DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

DAEN-CWH-D

21 March 1986

SUBJECT: Relative Sea Level Change

SEE DISTRIBUTION

1. The purpose of this letter is to provide the philosophy and distribute policy on the technical considerations required for relative sea level change in the design of coastal flood control and erosion protection projects.

2. Throughout geologic history, global sea level variations (both rise and fall) have occurred. Some authorities have found evidence to indicate we may be entering a new ice age with a resultant sea level drop. Others argue that increasing atmospheric concentrations of carbon dioxide and other gases are causing the earth to warm, thus contributing to a sea level rise. Global cooling or warming trends have at least two consequences: more extensive and rapid accumulation or melting of snow and ice in alpine and polar areas, and actual contraction or expansion of upper ocean waters. Both consequences contribute to "absolute" global sea level change. The absolute changes can not be distributed equally due to the dynamic and interactive nature of the earth's atmosphere, oceans, and crust and the changes required thereof by global cooling or warming.

3. Historic trends are commonly used in hydraulic and hydrologic studies to estimate expected future design conditions. Studies to determine expected precipitation intensities, water level frequencies, and shore erosion rates are typical examples. High confidence in the predicted values is generally limited to an average return period of not more than three times the length of data record. Local trends in local sea level change can perhaps best indicate what will occur in the future. The National Ocean Survey (NOS) has published sea level trends for regions along US Coasts based on yearly mean sea level records from its tide gages. These trends appear in the NOS publication entitled Sea Level Variations for the United States 1855-1980. Enclosure 1 is a table from this publication showing trends by region, from 1940 through 1980. Most existing tide gages are located on structures in harbors, and are responsive to land motions as well as water level changes.

4. Predicting future sea level rise is risky because there are so many variables and, as yet undefined, interrelationships involved (see enclosure 2, Can Mean Sea Level Changes be Predicted?). It is for this reason that the hydraulic designers should not make projections of the degree of either global or relative sea level rise on other than a historic basis. Corps of Engineers policy is that, until substantial evidence indicates otherwise, we will maintain the procedure of considering only local regional history of sea level changes to project a rise or fall for a specific project.

5. While emergence or rebound of a land mass normally is not a problem along the coast, submergence or subsidence may often be a contributing factor in coastal flooding and erosion problems. Where long periods of tidal records exist and are used in determining the exceedance frequency relationship for coastal flood levels, it may be necessary to adjust the water level records for relative sea level changes when such changes are significant. Similarly, Coastal Engineering Technical Aid 79-2, A Method for Estimating Long-Term Erosion Rates from a Long-Term Rise in Water Level, May 1979, explains how to account for relative sea level rise in beach erosion estimates. Prudence may require an allowance in a project design for the continuation over the project design life of an established significant long-term trend in relative sea level rise. Consideration must be given to the relative magnitude of the suggested allowance and the confidence band of the data the designer is using and the tolerance allowed in constructing the project. For instance there would be no need for a sea level rise allowance of about one foot when the construction tolerance of the project structure is plus or minus one half foot. Another consideration is whether it is more cost effective to include the allowance for significant sea level rise in the initial construction or to plan for modification later after the need for such is demonstrated.

FOR THE COMMANDER:

for S B Powell

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as

EARL E. EIKER
Acting Chief, Hydraulics and Hydrology Division
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Distribution:
(See page 3)

TABLE 6
TRENDS AND VARIABILITY*
AREA[a] AND U.S.[b] MEANS
1940 THROUGH 1980

Northern East Coast		
Trend	2.6 mm/yr	.009 ft/yr
Standard Error of Trend	± .3 mm/yr	±.0011 ft/yr
Variability[c]	±24.5 mm	±.080 ft
Southern East Coast		
Trend	1.9 mm/yr	.006 ft/yr
Standard Error of Trend	± .4 mm/yr	±.0013 ft/yr
Variability[c]	±31.1 mm	±.102 ft
Gulf Coast		
Trend	1.5 mm/yr	.005 ft/yr
Standard Error of Trend	± .4 mm/yr	±.0013 ft/yr
Variability[c]	±29.5 mm	±.097 ft
Southern West Coast		
Trend	1.0 mm/yr	.003 ft/yr
Standard Error of Trend	± .4 mm/yr	±.0012 ft/yr
Variability[c]	±27.2 mm	±.089 ft
Northern West Coast		
Trend	- .4 mm/yr	-.001 ft/yr
Standard Error of Trend	± .3 mm/yr	±.0011 ft/yr
Variability[c]	±25.9 mm	±.085 ft

[a] From area yearly mean sea level values rather than means of station trends, et cetera, in area.

[b] From means of area yearly mean sea level values rather than means of area trends, et cetera.

[c] Standard Error of Estimate.

* Variability is represented by the standard error of estimate, which is the standard deviation from the line of regression.

Attachment 1

Table 6, continued

United States		
Trend	1.3 mm/yr	.004 ft/yr
Standard Error of Trend	± .2 mm/yr	±.0007 ft/yr
Variability[c]	±16.2 mm	±.053 ft

[c] Standard Error of Estimate.