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VIMS statement Portsmouth refinery

Virginia Institute of Marine Science

VIMS Statement

Portsmouth Refinery

With regard to the Proposed Final Environmental Impact Statement issued by the U. S. Army Corps for the Portsmouth Refinery and Marine Terminal, we shall comment on four subject areas which the statement discusses. These are 1) the potential impact of new pollutant loadings in the lower James River, 2) the potential impact of oil spills, 3) transportation risks and 4) the effects of dredging for the marine terminal. In addition, comments are included which address: 1) interagency communications regarding oil spills in the Bay region, 2) safety precautions taken during the transportation of oil by vessels in Bay waters, and 3) concern for the continuing health of the lower James.

1) Potential Impact of New Pollutant Loadings on the Lower James River

Before assessing the potential impact of new pollutant loadings in the lower James, it must be pointed out that populations of several aquatic organisms are declining in this system, whereas they are not in neighboring rivers. Although we do not know the specific causes of these declines, we do know that organisms affected have widely differing life histories and physiologies. Specific resources showing declines in the James are the blue crab, oyster and certain fishes. Documentation of these declines is presented in the appendix.

In light of this situation, some investigators are of the opinion that the James has reached and/or surpassed its assimilative capacity for wastes and believe that any further additions could cause a percipitous decline in remaining populations or impact other populations which now appear stable.

The seed oyster beds of the James River are the basis of the Virginia oyster industry. These seed beds supply 75% or more of the seed which is transplanted to growing areas in other sections of the state. Furthermore they must be considered to be irreplaceable. The Marine Resources Commission and VIMS acting jointly have attempted to establish seed beds at other sites but have been less than totally successful. Diminution of productivity of the James River seed beds would not be the usual case in which loss to the seafood industry would be approximately proportional to the geographic area involved. Because the seed beds are unique and are the basis of an entire industry, their disruption would spell disaster to a significant Virginia industry.

Regardless of the above general observations, we must attempt to evaluate the specific problem at hand to the best of our ability. In order to do this for any effluent, we must:

1) be able to predict its concentration in the environment
2) know the cause-effect relationship for the substance on the organisms of interest.

VIMS recently completed a study of the proposed Pig Point Sewage Treatment Plant site which included dye tracer studies at both ebb and flood tides in the James River. From these studies predictions of concentrations of the different effluent constituents in the river can be made--if the decay rates for the various substances of interest are known. We know the loss or decay rates for some important factors such as coliform bacteria, BOD, residual chlorine and the like, and hence, can make predictions of their concentrations in the river at points distant from the outfall where they are released. Unfortunately, the decay rates are not known for other equally important items such as pesticides, many nutrients, PCB's and oil.

We can also evaluate the effects of such releases on the biota of the river if the cause-effect relationships for the substances in question and the animal of interest are known. The ability to predict effects is often limited, however, by the lack of cause-effect data. Such was the case, until recently, for residual chlorine and marine animals and plants.

Figures 1 and 2 show the concentrations of conservative substances, i.e. those that do not decay, in the river at equilibrium for both high and low slack water. These would result from a 16 mgd outfall located at the release site shown in the figures. To transform these data into meaningful terms, we must then select a concentration level in the effluent and a decay rate (if applicable).

The decay rate (k) for residual chlorine is 0.05 $hr.^{-1}$ ($\ln C = kt + \ln Co$) and dye distributions with this rate are shown in Figures 3 and 4. We then applied a loading level to the computations (in this case 2 ppm residual chlorine) and the distributions of residual chlorine shown in Figures 5 and 6 were predicted. Since we know the toxic levels of chlorine to several marine animals, we can now evaluate the impact of such a discharge. In this case, we would predict a significant acute impact on the oyster and clam larvae from this discharge, since field data indicate that a significant number of larval oysters move upstream with the tide through this zone where toxic levels of chlorine would be encountered.

The same procedure can be followed for any substance on which we have acute or chronic toxicity data. Since we do not know the specific substances which will be released from the refinery via the proposed Pig Point Waste Treatment Plant discharge, our estimates of both concentrations and effects are limited. They may not reflect what will happen in the river. It is our professional opinion however that they are reliable.

According to data supplied in the U. S. Army Corps impact statement, an estimated maximum loading of 125 lbs. per day of oil and grease would be allowed by EPA regulations, while the refinery estimates a maximum load of 40 lbs. per day for its facility. Based on these loadings to the treatment plant, if we assume 20% of the hydrocarbons to be nondegradable and chlorinated as they leave the plant, we can estimate their concentrations in the river by multiplying the predictions in Figures 1 and 2, which are based on a loading of 800 lbs., by 0.03 (for a 125 lbs. loading) and 0.01 (for a 40 lbs. loading).

Our models indicate that these loadings could result in equilibrium instream concentrations of between 0.2 and 0.1 ppb over a significant portion of the lower river at slack before ebb for the 125 lbs. loading and between 0.07 and 0.035 ppb for the 40 lbs. loading.

Predictions from this point on, however, become very tenuous since we do not know the identity of these potentially toxic chlorinated products. Recent studies using domestic waste water effluents have identified as many as 30 different chlorinated compounds, the majority being aromatic derivatives (Glaze and Henderson, 1975). In the above study which identified these thirty compounds, dechlorination was practiced prior to extraction of the water samples for compound identification and hence indicates the potential resistance of these substances to in-plant dechlorination.

At present, predictions as to the acute or chronic toxicity of the "potentially chlorinated products" whose concentrations were estimated previously can only be made by extrapolations from similar products which have been assayed. On an acute basis, only a few of the very toxic chlorinated hydrocarbon insecticides and residual chlorine approach toxic levels in the low part per billion range for marine organisms. We would therefore not expect acutely toxic conditions to develop in the river from this discharge alone, because the predicted maximum levels are below the acutely toxic levels for most substances. However, this discharge is not the only one impacting the lower James at this point, nor would the refinery effluent alone be responsible for all of the potentially toxic releases from the treatment plant.

Certainly there will be wastes from industries such as Virginia Chemical and others, as well as residential areas, which contain compounds which could also interact. For example, the HRSDC Boat Harbor Plant effluent is released directly into the zone of the influence shown by the Institute's dye studies for the Pig Point Plant. We would therefore expect the potentially toxic compounds from the refinery effluent to add an additional stress to the system. Potential for synergistic (augmenting interactions) effects also exists, especially when considering the overlapping nature of various discharges in the river.

It should be noted that the discussion presented in the impact statement on pages 9-73 & 74 dealing with low molecular weight chlorinated hydrocarbons is somewhat misleading since the majority of compounds likely to be formed would be aromatic in nature (Glaze and Henderson, 1975), whereas those tested to date are not aromatic. In addition, these authors point out that higher molecular weight compounds are formed but have not been sufficiently studied because of the analytical schemes usually employed.

Unfortunately, we cannot be more specific as to the degree of this additional stress, since as previously stated, specific data on the identity or toxicity of the compounds are not provided or available. However, we have reason to believe that present conditions, particularly with regard to chlorine, are already critical in the Newport News Point area.

In addition to the acute toxicity problems discussed above, the bioaccumulation (uptake and accumulation by the plants and animals in the system) of chlorinated hydrocarbons originating from the plant effluent poses another possible health hazard. The magnitude of this hazard is again difficult to assess since we do not know the identity or public health hazard of the compounds involved. We must point out, however, that recent information regarding the types of products produced when chlorinating both drinking water and waste waters leads one to believe that a real cause for concern exists.

Available data indicate that significant biomagnification of chlorinated hydrocarbons can result from levels of exposure in the low part per billion and even part per trillion range.

In light of the unknowns regarding both the toxicity and potential bioaccumulation of chlorinated hydrocarbons, it is the Institute's opinion that the refinery wastes should be treated separately from the domestic wastes since the latter must be subjected to bacterial disinfection by chlorination under health department rules. Additionally, location of the refinery treatment plant discharge so as to reduce or eliminate its chances of reaching the oyster seed beds would be desirable.

If the refinery is allowed to discharge into the sewage system that is chlorinated, which we strongly recommend against in the paragraph above, studies should be required to determine whether chlorinated hydrocarbons from its operation are accumulating in oysters. Should these continuing studies find accumulation to be occurring with potentially hazardous substances, the refinery should be required to remove them before releasing their effluent to the sewage treatment plant.

The potential chronic (longterm) effects of oil and/or refinery effluents in the marine environment are simply not known. Longterm or chronic effects include such possibilities as increased susceptibility to disease or other debility, reduced reproductive capacity, etc. Therefore we have no basis upon which to predict long term effects from this or any other similar facility. At present, studies are underway at VIMS and elsewhere which are directed toward determining chronic effects. However, it will be some time before the results are available.

2) <u>The Potential Impact of Oil Spills</u>

Considering the effects of oil spills on marine life, we can, from a fairly extensive literature, make the following statements:

I. Acute Toxicity

1) Crude oils are much less toxic than refined products

2) Damage from spills of any nature is far greater in the area affected if:

   a) the oil is released into a confined area; and

   b) the oil is physically driven into the sediments by the action of winds or tides; and

   c) refined oils or residuals are released.

3) Recovery of marine animal communities from oil spills may take from months to many years depending on the above factors plus, of course, the magnitude of the spill.

4) Larval stages of fish and invertebrates generally are more sensitive to soluble oils than are adults.

5) Acutely toxic levels of oil to marine invertebrates from Chesapeake Bay have been found when concentrations are as low as 0.4 ppm (Highland, 1974).

II. Bioactivity

1) Shellfish do not metabolize oils, but eliminate them in much the same form as taken in.

2) Depuration is generally rapid after the source of contamination has been removed, provided death has not occurred.

3) Finfishes and crustaceans both metabolize and depurate petroleum hydrocarbons

4) Carcinogens such as benz(a) pyrene are found in petroleum products and have been found to be concentrated by marine organisms.

Oil spilled in the terminal area but outside the containment booms could leave the Elizabeth River on an ebbing tide and on the next flood enter the Hampton Roads. Winds from the south would tend to push oil out of the Elizabeth River. Two recent spills have in fact reached the northern shore of Hampton Roads from the general area of the proposed marine terminal. In fact one of these recent spills resulted in heavy contamination of the Hampton River which is all the way across Hampton Roads from the Elizabeth where it occurred. Finally, the containment and cleanup of oil spilled in the marine environment is a much more complex and risky operation than the EIS leads one to believe. It is our opinion that oil spill cleanup and containment equipment is not currently available for ready use in Hampton Roads which will effectively function in anything but the mildest of weather. Such equipment, along with an effective operating organization, should be brought into the lower Bay area before oil traffic or refinery operations are expanded anywhere.

No matter what other changes or restrictions are imposed on the proposed refinery (should it be permitted) we believe that a monitoring program should be required, by the State Water Control Board, which identifies and quantifies the petroleum hydrocarbons in the refinery effluent. In addition, if the refinery discharges into the HRSDC proposed Pig Point plant, the dechlorinated effluent from the plant should be studied to determine levels of chlorinated products potentially toxic to marine life. Background hydrocarbon levels in oysters from the area should be established prior to operation of the plant and monitored after its operation begins. With this information, additional bioassay tests can be made which will enable a specific assessment of the toxic impact of the effluent. If this information discloses detrimental impacts due to the effluent, steps should be taken to further limit the toxic portion of the discharge until innocuous levels are reached.

Communications between the various state and federal agencies involved in oil spill investigations and cleanup must be improved. All too often, information flows only one way, i.e. to the State Water Control Board or Coast Guard. While these agencies have the primary responsibility, others such as VIMS, Virginia Marine Resources Commission and State Health Department need to be informed of potential problems so that appropriate actions or studies can begin immediately. The Institute has been concerned about this situation for some time and believes that appropriate arrangements to improve the flow of information should be made as soon as possible.

The oil spill which occurred on Feb. 1, in Chesapeake

Bay showed several problems in the present system for handling spills in the Bay. Of most concern is the apparent lack of control of the safety precautions which barges must take when transporting oil on the Bay. These procedures should be reviewed for adequacy and in addition the surveillance system to assure compliance should be carefully reviewed.

Another area in which responsibilities are not clear relates to the cleanup of wildlife fouled by oil. Although the actual cleanup of birds may remain a volunteer effort, some agency should oversee the effort and be responsible for assuring that the most up-to-date techniques are utilized. Difficulties which developed after the recent massive Chesapeake Bay oil spill indicate how badly an improved system is needed.

3) Transportation Risks

Although the EIS attempts to quantify the probability of vessel accidents resulting in the release of oil, qualitative differences in the nature of petroleum transportation in the lower Bay make these estimates irrelevant. First, there are no estimates for spill rates from barges engaged in coastal transport. Such spills have been a major problem in the Chesapeake Bay region and although the volume of oil spilled has usually been small, the frequency and widespread nature of such accidents and the fact that barges often transport more toxic refined products, make this a very serious risk. Barge and tug traffic is much less well regulated and environmental protection controls are much less sophisticated than for tankers. Location of a terminal in the Hampton Roads area will most certainly result in a large increase in the traffic of oil laden barges in the lower Bay region and thus significantly increase the probability of barge spills which is at present too great.

The second underestimated risk concerning both large tankers as well as barges is the unique nature of maritime traffic in Hampton Roads. Hampton Roads is, in addition to a notable commercial port, one of the world's largest naval ports. Petroleum carriers traveling to the Elizabeth River terminal site must pass directly off the berths at the Norfolk Operating Base. For a number of reasons, naval traffic is difficult to regulate and recent incidents (e.g. destroyer collision with York River Bridge, collisions with the Chesapeake Bay Bridge Tunnel) illustrate the problems of avoiding maritime risks. Experiences in other ports in which there is substantial petroleum traffic suggest that it is not unreasonable to expect a major tanker collision resulting in a large oil spill within ten years of the commencement of operations at the Hampton Roads refinery terminal. The significant risks from bulk transportation of oil into the enclosed Chesapeake Bay estuary led a state task force to conclude that the most appropriate way to handle incoming petroleum shipments in the Chesapeake Bay region is an off-shore port (e.g. a monobuoy mooring) rather than transhipment into Bay waters by vessel.

Whatever happens in regard to such an offshore terminal, it is clear that every effort must be made to assure that barge and tug traffic and vessel operations are as spill-free and collision-free as possible. New traffic control systems and collision and spill prevention arrangements are necessary. Unless the refinery <u>operators and/or whoever may be responsible for the various operations that could result in oil spills can guarantee major spills (here defined as more than 1,000 barrels) will either not occur or will be quickly and completely cleaned up, the proposed transportation system for crude oil and refinery products should not be accepted. As has been pointed out above, oil spills occur now in the Chesapeake and the lower James too frequently to be allowed to continue. We recommend, therefore, that state and federal agencies involved in water quality control and in oil spill prevention and clean-up review the situation at all terminals, transfer points, berthing areas and in the shipping lanes and take positive steps to eliminate the causes or at least markedly reduce the probability of oil spills. Within the last three months Hampton Creek was extensively fouled by an oil spill which</u>

reportedly occurred at a federal installation all the way across Hampton Roads in the Elizabeth system, quite near the site of the proposed refinery.

Further, the transportation of large amounts of refined products poses special problems. The greater toxicity of refined products has already been mentioned. There also exists the possibility of highly inflammable hydrocarbons from a major spill flooding under the piers and around the ships at the Norfolk Naval Base, which is less than a mile from the main channel, before it could be contained. Introduction of a spark could then produce a catastrophe. To our knowledge this point has not been addressed, and, although the protection of naval vessels and shore installations is not our area of expertise, the thought has occurred to us, and we would be remiss in not mentioning it.

4) The Effects of Dredging for the Marine Terminal

VIMS has recommended that several precautions be taken to minimize the impact of the dredging and most of these have been required by state regulatory agencies. There will still, however, be a long term, localized adverse impact on water quality in the terminal area due to the dredge depths involved. This fact is recognized in Section 9.100, page 9-52 of the PFEIS but is not recognized in Sections 9.13 through 9.16 of the same document. These two Sections present directly opposing views on the same question. This ambiguity should be reconciled.

As a final point, we must point out that we have not considered the possible environmental impact of the pipe lines between the refinery site and the proposed sewage treatment plant since no data were provided on the possible routes.

We have reviewed the statement submitted by the Corps and considered a large amount of data from other studies including those related to the status of marine resources in the lower James. Special attention has been paid to the interactions possible within the proposed Pig Point Plant and the overlapping nature of effluents from various sources in the river.

In summary, it is the Institute's position that the potential environmental effects of the proposed refinery can be substantially reduced by construction of a separate waste treatment system, location of the refinery treatment plant outfall so as not to impact seed oyster grounds and by the establishment of an effective oil spill cleanup group. We must reiterate, however, our deep concern for the diminishing health of the lower James. In light of its declining condition, the siting of a refinery along its shores presents, we believe, an unacceptable environmental risk for marine resources.

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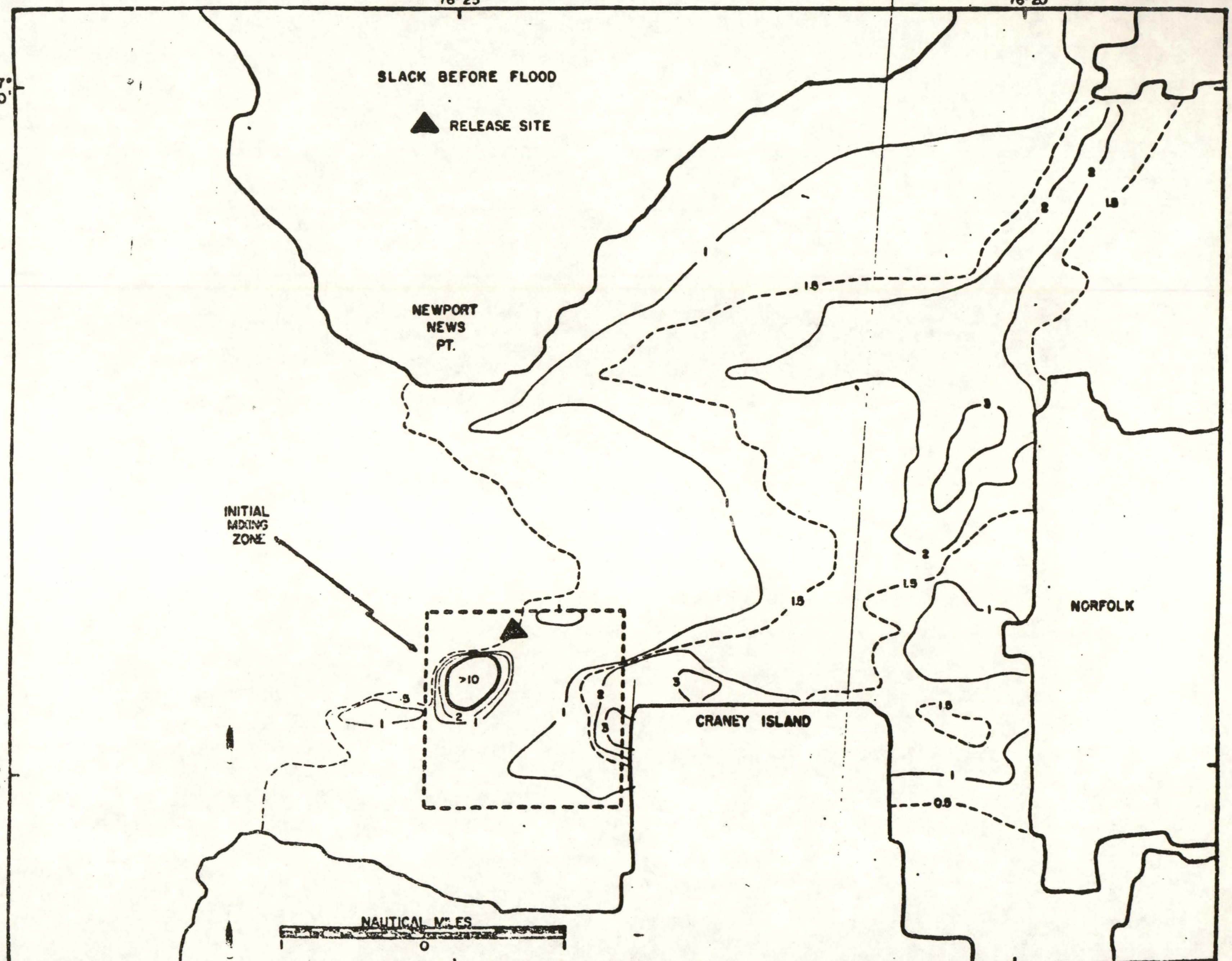


Figure 1. SBF, K=0.0, predicted dye concentration in ppb.

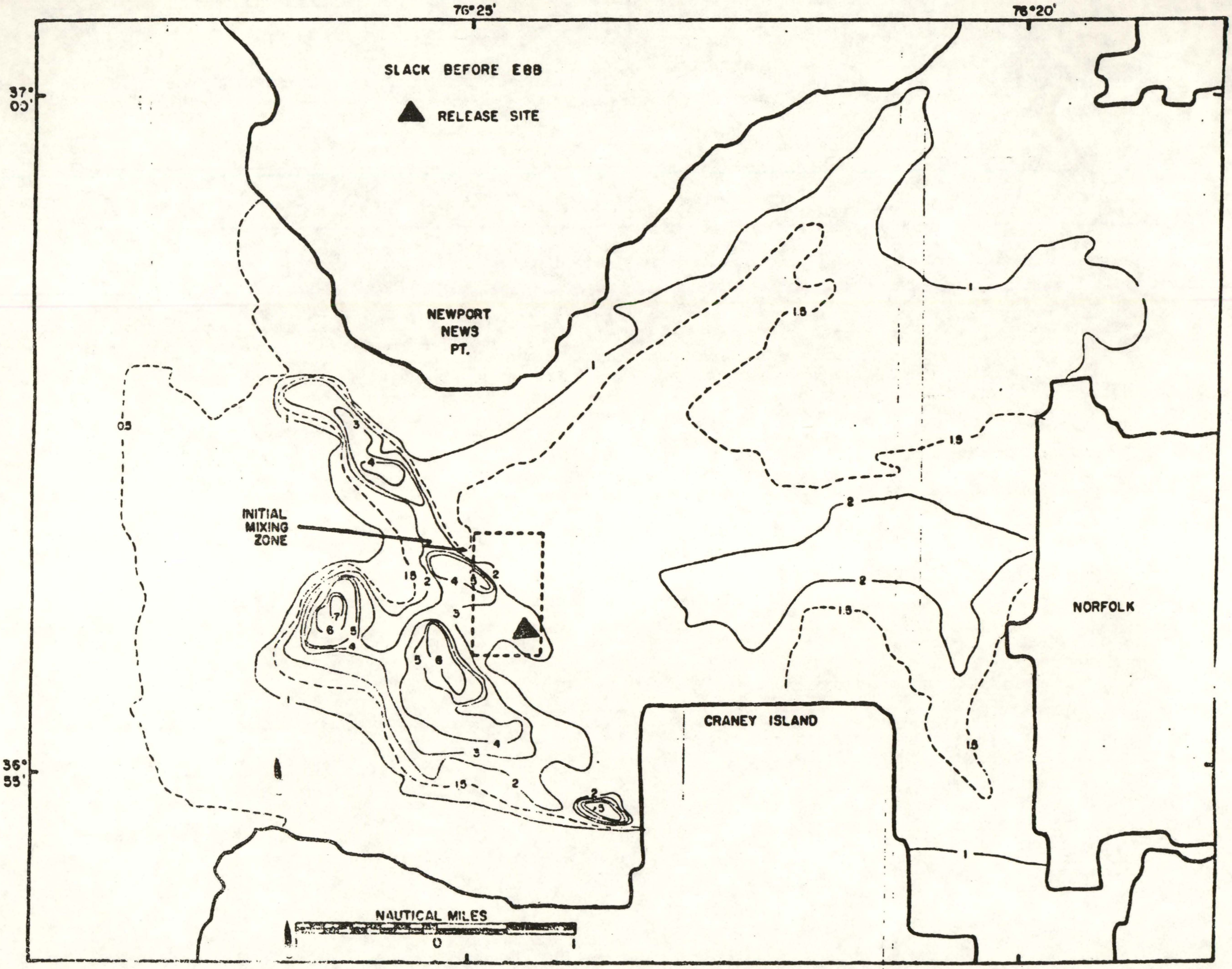


Figure 2. SBE, K=0.0, predicted dye concentration in ppb.

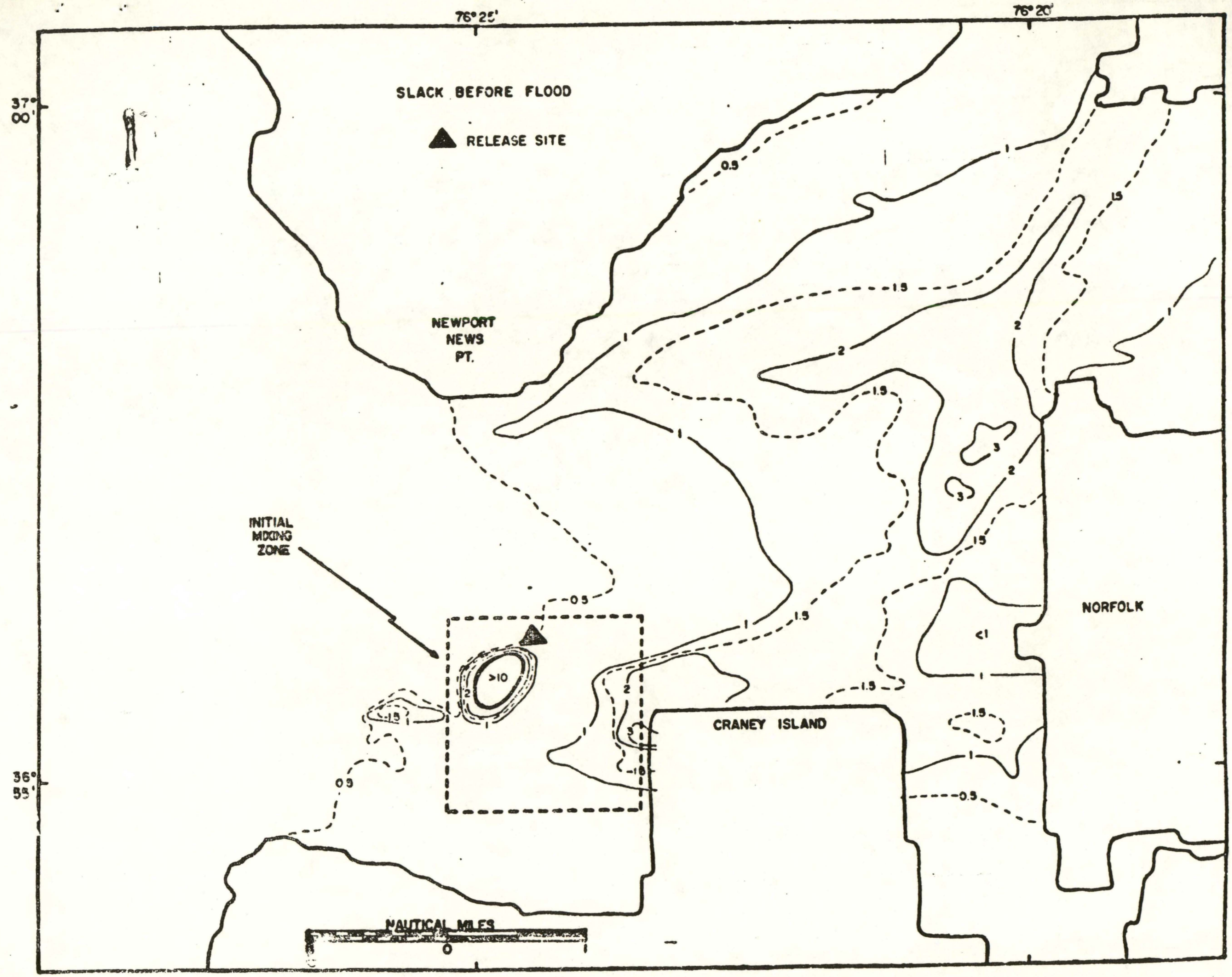


Figure 3. SBF, K=0.05, predicted dye concentration in ppb.

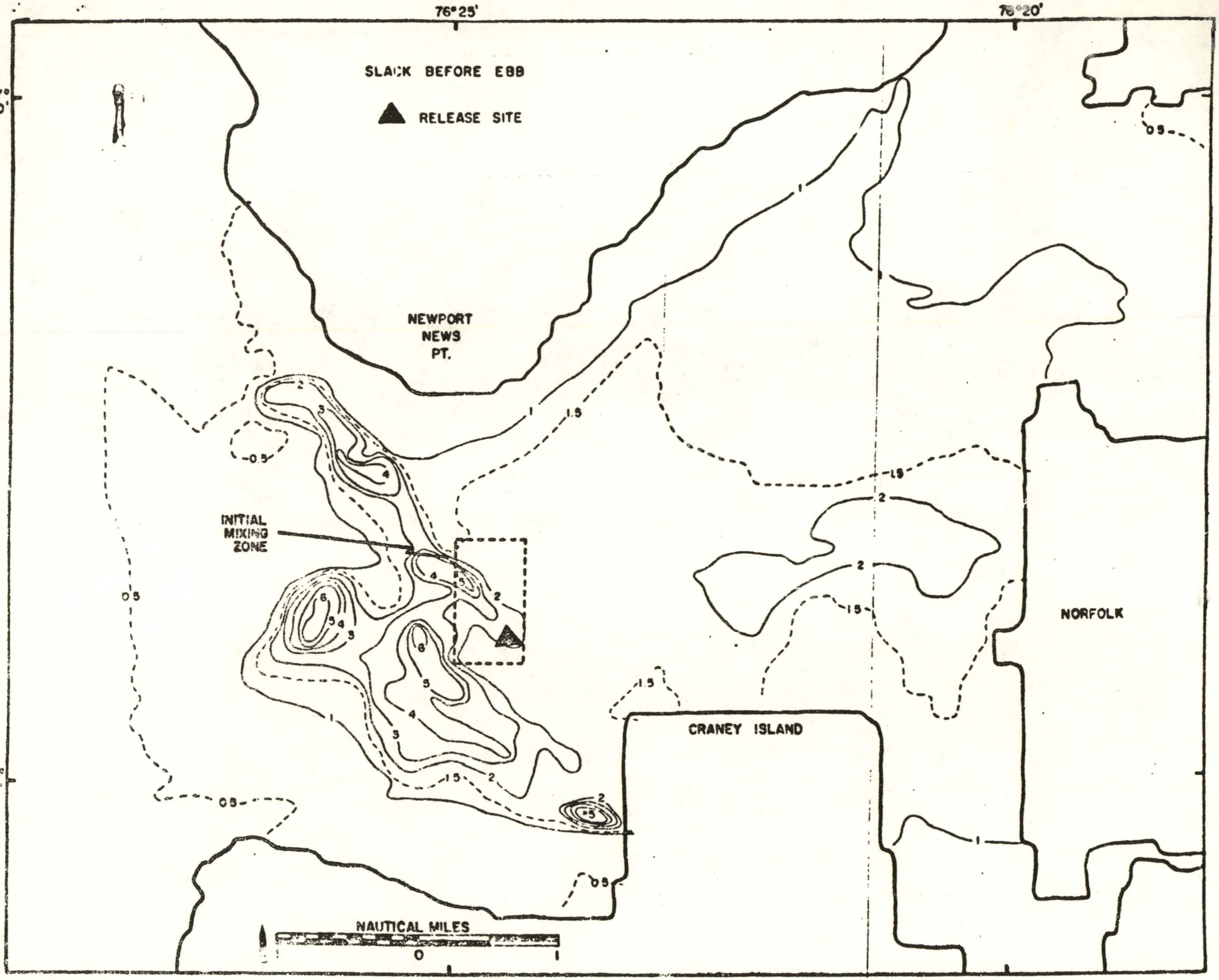
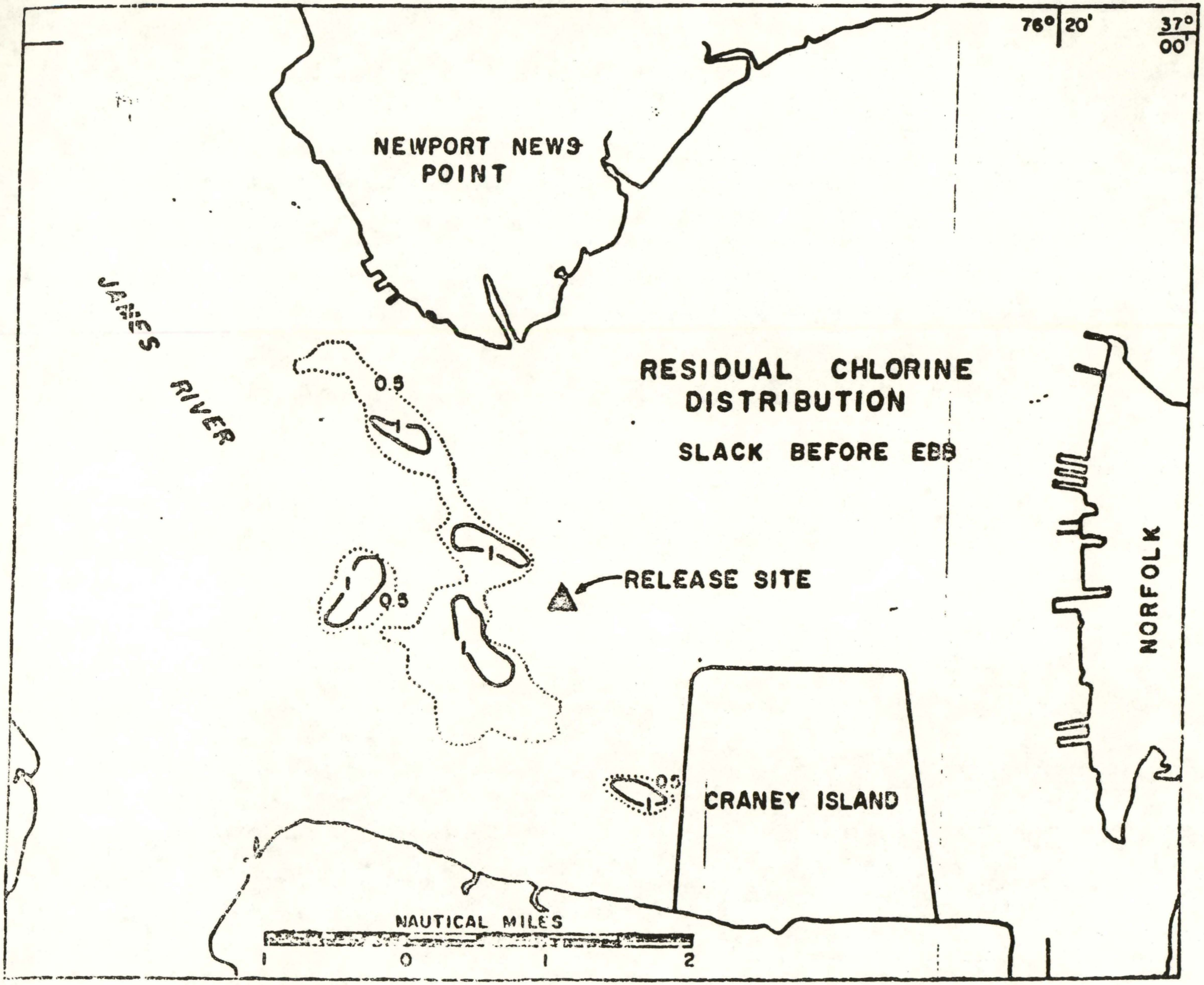


Figure 4. SBE, K=0.05, predicted dye concentration in ppb.


76° 20'
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NEWPORT NEWS POINT
JAMES RIVER
RESIDUAL CHLORINE DISTRIBUTION
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NORFOLK
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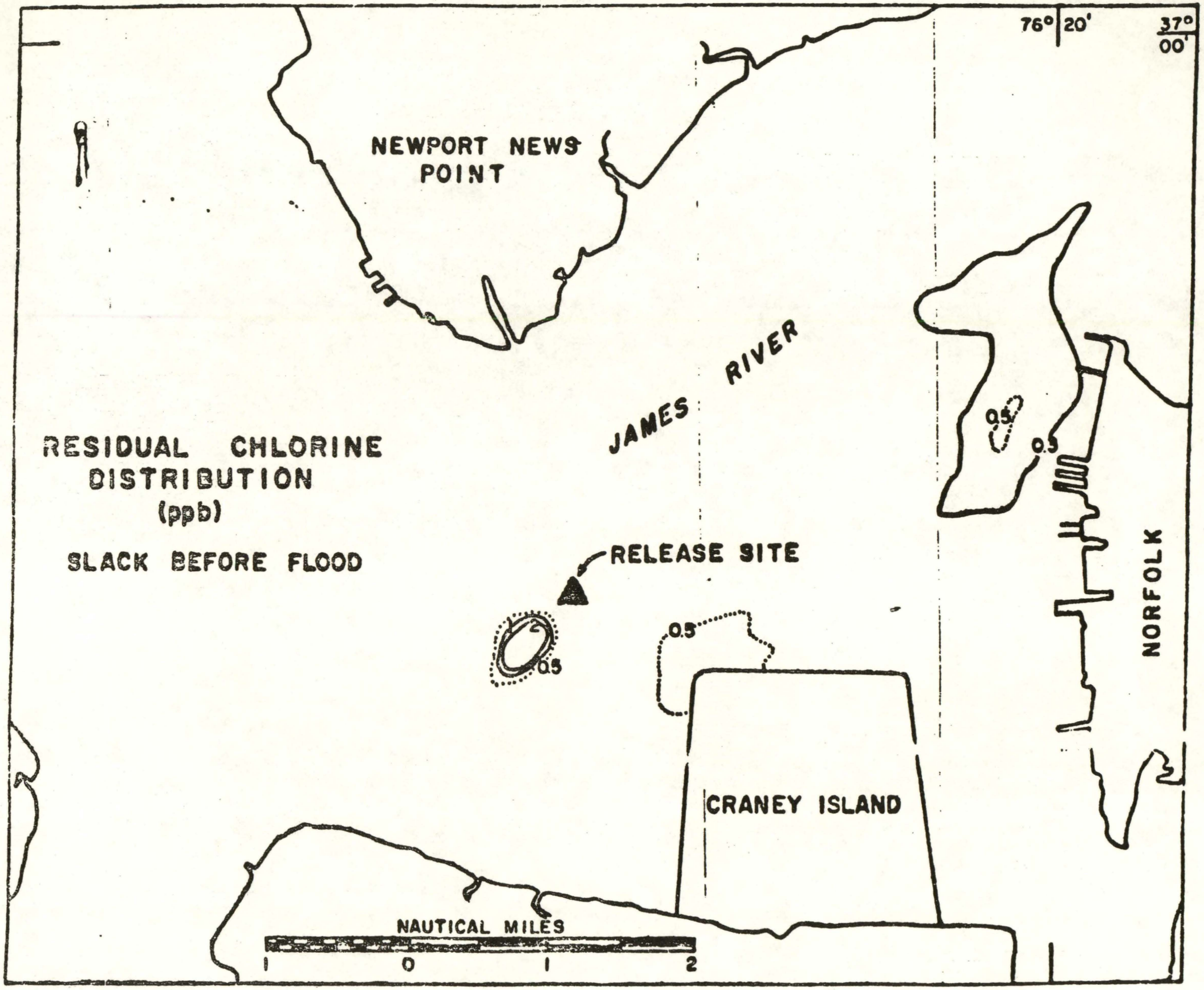
Figure 5.



76° 20'
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NEWPORT NEWS POINT
JAMES RIVER
RESIDUAL CHLORINE DISTRIBUTION (ppb)
SLACK BEFORE FLOOD
RELEASE SITE
0.5
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NORFOLK
CRANEY ISLAND
NAUTICAL MILES
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Figure 6.

APPENDIX

1) A Historical Review of the Decline in Productivity for Oysters of the James River

The history of oyster culture in the James River has been characterized since the mid-1800's by a decline in areas of productive bottoms and an overall decline in landings. Statistics on landings do not exist prior to 1931, but in the 1931 to 1960 period, annual production ranged from about 1.0 to 2.7 million bushels. By 1963 it had declined to 800,000 bushels; in 1975 only 317,000 bushels were harvested.

In the mid-1800's records indicate that the natural oyster rocks in the James extended from the up-river limit of oyster growth at Deep Water Shoals to the mouth of the system at Old Point Comfort. However, by about 1900, many of the natural oyster rocks in Hampton Roads on Hampton Bar, Mill Creek, Hampton Creek and off the Elizabeth River had been destroyed by overfishing. The up-river areas, however, were unaffected.

About 1935 pollution began to be a problem on the extensive and heavily utilized leased bottoms in Hampton Roads. Pollution increased during the 1940's and as a result extensive areas of leased bottoms in the lower river were restricted, or approved for harvesting only at certain seasons. The industry existed in that area either by relaying oysters grown there to pollution-free areas prior to sale, or by harvesting during approved seasons. By the late 1950's all the shellfish-growing areas on Hampton Roads (about 35,990 acres) were classed as restricted. Because of rising production costs the practice of relaying oysters was becoming unprofitable; consequently, oyster culture there was greatly restricted. After 1960, additional areas were classed as restricted for shellfish harvesting and today 49,400 acres are restricted in such valuable oyster-growing areas as the Elizabeth River, Hampton Creek, the Pagan, Nansemond and Warwick rivers and off Mulberry Island.

Beginning in 1960, the oyster pathogen MSX entered Chesapeake Bay and killed millions of bushels of oysters in the high salinity areas of the Bay and in Hampton Roads. Oyster culture was abandoned in that area because of MSX and pollution.

With the onset of MSX, there began a major decline in setting rates (attachment of oyster larvae to substrates) in the James which has persisted to the present time. This decline was about 90% from Wreck Shoals down river, and about 50% in the upper river section. This decrease has resulted today in an actual decline in numbers of oysters on the bottom.

Appendix 3

The cause of the decline in setting has never been fully established. Available evidence, however, suggests that it is associated with either a decline in brood stocks of adult oysters in the lower part of the river or increased mortality of oyster larvae due to pollutants or some other environmental factor. The fact that shortages of seed from the James has not become more critical today is largely due to a lowered demand for seed by dealers. However, if the present trend toward a decreasing set continues, even today's low demand may result in a further decline in existing stocks due to overfishing. Most certainly, if demand increases, then many of the marginally productive areas may become depleted.

In summary, the history of the James River oyster production has been one of progressively lowered production due to the combined effects of pollution, changes in socio-economic factors, and a decline in setting. Additional stresses on the system would most certainly result in a further decline in production.

2) Status of James River Fish Fauna

The fish fauna of the tidal James River is composed of anadromous, freshwater resident, estuarine resident, and marine migratory species. There are species of commercial and recreational importance within each group such as striped bass, catfishes, white perch, and spot or croaker respectively. Thus, the function of the James River habitat relative to the groups of fishes living there can range from total life span to a temporary feeding ground depending upon species considered. Most significant to fisheries of the Chesapeake Bay and middle Atlantic Coastal area is the importance of the James River and other estuaries such as the York and Rappahannock as nursery ground for the young stages of the anadromous and marine migratory species.

In the upper James, impoundments at Richmond on the main stream and at Petersburg on the Appamattox have eliminated spawning and nursery areas previously used by shad and river herring. The area between Richmond and Hopewell is subject to pollution from both domestic and industrial wastes. This has resulted in low dissolved oxygen, low benthic diversity and at times abiotic conditions. The fish fauna in this area is limited to a few species and at certain times fishes are absent. This area once served as a spawning and nursery area for alosine fishes, striped bass, white perch, and catfishes. It is no longer suitable. Pollution in the Hampton Roads-Norfolk area has lead to degradation in the flavor of flesh of fishes captured there and increased loads may make James River sport and commercial fishes unacceptable as food because of poor flavor. This condition may not be detrimental to the fishes themselves but would be disastrous to the commercial fishing and recreational industries.

Appendix 5

Increased siltation and, more recently, fill operations have caused a decline in Ruppia (submerged vegetation) beds in the area on the north side below the James River Bridge. This small region is no longer available as nursery and feeding grounds for fishes, and in addition, is no longer productive as a spot fishing area as it was in past years (Musick, M.S. 1972).

Recent information on lower James fish fauna shows that several populations of fishes are declining in abundance relative to other river systems. Most prominent among these is the white perch. Commercial landings for this species dropped from an average of about 45,000 KG during the 1964-71 period to less than 1,000 KG in 1973 and 1974. A similar trend is shown for the white perch in trawl data taken by VIMS over this period (for a complete review of the situation see St Pierre and Hoagman, 1975). In addition during the period between 1968 - 1974 populations of hogchoker, grey trout and silver perch also show definite declines in abundance, with catches declining from about 50 specimens per trawl to less than one. Striped bass populations, as indicated by young of the year catch, were also lower in the James than in the York and Rappahannock during both 1971 and 1972.

Only croaker populations appear to be increasing and this is a Bay wide phenomena which at present continues into the lower James.

Appendix 6

3) Status of the Blue Crab in the James River

Since 1964 abundance estimates for blue crabs have been made by trawl surveys conducted in the James, York and Rappahannock rivers. During this period of study the James has consistently shown a lower abundance of crabs than the other systems. In addition, except for one year class, the trend in the James River trawl catch of juvenile blue crabs, one-half to 4 inches wide, has not followed the trend in other rivers. The catches of every yearclass, except for 1970, have been small and as previously mentioned, do not follow those of other areas.

Marked changes in the distribution of crabs within the sampling area (J13-J27, coded in river miles) have occurred since 1964, beginning with the 1963 yearclass. Through August 1970, catches near Deep Water Shoals and Hog Pt. were usually larger than at the two lower river stations, in Rocklanding Shoal Channel and at White Shoal. Since September 1970, catches at the upper river stations have been about one-fifth the lower station catches, and since September 1972 the catches at all stations have approached zero.

Commercial fishermen and Virginia Marine Resources Commission inspectors have commented to us that no crab pots have been set in the James River above the James River Bridge for at least five years. The bridge is located about three miles downriver from our lowermost sampling station (J13; White Shoal).