Gulf of Mexico Jackup Operations for Hurricane Season

API RECOMMENDED PRACTICE 95J
FIRST EDITION, JUNE 2006

REAFFIRMED, APRIL 2013

AMERICAN PETROLEUM INSTITUTE

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Upstream Segment

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Foreword

This recommended practice (RP) is under the jurisdiction of the API Upstream Executive Committee on Drilling and Production Operations (ECDPO) and was developed with guidance from and in cooperation with the International Association of Drilling Contractors' (IADC) Jackup Rig Committee and the Offshore Operators Committee's (OOC) Drilling Technical Subcommittee. Additionally, the Minerals Management Service (MMS) and the U.S. Coast Guard (USCG) provided general guidance and assistance in the development of the RP.

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Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, D.C. 20005, standards@api.org.

Contents

Gulf of Mexico Jackup Operations for Hurricane Season

1 Scope

The purpose of this recommended practice (RP) is to present an approach to siting Jackup Mobile Offshore Drilling Units (MODUs) and to recommend certain operational procedures to enhance jackup survivability and stationkeeping during hurricane season in the Gulf of Mexico during drilling, workover, and while stacked (idled) at a non-sheltered location. This document provides guidance and processes and, when combined with an understanding of the environment at a particular location, the characteristics of the unit being utilized, and other factors, may be used to enhance operational integrity. This RP was developed through a cooperative arrangement with the International Association of Drilling Contractors' (IADC) Jackup Rig Committee. The information presented herein is premised on the existence of an evacuation plan, the intent of which is to assure timely evacuation of all rig personnel in anticipation of certain climatic conditions.

2 Overview

Recent hurricanes in the Gulf of Mexico have caused damage and loss of jackup rigs. However, the industry's practice of "shut-in and evacuate" has successfully resulted in no loss of life, minimal injuries, and no significant pollution associated with such incidents. Preliminary analysis of the damage and losses indicates the likely causes to be wave inundation and/or foundation failure leading to wave inundation. Additionally, the preliminary results of investigations of surviving jackups that experienced forces in excess of design criteria validate the premise that structural assessment methodologies tend to be conservative. Rig survival is a function of the environmental conditions (water depth, wind loading, wave heights, current, foundation, etc.) at the location. Based on the studies conducted to date, recommended practices contained in this document include, but are not limited to, site optimization (data), preloading procedures, air gap analysis, storm preparation, and post-storm recovery enhancements.

Historically, mat supported jackups have responded differently to wave impingement than independent leg units. Generally, these units have not experienced catastrophic failure. Rather, they have tended to slide for limited distances along the seabed during repeated wave impingement. Accordingly, only certain elements of this RP, such as the optimization recommendations set forth in Section 4, storm preparation, and setting an air gap for storm survival (see Section 6) may apply to such units.

Several recommended methods of assessment and analysis are contained in this RP. This RP should not be viewed as an endorsement of a particular methodology or product. Other scientifically valid methods are options that may also be considered.

3 Terms and Definitions

3.1
air gap
The distance from the lowest astronomical tide (LAT) to the underside of the hull.

3.2
API
American Petroleum Institute

3.3
drilling contractor
The individual, partnership, firm, or corporation retained by the owner or operator to perform drilling and/or well workover operations.

3.4
evacuation period
The period of time from the commencement of storm preparations until all evacuated personnel have obtained reasonable refuge ashore (generally 12 hours after arriving shore-side).

3.5
flag state
The government of the nation whose flag a vessel is entitled to fly.

3.6
hurricane
A severe tropical cyclone having one minute average 33 ft elevation winds in excess of 64 knots (74 mph).

3.7
hurricane season
The portion of the year having relatively high incidence of hurricanes. In the Atlantic, Caribbean and Gulf of Mexico, and for the purposes of this RP, it is the time period between June 1 and November 30.

3.8
IADC
International Association of Drilling Contractors

3.9
independent leg jackup
Jackup unit with legs that can be raised or lowered independently.

3.10
jackup
A mobile offshore unit with a buoyant hull and one or more legs that can be moved up or down relative to the hull. A jackup reaches its operational mode by lowering the leg(s) to the sea floor and then raising the hull to the required elevation. The majority of jackups have three (3) or more legs, each of which may be move independently, and which are supported on the sea floor by spudcans or a mat.

3.11
lowest astronomical tide (LAT)
The lowest level expected to occur under average meteorological conditions and any combination of astronomical conditions.

3.12
mat supported jackup
Jackup unit with the leg(s) connected to a single foundation structure.

3.13
mobile offshore drilling unit (MODU)

A vessel capable of moving or being transported between locations to engage in drilling or well workover operations for the exploration or exploitation of subsea resources.

3.14
mean water level (MWL)
Midpoint between lowest astronomical tide and highest astronomical tide.

3.15
OOC
Offshore Operators Committee

3.16
operator
The individual, partnership, firm, or corporation having control or management of operations on the leased area or a portion thereof. The operator may be a lessee, designated agent of the lessee(s), or holder of operating rights under an approved operating agreement.

3.17
owner
The individual, partnership, firm, or corporation to whom the U.S. issues a lease and has been assigned an obligation to make royalty payments required by the lease.

3.18
shall
For the purposes of this publication, the term shall indicates that the recommended practice has universal applicability to that specific activity.

3.19
should
For the purposes of this publication, the term should denotes a recommended practice a) where a safe comparable alternative practice is available; b) that may be impractical under certain circumstances; or c) that may be unnecessary under certain circumstances or applications. This word indicates that the rule is a recommendation, the advisability of which depends on the facts in each situation.

3.20
spudcan
The individual footings on each leg of a jackup rig equipped with independent legs.

3.21
unit
See MODU definition.

4 Site

a) *Site Data*: This data should include the location coordinates, seabed topography, and water depth referenced to a clearly specified datum [e.g. lowest astronomical tide (LAT) or chart datum (CD)]. Note that charts derived for use by comparatively shallow draft shipping are often not sufficiently accurate for siting jackups. Previous employment of jackup units at the location should be considered, particularly if the leg spacing differs from the unit being utilized. Appropriate bottom surveys should be conducted by the operator and provided to the drilling contractor sufficiently in advance of the jackup's arrival on location in order to identify the location of all pipelines and debris that could interfere with the safe movement of the unit and its placement on location as well as areas of soil disturbance from previous jackup operations. The passage of recent storms, which may displace pipelines, should be considered prior to relying on existing bottom survey information.

b) *Geotechnical Data*: An appropriate assessment of the soil in which a jackup is intended to operate is necessary in order to predict the leg penetration that may be achieved by the unit, and to assess the degree to which loads imposed on the unit will be redistributed to the foundation through the jackup structure. To permit the drilling contractor to determine the suitability of the location, foundation data sufficient to determine soil characteristics over depth and foundation strength should be obtained and provided by the operator sufficiently in advance of the jackup's arrival on location to allow a site assessment to be conducted. This geotechnical and soil data should be suitable for a shallow foundation assessment and of sufficient depth to capture soil characteristics, such as sand

lenses or layered systems, and to also determine if the proposed location is in a “mud slide” prone area that may affect the foundation assessment.

c) *Metocean Data*: The operator should provide site-specific metocean criteria including winds, waves, currents, storm surge, and tide sufficient for the drilling contractor to evaluate the positioning of the unit on location and to assist in the determination of the required air gap (see Section 6). For purposes of this document, “generic” metocean criteria such as that contained in the 21st and earlier editions of API 2A or in the ISO Gulf of Mexico Metocean Annex (ISO 19901-1; 2005) should only be used if evaluated as being applicable for the location in question by a metocean specialist. Site-specific hurricane criteria should be derived in accordance with the guidelines on preparation of site-specific criteria contained in Annex C. In lieu of site specific data, the generic metocean curve contained in Annex D may be utilized for air gap calculation (see Section 6, item a) and positioning evaluation.

5 Preloading Process

The spudcan should be preloaded to attain the maximum leg reaction possible. This preload may use variable load to augment the unit’s normal preload capacity and/or implementation of individual leg preloading. Allowing sufficient time for the preloading operation is critical for successful preloading, and individual leg preloading may be critical for optimized siting. Preload shall be applied to the soil for a sufficient period of time to consolidate the soil and ensure that penetration has ceased. Optimizing *preload holding time* minimizes the likelihood of additional penetration and provides for a reasonable test of the foundation strength at that leg reaction. In planning the preload procedure, the drilling contractor should incorporate the provided information (see Section 4) to ensure proper preloading is accomplished and advise the operator of anticipated preloading procedures. For purposes of this RP, *preload holding time* is defined as typically 1 to 2 hours from last occurrence of spudcan settling with full preload onboard as called for in the unit’s operations manual, although the duration may vary depending upon the soil data, type of strata underlying the spudcans, and the experience during initial preload cycles.

6 Air Gap

a) *Site Specific*: The air gap for the unit should be the site specific 100-year hurricane wave crest elevation plus a wave crest uncertainty allowance of 3 % to 5 % plus an appropriate settling allowance applicable to the jackup and the soil conditions anticipated at the location. The hurricane wave crest elevation is defined as the combination of hurricane wave crest plus storm surge plus the distance from LAT to MWL, and should be derived from approved site-specific metocean data as described under Section 4, item C. If Annex D is utilized, a settlement factor should be calculated based on the site-specific geotechnical assessment. Potential storm settlement calculations should be based on a 100-year return period storm or greater.

b) *Generic*: As an alternative to determining air gap based on site-specific data, the “generic” air gap curve provided in Annex A may be used. The graph includes a crest uncertainty factor and a settlement factor of approximately 4 ft.

7 Unit Preparations and Evacuation

Adherence to the unit’s flag state and/or U.S. Coast Guard approved *Marine Operations Manual* (*MOM*) for storm and/or survival mode instructions are mandatory. This will likely include, but not be limited to, skidding the cantilever or drilling package, elevating the unit to the required minimum air gap as defined in Section 6 (if not already at the minimum air gap), to place the unit into the “survival” condition. Any departure from the *MOM*’s procedures must be acceptable from a risk assessment perspective or should demonstrate that the unit is within the intent of the *MOM* requirements. The *MOM*’s procedures and instructions should be provided to the operator in advance of commencement of operations at the site.

Where possible, a unit that does not have leg clamps (rack chocks, etc.) should be jacked to an elevation where the hull’s lower guides are placed adjacent to horizontal leg members. However, the unit should be at or above the minimum air gap but may be jacked up to the next horizontal member.

Rig operations during hurricane season require an assessment of the time required to safely suspend operations, and to secure and evacuate the unit in advance of forecasted weather conditions with a reasonable contingency. To avoid impeding the timely hurricane shutdown, this assessment should include those discretionary well operations tasks, such as completing the drilling of a particular well section; or running casing or similar operations which, while desirable, may lengthen the time required in advance of a storm for these operations to be performed. Planning must include the time necessary to secure the well and the jackup and evacuate rig personnel. The evacuation plan should also consider the reasonable time required for personnel, once ashore, to evacuate potentially impacted coastal areas. The timeline for such operations is usually contained in the Emergency Evacuation Plan (EEP).

8 Post-storm Recovery

Satellite tracking equipment should be installed by drilling contractors on jackups to facilitate locating and tracking a unit in the event it goes adrift during a storm. The power supply for such equipment should be sufficient to power the system for a minimum of 7 days after the shut-down of the unit's primary power supply. Consideration should be given to providing read-only access to the appropriate coastal state agency, such as the U.S. Coast Guard, to potentially minimize adverse consequences of a storm.

9 Post-storm Inspections

In order to accurately assess the effects that hurricanes have had on the jackup fleet, each drilling contractor should initiate an internal database of jackup storm response parameters. Once the jackup can be safely assessed following a storm, data should be collected in an orderly fashion to ensure that an assessor will have all of the information necessary to make a complete evaluation of the damage and its root cause. A form is provided in Annex B which may be used to capture the data for each jackup that has encountered hurricane force winds. It is especially important to record the exact condition that the jackup was in during the passage of the storm, as well as details of any damage to the jackup's primary structure, including the leg members, the spudcans, the elevating and/or fixation system, the decks and bulkheads around the leg wells, and the gear unit brace structure.

Annex A

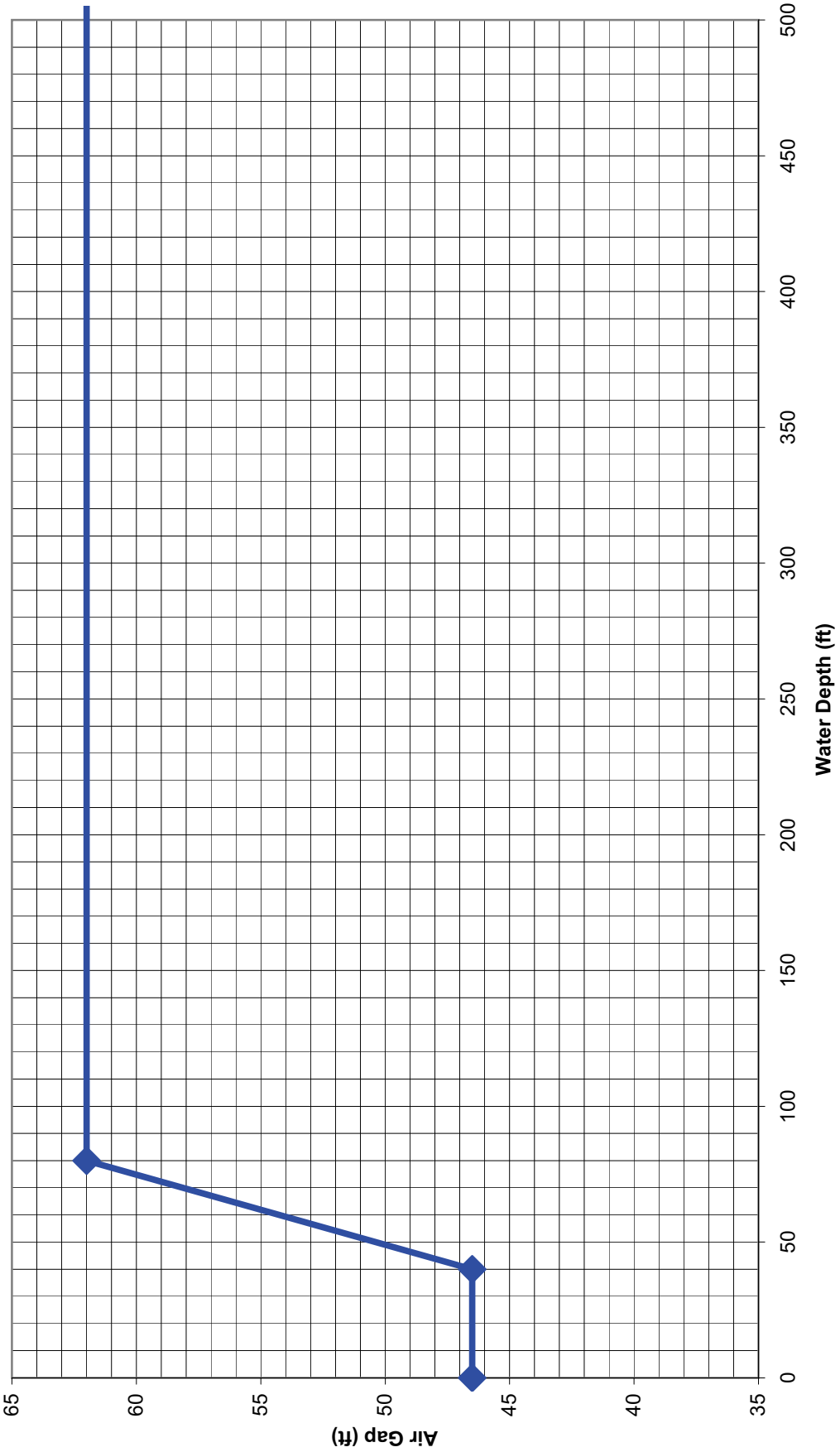

Figure A.1—Recommended Air Gap for Jackups in Hurricane Season

Annex B

Report for Hurricane: _____

Drilling Contractor: _____ Date: _____

Contact: _____ Email: _____

Rig Name: _____

General Jackup Characteristics Independent Leg ____ Mat _____

Designer: _____ Designer Class Description: _____

Rig Modified Since Delivered: Yes __ No __ Rig Instrumented: Yes __ No __

Description of Modification: _____

Leg Length: _____ feet Rack Chocks Engaged Yes __ No __ N/A __

Site Information Area and Block: _____

Location: _____ Latitude _____ Longitude:_____ Rig Heading: _____ degrees

Water Depth (LAT): _____ feet Airgap _____ feet

Leg Reactions

Going on Location (initial) (kips): _____ Bow _____ Port _____ Stbd

During Preloading (final) (kips): _____ Bow _____ Port _____ Stbd

At Time of Storm (kips): _____ Bow _____ Port _____ Stbd

(attach loading calculations documenting rig weight and centers of gravity at time of storm)

Leg Penetration

Going on Location: Bow Leg _____ feet Port Leg _____ feet Stbd Leg _____ feet

After Preloading: Bow Leg _____ feet Port Leg _____ feet Stbd Leg _____ feet

After Storm: Bow Leg _____ feet Port Leg _____ feet Stbd Leg _____ feet

Additional Settlement Due to Storm:

Bow Leg _____ feet Port Leg _____ feet Stbd Leg _____ feet

Rig Movement due to Storm

Rig Heading after Storm: _____ degrees

Rig Inclination (degrees): to Bow _____ to Stern _____ to Port _____ to Stbd _____

Rig Position Change (relative to a known datum after the rig was re-leveled):

Movement Forward: _____ feet Movement Aft: _____ feet

Movement to Port: _____ feet Movement to Stbd: _____ feet

Cantilever Condition at Time of Evacuation

Stowed: Yes ____ No ____ Rotary Position Aft of Transom _____ feet

Drive Pipe Tension: Yes ____ No ____ Tension _____ kips

Storm Effect Observations

- Record any significant damage, such as damage to leg members, elevating or fixation system components, or hull structure, especially in decks and bulkheads around leg wells.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Figure B.1—Jackup Hurricane Data Collection Form

Annex C

C.1 Guidelines for Site-specific Metocean Studies

It is recommended that the metocean criteria for all sites be based on a site-specific study performed by a metocean specialist. The analysis below properly accounts for regional variations in storm climate as well as local topographic and bathymetric effects.

A minimum site-specific study requires the following:

C.2 Hurricane Extremes

This analysis should be based on a hindcast database of winds, waves, and currents derived from numerical models that have been validated against severe historical storms. That validation will show the wave and wind models have a coefficient of variation (COV) no more than 15 % when comparing model peak storm values to measurements. The acceptable COV for the current model validation can be as high as 30 %. Any bias between the model and data will be removed with at least a simple linear fitting process.

The hindcasted period will include at least the 56-year period beginning 1950. The numerical models will be based upon discrete finite element or finite difference solutions of the governing partial differential equations, and not parametric models. Grid resolution will be a minimum of 15 km, and the overall domain will cover at least the northern half of the Gulf of Mexico.

An extremal analysis will be performed on the hindcast results using either a pooling method or a deductive model as described in Toro[1]. If pooling is chosen, then at least three sites in a general east-west direction will be pooled, with the pattern centered on the location of interest. These sites shall have a spacing of 75 km to 150 km but will span a total distance of no more than 300 km. When pooling within 200 km of the coast, the pooled sites must be chosen to ensure that they have fetch and depth similar to the site of interest.

[1]Toro, et. al, 2005, *Comparison of Historical and Deductive Methods for the Calculation of Low Probability Sea States in the Gulf of Mexico*, OMAE, 51634.

Annex D

100-year “Severe Area” Crest Height Elevation Including 5 % Uncertainty Allowance

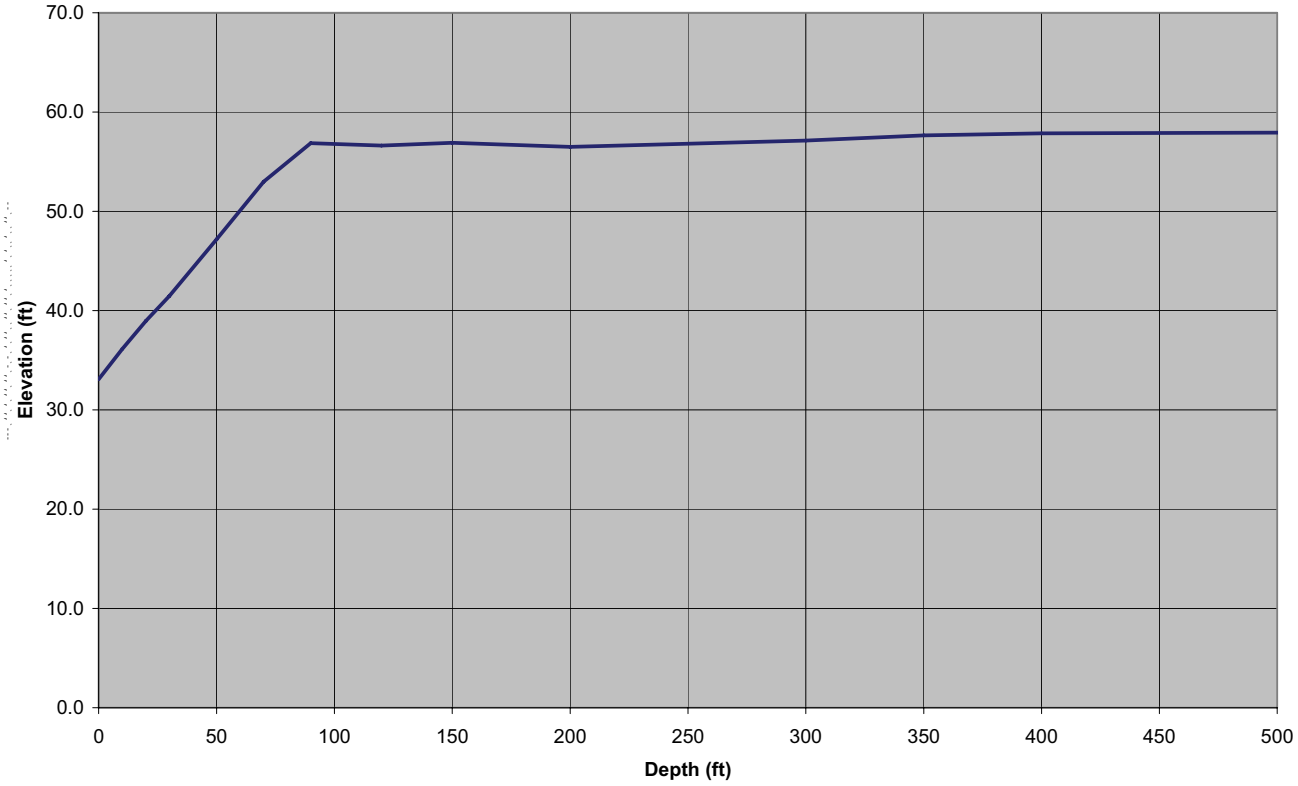

Figure D.1—Expected Wave Crest Elevation with Uncertainty

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