

Effect of the Bay County's Military Point Lagoon and Regional Wastewater Treatment Plant Discharge on the Water Quality of East St. Andrews Bay

FL0002631 (IW)
FL0167959 (DW)

FDEP
Environmental Assessment Section
Bureau of Standards and Special Projects

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Background

This report summarizes the water quality and transparency data collected in East St. Andrew's Bay in the vicinity of the Bay County Military Point Lagoon (Facility ID: FL0002631) and Regional Wastewater Treatment Facility's (Facility ID: FL0167959) combined outfall. The facilities utilize a multi-port diffuser pipe located approximately 850 meters west of Military Point to discharge their combined effluent. The average combined flow is 27.7 million gallons per day (MGD), of which Bay County Military Point Lagoon's effluent represents 86.6% (24.0 MGD) and the Regional Wastewater Treatment Facility is 13.4% (3.7 MGD). The average effluent color for Military Point Lagoon is 728 platinum cobalt units (PCU); however, color is not reported for the wastewater treatment facility as it is expected to be very low. The purpose of the study was to determine if the combined discharge causes or contributes to any violations of water quality standards and secondarily, explore the relationship between transparency and color, turbidity or Secchi depth.

Methods

Water quality samples, field measurements, photometer readings, and Secchi depth were taken on November 20, 2007 in the St. Andrew's Bay west of Military Point following procedures described in DEP-SOP 001/01. Samples and measurements were taken at five test sites and two control sites (see Figure 1 for map of the area). The test sites consisted of a station at the discharge "boil" and at four sites west of the discharge. MP Outfall Sites 2, 3, and 4 were located roughly 100, 200, and 400 meters northwest from the boil, respectively, while MP Outfall Site 5 was located two hundred meters southwest from the boil. Since the study took place near the end of an outgoing tide, these test sites were effectively "downstream" of the discharge. Two control sites were established, one situated approximately 1 kilometer north of the discharge and one approximately 2.3 river kilometers east of the discharge, in areas that visually appeared to be relatively unaffected by the effluent. The control sites were used to determine background conditions at the time of the sampling, especially relating to the transparency criterion.

Water quality samples were analyzed for chlorophyll-a (corrected), phaeophytin-a, turbidity and color. Field parameters measured included temperature, pH, dissolved oxygen, specific conductance and salinity. All water quality samples and field measurements were taken at an approximate depth of one foot (0.3 m**)** below the surface**.**

Submarine photometer readings were taken at the five test sites and the two control sites. Measurements were taken at one foot intervals using a Kahlsico model # 268 WA 310 submarine photometer, with simultaneous comparisons of the surface ambient light reading to the depth reading. These readings were then used to determine the depth of the compensation point at each sample site. The compensation point for photosynthetic activity is defined as the depth at which one percent of the light intensity at the surface remains unabsorbed (Rule 62-302.200 (6), F.A.C.). Secchi depth was determined for each site, with additional Secchi depth measurements taken at two locations farther west

of the discharge (referred to as “downstream points 1 and 2”) to help estimate the extent of the area affected by transparency reductions. Sample locations are shown in Figure 1.



Figure 1: Sample locations.

Results and Discussion

Water quality data are presented in Table 1 for each of the sample sites. In general, color, turbidity, and chlorophyll a measurements at the test sites were higher than the control site values, while Secchi depth and transparency were reduced at sites affected by the discharge. Most importantly, the compensation point for photosynthetic activity (transparency) at all five test sites was reduced by 36% to 45% when compared to the average of the control sites. If found to be persistent, these decreases in the compensation point could represent exceedances of Rule 62-302.530 (67), F.A.C, which prohibits reductions greater than 10% from natural background conditions. Additionally, reductions in the compensation point of more than 25% is expected to adversely affect submerged aquatic vegetation (e.g., *Thallassia testudinum*, a keystone species important for fish and wildlife habitat) (Haunert 1991).

Site	Overall Depth (m)	Secchi (m)	Compensation Point Depth (ft)	Chlorophyll-a, Corrected (ug/L)	Turbidity (NTU)	Color (PCU)	Depth (ft)	Temp. (C°)	pH (SU)	D.O. (mg/L)	Cond. (umhos/cm)	Salinity (PPTh)
MP Outfall	9.1	1.7	7	4.3	3.8	40	0.9	19.8	7.9	7.06	49,600	32.6
MP Outfall 2	8.7	2.1	7	5	2.1	20	1.1	19.6	7.98	7.41	50,800	33.4
MP Outfall 3	8.7	2.2	6	4.9	2.3	20	1	19.7	8	8.3	50907	33.5
MP Outfall 4	9.5	2.3	7	6.5	2.2	15	1	19.6	7.99	7.74	50915	33.5
MP Outfall 5	8.1	2.1	7	4.3	2.9	30	1	19.9	8.01	7.53	50708	33.3
MP Control North	5	3	10	3.7	1.8	15	1	18.9	7.96	7.92	50150	32.9
MP Control East	7.9	3.6	12	2.1	1.4	10	1	18.3	7.93	7.93	49213	32.2
Downstream Point 1	11.3	2.8	-	-	-	-	-	-	-	-	-	-
Downstream Point 2	8.3	3.4	-	-	-	-	-	-	-	-	-	-

Table 1. Water quality and field measurements for the sample locations.

A relatively robust correlation between the compensation point and Secchi depth was observed in the data set ($R^2 = 0.864$, see Figure 2 below). Weaker relationships were seen between the compensation point and turbidity ($R^2 = 0.396$, graph not shown) or color ($R^2 = 0.316$, graph not shown).

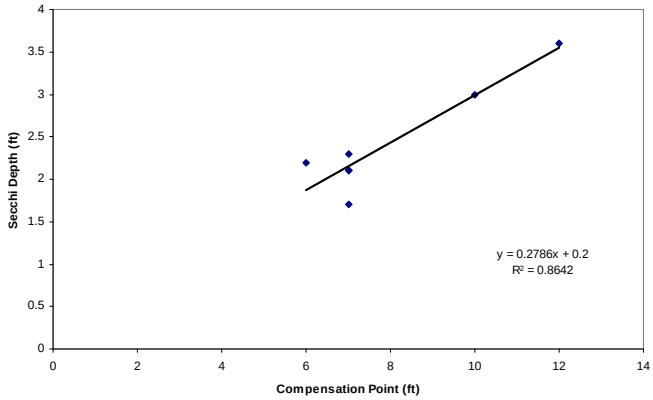


Figure 2. Comparison of Compensation Point to Secchi depth.

Based on Secchi measurements and visual map interpolation, we estimated that the relative area affected by the discharge plume (and associated transparency exceedances) was 2.4 km^2 (Figure 3). During data analysis, a 16% difference in transparency was observed between the control sites (Control East and Control North), which potentially may have been caused by the effluent. However, for this preliminary study, we conservatively estimated that the effects from the discharge were bounded by the northern edge of the shipping channel.

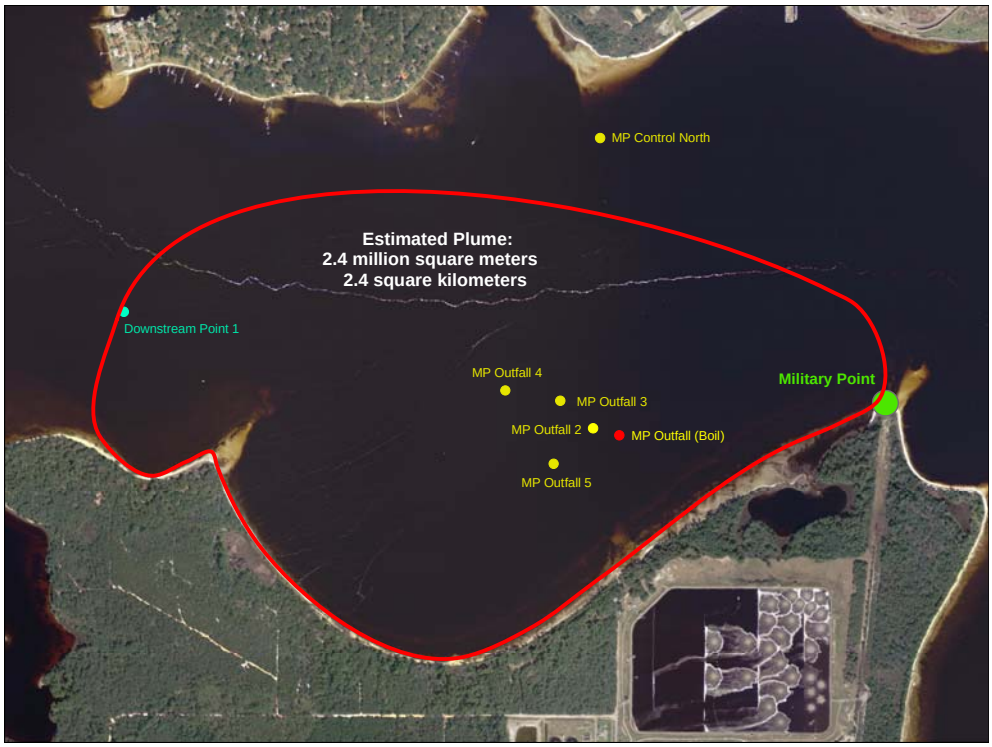


Figure 3. Estimated area of East St. Andrews Bay affected by the discharge and associated transparency exceedances.

Conclusions

The Military Point Regional WWTP discharge was responsible for widespread decreases in transparency, which could be expected to represent exceedances of the transparency criterion, Rule 62-302.530(67), F.A.C., given that the discharge is continuous. It was conservatively estimated that 2.4 km^2 of East St. Andrews Bay was affected by reductions in light penetration. It is expected that this large area of decreased potential photosynthetic activity would adversely affect submerged aquatic vegetation (e.g., *Thallassia testudinum*, a keystone species important for fish and wildlife habitat). Additional data should be collected to better define the spatial and temporal extent of the transparency problems, including documenting the effects on resident submerged aquatic vegetation.

References

Haunert, Dan; Kenworthy, W. Judson (1991) Results and Recommendations of a Workshop convened to Examine the Capability of Water Quality Criteria, Standards and Monitoring Programs to Protect Seagrasses from Deteriorating Water Transparency. South Florida Water Management District.