Publication No. 86-e28

WA-01-0020

ANDREA BEATTY RINIKER
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504-6811 • (206) 753-2353

MEMORANDUM
November 18, 1986

To: Dave Nunnallee

From: Will Kendra WK

Subject: Blaine Industrial Sector Wastewater Discharge to Drayton Harbor

ABSTRACT

Overloads at the newly constructed Blaine wastewater treatment plant in 1982 were attributed to excessive organic, solids, and grease loads contributed by local seafood processors. City officials diverted the untreated processing waste stream to the mouth of Drayton Harbor. Wastewater samples showed high turbidity, solids, oil and grease, biochemical oxygen demand, ammonia, and fecal coliforms. A receiving water survey of Drayton Harbor was precluded by complete blockage of the outfall line. However a literature review indicated that adverse effects of the discharge may include solids accumulation, oxygen depletion, ammonia toxicity, and impairment of aesthetic values. A popular recreational crab fishery at the harbor mouth may be threatened by fecal coliform contamination from the raw sewage component of the waste. Wastewater strength and the high quality of the receiving environment necessitate prevention of future illegal discharges. Simple screening and oil separation may provide sufficient pretreatment to prevent municipal plant overloads.

INTRODUCTION

The city of Blaine, Washington, completed construction of a new wastewater treatment plant (WTP) in 1981-82. Overloads at the WTP in 1982 were attributed to excessive biochemical oxygen demand (BOD), solids, and grease loads contributed by local seafood processors. City officials responded to the overloads by intercepting the offensive untreated waste stream and diverting it to the former WTP outfall for discharge at the mouth of Drayton Harbor. The Northwest Regional Office (NWRO) of the Washington State Department of Ecology (Ecology) directed the city to eliminate the discharge and reroute the waste stream to the sanitary sewer, but the city has not complied. NWRO requested that the Water Quality Investigations Section (WQIS) assess the impacts of the illegal discharge.

Memo to Dave Nunnallee
Blaine Industrial Sector Wastewater Discharge to Drayton Harbor
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The city of Blaine is located in the northwestern corner of Whatcom County and supports a substantial fishing industry. Seafood processing plants are clustered in an industrial sector near the mouth of Drayton Harbor (Figure 1). The processors operate intermittently, subject to supply. A restaurant and several small businesses are also present in the industrial sector. As a result, wastewaters from the sector contain raw sewage as well as seafood processing waste.

Seafood processing wastes originate from the cleaning and packaging of fish and shellfish. For the most part, the industries in Blaine process salmon and bottom fish. Waste products are typically high in proteins, fats, and other organic compounds (Champ, et al., 1981). Water quality parameters affected by the discharge of untreated process effluent are BOD, suspended solids, turbidity, ammonia, and oil and grease. Drayton Harbor is a Class A (excellent) surface water and, as such, characteristic uses include recreation; wildlife habitat; and fish/shellfish spawning, rearing, and harvesting (Ecology, 1982). The objectives of the present survey were: (1) to assess the quality of the waste stream from the industrial sector, and (2) to evaluate the effects of the illegal discharge on Drayton Harbor receiving waters.

METHODS

A reconnaissance survey was conducted during a -2.2 foot tide on June 9, 1986. Industrial sector wastewaters were tagged with Rhodamine WT dye in order to locate the outfall. Receiving water turbidity and fecal coliform samples were collected with a Kemmerer bottle at eight sites (Figure 1). Samples were iced in a cooler and transported within 24 hours to Ecology's Manchester laboratory for analysis as per EPA (1979) and APHA et al. (1985).

An intensive receiving water survey was scheduled for August 5-6, 1986. Sampling was to coincide with the onset of the sockeye fishery season. However, the outfall became plugged in the interim, causing all wastewater to flow to the WTP. Hence, no wastewaters were being discharged to the harbor in early August. Still, the raw waste stream was sampled from a manhole on the morning of August 6 for the following parameters: temperature, pH, specific conductance, salinity, turbidity, solids (4), oil and grease, total and soluble BOD, NO_3-N/NO_2-N (combined form), NH_3-N, total P, and fecal coliform bacteria. Samples were iced and processed as described earlier.

RESULTS AND DISCUSSION

Wastewater from the Blaine industrial sector collects in a wet well near the old municipal WTP site (Figure 1). Upon filling, the contents of the well are ground and pumped to a manhole across the road (Figure 2). Originally, the wastewater joined the sanitary sewer at this point. However, after overloading the new WTP, the wastewater was diverted to a second manhole nearby where it flowed into an old outfall line. As a result, untreated wastes from the industrial sector are discharged directly to the mouth of Drayton Harbor.

Dye studies during the reconnaissance survey failed to reveal the outfall location. To enhance the wastewater flow rates and thus increase the possibility of locating the outfall, the city pumped 1,500 gallons of freshwater into the outfall line. Despite the additional input, later flow calculations indicated that the dye probably did not reach the end of the outfall line during the survey. However, water samples collected across the mouth of the harbor on an incoming tide showed mid-channel, near-bottom turbidity levels to be elevated relative to an upcurrent control site (Table 1). The decreased water clarity may have been caused by the illegal discharge, but increased current velocities through the harbor mouth could also have produced this effect.

Visual inspection of Manhole 2 during the reconnaissance survey showed that the diversion line from Manhole 1 led to the old WTP outfall line (Figure 2). During wet-well pump cycles at Lift Station 1, industrial wastewater backsurged into Manhole 2 from a loose fitting in the outfall line. A three-foot tidewall prevented the backsurge from overflowing into the sanitary sewer via the Lift Station 2 bypass. Upon completion of each pump cycle, the backsurged wastewater would slowly drain back into the old outfall line, suggesting that the line was only partially blocked in June.

Visual inspection of Manhole 2 during a low tide in August showed the backsurge completely overflowing the tidewall during pump cycles. The overflow drained into the sanitary sewer through both the Lift Station 2 bypass and the diversion line conduit (Figure 2); thus the overflow was ultimately treated at the WTP. Rate of tidewall overflow was estimated to be 100 gallons per 10-second cycle, with two minutes separating cycles. Between pump cycles, the level of backsurged wastewater did not subside, indicating that the outfall line was completely blocked. City officials noted that the age and condition of the old outfall are such that the line periodically fills with sediment. In the past, the city has tried to clear the blockage with high-pressure water blasts, but these attempts have met with limited success.

The raw waste stream from the industrial sector was high in turbidity, solids, oil and grease, BOD, ammonia, and fecal coliforms (Table 2). Heffner (1983) reported similar findings in February 1983. Fish parts (e.g., gills) and fecal solids were evident. Analysis of total and soluble BOD revealed that half of the BOD was contributed by particulate solids. The high fecal coliform densities are particularly disturbing because a pier near the outfall supports a popular recreational crab fishery. Comparison of industrial sector wastewater to Blaine WTP influent and typical wastewater from salmon processing plants shows that the former is clearly a stronger waste than either of the latter (Table 2).

EPA (1980) provided an excellent review of available data concerning the discharge of untreated seafood processing wastes to estuarine and marine environments. Much of the remaining discussion was gleaned from that document. Effects of seafood waste disposal on receiving waters are site-specific and a function of wastewater quality and quantity, outfall location and type, and rates of dilution and dispersion. Assimilation of untreated wastewater at the mouth of Drayton Harbor may be adequate when currents are strong (ebb and flood tides), but waste products likely accumulate in the protected confines of the harbor and its tidal flats.

Adverse effects of raw process wastewater discharge may include:

1. Solids accumulations - solids smother benthic animals and spawning grounds; sludge beds, if formed, can produce toxic hydrogen sulfide.

2. High oxygen demand - bacterial decomposition of wastes depletes seawater oxygen levels, possibly to the detriment of aquatic life.

3. Ammonia toxicity - a product of protein catabolism, ammonia is toxic in unionized form and exerts an oxygen demand when nitrified.

4. Surface slicks of oil and grease - slicks foul aquatic animals and marine birds, as well as beaches and shorefront property.

5. Aesthetic impairment - floating solids and noxious odors impair the aesthetic value of surface waters and shorelines, and may attract scavenging fish and birds.

The seafood processing industry argues that treatment of their wastewater is often unnecessary because the waste products are natural in origin and are recycled in a manner not unlike the natural process of death and decay. Further, the industry contends that the enrichment of receiving waters through raw waste discharge may actually enhance populations of aquatic organisms. Scientists agree that "bioenhancement" is a possibility, but many question its desirability, particularly if the increases occur in confined locations or among pollution-tolerant scavenger populations (e.g., bacteria, benthic worms, and scavenger fish). These arguments aside, the fact remains that state law requires "the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington" (RCW 90.48.010).

The strength of Blaine's industrial sector effluent and the high quality of the Drayton Harbor receiving environment necessitate prevention of future illegal discharges. Simple screening and oil separation should provide adequate pretreatment to prevent municipal WTP overloading. Pretreatment costs may be partially offset by shipping recovered wastes to a reduction facility for processing into meal, oil, and fertilizer.

WK:cp

Attachments

cc: Lynn Singleton

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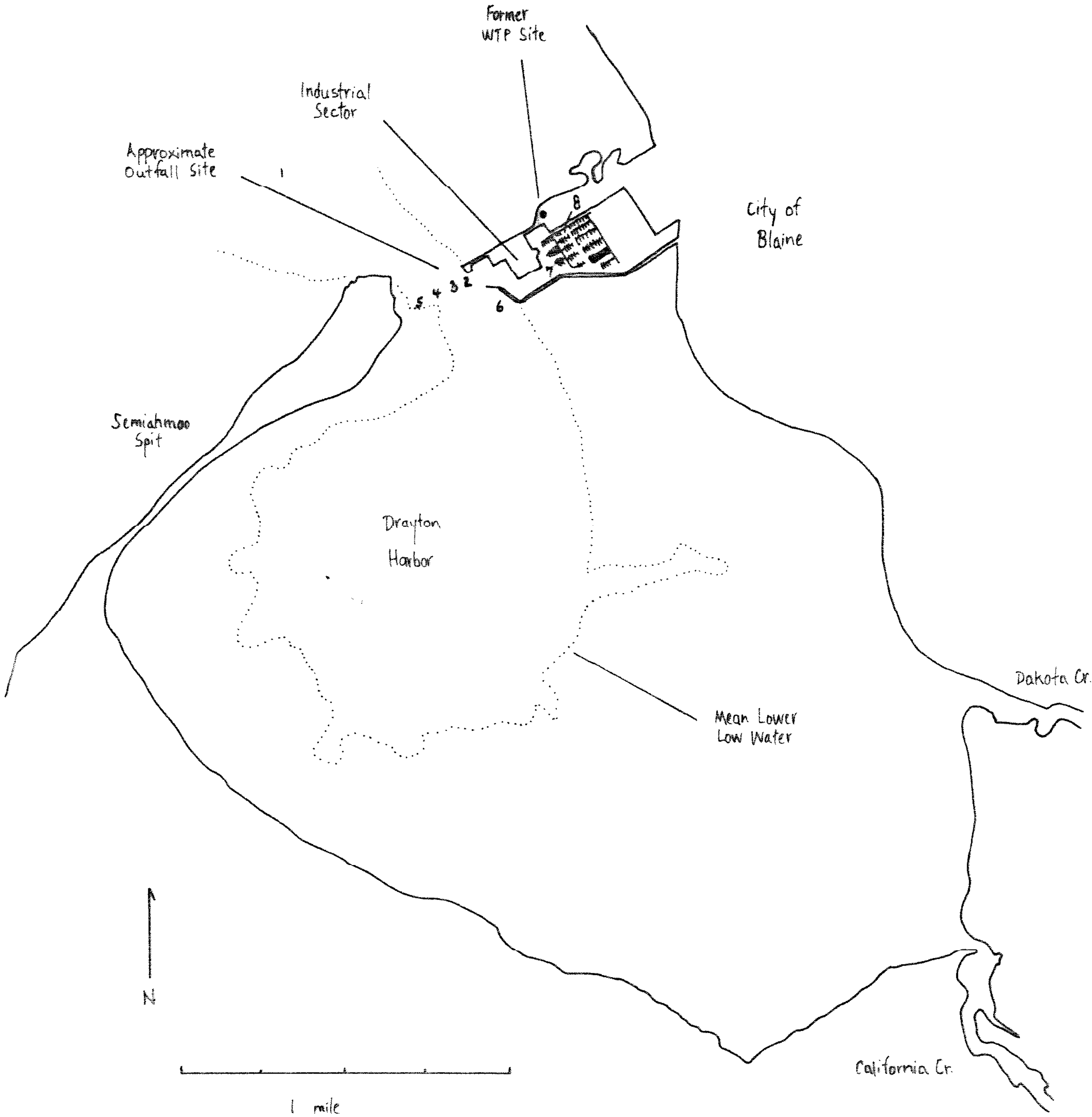

Figure 1. Map of Drayton Harbor showing location of industrial sector and approximate site of illegal discharge. Numerals represent receiving water sampling sites during the reconnaissance survey.

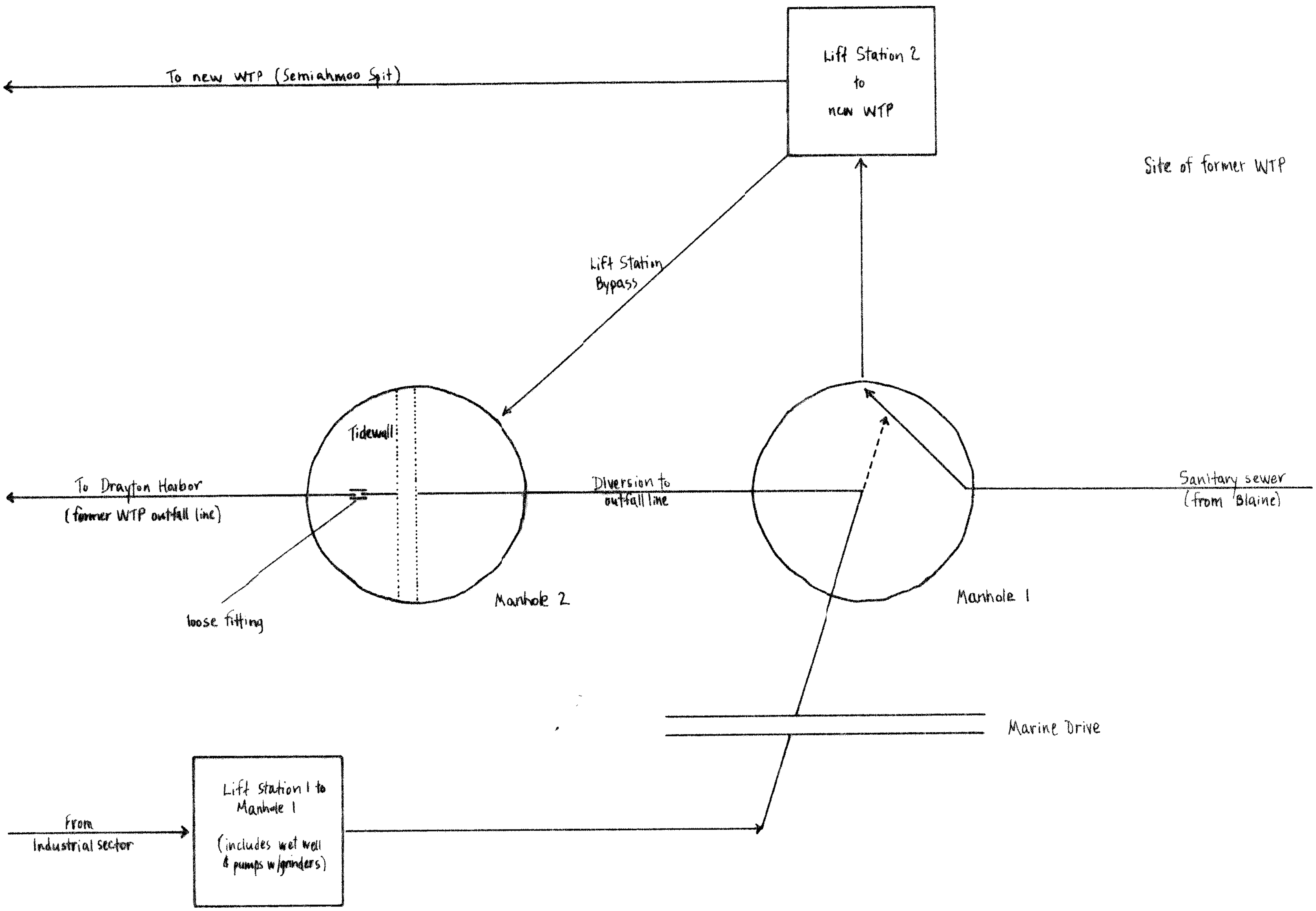

Figure 2. Flow diagram showing diversion of industrial sector wastewater to Drayton Harbor (dashed line indicates original flow path of industrial waste stream). For reference, manholes are located 20 feet apart, while lift stations are about 200 feet apart.

Table 1. Results of limited water quality sampling conducted in Drayton Harbor during a reconnaissance survey on June 9, 1986. Station locations are shown in Figure 1.

Station	Time	Water Depth (m)	Sampling Depth (m)*	Turbidity (NTU)	Fecal Coliform (#/100 mL)
1	1500	6	S	<1	<1
			B	1	--
2	1523	6	S	--	<1
			B	1	--
3	1530	20	S	--	<1
			B	3	--
4	1530	21	S	--	<1
			B	3	--
5	1534	18	S	--	<1
			B	4	--
6	1541	15	S	--	<1
7	1550	5	S	--	36
8	1555	--	S	--	2

*S = Surface; B = 1 meter off bottom.

Table 2. Quality of untreated wastewater from the Blaine industrial sector, Blaine WTP, and four representative salmon processing plants in the Pacific Northwest and Alaska.

Parameter	Blaine Ind. Sector		Blaine WTP	Four Salmon Plants
	August 1986	February 1983[a]	February 1983[a]	August-September 1973[b]
Temperature (^{o}C)	18.5	10.6	10.7	13.0
pH (S.U.)	6.7	7.8	7.2	6.6
Conductivity (umhos/cm)	306	3,350[c]	405	--
Salinity (o/oo)	<3.6	2.1	0.2	--
Turbidity (NTU)	57	140	43	--
Total Solids (mg/L)	1,200	2,600	320	--
Total Non-Volatile Solids (mg/L)	320	1,900	190	--
Total Suspended Solids (mg/L)	420	230	70	194
Total Non-Vol. Susp. Solids (mg/L)	42	28	12	--
Recoverable Oil and Grease (mg/L)	140	199	19	38
Total BOD_5 (mg/L)	1,100	470	80	487
Soluble BOD_5 (mg/L)	560	--	--	--
NO_3-N and NO_2-N (mg/L)	0.19	<0.10	0.38	--
NH_3-N (mg/L)	4.4	5.6	6.5	2.7
Total P (mg/L)	1.3	5.3	1.8	--
Fecal Coliform (#/100 mL)	2.4×10^6	2.2×10^4	8×10^6 [d]	--

[a]From Heffner (1983).

[b]From EPA (1975).

[c]Attributed to seawater intrusion into the outfall line during high tide.

[d]Typical fecal coliform value for raw domestic sewage (from Geldreich, 1978).