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Publication No. 82-e06

WA-15-0110

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DEPARTMENT OF ECOLOGY
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MEMORANDUM
May 19, 1982

To: Dick Cunningham

From: Dale Clark DC

Subject: Purdy Shopping Center Sanitary System/storm Drain Fecal Coliform and Rhodamine WT Dye Study

Introduction

On April 6 and 7, 1982, the Washington Department of Ecology (WDOE), in cooperation with the Washington Department of Social and Health Services (DSHS) and the Pierce County Environmental Health Department (PCEHD), carried out a sanitary survey of the Purdy shopping center located in Purdy on the Kitsap Peninsula (Figure 1). Personnel involved in the survey included Dick Cunningham and Dale Clark (WDOE), Frank Cox (DSHS), and Dick Pedlar and Michael McGirk (PCEHD). The survey was carried out in response to an earlier DSHS survey in which a water sample from the outfall of a storm drain that serves the shopping center exhibited fecal coliform counts of 250,000 org/100 ml (Cox, 1981) (Figure 1).

Purpose

The purpose of this survey was to further document fecal counts in the storm sewer outfall and to determine, if possible, the source and pathway(s) of contamination.

Description of the Survey Area

Purdy shopping center is built on a landfill over a site that was historically used for the disposal of woodwaste (Figure 1). Along the north bank of the shopping center flows Purdy Creek, the second largest contributor of freshwater to the lagoon (Clark and Determan, 1981). Runoff from roofs and the parking area collects in a storm drain located at the southwest corner of the shopping center. This drain discharges through an 18-inch concrete pipe adjacent to the Western Oyster Company (Figure 1). The outfall is located about two feet above the low tide (zero tide) level and water from the bay backs up into the sewer at high

tide. During the low tide cycle, water discharges continuously from the sewer outfall to the bay, indicating that the landfill is charged with saltwater during high tide. The charging of the landfill suggests a potential for leaching and the channeling of the woodwaste and associated material within the fill.

Located under the shopping center complex are two septic systems connected to three discrete drainfields. One septic tank (#2) and drainfield serves the grocery store. A second septic tank (#1) with two drainfields serves the remaining stores of the complex. Observation of the placement of manholes and discussion with shopping center store operators and PCEHD personnel indicate that the septic tanks and two associated drainfields are approximately 30 years old. A mound-type drainfield, associated with septic system #1, was installed in 1975. It acts as an auxiliary drainfield for septic system #1 during periods of extreme high tide and wet weather. The mound-type drainfield with a sump pump is designed to be used whenever the water in the original septic system drainfield #1 exceeds a specified level.

Methods

The major portion of the survey was conducted over a two-day period and was designed to determine actual and potential bacterial contamination problems by collecting bacterial samples and Rhodamine dye samples, respectively. Sampling periods were scheduled during low tide cycles that totally exposed the storm sewer outfall. After initial sampling and dye addition to the septic tank system #2, followup sampling over the next ten days was carried out by PCEHD to aid in assessing long-range dye and fecal coliform concentrations in the storm sewer. The following is a brief description of sampling procedures for the first two days and the remainder of the survey:

Day 1 (April 6, 1982)

Sampling occurred over a two-hour period at 1/2-hour intervals. Grab samples for fecal coliforms, salinity, and temperature were taken. First-day sampling was designed to provide data to aid in assessment of dye study findings scheduled for day two. A grab sample was collected from the storm sewer outfall to provide a background florescence value for the scheduled dye study.

Memo to Dick Cunningham
Purdy Shopping Center Sanitary System/storm Drain Fecal Coliform and Rhodamine WT Dye Study
May 19, 1982

Day 2 (April 7, 1982)

Sampling occurred over a two-hour period after 1000 ml of dye was introduced into the second chamber of septic system #2 (Figure 1). Grab samples for dye concentration, fecal coliforms, salinity, temperature, and nutrients were taken. Flow measurements of the storm sewer were determined using a five-gallon bucket and a stop-watch to measure gallons per minute (gpm).

Day 3 to Day 9 (April 13, 1982)

The Pierce County Environmental Health Department continued to collect fecal coliform and dye samples and temperature information during the next six days. (Refer to Table 1 for a brief discussion of parametric coverage and rationale for measuring each during the survey.)

Results

Table 2 summarizes data collected during the survey.

Day 1 (April 6, 1982)

Fecal coliform samples taken from the outfall over a two-hour period consistently show values less than 1 org/100 ml. Salinities were comparable to salinties historically found in the lagoon (Clark and Determan, 1981) with a mean value of 24.2 parts per thousand.

Thus, all or almost all flow appears to be surcharged saltwater and not a freshwater source.

Day 2 (April 7, 1982)

Fecal coliform counts taken from the outfall over a two-hour period ranged from less than 1 to 3,400 org/100 ml. Salinities were consistent with salinities found in the lagoon with a mean value of 24.0. Temperature remained constant throughout the sampling period at 6.75°C. Dye studies indicate a strong positive correlation between florometer readings and fecal coliform counts (Table 2).

Measurements taken during the survey indicate that approximately six gpm flow occurred from the storm drain during a period of no precipitation (Table 1). This flow remained constant during the entire sampling period, right up to the time that advancing tides covered the discharge.

Memo to Dick Cunningham
Purdy Shopping Center Sanitary System/storm Drain Fecal Coliform and Rhodamine WT Dye Study
May 19, 1982

Discussion

On April 6, 1982 during a visual survey of septic systems #1 and #2, it was apparent that system #2 displayed signs of possible drainfield failure. Upon removal of three six-inch manhole covers, it was evident that material in the system had risen to the top of the ports at some recent time. Upon request, the employees of the grocery store turned on several taps and flushed a connecting toilet which resulted in water in two of the manholes rising to within two inches of the cover.

Due to the proximity of system #2 to the storm drain (Figure 1), it was decided to test the system the following day using Rhodamine WT dye.

On April 7, 1982, dye was added to the system at the manhole farthest from the Purdy shopping complex and water taps were turned on at my request. At approximately 1120 hours, water was observed to be discharging out of one of the manholes (covers in place) onto the parking lot and flowing toward the storm drain collector. Water from the septic system was observed entering the storm drain collector at 1135 hours and this continued for several minutes. The overflow was documented by photographs and observed by personnel from WDOE, DSHS, PCEHD, and grocery store employees.

Grab sampling for fecal coliforms began prior to the overflow episode at the storm sewer outfall and continued throughout the episode. Water in the storm drain took on a definite florescent pink hue from the dye during a portion of the sampling period. Fecal coliform counts rose from less than one to 3,400 org/100 ml during this period and then declined finally reaching 2 org/100 ml at 1330 hours, approximately two hours after the overflow. The highest count occurred simultaneously with the highest concentration of Rhodamine dye (Table 2).

No rain fell during sampling, therefore only water from the septic system that could travel the 20 feet over dry roadway to the storm drain collector ever entered the receiving water. During a period of rainfall, overflow episodes could result in a higher percentage of sewage contact since the storm water would carry the effluent along with it. The effluent follows the parking lot slope directly to the storm drain.

Leaching from the septic system drainfield #2 into the surrounding landfill does not appear to be a significant pathway for fecal contamination of the storm sewer. Background levels remained at close to or less than 1 fecal coliform per 100 ml prior to and following the overflow event. The overflow suggests that the drainfield lacks sufficient carrying capacity for the septic tank as documented by the overflow and past high fecal coliform counts collected at the storm sewer outfall (Cox, 1981).

Memo to Dick Cunningham
Purdy Shopping Center Sanitary System/storm Drain Fecal Coliform and
Rhodamine WT Dye Study
May 19, 1982

On April 13, 1982 a fecal coliform sample collected by the PCEHD produced values above 200 org/100 ml (Table 2 [TNTC]). This value suggests that another overflow event may have occurred shortly before sampling. Rainfall had occurred the night previous to April 14 which would account for the exceptionally high counts.

Recommendations

1. Empty septic tanks and clean or replace drainfield so that overflows do not occur.

2. Continue to monitor system by local health authorities to assure that contamination does not occur.

DC:cp

Attachments

REFERENCES

Cox, F., 1982. Department of Social and Health Services, personal communication.

Clark, D. and T.A. Determan, 1980. Burley Lagoon Water Quality Survey, WDOE intra-agency memorandum.

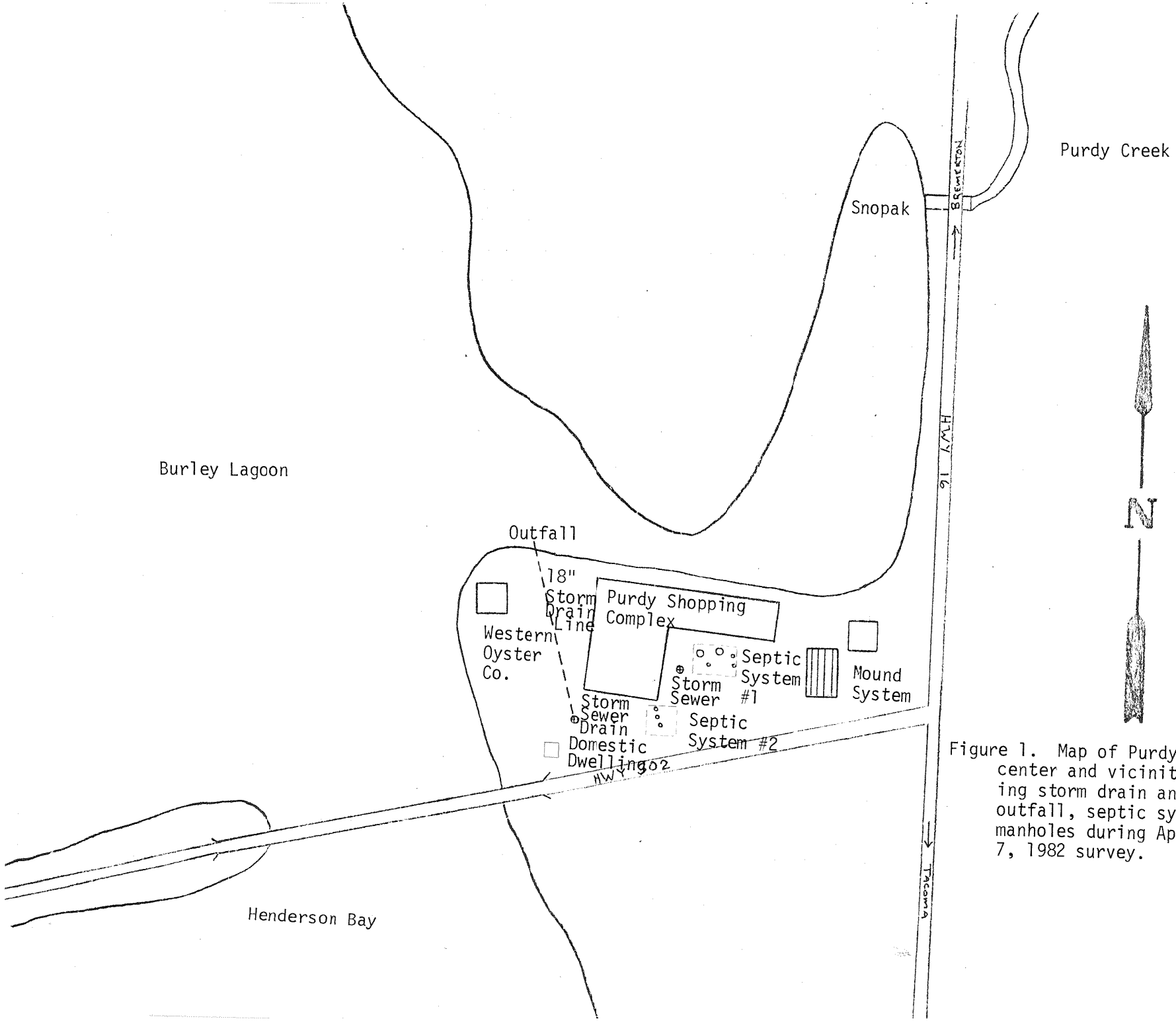

Figure 1. Map of Purdy shopping center and vicinity displaying storm drain and associated outfall, septic systems, and manholes during April 6 ard 7, 1982 survey.

Table 1. Parametric coverage and rationale for measuring each during Purdy Shopping Center Sanitary System/storm drain fecal coliform and Rhodamine WT dye study, April 6 and 7, 1982.

Parameter	Location	Method	Reason for Sampling	Water Quality Standard (Class A)
Temperature (°C)	Storm drain outfall	Thermometer	Used with salinity to determine water density; temperature also affects gas solubility and rates of biological processes.	Not to exceed 16°C due to human activities. (t = 12/[T-2])
Salinity (o/oo)	Storm drain outfall	Beckman laboratory induction salinometer	Used to trace passage of fresh-water through marine waters, mixing rates, and density distribution in water column.	No standard.
Dye (ug/L)	Storm drain outfall	Turner florometer	Used as a water movement tracer and gauge of dilution and mixing processes downstream from discharge point.	N.A.
Fecal Coliform (FC/100 ml)	Storm drain outfall	APHA (1976); EPA (1979)	Indicator of presence of sewage wastes from humans and other animals.	Not to exceed 14 FC per 100 ml; not more than 10% of samples to exceed 43 FC/100 ml.

Table 2. Data table for samples collected at the Purdy shopping complex storm drain outfall, Purdy, Washington, April 6, 7, 8, 12, and 13, 1982.

Date	Time	Dye Concentration (Absorbance Units)	Fecal Coliform (org/100 ml)	Salinity (o/oo)	Temperature (°C)	Nutrients (mg/L)	Flow (GPM)	Comments
4/06		--	Less than 1	24.2	--	--		
		--	Less than 1	22.4	--	--		
		--	Less than 1	--	--	--		
		--	Less than 1	--	--	--		
4/07	1035	0	Less than 1	--	6.75	0.10 ammonia un-ionized	6	
	1140	2	--	--	--		--	
	1143	59	290 est.	--	6.75	0.10 ammonia un-ionized	6	
	1149	85	3,400	24.1	6.75	--	6	
	1220	1	5 est.	24.0	6.75	--	6	
	1330	0	2 est.	23.7	6.75	--	6	
4/08	0940	0	1	--	--	--	--	
4/12	1000	0	5	--	--	--	--	
4/13	1015	0	TNTC[1/]	--	--	--	--	Followed a rain event.

[1/] Upper limit of test is 200 fecal coliform per 100 ml.