



REPLY TO  
ATTENTION OF

DEPARTMENT OF THE ARMY  
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS  
WANAMAKER BUILDING, 100 PENN SQUARE EAST  
PHILADELPHIA, PENNSYLVANIA 19107-3390

November 30, 2001

Engineering and Construction Division

Mr. Robert J. Shantz, P.E.  
Motiva Enterprises LLC  
Delaware City Refinery  
200 Wrangle Hill Road  
Delaware City, Delaware 19706

Dear Mr. Shantz:

As Chief of the Engineering and Construction Division for the U.S. Army Corps of Engineers, Philadelphia District, I am responding to your 27 November 2001 letter which included a copy of a report entitled: "Examination of Possible Affects due to the Proposed Delaware River Channel Deepening on Motiva's Water Dependent Operations." CoastWatch Engineering and Planning of Baltimore, MD prepared the report dated November 20, 2001.

We have completed our initial review of the report and a list of our preliminary comments is attached. The Corps' Waterways Experiment Station is performing a more thorough review regarding hydrodynamics and sediment transport and comments from that review will be provided to you as soon as possible.

For the record, our preliminary finding (see attachment) is that the conducted investigation is inadequate to reach a conclusion that deepening Delaware River ship channel will lead to adverse impacts on Motiva's water dependent operations.

If you have any questions, please call Mr. Jeffrey Gebert of my Hydrology and Hydraulics Branch at 215-656-6682.

Sincerely,

A handwritten signature in black ink, appearing to read "P. Tranchik", is positioned above the typed name.

PETER M. TRANCHIK, P.E.  
Chief, Engineering and Construction  
Division

Attachment

**U.S. ARMY CORPS OF ENGINEERS, PHILADLEPHIA DISTRICT**  
**PRELIMINARY REVIEW COMMENTS**

**ON**

**REPORT ENTITLED: "EXAMINATION OF POSSIBLE AFFECTS DUE  
TO THE PROPOSED DELAWARE RIVER CHANNEL DEEPENING ON  
MOTIVA'S WATER DEPENDENT OPERATIONS"**

**DATED NOVEMBER 20, 2001**

**PREPARED BY COASTWATCH ENGINEERING AND PLANNING OF  
BALTIMORE, MD.**

**ATTACHMENT**

***U.S. ARMY CORPS OF ENGINEERS PHILADELPHIA DISTRICT  
PRELIMINARY REVIEW COMMENTS***

**1. SECTION 4-BACKGROUND**

There are a number of erroneous statements in the section that indicate a lack of understanding of the regional setting of the Motiva refinery that may lead to wrong conclusions on the impact of deepening the shipping channel. These statements include:

- Paragraph 2: the downstream and upstream boundaries of Delaware City are at RM 60.7 and 61.6, respectively, thus the refinery is not at "RM 57" as stated.
- Paragraph 2: the water-dependent facilities of the refinery are in the Coastal Plain physiographic province, not the "transition zone of the fall line" as stated.
- Paragraph 3 includes discussion of tidal flows around Pea Patch Island and states that the Pea Patch Island dike "has the obvious consequence of reducing velocities to the outside of the meander, which happens to be the location of the plant." That may or may not be true, but the jetty was completed in 1932, prior to the refinery construction, and has therefore been in place for almost 70 years. It should also be noted that the 1896 chart of the Delaware River and Bay, surveyed three decades before construction of the Pea Patch Island dike could possibly have any effect on the river, indicates that the "back channel" west of Pea Patch Island was configured (i.e., depth, width, alignment) approximately as it is today. The 1896 chart also indicates that the main natural channel of the river passes to the east of Pea Patch Island, and that the back channel between Delaware City and Pea Patch Island was the secondary channel.
- Paragraph 4 attributes "reduced velocities to the plant as a result of the jetty." It is not clear what the "reduced velocities" are being compared to, nor is there evidence presented that the cause of the alleged "reduced velocities" is the Pea Patch Island jetty.
- Paragraph 4 also states that the shoreline configuration at the location of the CWIC causes a "clockwise eddy" that "strongly" adds to the shoaling problem. It is not clear how this is relevant to investigation of the proposed Delaware Deepening on sedimentation at the Motiva facilities. Is the eddy "clockwise" under both ebb and flood tide conditions?

## 2. SECTION 5-ANALYSIS OF POTENTIAL IMPACTS, SALINITY

There are about one and a half pages of text that describe some of the fundamentals of estuarine sediment particle interactions with regard to surface charge, organic coatings and salinity. There is a single plot from one laboratory research paper (Gibbs, 1983) that is apparently the basis for the conclusion that the proposed Delaware Deepening project may increase Motiva's shoaling problem "by a factor of 1.5 to 2.0." Given the complex nature of flows, sediment transport, and the salinity regime of the Delaware estuary in the vicinity of the Motiva facility, it appears highly unrealistic to us to predict a significant increase in sedimentation solely by extrapolating results of a single laboratory experiment that examined only one of many parameters relevant to estuarine sedimentation processes. There is no scientific basis presented in the CoastWatch report that indicates how it was determined that salinity changes alone control sedimentation at Motiva.

It appears premature and scientifically unsound to conclude that potential salinity changes induced by deepening the Delaware River are capable of the stated impacts on Motiva facility shoaling. Based on 40 years of USGS observed salinity data from Reedy Island, it is evident that the Motiva channel is exposed to long-term variations in salinity that range from 0 ppt (fresh water) to as much as 13 to 15 ppt (40% to 50% sea water, by weight). It is unlikely that the entire range from 0 to 15 ppt is experienced during any given year. However, there is a very dynamic salinity regime at the site reflecting the natural variability - from season to season and from year to year - in the freshwater inflow to the estuary.

The major shoaling areas of the Delaware River Main Channel are located in the Marcus Hook, Deepwater, and New Castle Ranges. Together these three ranges account for about 85% of the annual volume of maintenance dredging in the Delaware River, Philadelphia to the Sea project. These ranges extend over a distance of about 20 miles (Marcus Hook shoal ~ RM 80; New Castle shoal ~ RM 60), and experience a large variation in salinity, both between sites at any given time, and over any given period with varying fresh water inflows. The Delaware Estuary salt line (7-day average location of the 250 ppm isochlor, which is equivalent to a 1:77 dilution of sea water) is typically located downstream of the shoal in Marcus Hook Range, but upstream of both the Deepwater and New Castle shoal areas. The centroid of the New Castle Range shoal is about one mile east of the centroid of the Motiva channel shoal.

Corps of Engineers hydrographic surveys and dredging records show that shoaling in the three Delaware River Main Channel ranges is essentially independent of antecedent hydrologic conditions. This is not the same as stating that there is "zero" contribution from salinity/flocculation effects at these sites. However, if there is a salinity effect on shoaling, it appears to be negligible. Shoaling at these sites is almost certainly dominated by other factors, such as the underlying tidal flow characteristics, adjacent estuary bottom geometry and sediment type. It appears likely that the shoaling situation at Motiva is

similarly controlled by tidal flow characteristics and adjacent bottom geometry and sediment distribution.

In effect, the logic used in the analysis of salinity implies that the only factor influencing shoaling is the salinity of Delaware River water. It ignores the probable larger impacts of other factors, such as the underlying tidal flow distribution, adjacent estuary bottom geometry and sediment type. It is likely that the background, natural salinity variability in the vicinity of Motiva's channel is so large, and the salinity changes attributed to deepening so small, that the deepening project will have no practical impact on shoaling at Motiva's facilities.

### **3. SECTION 5-ANALYSIS OF POTENTIAL IMPACTS, CIRCULATION**

Paragraph 2 states:

- The paragraph "Model Results" is presented without antecedent discussion of the details of the model. Is it a 2D or 3D model? If 2D, is it vertically integrated? If it is vertically integrated, is there evidence showing this to be a valid representation of the physical processes pertinent to sedimentation at the site?
- The text mentions "148 time steps" but does not indicate what the interval is between steps, not the essentials of the period simulated. Was it one tide cycle, or several? Was a uniform tidal signal applied, or a realistic, time-varying input used?
- There appears to be too little documentation of the model characteristics, the verification process and results (if any,) and the type of boundary conditions applied to justify faith in the conclusion stated in Section 6.

#### 4. SECTION 6-CONCLUSIONS

Given the comments above regarding Sections 4 and 5 of the report, it is difficult to understand how the study reached the following conclusion:

*“ ... there exists a strong body of evidence to suggest that the proposed deepening project may result in there being a greater risk of increased Siltation (sic) from a combination of affects (sic.) These include an increase in salinity around the plant modifying the flocculation efficiency of the fine suspended material. This in combination with reduced capacitance near the CWIC as a result of a peak 10% reduction in velocities around the canal suggest that there is a high probability of a greater dredging requirement.”*

Based on our preliminary review of the investigation and in light of the lack of data support and analysis, it is not credible to conclude that there is a link between the proposed channel deepening and any potential adverse impacts to Motiva's facility.