

ANDREA BEATTY RINIKER
Director



STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504-6811 • (206) 753-2353

M E M O R A N D U M

December 4, 1986

To: Dave Nunnallee
From: Will Kendra *WK*
Subject: Elevated Levels of Cadmium in Dakota Creek, Whatcom County

As you requested, the Water Quality Investigations Section of Ecology sampled the surface waters and sediments of Dakota Creek for cadmium on August 6, 1986. Sampling occurred at the mouth of Dakota Creek, near the property of the Drayton Harbor Shipyard Company (Figure 1). A grab sample of water was collected from the creek surface for cadmium and hardness analysis at 1015 hours during a falling tide (height approximately 1-2 feet). A mid-intertidal sediment sample was collected for cadmium analysis afterward. The sample was a composite of six spoons of sediment taken from the upper 2 cm of exposed tideflat. Samples were iced and shipped to Ecology's Manchester laboratory for analysis as per EPA (1979), EPA (1985), and APHA, *et al.* (1985). Potential salinity interferences were accounted for through use of an ammonium phosphate matrix modifier (S. Twiss, Ecology, personal communication).

Dakota Creek water had a total cadmium concentration of 12.1 ug/L. EPA (1986) criteria specify that:

"saltwater aquatic organisms and their uses should not be affected unacceptably if the 4-day average concentration of cadmium does not exceed 9.3 ug/L more than once every 3 years on the average and if the 1-hour average concentration does not exceed 43 ug/L more than once every 3 years on the average."

Because the acute toxicity of cadmium generally increases as salinity decreases, the EPA criteria may be underprotective in the brackish waters at the mouth of Dakota Creek. A grab sample collected last winter at the same site had a cadmium level of 25 ug/L (S. Cook, Freshwater Assessments, personal communication). Thus, although the

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data are limited, it appears that cadmium concentrations in Dakota Creek may exceed EPA standards.

Saltwater criteria were applied in the foregoing analysis because water hardness at the time of sample collection was 3,800 mg/L as CaCO_3 , which suggests the presence of seawater. However, it seems likely that the cadmium was introduced from an upstream source. If the sample had been collected farther upstream, a more representative hardness value of 50 mg/L would probably have been obtained. In this scenario, the freshwater criteria would apply (EPA, 1986):

"freshwater aquatic organisms and their uses should not be affected unacceptably if the 4-day average concentration (in ug/L) of cadmium does not exceed the numerical value given by $e^{(0.7852[\ln(\text{hardness})]-3.490)}$ more than once every 3 years on the average and if the one-hour average concentration (in ug/L) does not exceed the numerical value given by $e^{(1.128[\ln(\text{hardness})]-3.828)}$ more than once every 3 years on the average."

At a hardness of 50 mg/L as CaCO_3 , the chronic (4-day) and acute (1-hour) cadmium criteria are 0.66 ug/L and 1.8 ug/L, respectively. The 12.1 ug/L detected in the present survey clearly exceeds these standards.

Intertidal sediments at the mouth of Dakota Creek had a total cadmium content of 400 ug/Kg dry weight. For reference, areas of Puget Sound removed from known sources of contamination had a median sediment cadmium content of 700 ug/Kg dry weight (Tetra Tech, 1986). No state or federal criteria for cadmium in sediments have been promulgated. However, Tetra Tech (1986) used chemical and biological data from several Puget Sound investigations to develop an Apparent Effect Threshold (AET) for cadmium in marine sediments. An AET is the concentration above which significant biological effects are predicted to occur. For cadmium in sediments, the AET for benthic infauna abundance is 5,800 ug/Kg dry weight. AETs for amphipod, oyster larvae, and *Microtox* toxicity ranged from 6,700 to 9,600 ug/Kg dry weight. Again, the data are too limited to draw firm conclusions, but it appears that cadmium levels in Dakota Creek waters pose a greater ecological threat than cadmium levels in adjacent intertidal sediments.

Cadmium is used in the manufacture of paints, pigments, and plastics, as well as in electroplating operations (EPA, 1980). Land use in the Dakota Creek basin is largely devoted to dairy production, thus a

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specific source of cadmium is not readily discernible. Our findings indicate the need for further study of Dakota Creek to determine the source and extent of cadmium contamination in the watershed. If the source is continuous, survey objectives could be met by collecting water samples at various locations along the mainstem and tributaries. However, concurrent sediment sampling at the same sites is recommended in the event that cadmium inputs to the system are intermittent. If survey results demonstrate that cadmium levels in the creek are of major concern, sampling of commercially grown oysters in Drayton Harbor will be necessary because shellfish can accumulate cadmium in their tissues to concentrations potentially harmful to humans (EPA, 1980).

WK:cp

Attachments

cc: John Glynn
Lynn Singleton
Bill Yake
Susan Cook

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REFERENCES

- APHA, et al. (American Public Health Association, American Water Works Association, and Water Pollution Control Federation), 1985. Standard Methods for the Examination of Water and Wastewater. 16th Ed., Washington, D.C. 1268 pp.
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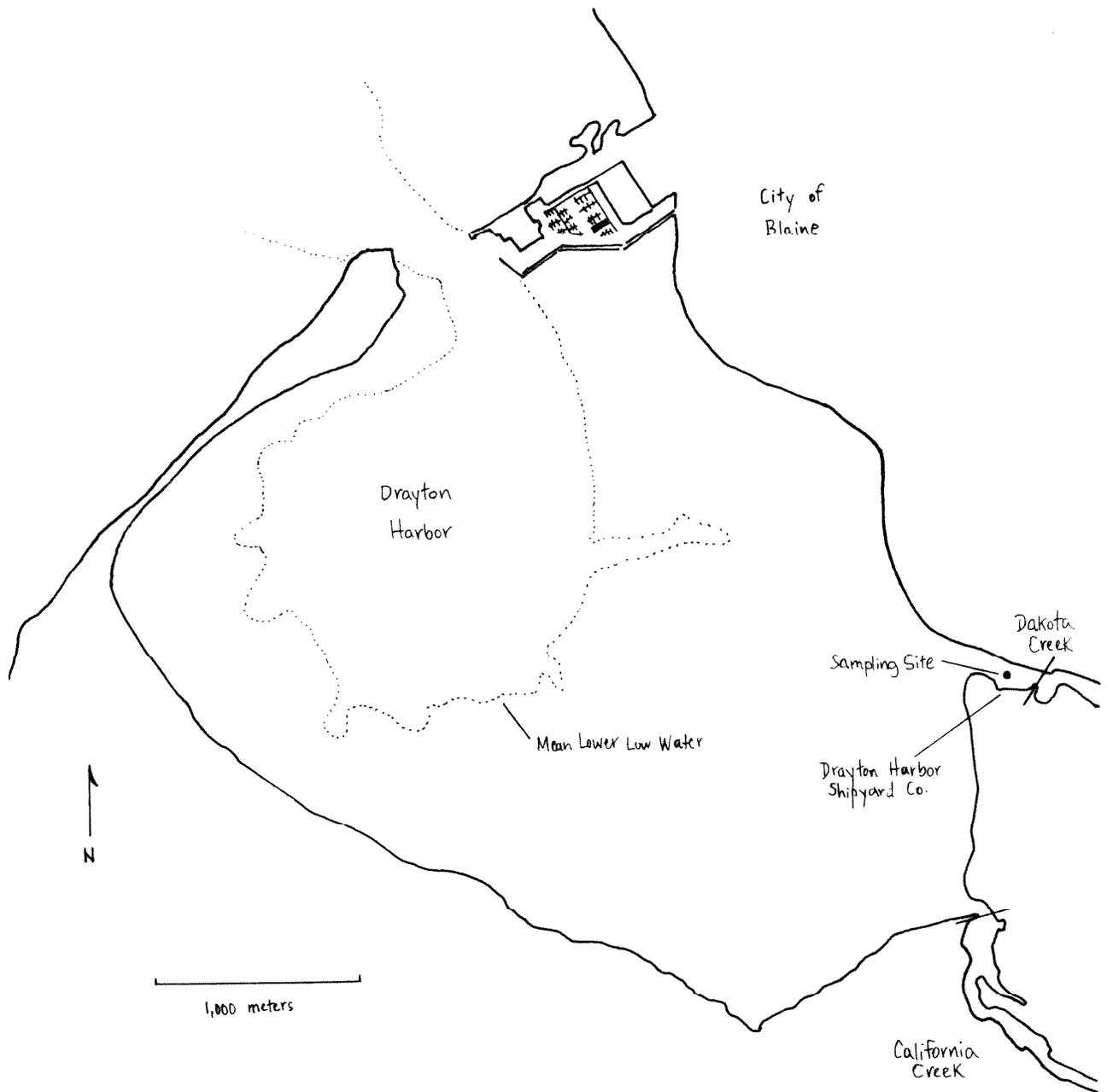


Figure 1. Map of Drayton Harbor showing location of cadmium sampling site at mouth of Dakota Creek.