Name	Assessment Unit	2005	2035	Increase
Halls Bayou below US 59	1006D_01	40,164	51,824	23%
Halls Bayou above US 59	1006D_02	95,599	121,775	21%
Unnamed Tributary of Halls Bayou	1006I_01	751	990	24%
Unnamed Tributary of Halls Bayou	1006J_01	9,256	13,143	30%

Source: HGAC 2007

On-Site Sewage Facilities



On-Site Sewage Facilities


Segment	Stream Name	OSSF Estimate using 1990 Census method
1006D_01	Halls Bayou below US 59	0
1006D_02	Halls Bayou above US 59	4,042
1006I_01	Unnamed Tributary of Halls Bayou	0
1006J_01	Unnamed Tributary of Halls Bayou	1,157

^a Using 12% failure rate.

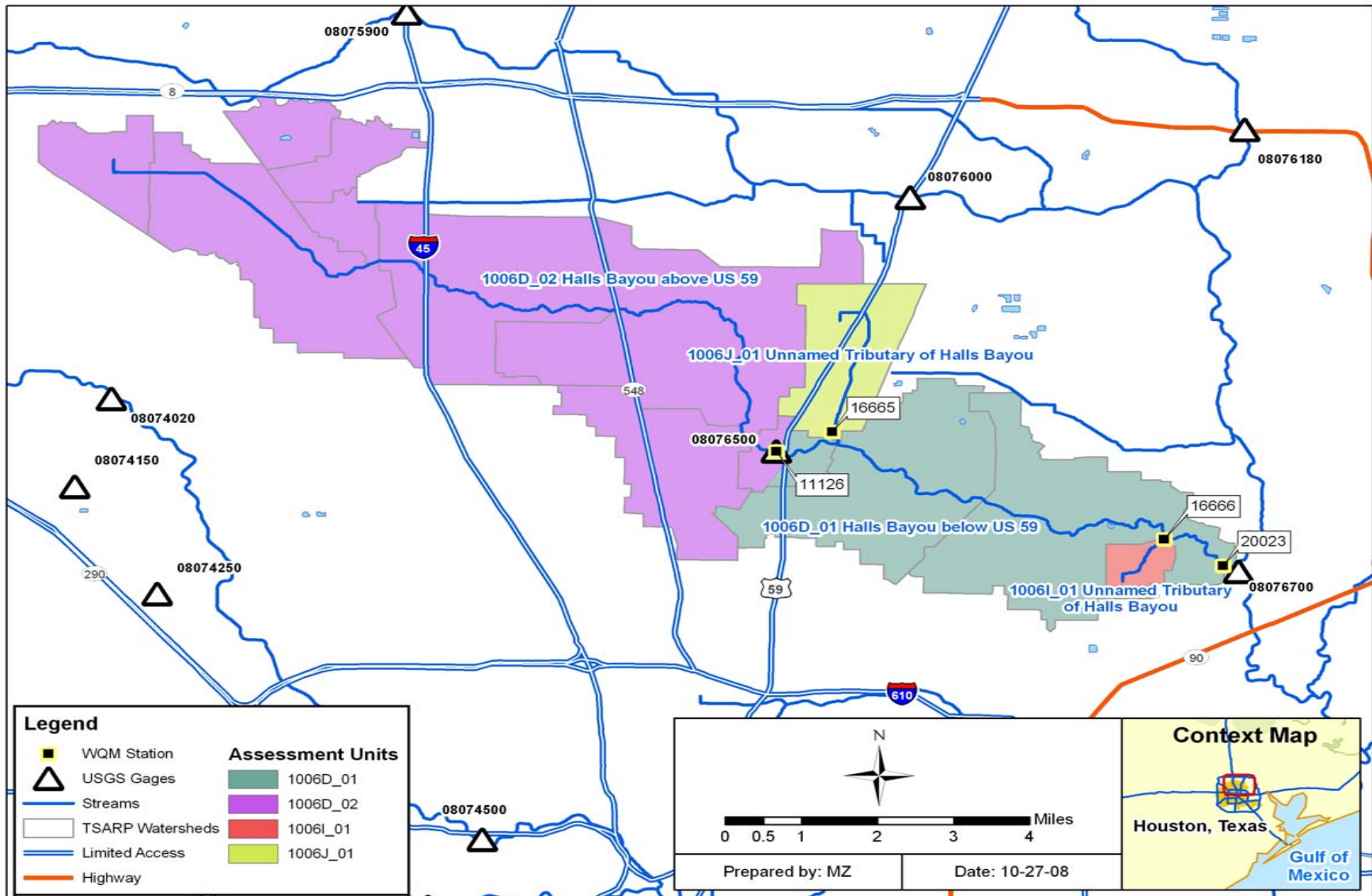
Estimated Number of Pets

Segment	Stream Name	Dogs	Cats
1006D_01	Halls Bayou below US 59	10,956	12,467
1006D_02	Halls Bayou above US 59	15,400	17,524
1006I_01	Unnamed Tributary of Halls Bayou	1,220	1,389
1006J_01	Unnamed Tributary of Halls Bayou	3,433	3,907

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WQM Stations Targeted for TMDL Development



USGS Gages in the Halls Bayou Watershed

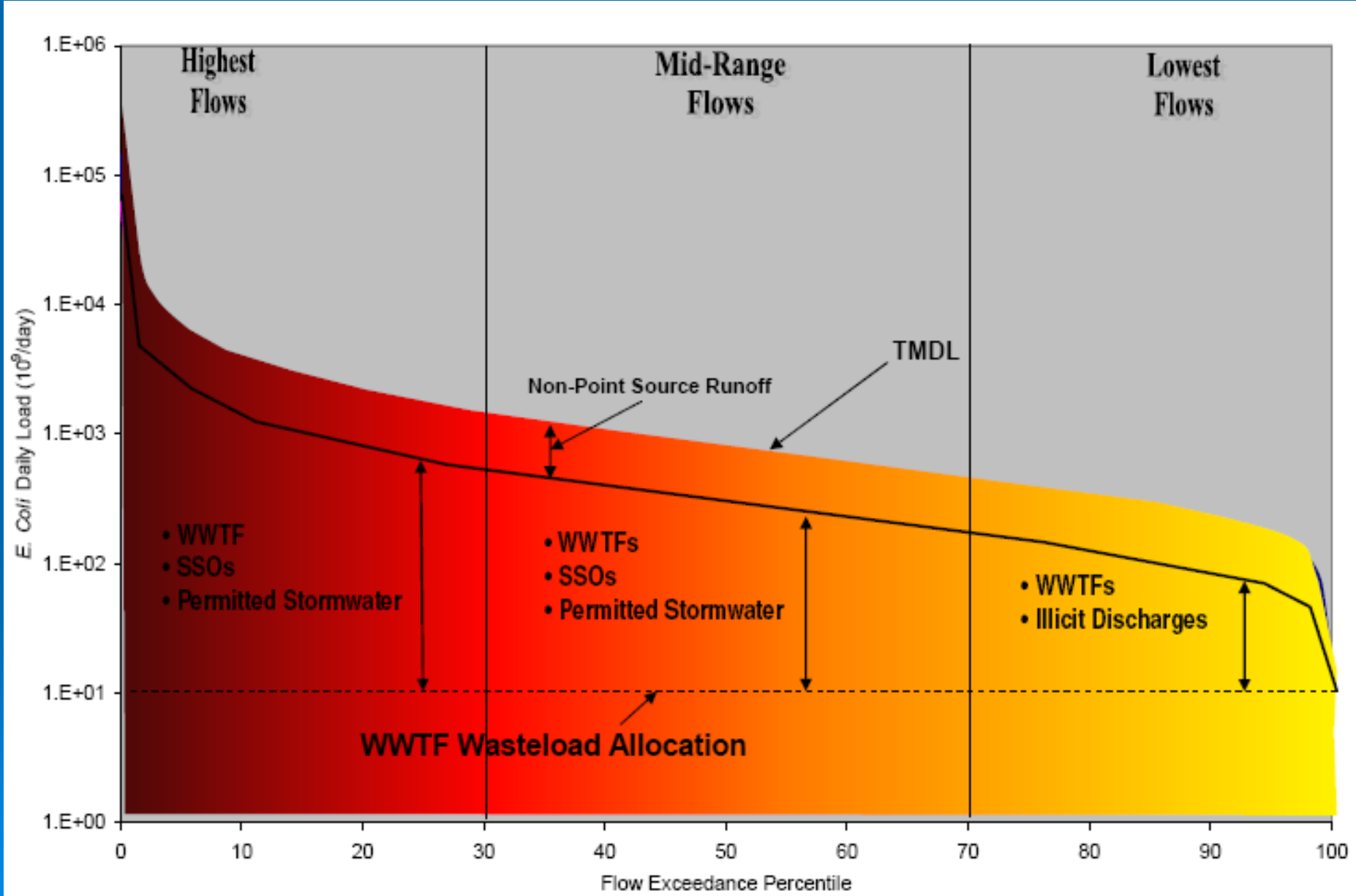
USGS Gage Number	Name	Period of Record	Data Type
8076500	Halls Bayou at Houston, TX	11/1952 – 09/1993 and 10/2000 - Present	Discharge (cfs)
		10/1996 - Present	Gage Height (ft)

* Highlight - USGS gage station used to project flows.

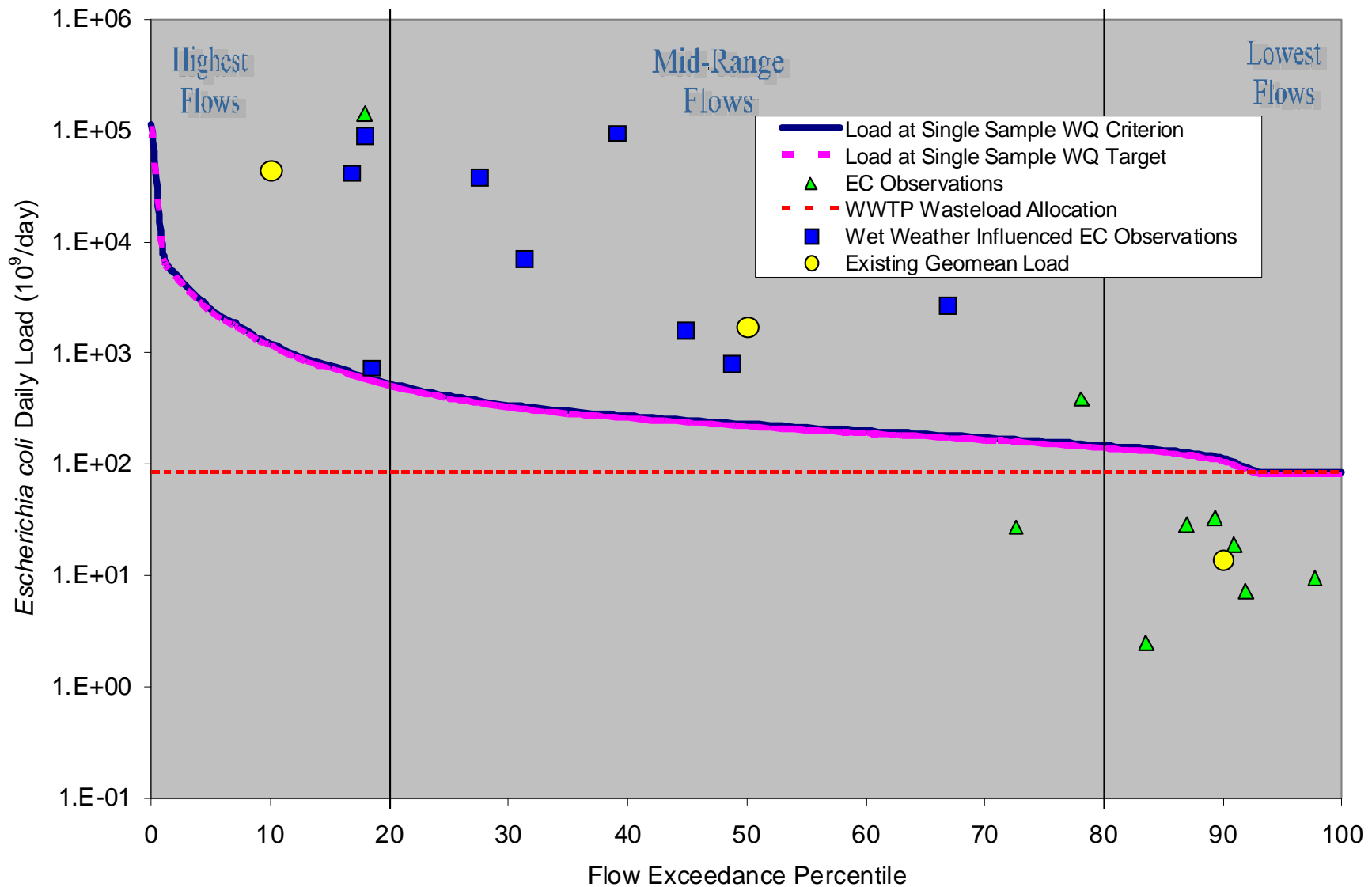
Flow Percentiles

Segment	1006D_01	1006D_02	1006I	1006J
NRCS Curve Number	80.3	83.9	77.7	84.5
Average Annual Rainfall (inch)	49.1	45.7	55.1	45.7
Percentile	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)
0	12,005	7,292	92	854
10	127	80	0.9	8
20	55	33	0.34	3.1
30	35	21	0.18	1.6
40	28	16	0.12	1.1
50	24	14	0.09	0.8
60	21	12	0.07	0.6
70	18	11	0.05	0.50
80	15	10	0.04	0.39
90	12	7.8	0.03	0.28
100	1	0.42	0	0

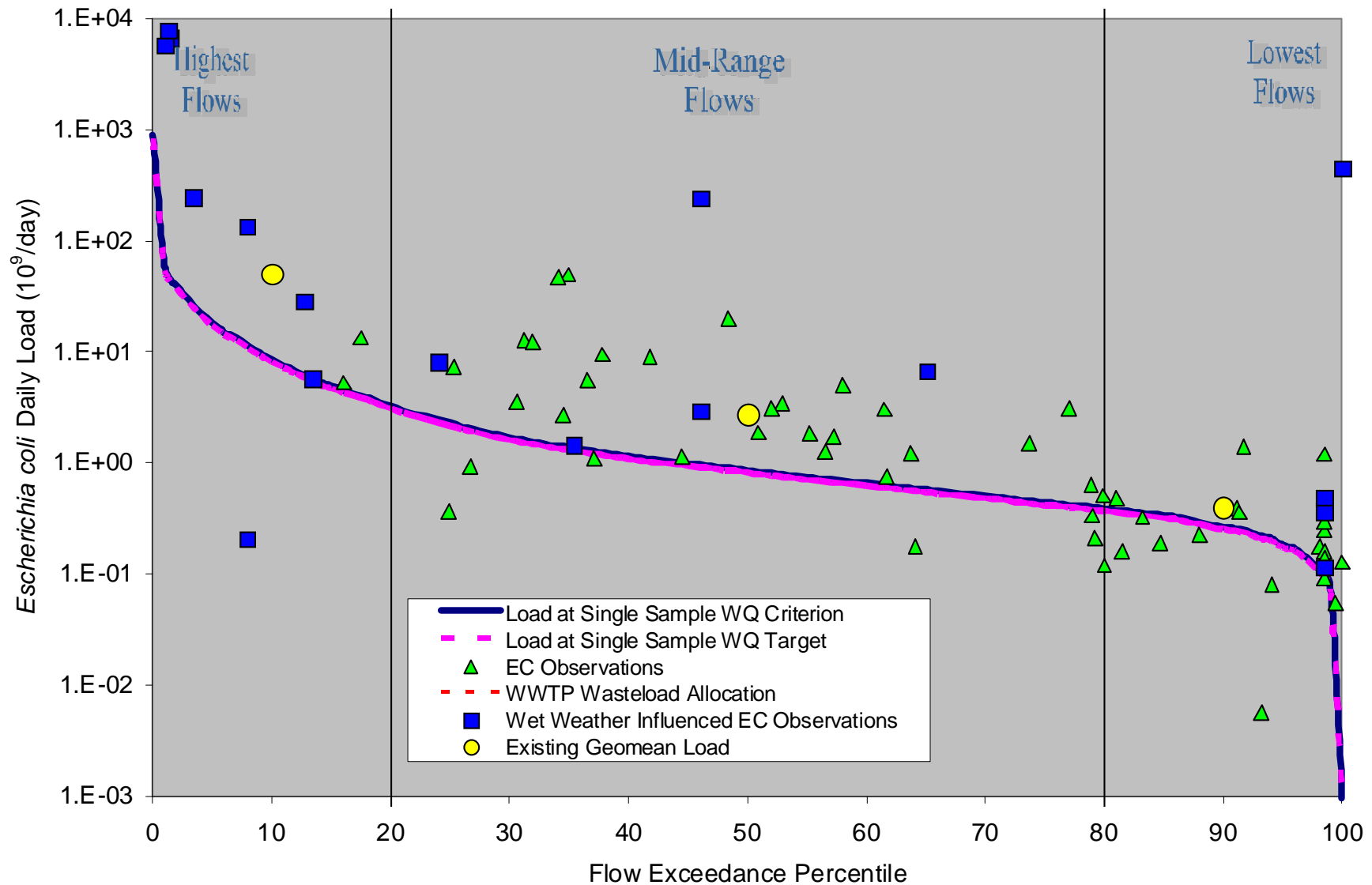
LDC Schematic



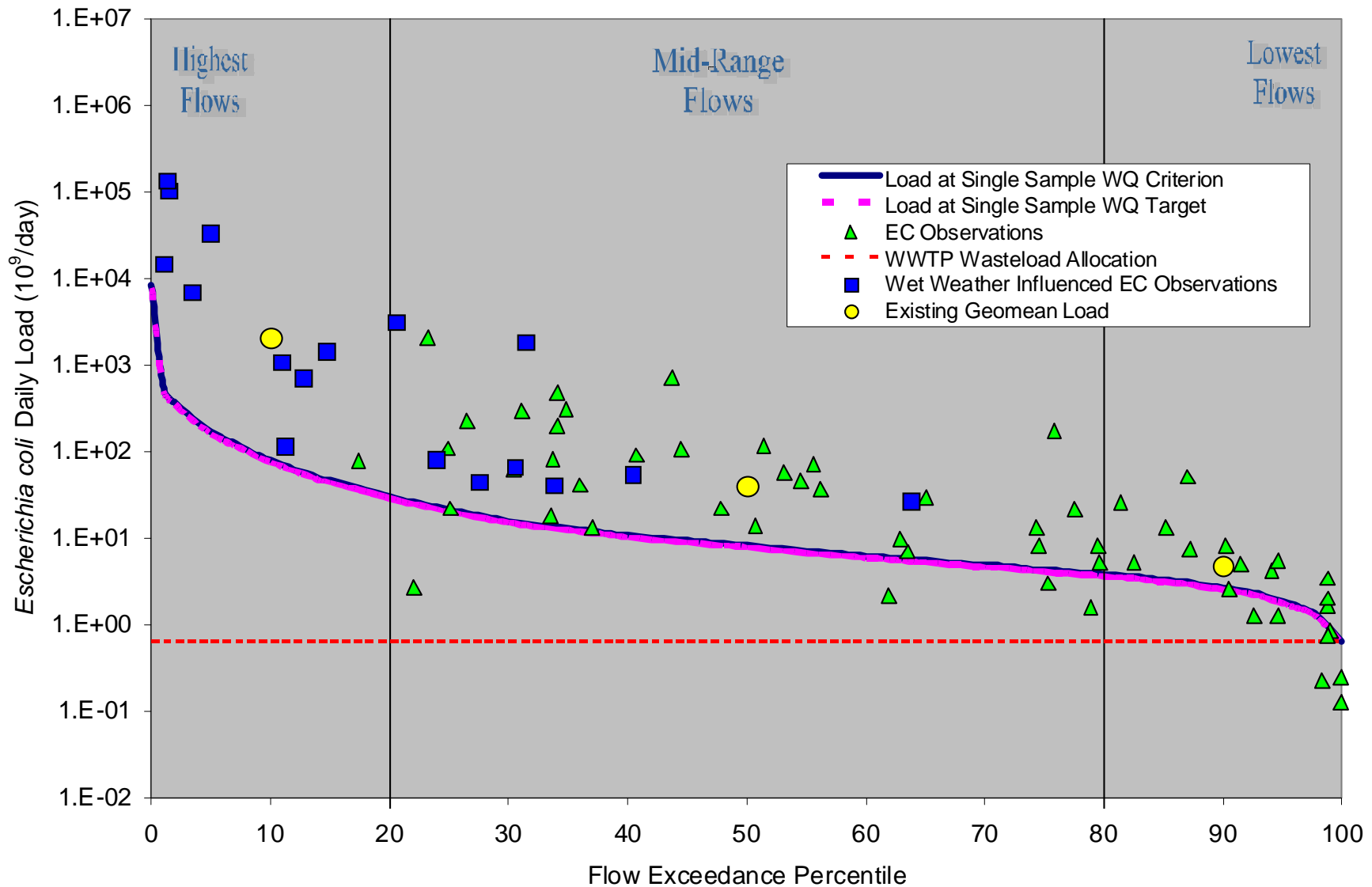
Load Duration Curve for Halls Bayou below U.S. 59 (1006D_01)




Load Duration Curve for Unnamed Tributary of Halls Bayou (1006I_01)



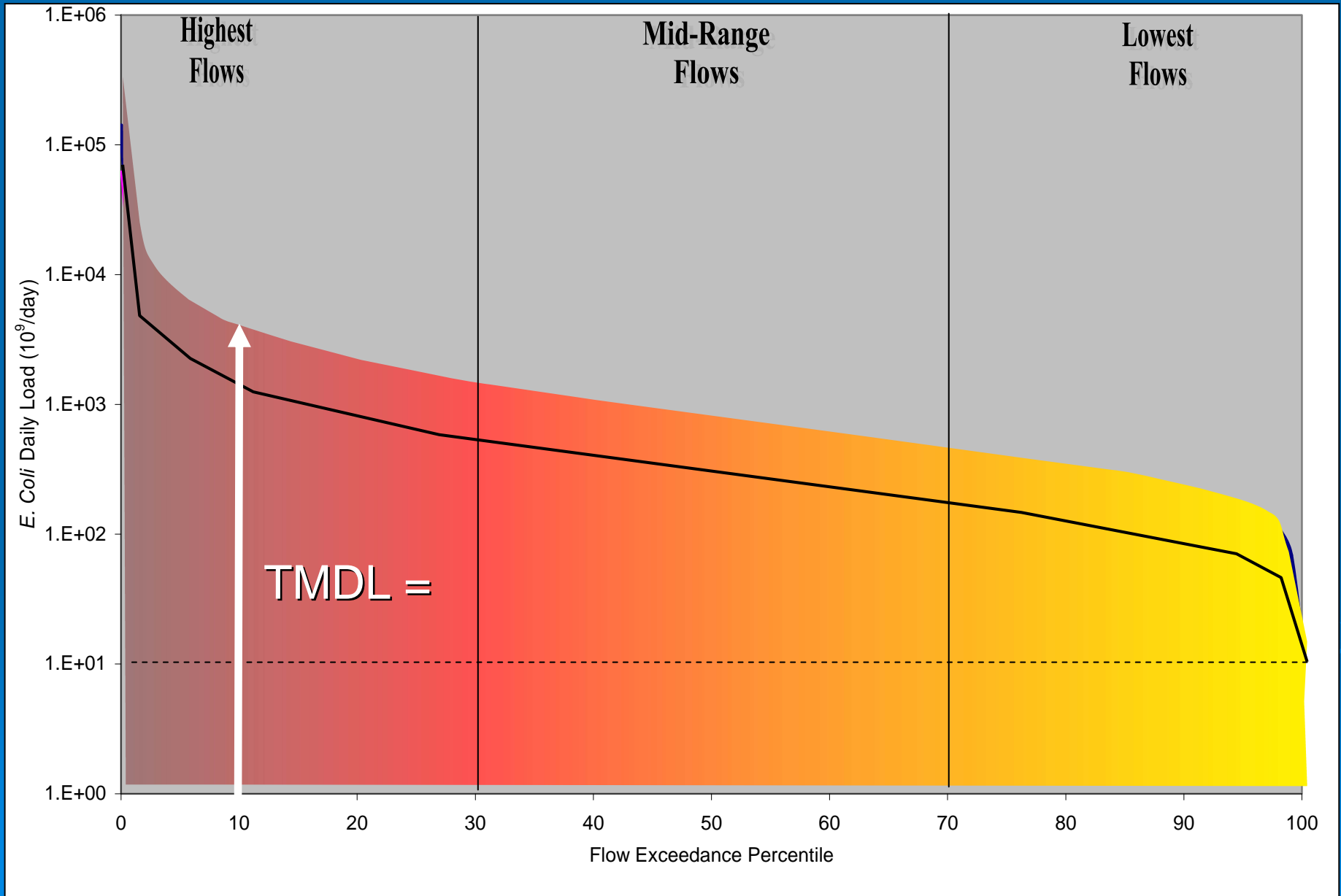
Load Duration Curve for Unnamed Tributary of Halls Bayou (1006J_01)



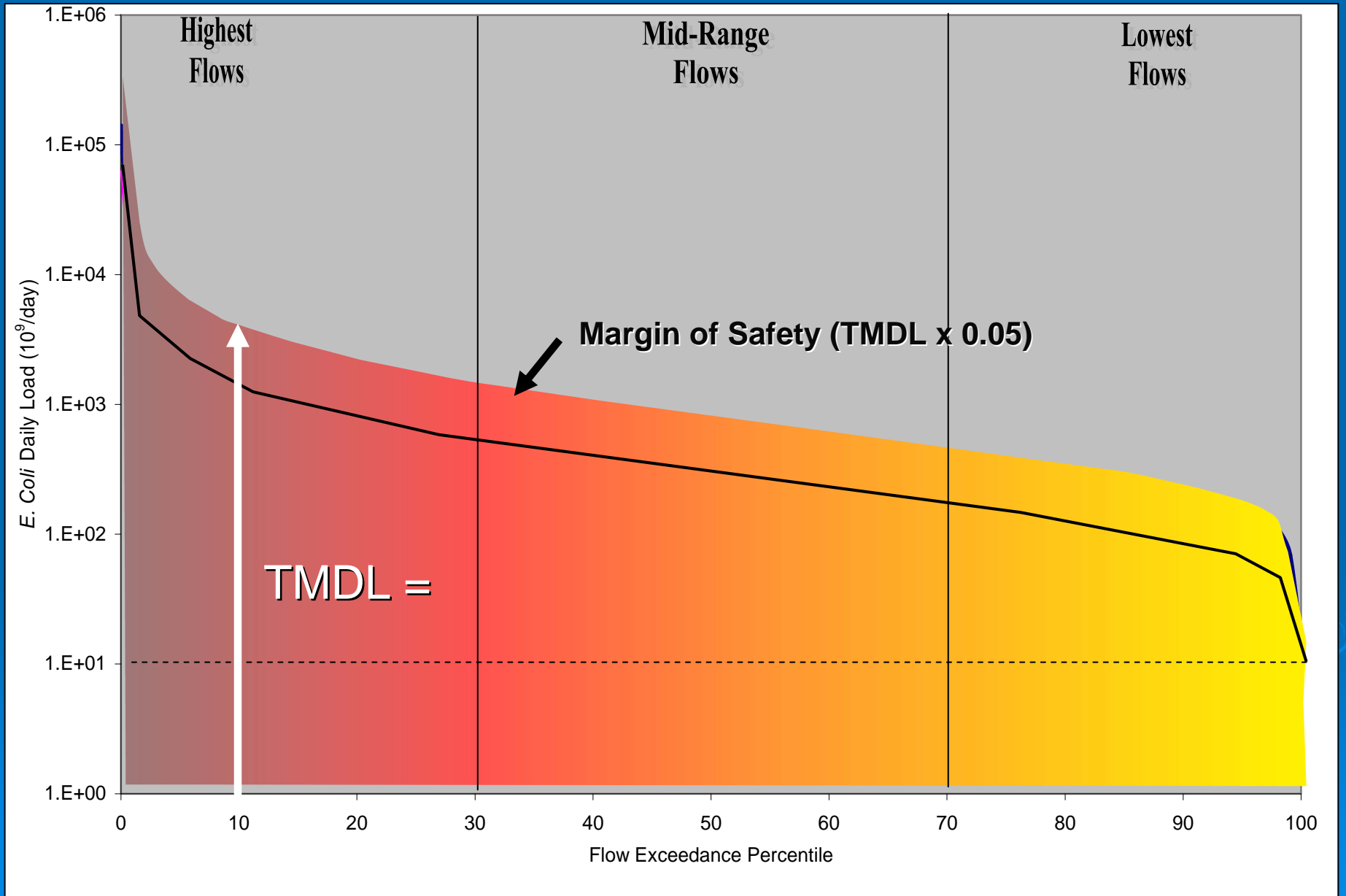
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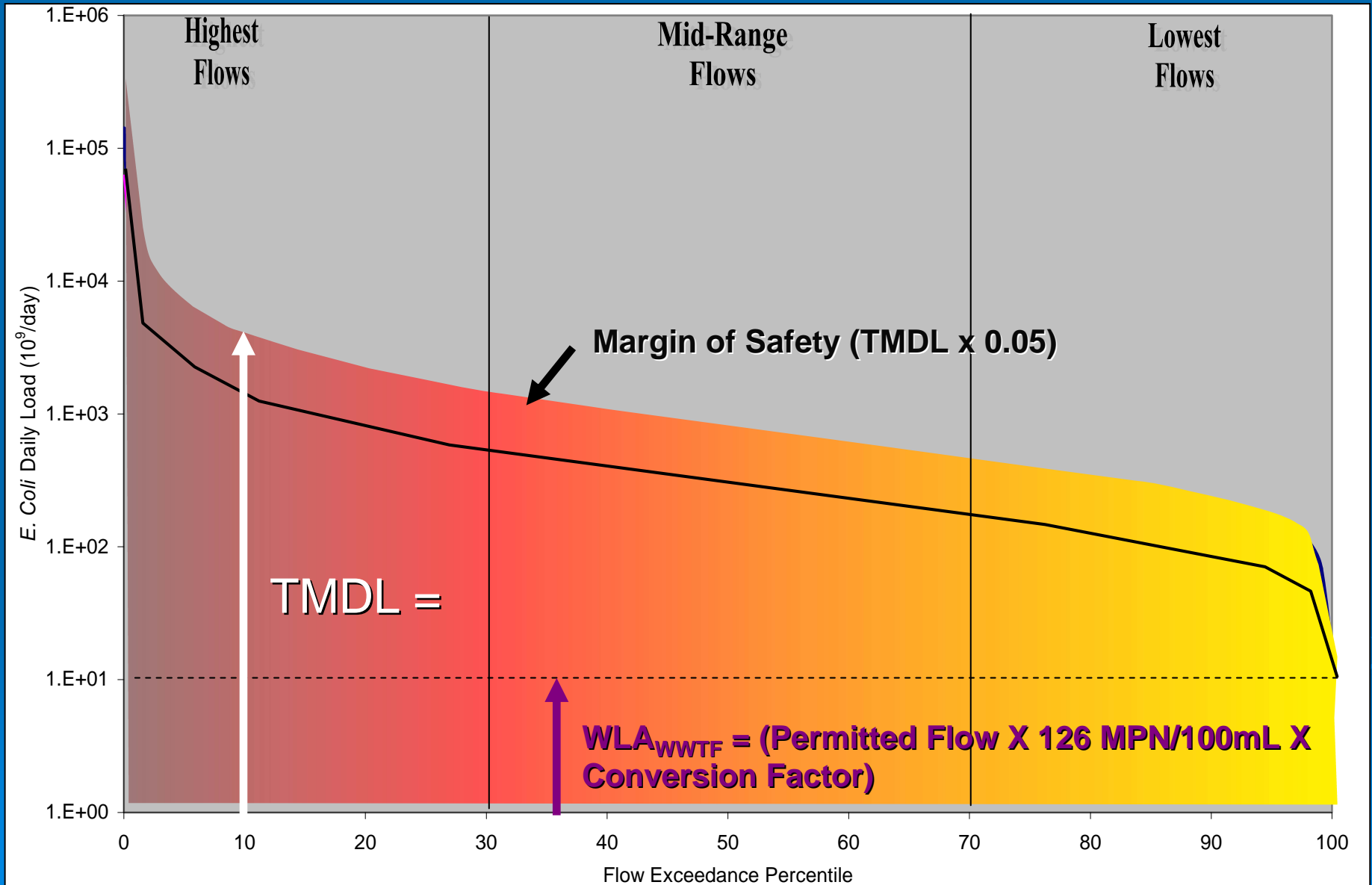
TMDL Calculations



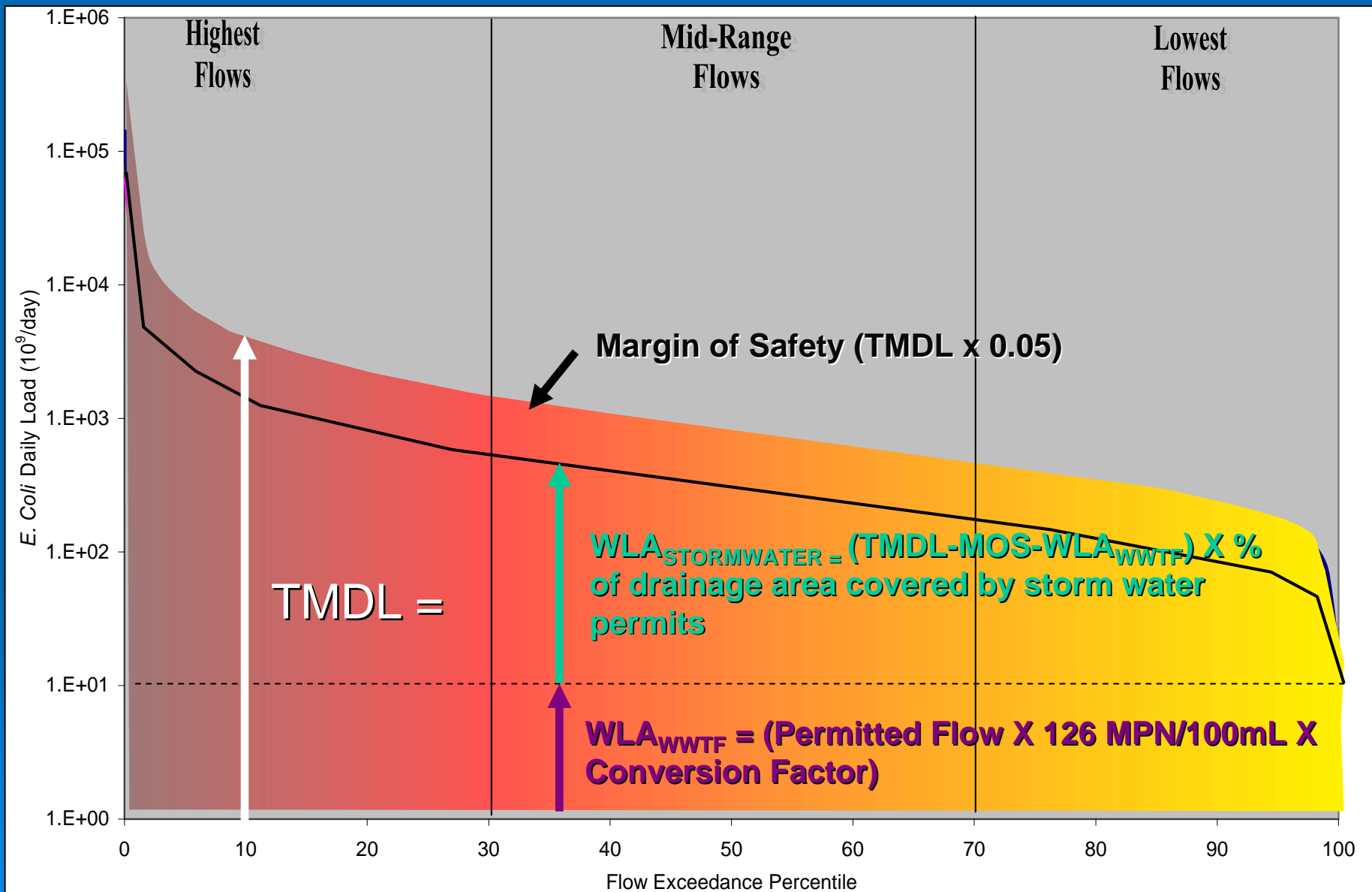
TMDL Calculations



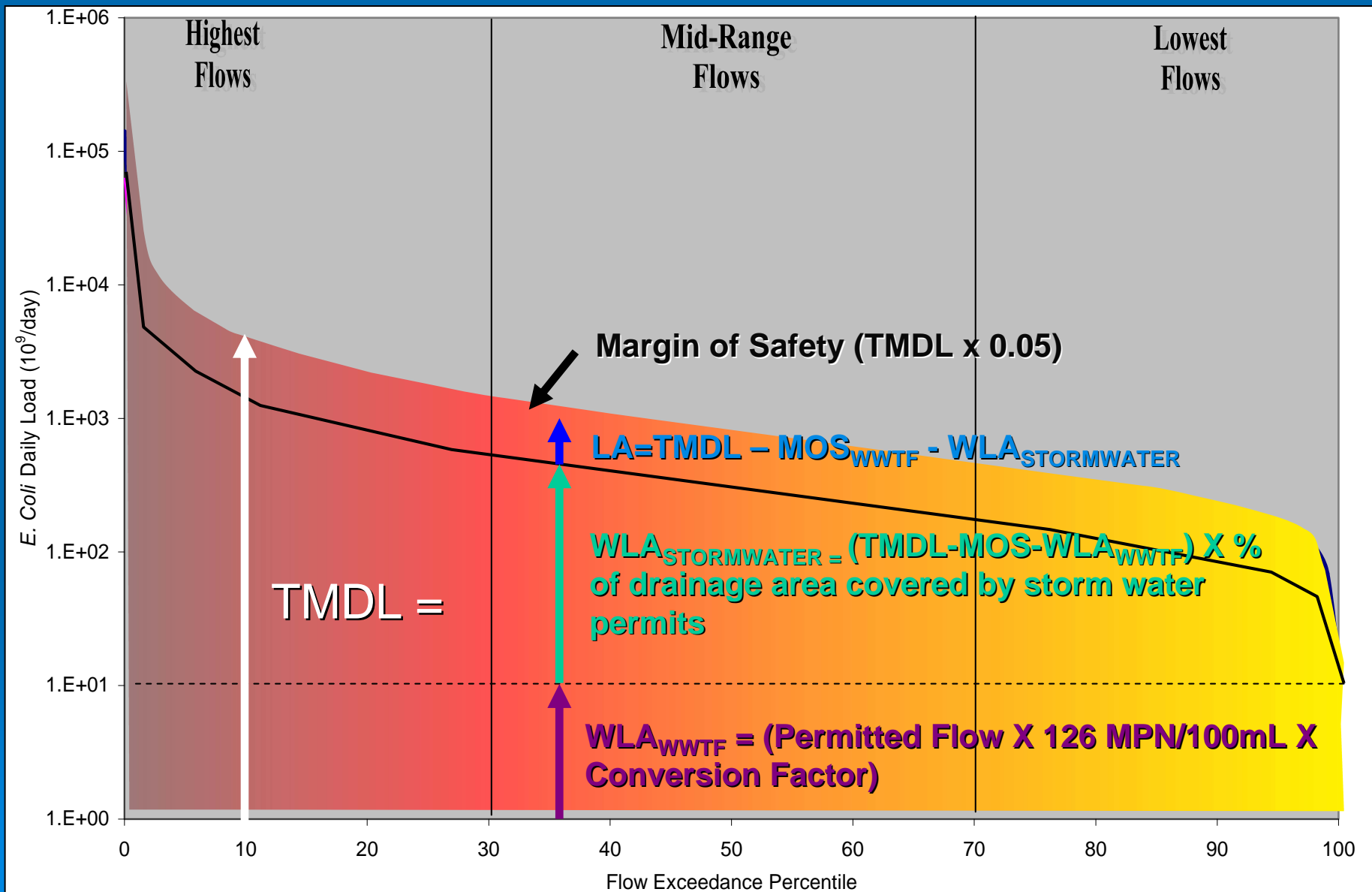
TMDL Calculations



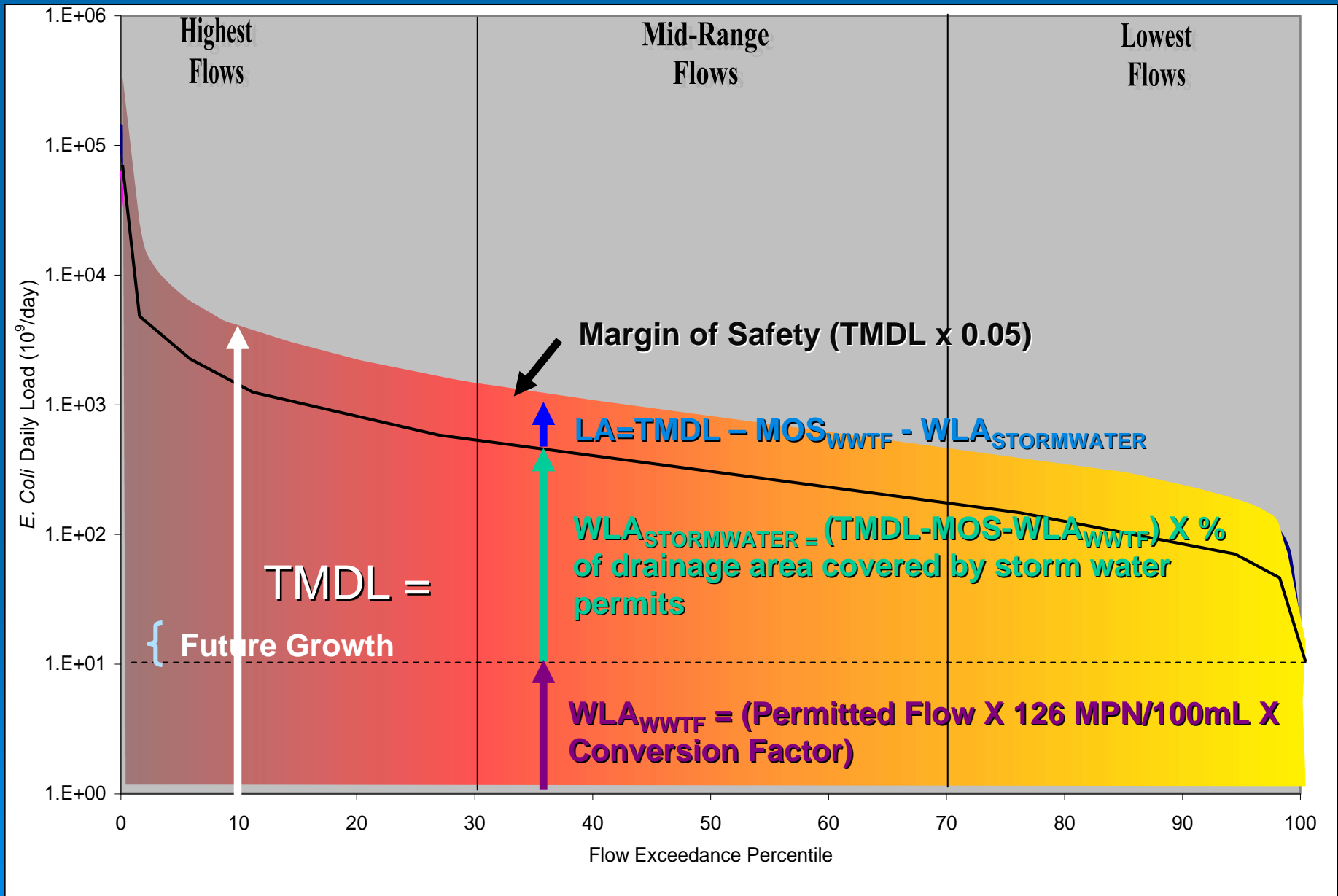
TMDL Calculations



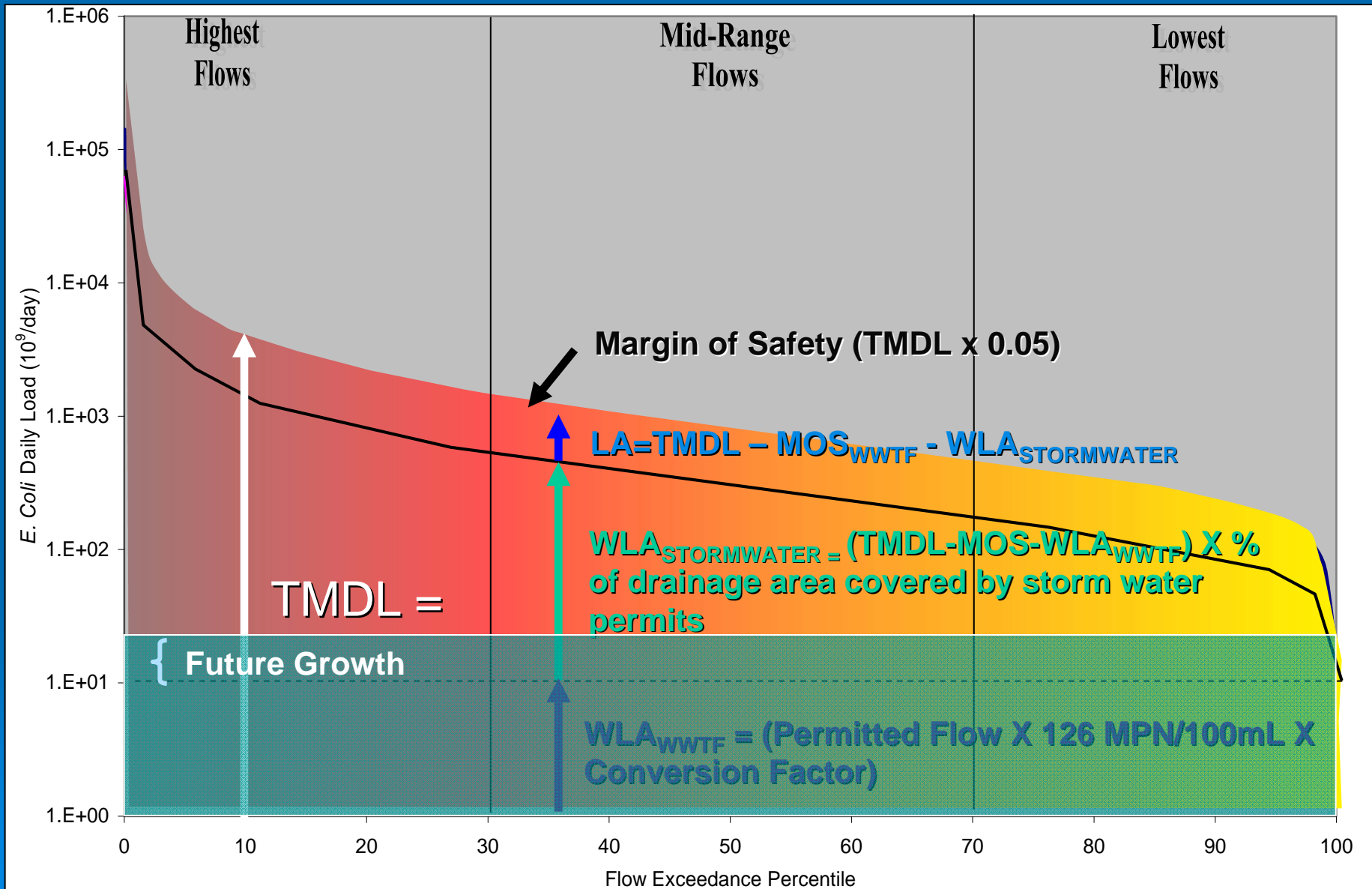
TMDL Calculations



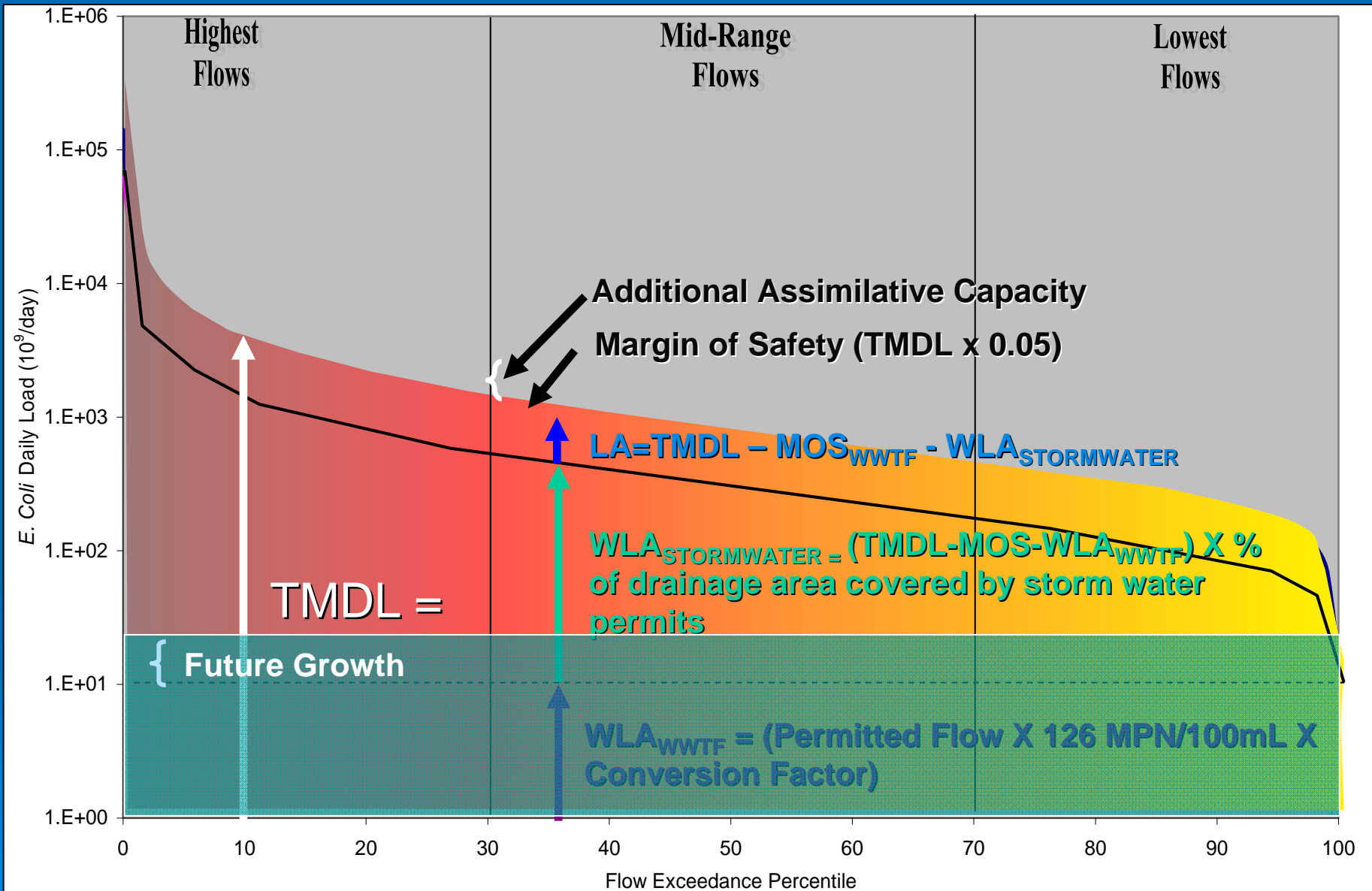
TMDL Calculations



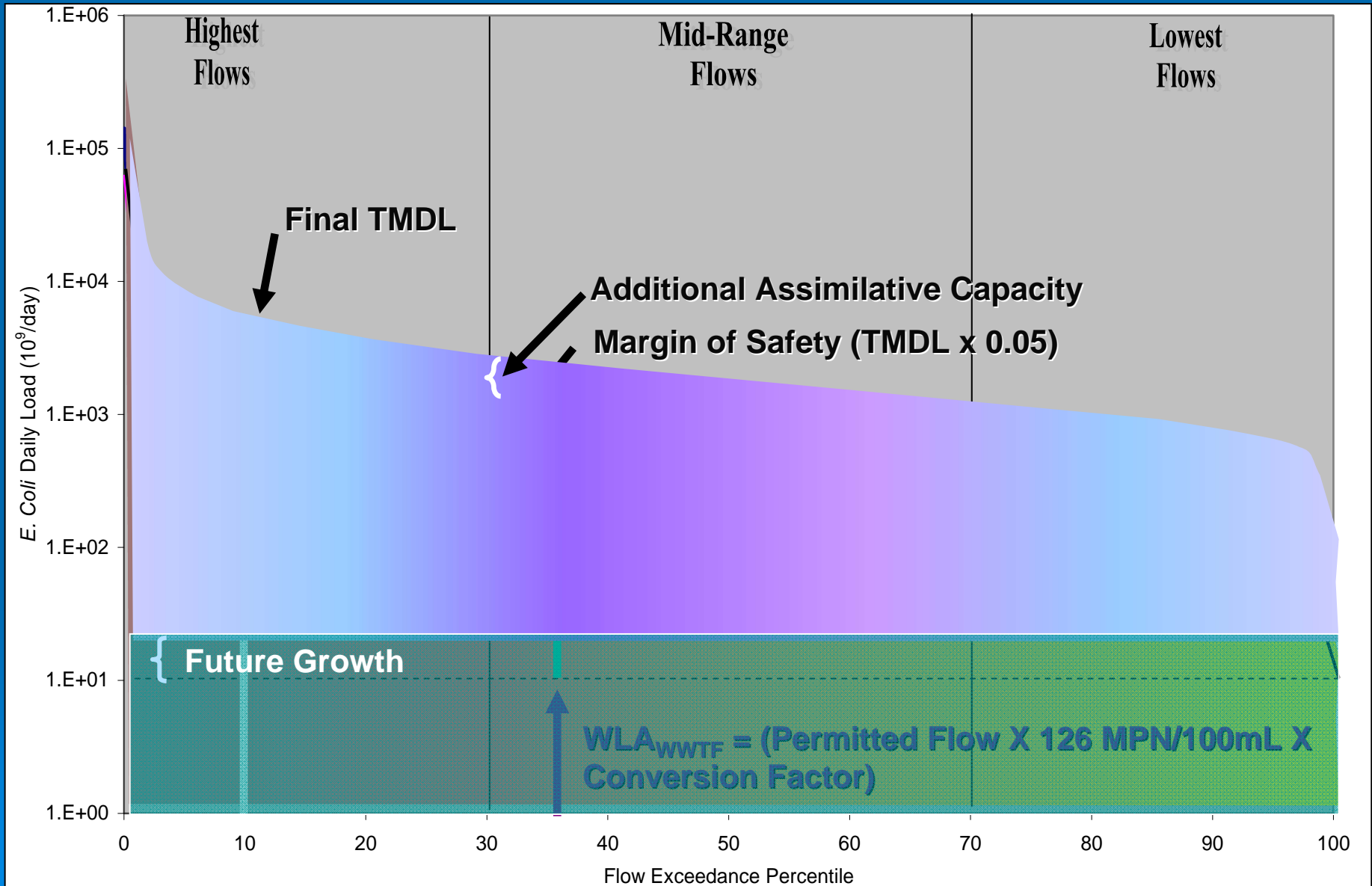
TMDL Calculations



TMDL Calculations



TMDL Calculations



Final TMDL Allocations

Assessment Unit	TMDL (MPN/day)	WLA _{WWTF} (MPN/day)	WLA _{STORM WATER} (MPN/day)	LA (MPN/day)	MOS (MPN/day)
1006D_01	4.58E+11	1.04E+11	3.24E+11	7.51E+09	2.29E+10
1006D_02	2.77E+11	6.17E+10	2.01E+11	0	1.38E+10
1006I_01	2.72E+09	0	2.15E+09	4.35E+08	1.36E+08
1006J_01	2.60E+10	8.22E+08	2.39E+10	0	1.30E+09

a $WLA_{WWTF} = WLA_{WWTF} + \text{Future Growth}$

b LA includes upstream loads