

Segment Number:	2432	Name:	Chocolate Bay			
Area:	7.6 square miles	Miles of Shoreline:	20.4 miles	Designated Uses:	Contact Recreation; High Aquatic Life Use; Oyster Waters	
Number of Active Monitoring Stations:	7	Texas Stream Team Monitors:	0	Permitted Outfalls:	14	
Description:	<p>Adjoining the northwest side of West Galveston Bay at the Gulf Intracoastal Waterway and extending upstream to confluence with Chocolate Bayou approximately ¾ mile downstream of FM 2004 in southeast Brazoria County</p> <p>Sub-Segment 2432C: Halls Bayou Tidal (unclassified water body)—From the Chocolate Bay confluence upstream to a point 31.5 km (19.6 mi) upstream</p> <p>Sub-Segment 2432D: Persimmon Bayou (unclassified water body)—From the New Bayou confluence upstream to the Mustang Bayou confluence</p> <p>Sub-Segment 2432E: New Bayou (unclassified water body)—From the Chocolate Bayou confluence upstream 25.4 km (15.8 mi) to an unnamed tributary</p>					

Degree of Impairment and Overall Trends						
Segment ID	Dissolved Oxygen	Bacteria	Nutrients	PCBs/Dioxin	Chlorophyll <i>a</i>	Other
2432				100		
2432B	100					
2432C	100			100		
2432D	100					
2432E	100					

■ Indicates general improvement
■ Indicates general degradation
Numbers indicate percent of segment impaired

FY 2011 Active Monitoring Stations					
Site ID	Site Description	Frequency	Monitoring Entity	Parameter Groups	
11422	Halls Bayou at FM 2004	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll-a	
11422	Halls Bayou at FM 2004	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll-a	
13346	Chocolate Bay at CM 9	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll-a	
13347	Chocolate Bay at Marker C-25	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll-a	
16228	Chocolate Bay at 97gb034	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll-a	
16228	Chocolate Bay at 97gb034	Once / Year	TCEQ	Benthics, Metals in Sediment	

17911	New Bayou at FM 2004	Quarterly	EIH	Field, Conventional, Bacteria
17913	Persimmon Bayou at FM 2004	Quarterly	EIH	Field, Conventional, Bacteria
18668	Willow Bayou at Baker Street	Quarterly	EIH	Field, Conventional, Bacteria

Segment 2432			
Standards		Screening Levels	
Temperature (°C):	35	Ammonia-N (mg/L):	0.10
Dissolved Oxygen (24-Hr Average) (mg/L):	4.0	Nitrate-N (mg/L):	0.17
Dissolved Oxygen (Absolute Minima) (mg/L):	3.0	Orthophosphate Phosphorus (mg/L):	0.19
pH (standard units):	6.5-9.0	Total Phosphorus-P (mg/L):	0.21
Enterococci (MPN/100mL) (grab):	89	Chlorophyll- <i>a</i> (µg/L):	11.6
Enterococci (MPN/100mL) (geometric mean):	35		
Fecal Coliform in Oyster Waters (CFU/100mL) (median/grab):	14/43		

Water Quality Issues Summary					
Issue	2008 Assessment	Draft 2010 Assessment	Affected Area	Possible Causes/Influences / Concerns Voiced by Stakeholders	Possible Solutions / Actions To Be Taken
Elevated Levels of Bacteria causing impairment for contact recreation and oyster harvesting	-	I	2432D_01	<ul style="list-style-type: none"> - WWTP non-compliance, overflows, collection system by-passes - Small, privately-run WWTP - Developments with septic tanks - Rapid urbanization and increased impervious cover - Constructed storm water controls failing - Direct and dry weather discharges - Waste haulers illegal discharges/improper disposal - Improper or no pet waste disposal - Animal waste from agricultural production, hobby farms, and riding stables 	<ul style="list-style-type: none"> - Increase monitoring requirements for self-reporting - Impose new or stricter bacteria limits than those designated by TCEQ - Require all systems to develop and implement a utility asset management program and protect against power outages at lift stations or provide alternative power supplies during outages - Regionalize wastewater treatment to minimize number of small package plants and reduce OSSF dependency - Require larger partials of land in developments platted to use OSSFs

					<ul style="list-style-type: none"> - More public education regarding OSSF operations and maintenance - More public education regarding pet waste disposal - Improve storm water controls in new developments by adding bacteria reduction measures - Improve compliance and enforcement of existing storm water quality permits to minimize contaminated runoff - Improve construction oversight to minimize TSS discharges to waterways - Implement stream fencing or alternative water supplies to keep livestock out of or away from waterways <p><i>Continued on following page</i></p> <ul style="list-style-type: none"> - Promote and implement Water Quality Management Plans for individual agricultural properties - Protect or install vegetative buffers along waterways
<p>Low Dissolved Oxygen Concentrations</p>	<p>C</p>	<p>C</p>	<p>2432B_01 2432C_01 2432D_01</p>	<ul style="list-style-type: none"> - Excessive nutrients and organic matter from WWTP effluent, sanitary sewer overflows, malfunctioning OSSFs, illegal disposal of grease trap waste, biodegradable solid waste such as grass clippings and pet waste - Excessive nutrients and organic matter from agricultural production, and related activities - Vegetative canopy removed - High temperatures discharges from industrial WWTPs 	<ul style="list-style-type: none"> - Improve compliance and enforcement of existing storm water quality permits - Improve operation and maintenance of existing WWTP and collection systems - Regionalize wastewater treatment to minimize number of small package plants and reduce OSSFs dependency - More public education regarding pet waste disposal - More public education regarding disposal of household fats, oils, and grease - More stringent OSSF maintenance and education - Create and implement Water Quality Management Plans for individual agricultural properties - Install and/or maintain riparian buffer areas

					<ul style="list-style-type: none"> - between agricultural fields and waterways - Conserve or plant canopy trees and habitat along waterways - Work with drainage districts and agencies to change practices of clear cutting waterways
Dioxin/PCBs	I	I	2432_01 2432D_01	<ul style="list-style-type: none"> - Concentrated deposits outside boundaries of the waste pits - Unknown industrial or urban sources 	<ul style="list-style-type: none"> - Remove or contain contamination from locations already identified - Encourage additional testing to locate all unknown sources/deposits

Segment Discussion:

Watershed Characteristics: The Chocolate Bay Watershed is on the northwest side of West Galveston Bay at the Gulf Intercoastal Waterway and extends upstream to the confluence with Chocolate Bayou in Brazoria County. Wetlands and grasslands surround this segment which supports barge traffic servicing the petrochemical industries located upstream. Agriculture, including ranching, is the primary land use throughout the watershed. The one major urban area in the watershed is the City of Alvin which is located in the upper middle of Mustang Bayou, a tributary to Chocolate bay.

Water Quality Issues: This segment is not supporting of its recreation and fish consumption designations. The Assessment Units (AUs) 2432D_01 and 2432E_01 are listed as impaired for bacteria in the *Draft* 2010 Texas Integrated Report (IR) but not listed in the 2008 IR. In the data set from December 2001 through November 2008, 58% of the enterococci samples collected exceeded the single grab criteria of 89 MPN/100mL. A geometric mean of 80 MPN/100mL was reported which is more than twice the standard of 35 MPN/100mL. Bacteria was not listed as an impairment in the 2008 IR for any of the AUs.

Due to elevated levels of dioxin and PCBs in edible tissue as well as high fecal coliform concentrations in oyster waters, the Texas Department of State Health Services issued a Limited Consumption Fish and Shellfish Advisory for this water body. It was also identified a concern for Dissolved Oxygen (DO) in the single grab sample because 16% of the samples were below the grab screening criteria of 5.0 mg/L. DO was listed as a concern in the 2008 IR as well.

Special Studies/Projects: This segment is included in one TMDL project, the Galveston Bay System Survey for Dioxin and PCBs, which is currently under way. For more information, please refer to the detailed discussions located at the beginning of the water quality section of the 2011 Basin Summary Report regarding dioxin and PCB contamination. There was also a special study conducted on Mustang Bayou by the USGS. The project report was published in 2006.

Trends: The *Draft* 2010 IR identifies impairments related to PCB and dioxin compounds and depressed DO in Chocolate Bay. Regression analysis of data pooled from all stations reveals several possible trends, mostly in the unclassified waterways of the watershed. Total phosphorus (TP) appears to be trending upward in the classified bay. TP and orthophosphate phosphorus (OP) are trending higher in the unclassified tributaries, while chlorophyll *a* concentrations appear to be

declining.

Regression analysis of the annual median suggests that DO concentrations are trending higher at one of the five stations in the classified bay, but analysis of individual sample results does not provide supporting evidence. No other statistically-significant trends for DO were found.

In contrast to the negative chlorophyll *a* trend implied by the analysis of pooled data, analysis of single-sample data from three of the five stations in the classified portion of the watershed suggests chlorophyll *a* concentrations are increasing. Analysis of annual median concentrations supports this trend for station 13346, located in assessment unit 2432_01, and provides evidence of a negative trend at station 11422, located on an unclassified tributary. A graph of this trend appears below. Single-sample analysis of TP concentrations suggests that TP concentrations are increasing at three stations in the watershed, one of which exists at a station exhibiting a statistically significant chlorophyll *a* trend (13346). Only one significant trend was found for nitrate nitrogen (nitrate), also at station 11346, but the trend is not supported by the analysis of annual median concentrations. A positive ammonia trend was also suggested by data from station 11346. Because there are outliers in this series, there is no significant trend in the annual median concentration. It must be noted that inference of trends from station 11346 data is hindered by a data gap between 1998 and 2003. Graphs of chlorophyll *a*, total phosphate, nitrate, and nitrate /chlorophyll *a* relationships at station 13346 follow.

One significant bacteria trend was found. The annual *E. coli* geometric mean is trending lower at freshwater tributary station 18868, but this analysis is based spanning all or part of four calendar years, so it provides little evidence that conditions are changing. Total suspended solids concentrations are decreasing at three of nine stations and increasing at one.

Recommendations:

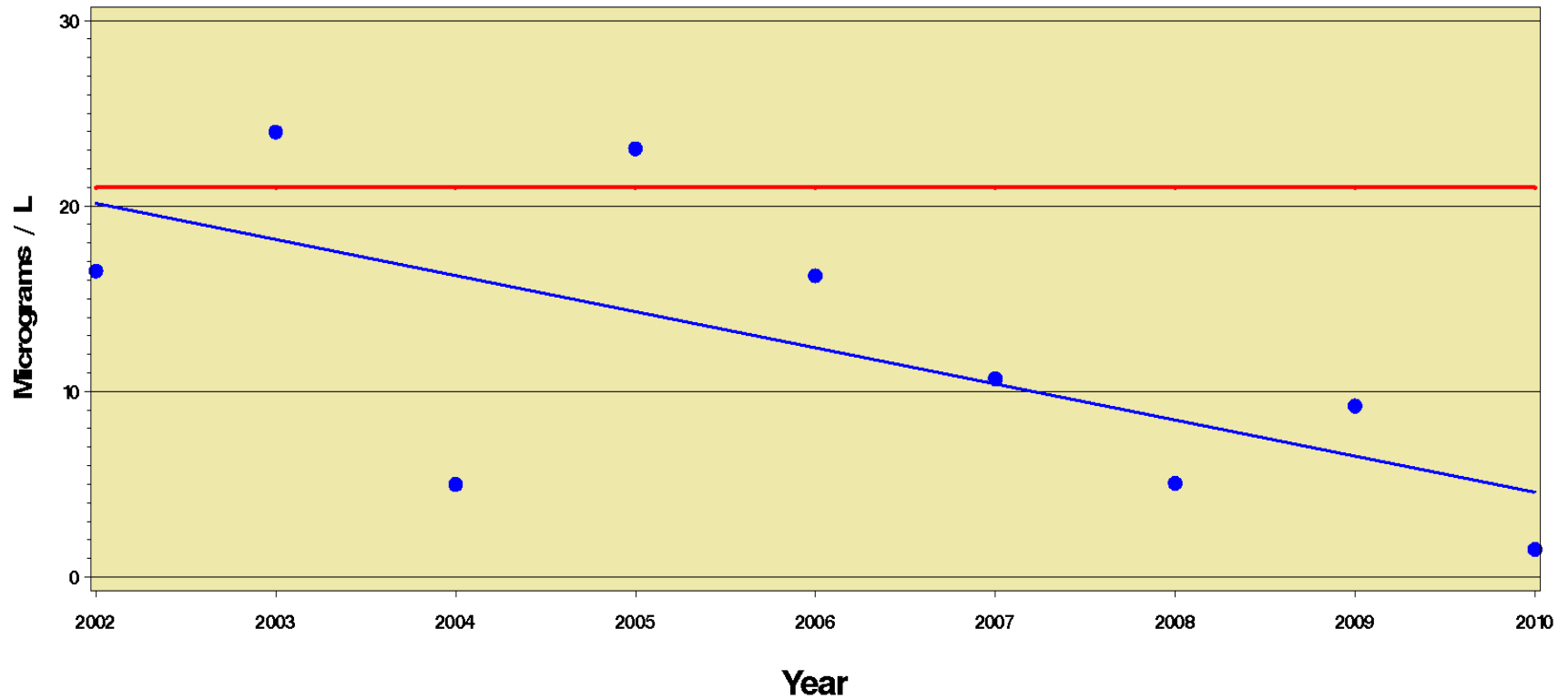
- Continue collecting water quality data to support actions associated with watershed protection plan development and future modeling.
- Pursue new local partners to Clean Rivers Program to collect additional data that would help better isolate problem areas.
- Work with residents and local businesses to address excessive nutrients through education.
- Support additional sampling to investigate sources of elevated dioxin and PCB levels.
- Coordinate with other local TMDL and WPP efforts.

Chocolate Bay

Monitoring Station: 11422 Segment: 2432 Assessment Unit: 2432C_01

Parameter: Chlorophyll a Annual Median

2010 Nutrient Screening Level: 21 Micrograms / L



Trends are considered significant if the p-value is < 0.10

Trend is significant at p= 0.0534 R-Square = 0.4348 T-Value = -2.321 Number of Samples= 25

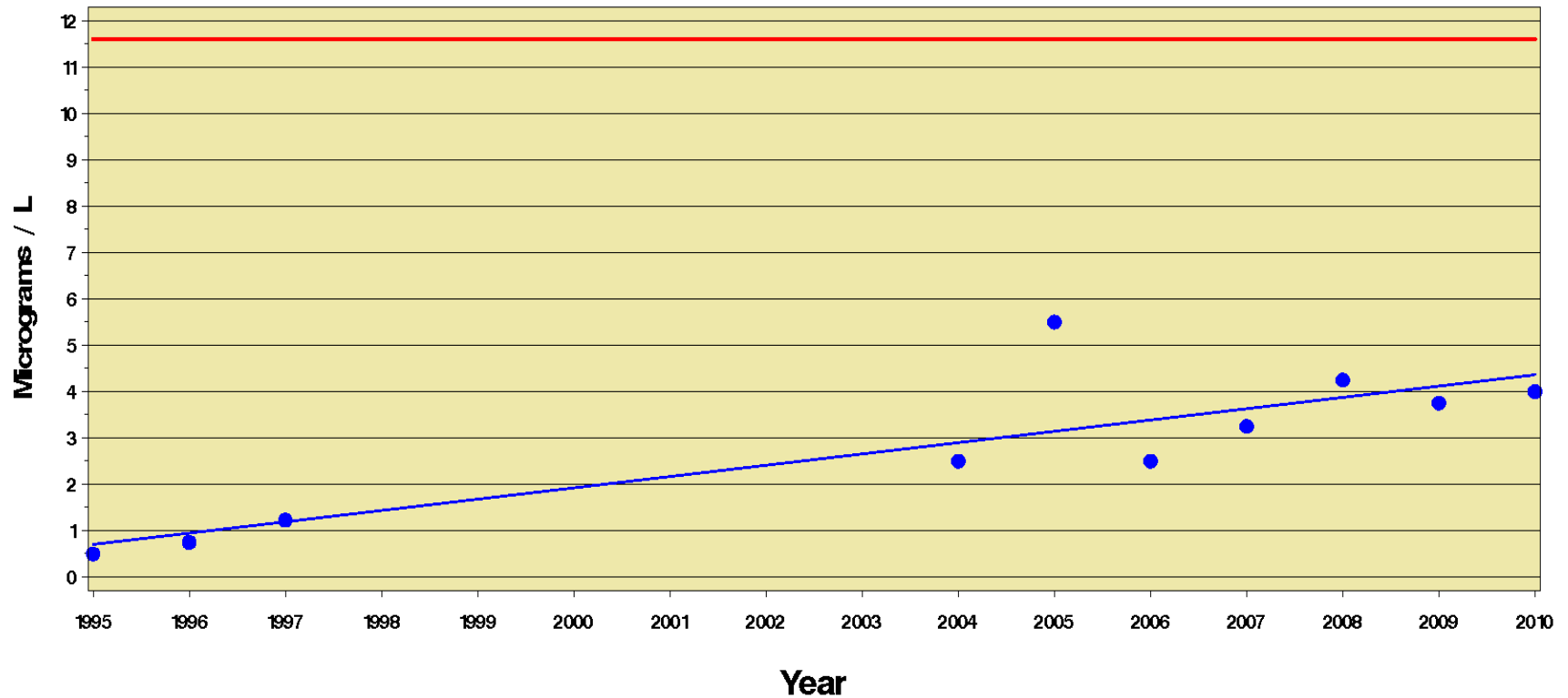
Red line indicates the applicable 2010 Nutrient Screening Level

Chocolate Bay

Monitoring Station: 13346 Segment: 2432 Assessment Unit: 2432_01

Parameter: Chlorophyll a Annual Median

2010 Nutrient Screening Level: 11.6 Micrograms / L



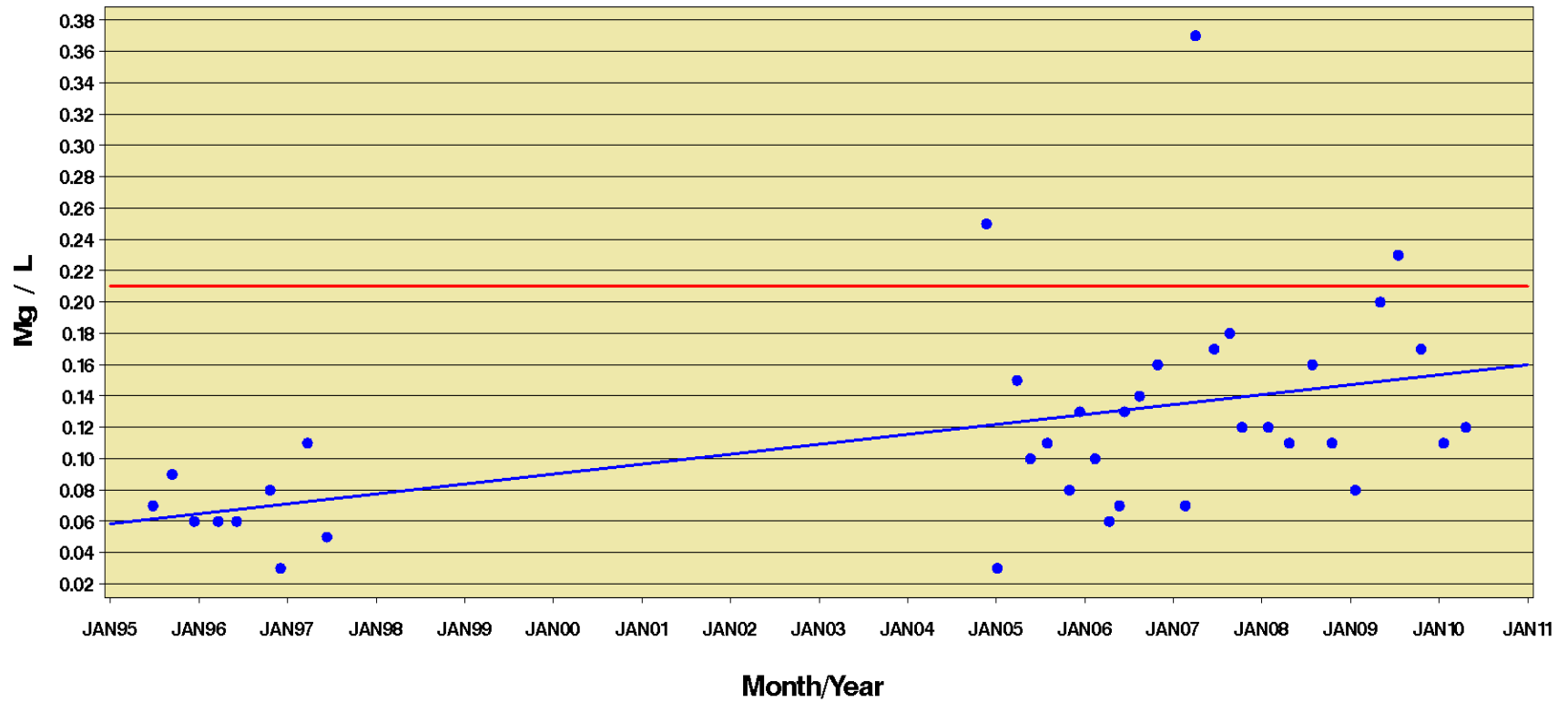
Trends are considered significant if the p-value is < 0.10

Trend is significant at p= 0.0024 R-Square = 0.7035 T-Value = 4.357 Number of Samples= 32

Red line indicates the applicable 2010 Nutrient Screening Level

Chocolate Bay

Station: 13346 Segment: 2432 Parameter: Total Phosphorus
2010 Nutrient Screening Level: 0.21 Mg / L
Assessment Unit: 2432_01



Trends are considered significant if the p-value is < 0.10

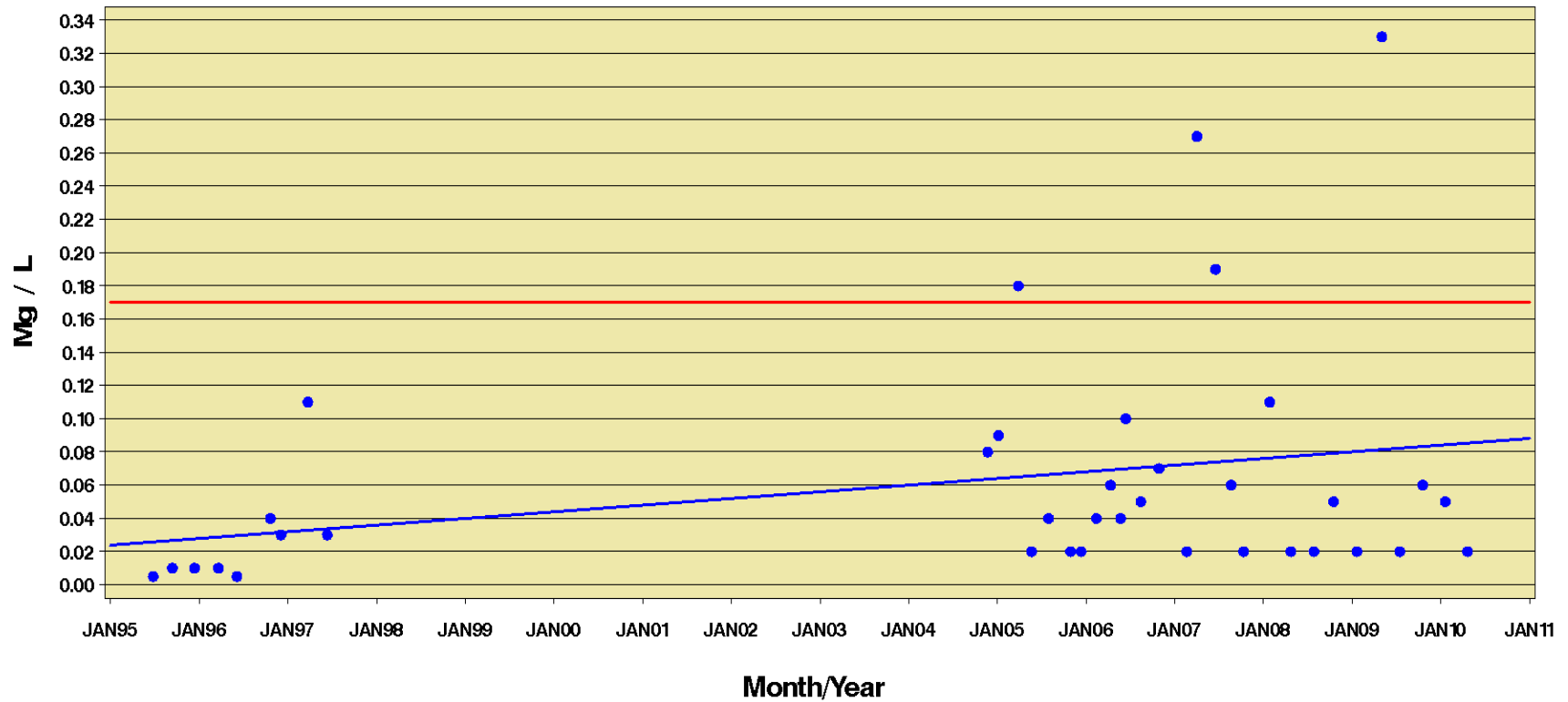
Trend is significant at p=0.0004 R-Square= 0.3081 T-Value= 3.9480 Number of Samples= 37

The blue regression line applies to the plot of actual values ; regression statistics are derived from regression of log-transformed data

Red line indicates the applicable 2010 Nutrient Screening Level

Chocolate Bay

Station: 13346 Segment: 2432 Parameter: Nitrate—N
2010 Nutrient Screening Level: 0.17 Mg / L
Assessment Unit: 2432_01



Trends are considered significant if the p-value is < 0.10

Trend is significant at p= 0.0055 R-Square= 0.2003 T-Value= 2.9610 Number of Samples= 37

The blue regression line applies to the plot of actual values ; regression statistics are derived from regression of log-transformed data

Red line indicates the applicable 2010 Nutrient Screening Level

Chlorophyll-a and Nitrate-Nitrogen Trends

Segment: 2432 Watershed: Chocolate Bay
Station: 13346 Assessment Unit: 2432_01

