



575 Market Street
Suite 3700
San Francisco, CA 94105
415.896.5900 **phone**
415.896.0332 **fax**

esassoc.com

memorandum

date September 23, 2026
to Tess Byler, PG, CHG (San Francisco Bay Area Water Agency)
from Matt Brennan, PhD, PE; Merritt Shepherd
subject Analysis of coastal wave heights, wave runup, total water levels, and levee design elevations for the SAFER Bay Project under existing and future sea level rise scenarios.

1 Introduction

This memo describes predicted wave heights and wave runup along the SAFER Bay Project's alignment for existing and +3.5 ft sea level rise (SLR) conditions. The predictions are based on wind-wave modeling and wave runup calculations conducted for FEMA coastal flood transects B44 – B53 (FEMA 2019; BakerAECOM 2014). The location of these transects is shown in Figure 1. In addition to considering the effects of SLR on still water levels, the effects of SLR on future wave heights and future marsh evolution are also considered.

Wave model and wave runup results are summarized in the next section. Additional details regarding the methods used to generate these results are provided in the last section.

2 Modeled Wave Heights and Wave Runup

Modeled wave heights and wave crest elevations adjacent to the outboard side of the SAFER levee alignment along FEMA Transects B44 – B53 are provided in the tables below. Note that BakerAECOM (2014) uses a different naming convention for the FEMA transects: FEMA Transect B44 corresponds to BakerAECOM Transect 1013, B45 corresponds to 1014, and so forth, such that B53 corresponds to 1022.

To reflect a range of possible water level and wave conditions which could combine to generate the 1% wave crest elevation (WCE), BakerAECOM (2014) developed and applied two hydrologic scenarios:

- Scenario 1 assumes occurrence of the 1% still water level (SWL), which maximizes inundated extent and depths. The coincident wave height is then calculated by subtraction to achieve the 1% WCE when combined with the 1% SWL.
- Scenario 2 assumes occurrence of the 1% controlling wave height (H_c), which maximizes wave conditions. The coincident SWL is then calculated by subtraction to achieve the 1% WCE when combined with the 1% wave height.

In this study, Scenario A1 and Scenario A2 correspond to these two existing conditions scenarios modeled by BakerAECOM (2014). Although BakerAECOM (2014) does not provide wave modeling

results for Scenario A1 for the southern four transects (B50 – B53), with the rationale that the offshore wave heights are less than 0.5 ft for these transects, this scenario was developed for this study to serve as a comparison for future conditions with SLR.

To predict potential future conditions with +3.5 ft of SLR, the other scenarios consider a range of potential future geomorphic conditions for the marsh plain that fronts the levee alignment:

- Scenarios B1 and B2: likely conditions with projected marsh accretion
- Scenarios C1 and C2: no accretion on the marsh plain, loss of vegetation due to increased inundation duration of this elevation
- Scenarios D1 and D2: the marsh plain in front of these transects is completely eroded down to outboard mudflat

The two-percent wave runup ($R_{2\%}$) was calculated where each transect crosses the SAFER levee alignment for each scenario using the WHAFIS wave height and period results as input to the Technical Advisory Committee for Water Retaining Structures (TAW) method (van der Meer 2002). Maximum wave runup ($R_{\max}$) was calculated from $R_{2\%}$ using relationships from Walton (1992). Maximum total water level ($TWL_{\max}$) was calculated as SWL plus $R_{\max}$.

Modeled wave conditions along Transects B44 – B52 are shown in Figure 2 to Figure 12. The wave and runup conditions of these transects at the SAFER levee alignment, as well as elevations which consider FEMA accreditation freeboard requirements, are summarized in Table 1 for existing conditions (where Scenario A refers to the higher target crest elevation of Scenario A1 and Scenario A2) and for likely future conditions (Scenario B, the higher target crest elevation of Scenario B1 and Scenario B2). For the full set of wave and wave runup output for each transect and all four scenarios, see the appendix.

TABLE 1
TRANSECTS B44-B53 WAVE MODELING AND RUNUP

Transect	Scenario	SWL (ft NAVD)	Wave height (H _s) (ft)	Wave crest elevation (WCE) (ft NAVD)	Max Wave Runup (R _{max}) (ft)	Max Total Water Level (TWL _{max}) (ft NAVD)	SWL + 2 ft Freeboard (ft)	WCE+ 1 ft Freeboard (ft)	TWL _{max} + 1 ft Freeboard (ft)	Target Crest Elevation (ft)
B44	A, +0 ft SLR	9.7	0.9	10.7	3.2	12.9	11.7	11.7	13.9	13.9
	B, +3.5 ft SLR	13.6	1.5	15.3	4.1	17.7	15.6	16.3	18.7	18.7
B45	A, +0 ft SLR	10.5	0.4	10.9	0.9	11.2	12.5	11.9	12.4	12.5
	B, +3.5 ft SLR	13.7	0.7	14.5	1.7	15.0	15.7	15.2	16.4	16.4
B46	A, +0 ft SLR	9.8	1.1	11.0	1.6	12.0	12.8	12.4	13.4	13.4
	B, +3.5 ft SLR	13.6	1.2	14.9	3.0	15.8	15.6	15.9	17.6	17.6
B47	A, +0 ft SLR	10.8	0.9	11.9	1.4	12.2	12.8	12.9	13.2	13.2
	A, +1 ft SLR	11.8	0.5	12.4	1.0	12.8	13.8	13.4	13.8	13.8
	B, +3.5 ft SLR	14.3	0.6	15.0	1.4	15.7	16.3	16.0	16.7	16.7
B48	A, +0 ft SLR	10.9	0.6	11.6	2.5	13.4	12.9	12.6	14.4	14.4
	B, +3.5 ft SLR	14.4	0.7	15.2	3.0	17.4	16.4	16.2	18.4	18.4
B49	A, +0 ft SLR	10.9	0.4	11.3	1.1	12.0	12.9	12.3	13.0	13.0
	B, +3.5 ft SLR	14.4	0.4	14.8	1.1	15.5	16.4	15.8	16.5	16.5
B50	A, +0 ft SLR	11.0	0.1	11.1	0.2	11.2	13.0	12.1	12.2	13.0
	B, +3.5 ft SLR	14.5	0.1	14.6	0.2	14.7	16.5	15.6	15.7	16.5
B51	A, +0 ft SLR	11.0	0.4	11.5	1.0	12.0	13.0	12.5	13.0	13.0
	B, +3.5 ft SLR	14.5	0.5	15.2	1.6	16.1	16.5	16.2	17.1	17.1
B52	A, +0 ft SLR	11.0	0.3	11.5	1.0	12.0	13.0	12.5	13.0	13.0
	B, +3.5 ft SLR	14.5	0.4	15.1	1.4	15.9	16.5	16.1	16.9	16.9
B53	A, +0 ft SLR	11.0	0.3	11.5	0.6	11.6	13.0	12.5	12.6	13.0
	B, +3.5 ft SLR	14.5	0.4	15.1	1.4	15.9	16.5	16.1	16.9	16.9

Source: WHAFIS wave modeling, TAW wave runup calculations

3 Wave Modeling and Wave Runup Methods

FEMA coastal flood mapping calls for overland wave modeling along shore-normal transects at representative locations along the shoreline with WHAFIS (FEMA 2023a; FEMA 2023b). This model can account for local wind-wave generation, attenuation by vegetation, and depth-limited breaking in shallow water (FEMA 1988; Divoky 2007; FEMA 2023b). Along the southern portion of San Mateo County's San Francisco Bay shoreline that includes the SAFER Project, WHAFIS analysis was conducted for FEMA mapping updates (FEMA 2019) by BakerAECOM (2014).

To determine hydrologic boundary conditions for the WHAFIS runs, BakerAECOM (2014) used a response-based method (FEMA 2022). First, a hindcast time series of wave crest elevation (WCE) at the offshore end of the transect were calculated from two-dimensional hydrodynamic and wave modeling hindcast simulations (DHI, 2013). Then this WCE time series was subjected to extreme value analysis to estimate the 1% annual chance of exceedance WCE (1% WCE). Since the 1% WCE is created by a combination of water level and waves, two scenarios that could generate these wave crest conditions were identified (as depicted in BakerAECOM 2014 Figure 8 and Figure 9) as an event-selection method:

- Scenario 1 assumes occurrence of the 1% SWL, which maximizes inundated extent and depths. The coincident wave height is then determined to achieve the 1% WCE when combined with the 1% SWL.
- Scenario 2 assumes occurrence of the 1% controlling wave height (H_c), which maximizes wave conditions. The coincident SWL is then determined to achieve the 1% WCE when combined with the 1% wave height.

This pair of hydrologic scenarios are both modeled in WHAFIS (Section 3.1) and both scenarios' wave height and period at the toe of the levee are used for wave runup calculations (Section 3.2). In addition, WHAFIS wave crest elevation plus one foot of freeboard is considered in addition to other elevations as a possible design elevation to meet FEMA accreditation requirements.

For results presented in this memo, this BakerAECOM (2014) methodology and results were replicated to characterize existing wave conditions, except simplified bed elevations, as described in Section 3.1.3 below, were used instead of the higher resolution bed elevation profiles shown in BakerAECOM (2014). Simplified bed elevation profiles were used to facilitate modification of the bed elevation profiles to represent geomorphic change. Before proceeding with the other scenario runs, results from this study's A1 and A2 scenarios with the simplified bed elevation profiles were verified as replicating BakerAECOM (2014) results to typically within 0.1 ft. The verified model configuration was then modified and extended to assess potential future wave conditions with 3.5 ft of SLR and different outboard geomorphic changes along the proposed SAFER Bay alignment.

3.1 Wave Modeling

3.1.1 Hydrologic Boundary Conditions

For each transect, hydrologic boundary conditions for still water level, wave height, wave period, and wind speed were selected for each WHAFIS run according as per the sources and calculations in Table 2.

TABLE 2
SOURCES AND CALCULATIONS FOR WHAFIS HYDROLOGIC BOUNDARY CONDITIONS

Climate conditions	Scenario	1% wave crest elevation 1% WCE (ft NAVD)	Still water level SWL (ft NAVD)	Wave height H _c (ft)	Wave period T _p (seconds)	Wind speed U, (mph)
Existing Conditions (EC) for Scenario A	1	1% WCE _{EC} (from BA14) ¹	1% SWL _{EC} (from BA14)	(1% WCE _{EC} – 1% SWL _{EC}) ÷ 0.7 ²	f(H _{c,EC,1}) (Goda 2000) ³	0.65 ⁴ × U _{EC,2}
	2	1% WCE _{EC} (from BA14)	1% WCE _{EC} – (0.7 × 1% H _{c,EC,2})	1% H _{c,2} (from BA14)	f(H _{c,EC,2}) (Goda 2000)	U _{EC,2} (from BA14)
+ 3.5 ft SLR for Scenarios B, C, & D	1	1% WCE _{EC} + 3.5 ft SLR + Δ Barnard et al. (2019) ⁵	1% SWL _{EC} + 3.5 ft SLR	(1% WCE _{SLR} – 1% SWL _{SLR}) ÷ 0.7	f(H _{c,SLR,1}) (Goda 2000)	0.65 × U _{EC,2}
	2	1% WCE _{EC} + 3.5 ft SLR + Δ Barnard et al. (2019)	1% WCE _{SLR} – (0.7 × 1% H _{c,SLR,2})	1% H _{c,EC,2} + Δ Barnard et al. (2019)	f(H _{c,SLR,2}) (Goda 2000)	U _{EC,2} (from BA14)

Notes

¹ 'from BA14' – transect-specific value from BakerAECOM (2014) Table 5

² Dividing by 0.7 accounts for the portion of wave height that is above SWL, with the other 0.3 of the wave height occurring as the trough under SWL.

³ 'Goda (2000)' – $T_p = 2.41 \sqrt{H_o/1.6}$

⁴ Scenario 1 wind speed are not reported in BA14 because the corresponding wave height is less than 0.5 ft. To estimate Scenario 1 wind speeds, this study scaled the corresponding Scenario 2 wind speed by 65%, a scaling factor between that is near the top end of BA14's ratio of Scenario 1 to Scenario 2 wind speeds for other transects.

⁵ Δ Barnard et al. (2019) – The incremental wave height increase predicted by 2D modeling of future 1% wave conditions (Barnard et al. 2019) at each transect's offshore location, to account for wave height increase due to waves propagating in deeper water.

3.1.2 Transect Inputs and Results

3.1.2.1 Transect B44

For Transect B44 (BakerAECOM Transect 1013), the WHAFIS input parameters listed in Table 3 yield the wave predictions in Figure 2 as well as the wave and runup predictions in Table 4.

Transect B44 crosses former salt ponds which are still owned by Cargill, Incorporated. Cargill has not identified its current plan for future land use in these ponds, so these ponds are assumed to remain unchanged from their existing conditions, unvegetated managed wetlands.

3.1.2.2 Transect B45

For Transect B45 (BakerAECOM Transect 1014), the WHAFIS input parameters listed in Table 5 yield the wave predictions in Figure 3 as well as the wave and runup predictions in Table 6.

Transect B45 crosses three former salt ponds that are now owned and managed by the US Fish and Wildlife Service as part of the Don Edwards National Wildlife Refuge. The outer pond was recently breached to enable full tidal exchange, with the intent of restoring tidal marsh. The middle pond remains managed for snowy plover habitat. To prevent inundation of the middle pond and inner pond from the breached conditions in the outer pond, the berm between the outer pond and the middle pond was raised to 15 ft NAVD (Ducks Unlimited 2023). The inner pond remains managed for aquatic habitat and stormwater detention.

3.1.2.3 Transect B46

For Transect B46 (BakerAECOM Transect 1015), the WHAFIS input parameters listed in Table 7 yield the wave predictions in Figure 4 as well as the wave and runup predictions in Table 8.

Transect B46 also crosses the two outer former salt ponds that Transect 45 crosses. As for Transect B45, these ponds, part of the Don Edwards National Wildlife Refuge, consist of an outer pond recently breached to restore tidal marsh and an inner pond managed for snowy plover habitat. To prevent inundation of the inner pond from the breached conditions in the outer pond, the berm between the outer pond and the inner pond was raised to 15 ft NAVD (Ducks Unlimited 2023).

3.1.2.4 Transect B47

For Transect B47 (BakerAECOM Transect 1016), the WHAFIS input parameters listed in Table 9 yield the wave predictions in Figure 5 as well as the wave and runup predictions in Table 10.

Transect B47 crosses two former salt ponds that are now owned and managed by the US Fish and Wildlife Service as part of the Don Edwards National Wildlife Refuge. As part of SAFER, these two salt ponds will be breached to re-introduce full tidal exchange with the bay. Initially, the interior of these restored areas will be too low in elevation to support tidal marsh vegetation. In one or two decades after breaching, natural sediment accretion is anticipated to raise the bed elevations such that they will then be able to host tidal marsh vegetation. To represent this change in conditions between the lower, unvegetated bed at the start of the Project (approximately 2030) and the conversion to higher, vegetated bed after two decades (approximately 2050), an additional intermediate set of runs was conducted for this profile. These scenarios, referred to as Scenario A2050, are assumed to occur with one foot of SLR. Wave modeling for Scenarios A1 and A2 are compared to wave modeling for Scenario A2060 in Figure 6.

To provide a more gradual ecotone transition zone from the restored marsh at the inboard side of the restored areas up to the levee crest, the proposed SAFER levee slope used for this transect's wave runup calculations is 10H:1V instead of the 3H:1V slope proposed for all other levee segments.

3.1.2.5 Transect B48

For Transect B48 (BakerAECOM Transect 1017), the WHAFIS input parameters listed in Table 11 yield the wave predictions in Figure 7 as well as the wave and runup predictions in Table 12.

Transect B48 crosses Mosley Tract, a former managed tidal wetland that has breached to full tidal exchange in the last decade. Vegetation has colonized this wetland in recent years and is included in Scenario A for this study, even if there was not substantial vegetation at the time of the BakerAECOM (2014) study.

3.1.2.6 Transect B49

For Transect B49 (BakerAECOM Transect 1018), the WHAFIS input parameters listed in Table 13 yield the wave predictions in Figure 8 as well as the wave and runup predictions in Table 14.

After crossing a narrow outboard tidal marsh, this transect cuts across a series of managed wetlands that are part of the Don Edwards National Wildlife Refuge. The proposed SAFER alignment in this segment runs just landward of the outermost managed wetland. This outermost wetland may remain managed or may be breached to restore tidal conditions. To predict the upper limit of wave conditions that could occur if the outer managed wetland is not restored to wave-attenuating marsh, no vegetation is assumed in this outer managed wetland for all scenarios.

3.1.2.7 Transect B50

For Transect B50 (BakerAECOM Transect 1019), the WHAFIS input parameters listed in Table 15 yield the wave predictions in Figure 9 as well as the wave and runup predictions in Table 16.

This transect cuts across the Cooley Landing Restoration Project (now referred to as the Ravenswood Preserve). The transect includes a former ring levee, which shows up as the two berms bayward of the SAFER levee alignment. This ring levee was breached on the outboard side to full tidal exchange in 2002. The site's interior had subsided and, since breaching, has been gradually accreting sediment to raise its bed elevations. The bed profile and vegetated extent shown in Figure 9a reflects conditions in the years just before the BakerAECOM (2014) study, where the bayward portion of the site was lower than the landward section and extensive tidal marsh vegetation was only present in the narrow strip between the landward segment of the ring levee and the SAFER levee alignment. This site is anticipated to continue its restoration trajectory of further bed elevation increase, which will allow tidal marsh to establish, as shown in Figure 9b.

3.1.2.8 Transect B51

For Transect B51 (BakerAECOM Transect 1020), the WHAFIS input parameters listed in Table 17 yield the wave predictions in Figure 10 as well as the wave and runup predictions in Table 18.

This transect cuts across the Ravenswood Preserve in a similar manner to Transect B50. See Section 3.1.2.7 for a description of this transect's recent history and anticipated geomorphic evolution.

3.1.2.9 Transect B52

For Transect B52 (BakerAECOM Transect 1021), the WHAFIS input parameters listed in Table 19 yield the wave predictions in Figure 11 as well as the wave and runup predictions in Table 20.

Note that this transect cuts across Laumeister Marsh, one of the few undisturbed historic tidal marshes along the San Francisco Bay shoreline.

3.1.2.10 Transect B53

For Transect B53 (BakerAECOM Transect 1022), the WHAFIS input parameters listed in Table 21 yield the wave predictions in Figure 12 as well as the wave and runup predictions in Table 22.

Note that this transect cuts across Faber Tract. While now a healthy tidal marsh, this site had been separated from the bay by a berm, to facilitate placement of dredge spoils within the marsh. Although this berm is breached, remnants remain, as indicated by the berm in the outer portion of this transect.

3.1.3 Bed Elevation Profiles

Bed elevation profiles along each transect were derived from the corresponding bed elevation profile in BakerAECOM (2014) and then modified to reflect the recent modifications to existing conditions described above for each transect. Unvegetated portions of a profile were represented in WHAFIS with IE entries when bed elevations are below the water level and with AS entries when bed elevations are above the water level. Vegetated portions of a profile were represented with VH and MG entries, with the pickleweed parameters specified in BakerAECOM (2014) Table 7.

3.1.3.1 Profile A: Existing Conditions

A simplified version of the bed elevation profiles from BakerAECOM (2014) Appendix C was developed for each transect, to facilitate modification to the existing conditions profile to account for future geomorphic change (as described in the next sections). The simplified profile replicated the distance from the offshore starting point, the typical mudflat slope, the location of the marsh scarp, a typical and constant marsh plain elevation, berms within the marsh plain, and the location of the existing embankment that will be replaced with the SAFER levee. Since the purpose of this study is coastal hazard wave conditions at the SAFER levee, not mapping interior to this levee alignment, portions of the BakerAECOM (2014) transects landward of the SAFER alignment were not included.

For each transect, Profile A with Scenario 1 (except for southern four transects, for which BakerAECOM (2014) did not conduct WHAFIS modeling) and Scenario 2 hydrologic boundary conditions were run in WHAFIS and the results compared to the WHAFIS results in BakerAECOM (2014) Appendix C, to verify that the simplified bed elevation profile produces model results that agree with the BakerAECOM (2014) results to within ± 0.1 ft for almost all of the transects and to within ± 0.25 ft in some segments local to steeper topographic change.

3.1.3.2 Profile B: SLR and Marsh Accretion

San Francisco Bay marshes and marsh restoration sites have demonstrated capacity to accrete sediment and raise their bed elevations in response to increased water levels (Williams and Orr 2002; Stralberg et al. 2011; Thorne et al. 2024). Based on site-specific predictions of tidal marsh evolution with SLR (ESA 2025), the existing marsh plain is projected to accrete approximately 2.3 to 2.8 ft in response to 3.5 ft SLR by 2100. This case, represented by Profile B, is considered to be the most likely future condition. This profile was created by raising the existing marsh portions of Profile A by the projected accretion amount.

3.1.3.3 Profile C: SLR and Static Bed, Loss of Vegetation

If marsh accretion cannot pace SLR, then another, although less likely, scenario would be an unvegetated bench at the current marsh plain elevation, e.g. no accretion or deposition on the marsh plain. If the bed remains at its current elevation, the increase in water levels due to SLR would cause increased inundation duration at these bed elevations, which would preclude marsh vegetation. Therefore, for Profile C, bed elevations are identical to Profile A, but vegetated portions are converted to unvegetated segments (by changing VH and MG entries to IE entries). As such, wave dissipation by vegetation is not considered in these WHAFIS runs.

3.1.3.4 Profile D: SLR and Erosion to Mudflat

A potential, although relatively unlikely, future profile with 3.5 ft of SLR would be erosion of the marsh plain entirely, such that the offshore mudflat slope extends to the levee toe. This results in the deepest water leading up to the levee and hence the largest wave condition at the levee alignment. Profile D was created by extending the offshore mudflat slope to the levee toe, entirely replacing the marsh plain bench.

For consistency and comparative purposes, the scenarios with Profile D were analyzed with the same event-selection method and overland wave propagation modeling (WHAFIS) as the other scenarios using Profiles A, B, and C. This results in relatively high stillwater levels and large waves predicted for the toe of the SAFER levee, which results in corresponding high total water levels. As indicated by other studies (COWI 2023; Schaaf & Wheeler 2023) which have used the BakerAECOM (2014) response-based method for predicting total water levels at nearby shoreline transects that currently do not have outboard tidal marsh or managed wetlands, the event-selection method likely overpredicts maximum total water levels that would be used for determining crest elevations that meet FEMA accreditation requirements with 3.5 ft of SLR.

3.2 Wave Runup and Total Water Levels

Wave runup at the SAFER levee was calculated according to the TAW method (van der Meer 2002), which estimates the 2-percent exceedance wave runup ($R_{2\%}$) as a function of structure geometry, surface roughness, and the height and steepness of incident waves at the structure toe. The reference water level for the TAW calculations is the 2-percent dynamic water level ($DWL_{2\%}$), defined as the sum of still water level (SWL), static wave setup, and dynamic wave setup. Consistent with BakerAECOM (2014), the spectral peakedness parameter for JONSWAP spectra (γ) was set to 3.3 for this study. Since γ was set to 3.3, the dynamic setup was set to zero. Wave setup was applied outboard of the structure toe.

At each transect intersection with the SAFER levee alignment, the outboard side levee consists of earthen fill, roughness factor of 1.0, placed at a 3H:1V slope for all transects except for B47. The proposed levee at B47 has an outboard slope of 10H:1V, to provide an ecotone slope along the adjoining tidal marsh restoration. Significant wave height (H_s) at the toe of the levee is determined by dividing the controlling wave height (H_c) from the WHAFIS modeling by 1.6 (FEMA 2023b) for each transect and scenario.

To calculate maximum wave runup, the $R_{2\%}$ values for annual maxima were converted to $R_{\max}$ using relationships from Walton (1992), and these values were then used to calculate the 1-percent-annual-chance maximum total water levels. Total water levels for each transect were calculated as the sum of still water level (SWL) and computed wave runup. The resulting maximum wave runup elevations, stillwater

surge elevations, and corresponding freeboard requirements for levee-intersecting transects are summarized in Table 1.

4 References

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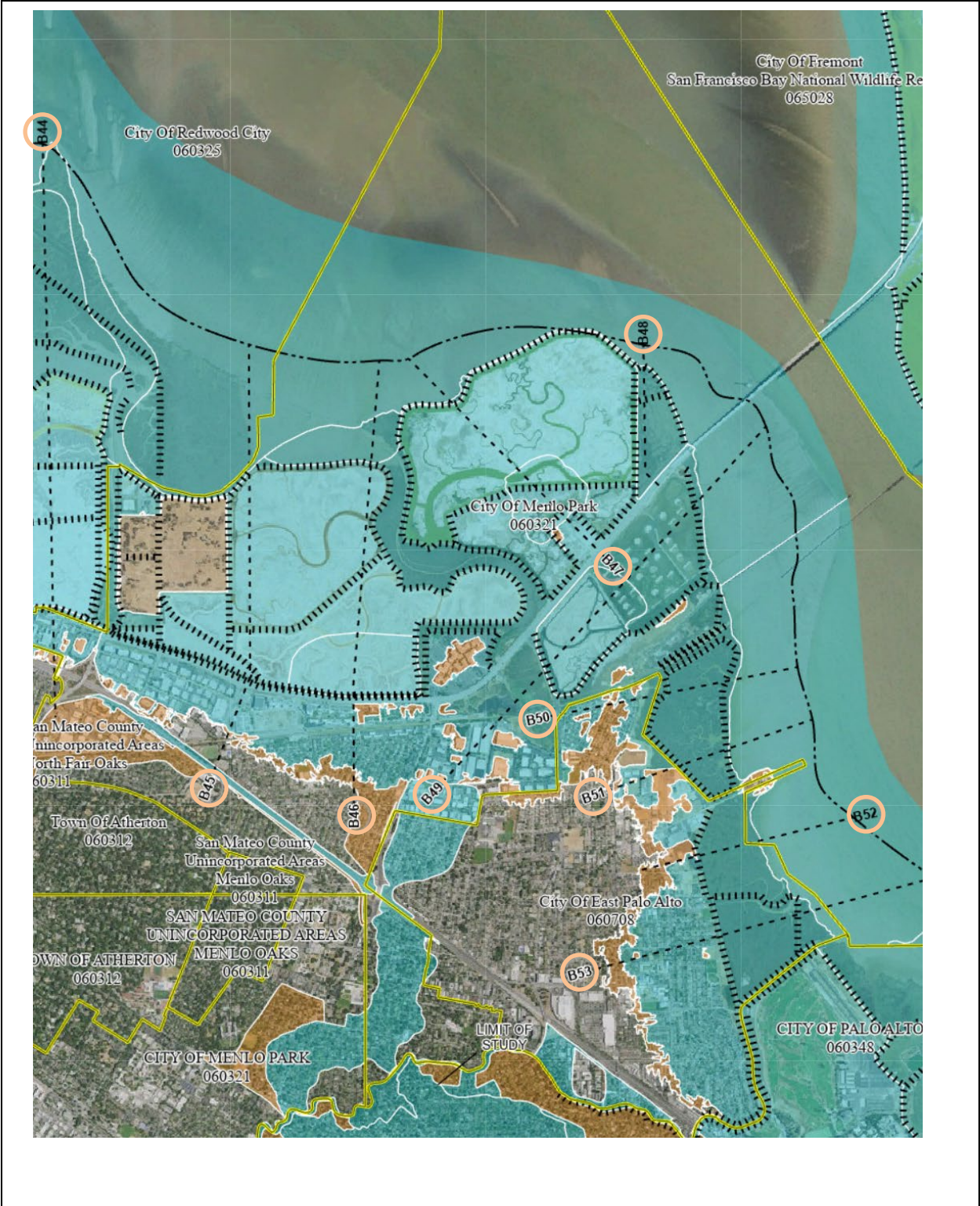
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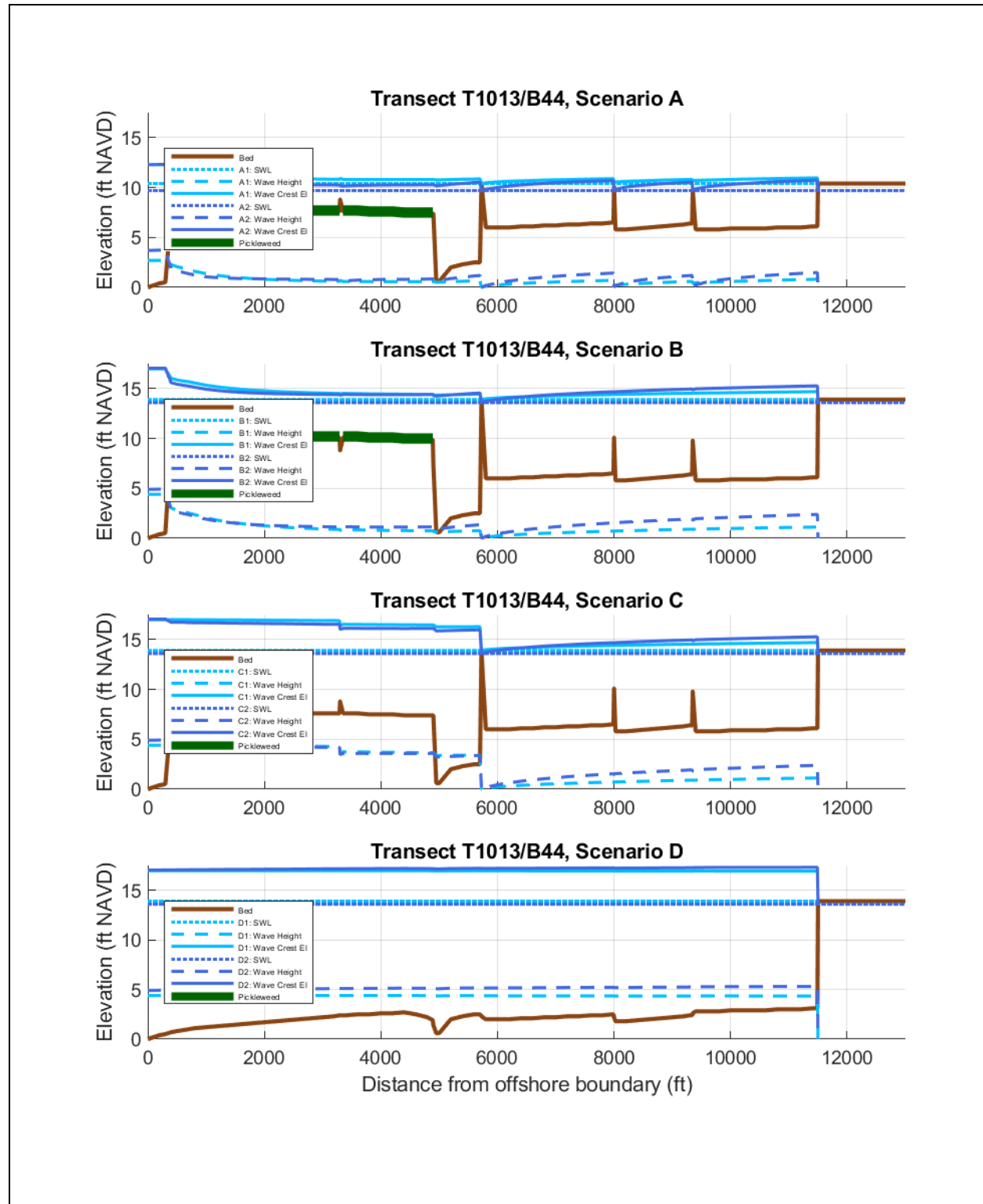
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5 Figures



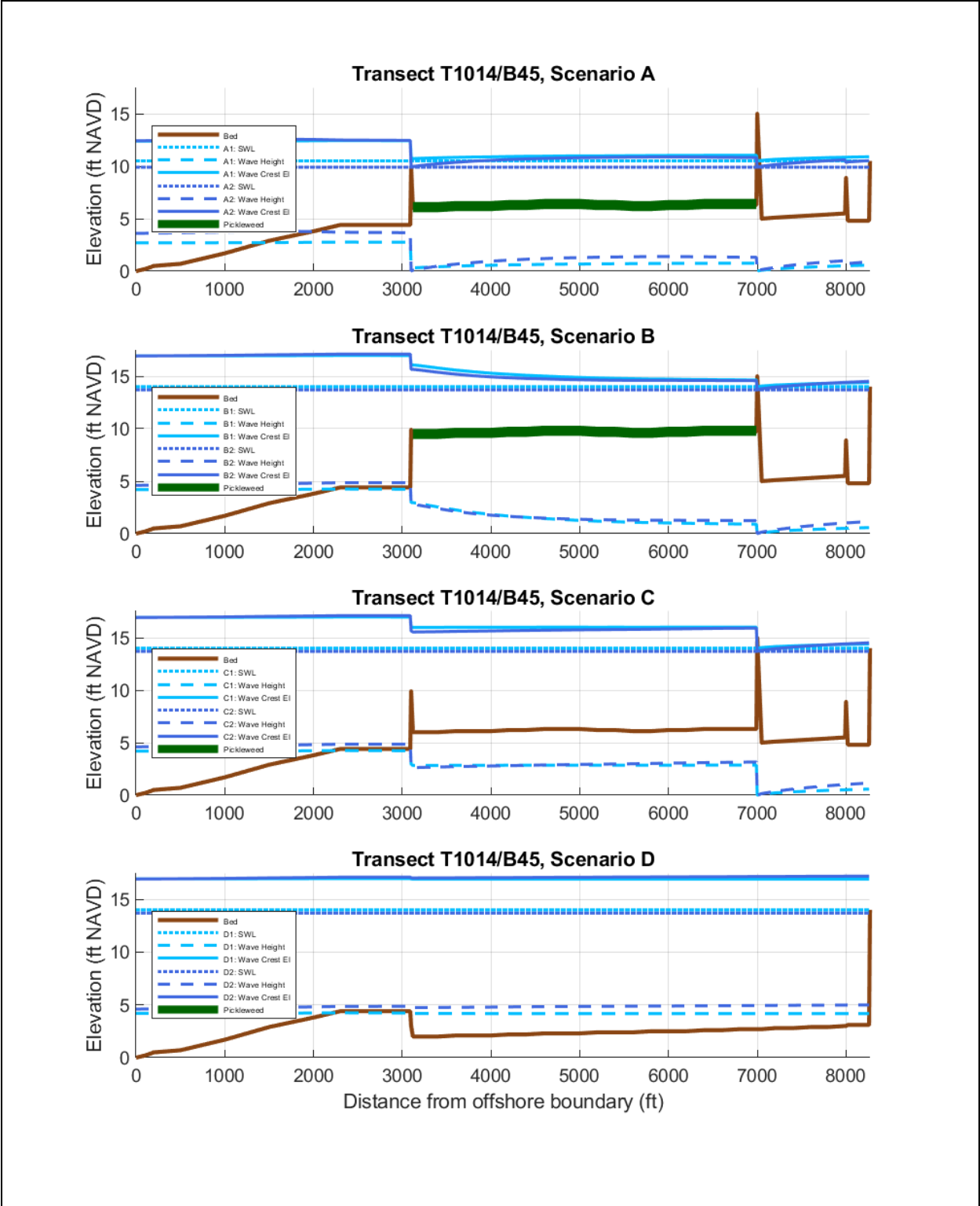
SOURCE: FEMA (2019)

Figure 1
FEMA FIRM – East Palo Alto & Menlo Park



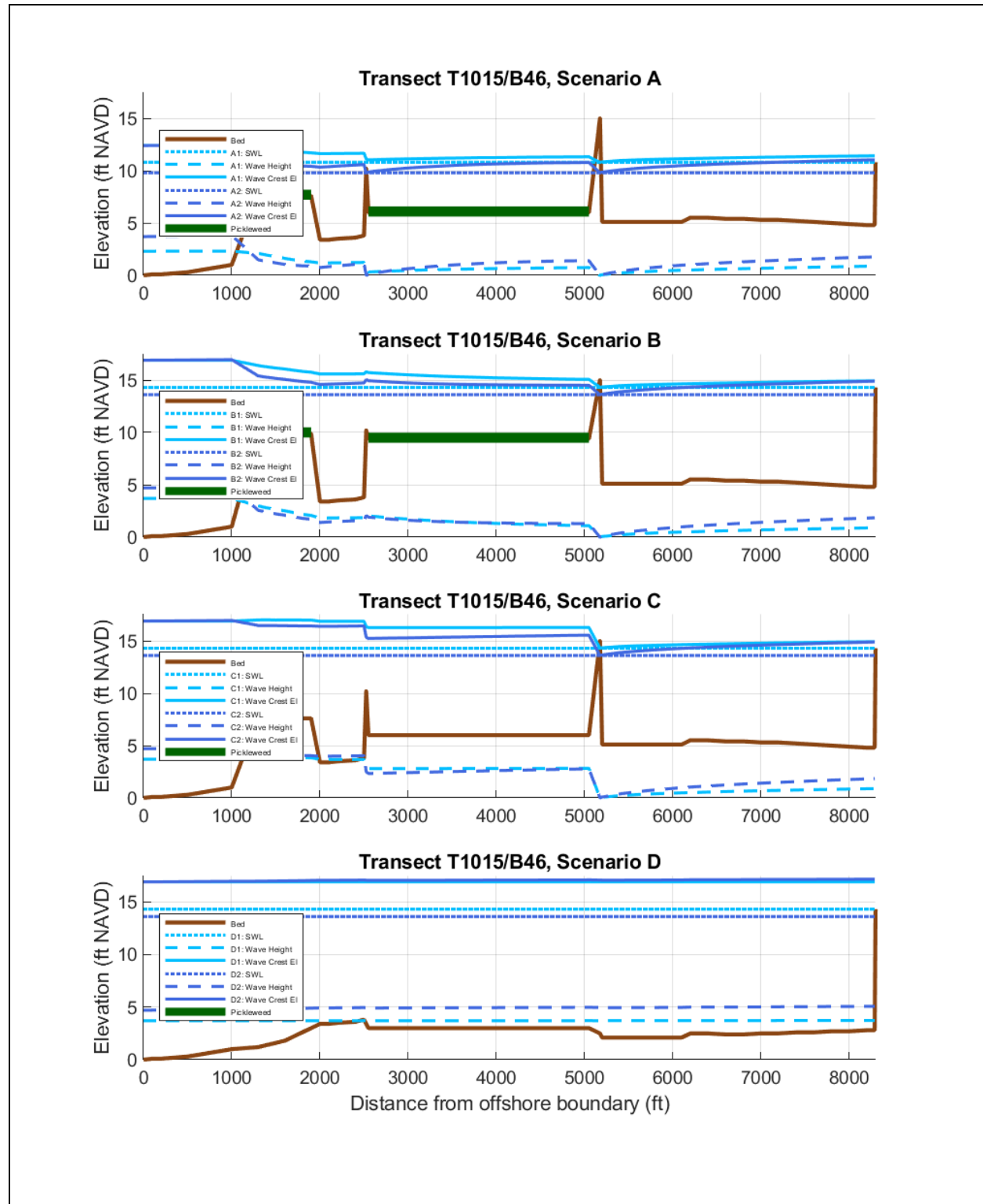
SOURCE: ESA (2026) WHAFIS wave modeling

Figure 2
Overland Wave Propagation – Transect B44



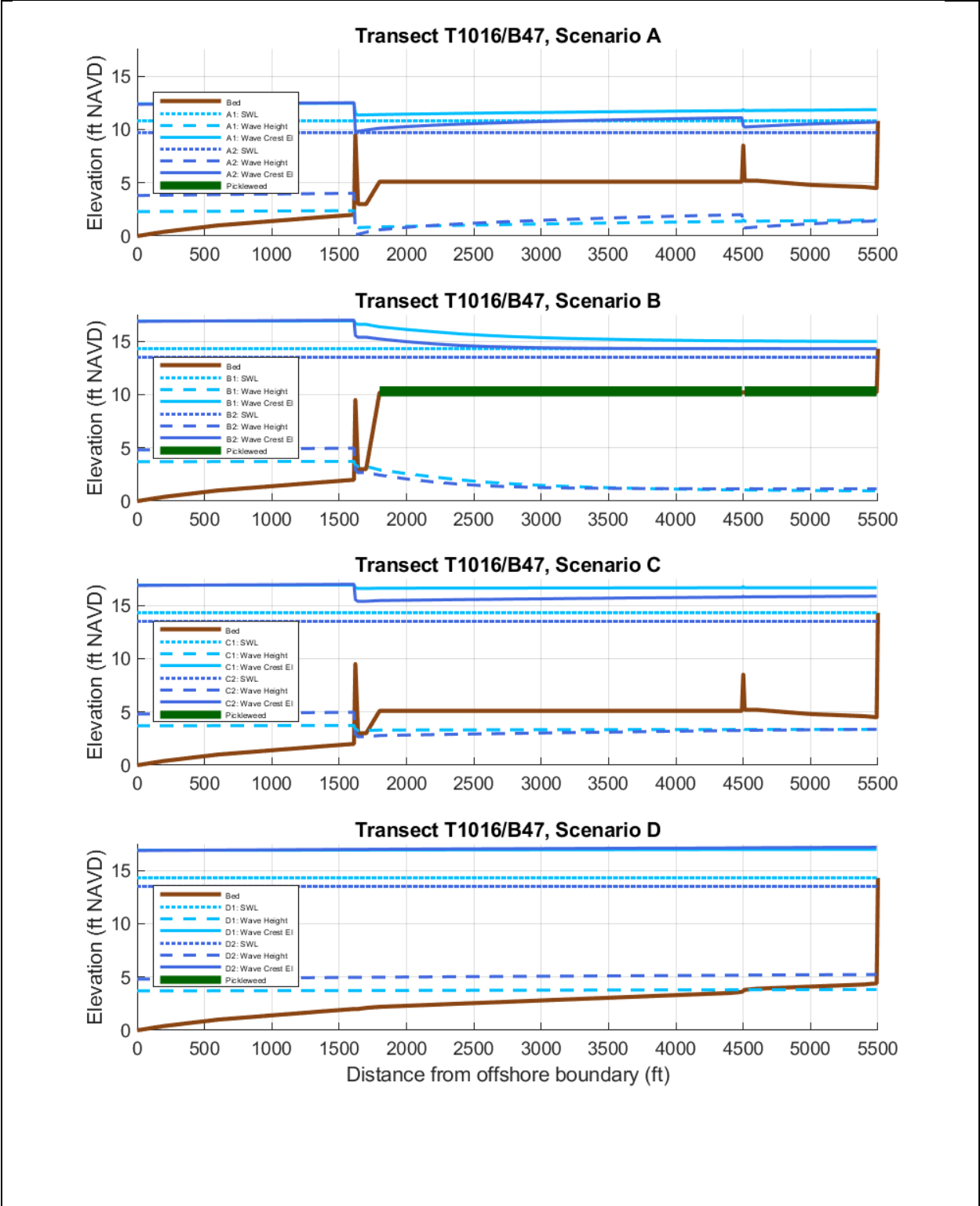
SOURCE: ESA (2026) WHAFIS wave modeling

Figure 3
Overland Wave Propagation – Transect B45



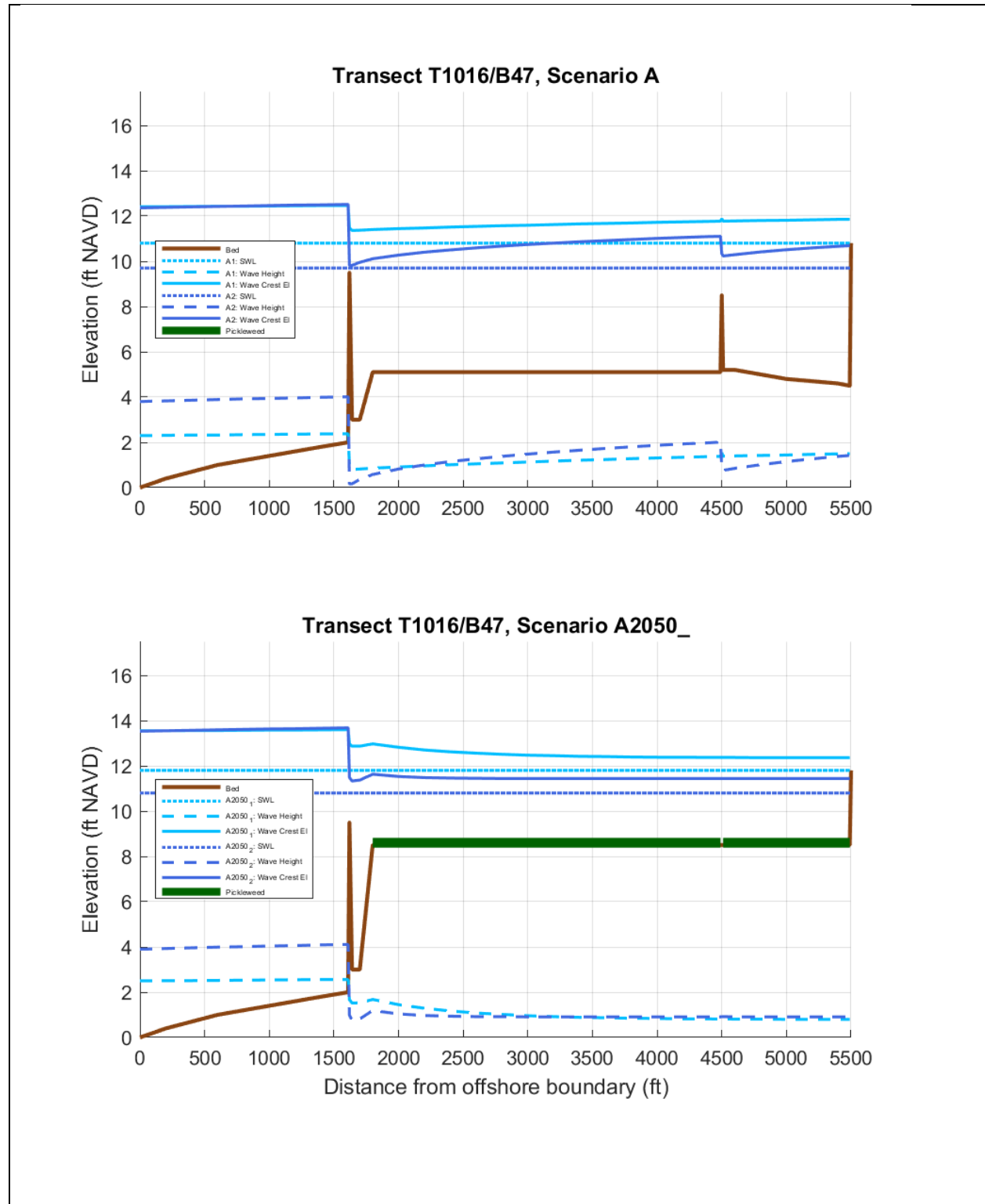
SOURCE: ESA (2026) WHAFIS wave modeling

Figure 4
Overland Wave Propagation – Transect B46



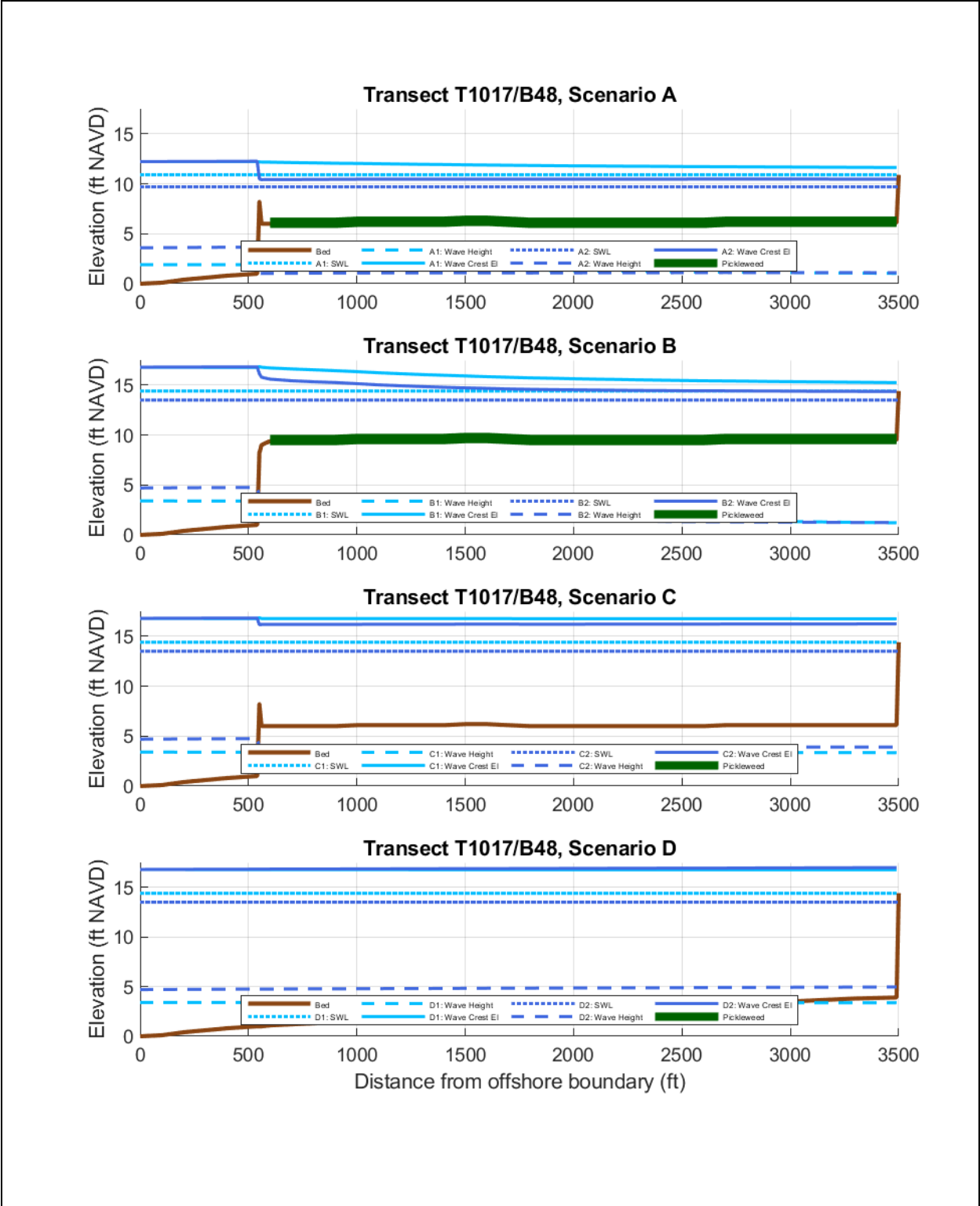
SOURCE: ESA (2026) WHAFIS wave modeling

Figure 5
Overland Wave Propagation – Transect B47



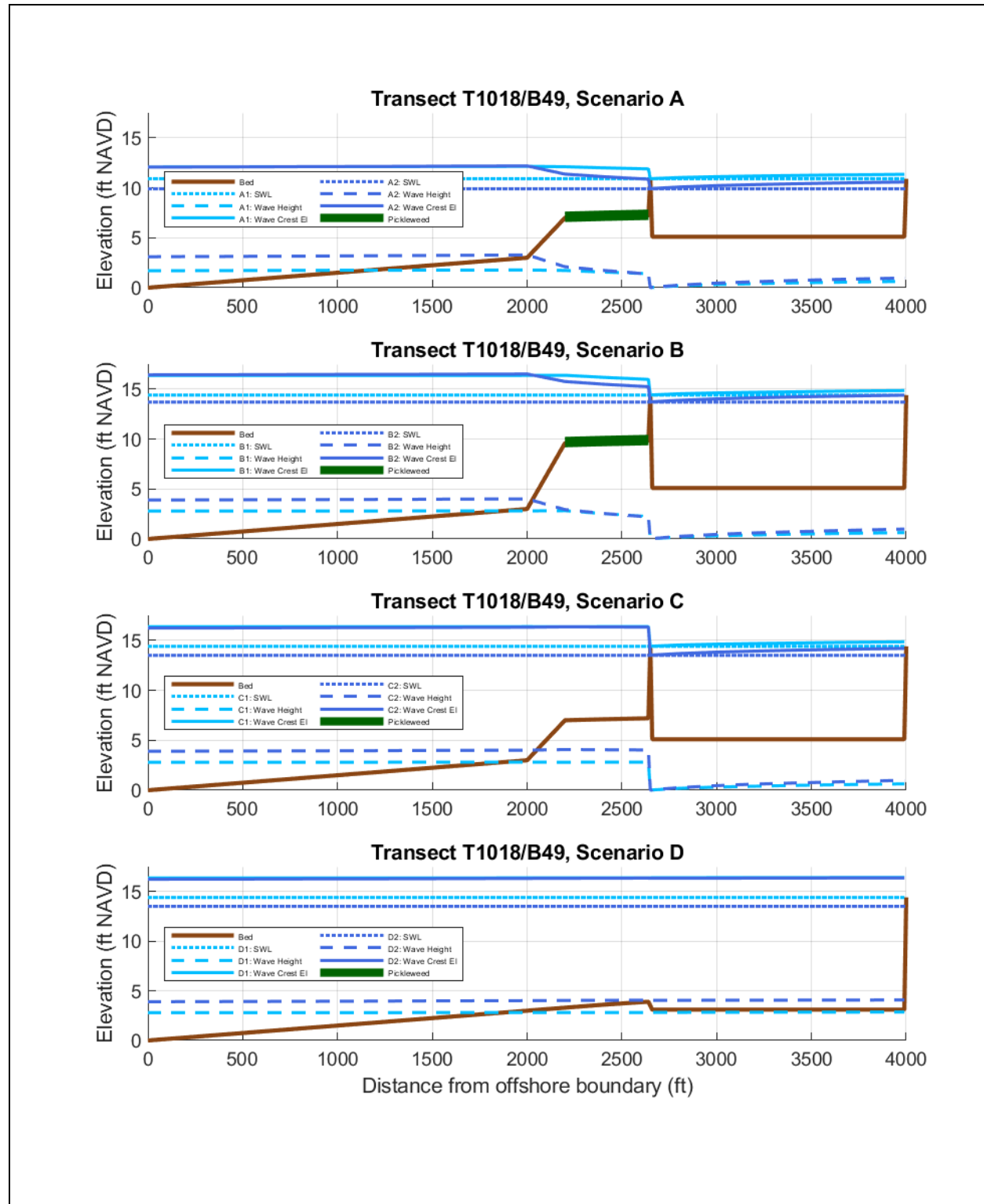
SOURCE: ESA (2026) WHAFIS wave modeling

Figure 6
Overland Wave Propagation – Transect B47 Scenario A and Scenario A 2050



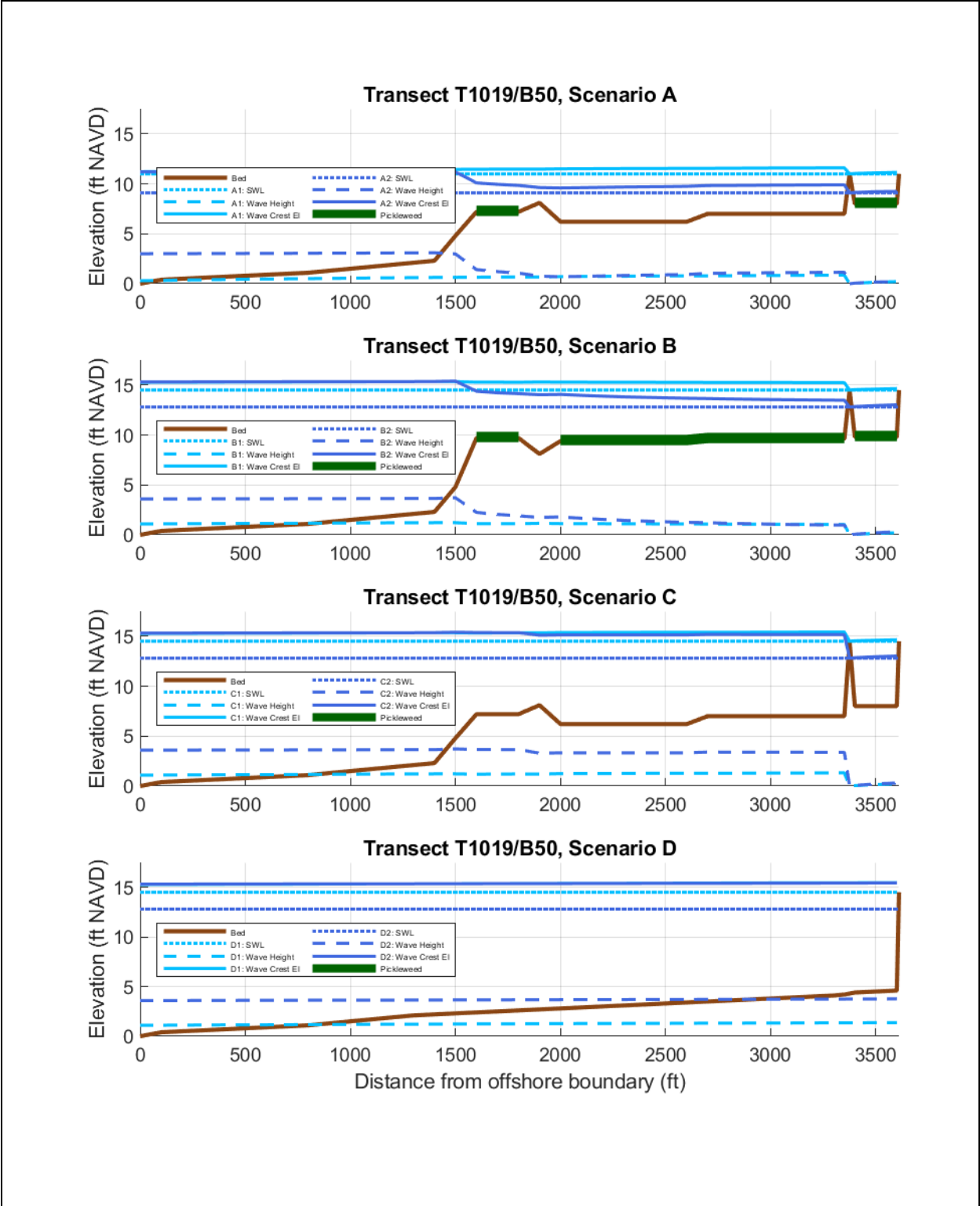
SOURCE: ESA (2026) WHAFIS wave modeling

Figure 7
Overland Wave Propagation – Transect B48



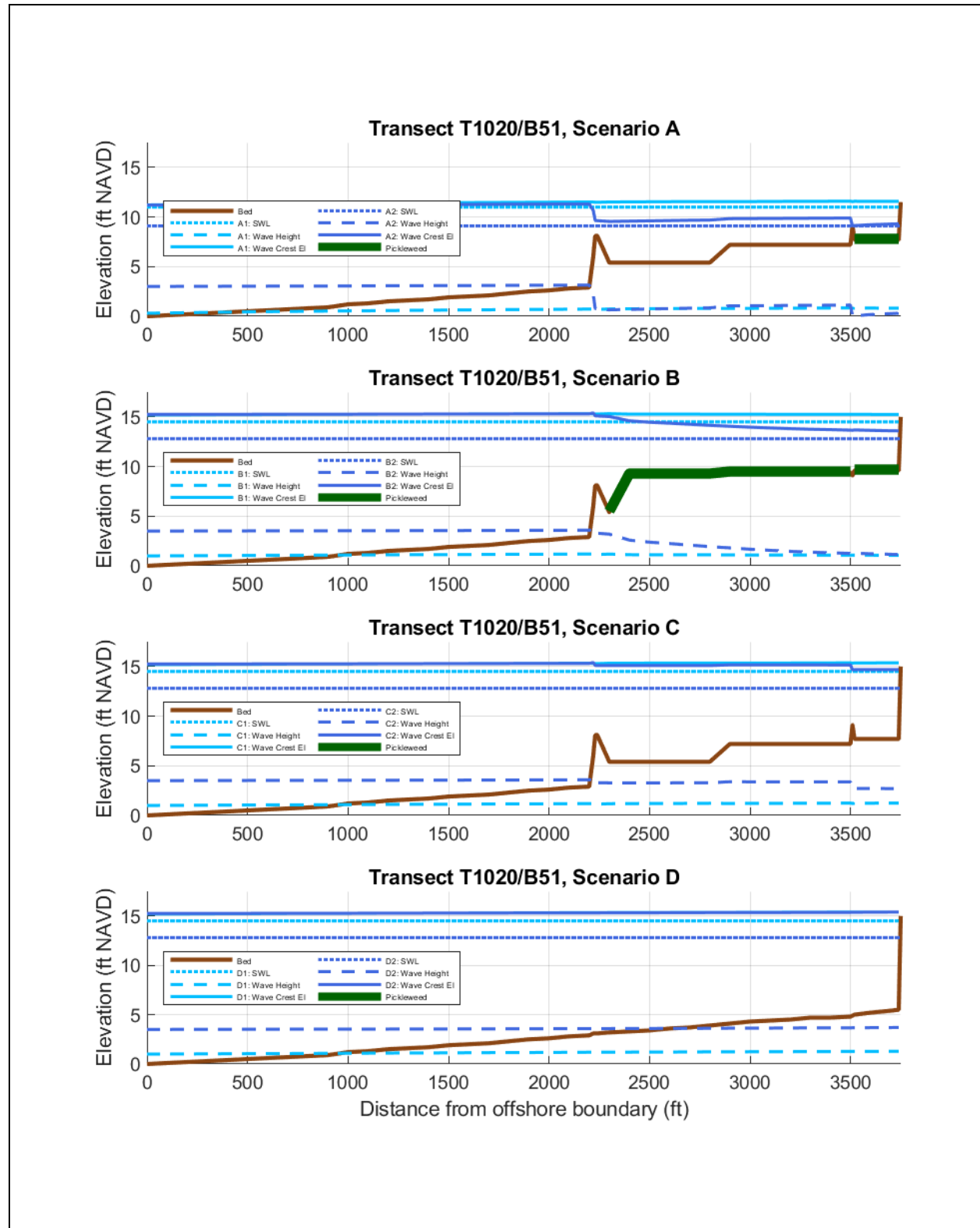
SOURCE: ESA (2026) WHAFIS wave modeling

Figure 8
Overland Wave Propagation – Transect B49



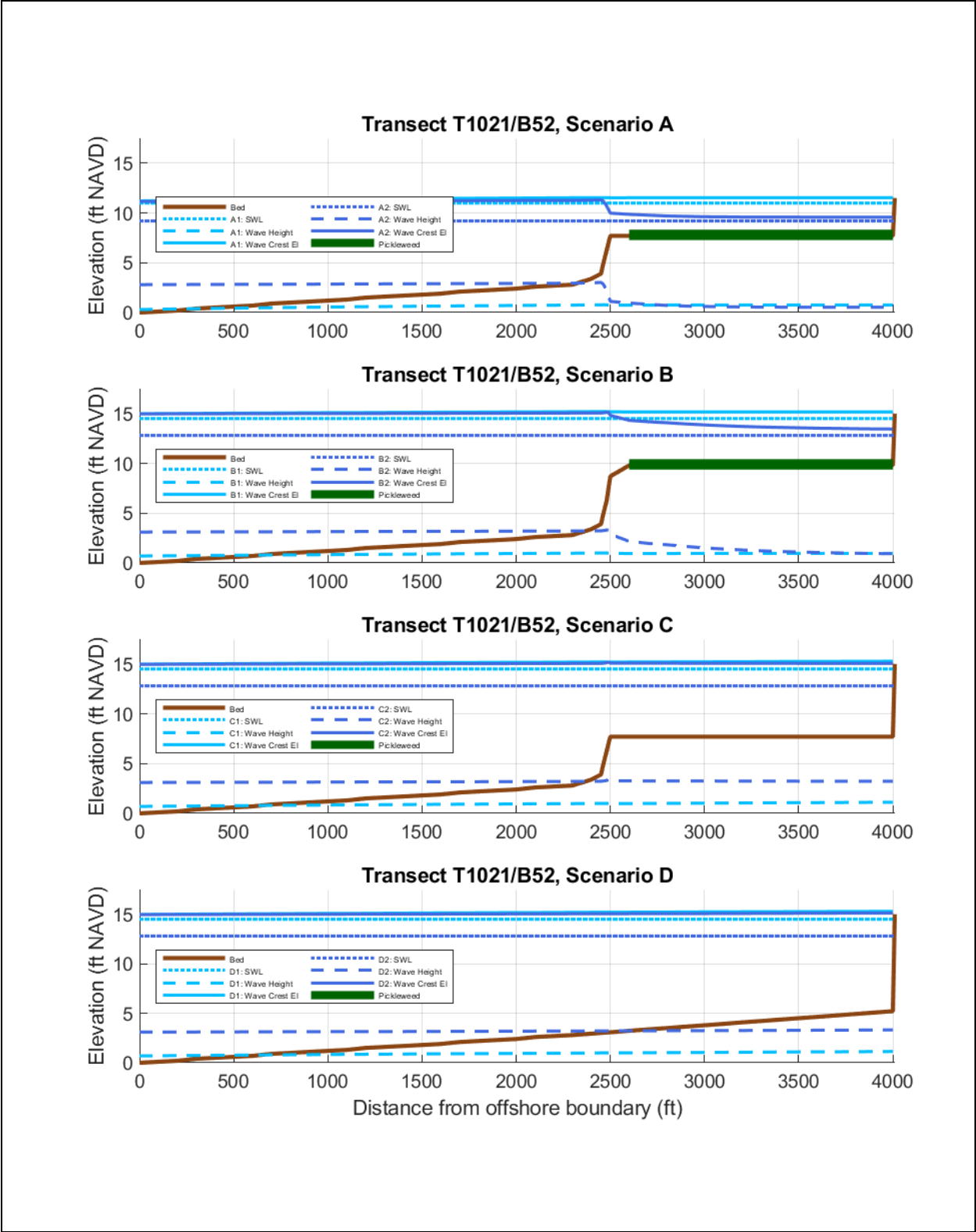
SOURCE: ESA (2026) WHAFIS wave modeling

Figure 9
Overland Wave Propagation – Transect B50



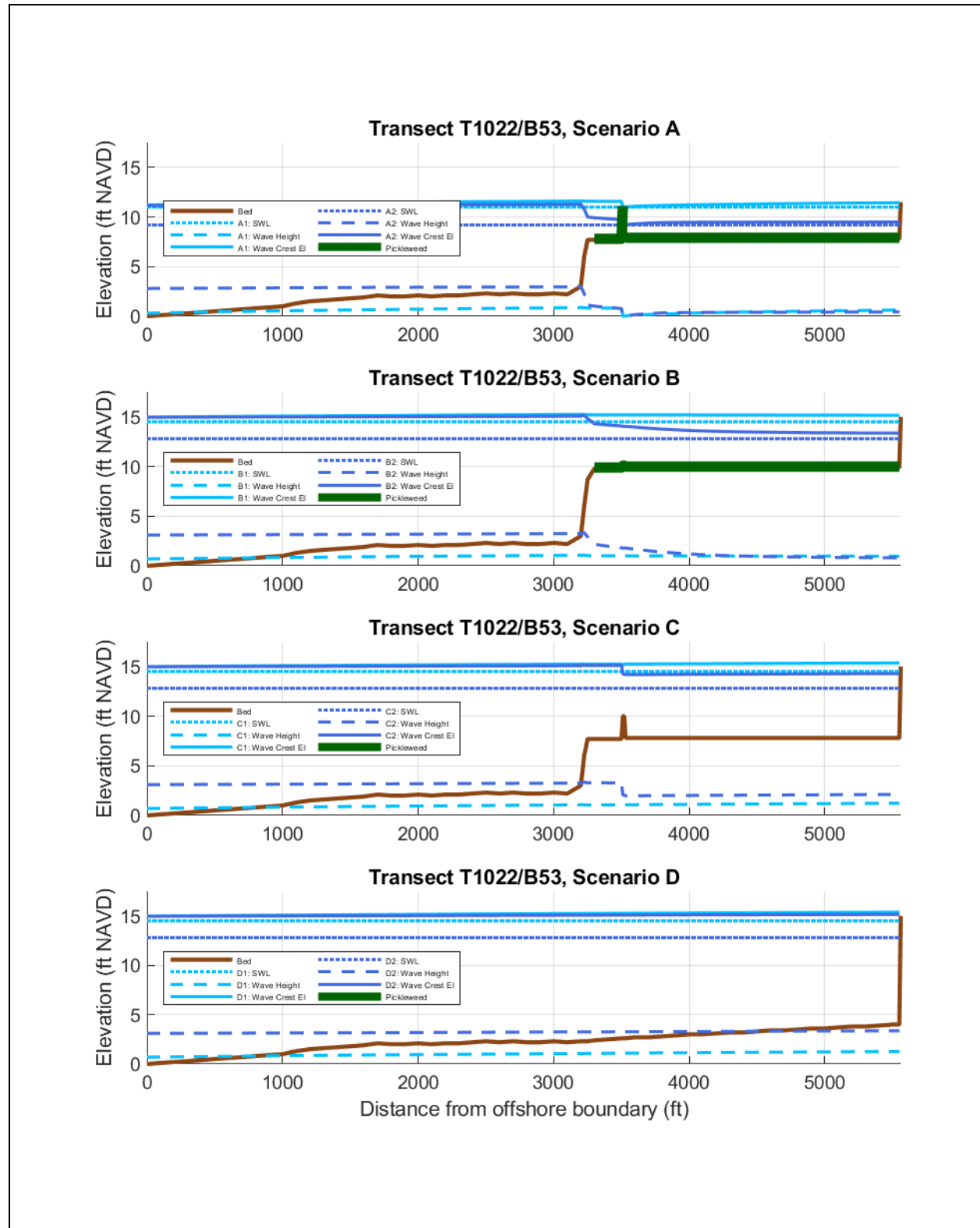
SOURCE: ESA (2026) WHAFIS wave modeling

Figure 10
Overland Wave Propagation – Transect B51



SOURCE: ESA (2026) WHAFIS wave modeling

Figure 11
Overland Wave Propagation – Transect B52



SOURCE: ESA (2026) WHAFIS wave modeling

Figure 12
Overland Wave Propagation – Transect B53

6 Appendix: Transect Inputs and Results

6.1 Transect B44

TABLE 3
TRANSECT B44 INPUT PARAMETERS

Scenario ID	1% Offshore Wave Crest Elevation (ft NAVD)	SWL (ft NAVD)	Wave Height (ft)	Wave period (seconds)	Wind speed (mph)
Existing Conditions					
A1	12.3	10.4	2.7	3.2	19.9
A2	12.3	9.7	3.7	3.7	38.3
+3.5 SLR Conditions					
B1, C1, D1	17.0	13.9	4.4	4.0	19.9
B2, C2, D2	17.0	13.6	4.9	4.2	38.3

BakerAECOM Transect 1013

TABLE 4
TRANSECT B44 WAVE MODELING AND RUNUP RESULTS

Scenario	Description	Still Water Level	Wave height	Wave crest elevation	Wave Runup	Max Runup	Total Water Level	Max TWL	SWL	WCE	Max TWL	Design TWL
		(SWL)	(H _s)	(WCE)	(R _{2%})	(R _{max})	(TWL)	(TWL _{max})	+ 2 ft FB	+ 1 ft FB	+ 1 ft FB	
		ft	ft	ft NAVD	ft	ft	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD
Existing Conditions												
A1	Existing, 1% SWL	10.4	0.5	11.0	1.4	1.8	11.8	12.2	12.4	12.0	13.2	13.9
A2	Existing, 1% wave	9.7	0.9	10.7	2.4	3.2	12.1	12.9	11.7	11.7	13.9	
3.5 ft SLR Conditions												
B1	+3.5 ft SLR, w/marsh rise & vegetation, 1% SWL	13.9	0.7	14.7	1.6	2.2	15.5	16.1	15.9	15.7	17.1	18.7
B2	+3.5 ft SLR, w/marsh rise & vegetation, 1% wave	13.6	1.5	15.3	3.1	4.1	16.7	17.7	15.6	16.3	18.7	
C1	+3.5 ft SLR, w/o marsh rise & no vegetation, 1% SWL	13.9	0.7	14.7	1.6	2.2	15.5	16.1	15.9	15.7	17.1	18.7
C2	+3.5 ft SLR, w/o marsh rise& no vegetation, 1% wave	13.6	1.5	15.3	3.1	4.1	16.7	17.7	15.6	16.3	18.7	
D1	+3.5 ft SLR, eroded to mudflat, 1% SWL	13.9	2.7	16.9	7.9	10.4	21.8	24.3	15.9	17.9	25.3	27.3
D2	+3.5 ft SLR, eroded mudflat, 1% wave	13.6	3.3	17.3	9.6	12.7	23.2	26.3	15.6	18.3	27.3	

6.2 Transect B45

TABLE 5
TRANSECT B45 INPUT PARAMETERS

Scenario ID	1% Offshore Wave Crest Elevation (ft NAVD)	SWL (ft NAVD)	Wave Height (ft)	Wave period (seconds)	Wind speed (mph)
Existing Conditions					
A1	12.4	10.5	2.7	3.2	21.0
A2	12.4	9.9	3.6	3.6	38.8
+3.5 SLR Conditions					
B1, C1, D1	16.9	14.0	4.2	3.9	21.0
B2, C2, D2	16.9	13.7	4.6	4.1	38.8

BakerAECOM Transect 1014

TABLE 6
TRANSECT B45 WAVE MODELING AND RUNUP RESULTS

Scenario	Description	Still Water Level	Wave height	Wave crest elevation	Wave Runup	Max Runup	Total Water Level	Max TWL	SWL	WCE	Max TWL	Design TWL
		(SWL)	(H _s)	(WCE)	(R _{2%})	(R _{max})	(TWL)	(TWL _{max})	+ 2 ft FB	+ 1 ft FB	+ 1 ft FB	
		ft	ft	ft NAVD	ft	ft	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD
Existing Conditions												
A1	Existing, 1% SWL	10.5	0.4	10.9	0.7	0.9	11.2	11.4	12.5	11.9	12.4	12.5
A2	Existing, 1% wave	9.9	0.6	10.5	1.2	1.5	11.1	11.4	11.9	11.5	12.4	
3.5 ft SLR Conditions												
B1	+3.5 ft SLR, w/marsh rise & vegetation, 1% SWL	14.0	0.4	14.4	0.7	1.0	14.7	15.0	16.0	15.4	16.0	16.4
B2	+3.5 ft SLR, w/marsh rise & vegetation, 1% wave	13.7	0.7	14.5	1.3	1.7	15.0	15.4	15.7	15.5	16.4	
C1	+3.5 ft SLR, w/o marsh rise & no vegetation, 1% SWL	14.0	0.4	14.4	0.7	1.0	14.7	15.0	16.0	15.4	16.0	16.4
C2	+3.5 ft SLR, w/o marsh rise& no vegetation, 1% wave	13.7	0.7	14.5	1.3	1.7	15.0	15.4	15.7	15.5	16.4	
D1	+3.5 ft SLR, eroded to mudflat, 1% SWL	14.0	2.6	16.9	7.6	10.0	21.6	24.0	16.0	17.9	25.0	26.7
D2	+3.5 ft SLR, eroded mudflat, 1% wave	13.7	3.1	17.2	9.1	12.0	22.8	25.7	15.7	18.2	26.7	

6.3 Transect B46

TABLE 7
TRANSECT B46 INPUT PARAMETERS

Scenario ID	1% Offshore Wave Crest Elevation (ft NAVD)	SWL (ft NAVD)	Wave Height (ft)	Wave period (seconds)	Wind speed (mph)
Existing Conditions					
A1	12.4	10.8	2.3	2.9	20.8
A2	12.4	9.8	3.7	3.7	38.7
+3.5 SLR Conditions					
B1, C1, D1	16.9	14.3	3.7	3.7	20.8
B2, C2, D2	16.9	13.6	4.7	4.2	38.7

BakerAECOM Transect 1015

TABLE 8
TRANSECT B46 WAVE MODELING AND RUNUP RESULTS

Scenario	Description	Still Water Level	Wave height	Wave crest elevation	Wave Runup	Max Runup	Total Water Level	Max TWL	SWL	WCE	Max TWL	Design TWL
		(SWL)	(H _s)	(WCE)	(R _{2%})	(R _{max})	(TWL)	(TWL _{max})	+ 2 ft FB	+ 1 ft FB	+ 1 ft FB	
		ft	ft	ft NAVD	ft	ft	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD
Existing Conditions												
A1	Existing, 1% SWL	10.8	0.6	11.4	1.2	1.6	12.0	12.4	12.8	12.4	13.4	13.7
A2	Existing, 1% wave	9.8	1.1	11.0	2.2	2.9	12.0	12.7	11.8	12.0	13.7	
+3.5 SLR Conditions												
B1	+3.5 ft SLR, w/marsh rise & vegetation, 1% SWL	14.3	0.6	14.9	1.2	1.6	15.5	15.9	16.3	15.9	16.9	17.6
B2	+3.5 ft SLR, w/marsh rise & vegetation, 1% wave	13.6	1.2	14.9	2.2	3.0	15.8	16.6	15.6	15.9	17.6	
C1	+3.5 ft SLR, w/o marsh rise & no vegetation, 1% SWL	14.3	0.6	14.9	1.2	1.6	15.5	15.9	16.3	15.9	16.9	17.6
C2	+3.5 ft SLR, w/o marsh rise& no vegetation, 1% wave	13.6	1.2	14.9	2.2	3.0	15.8	16.6	15.6	15.9	17.6	
D1	+3.5 ft SLR, eroded to mudflat, 1% SWL	14.3	2.3	16.9	6.8	9.0	21.1	23.3	16.3	17.9	24.3	26.9
D2	+3.5 ft SLR, eroded mudflat, 1% wave	13.6	3.2	17.2	9.3	12.3	22.9	25.9	15.6	18.2	26.9	

6.4 Transect B47

TABLE 9
TRANSECT B47 INPUT PARAMETERS

Scenario ID	1% Offshore Wave Crest Elevation (ft NAVD)	SWL (ft NAVD)	Wave Height (ft)	Wave period (seconds)	Wind speed (mph)
Existing Conditions					
A1	12.4	10.8	2.3	2.9	26.5
A2	12.4	9.7	3.8	3.7	42.1
+1.0 SLR Conditions					
A2050_1	13.5	11.8	2.5	3.0	26.5
A2050_2	13.5	10.8	3.9	3.8	42.1
+3.5 SLR Conditions					
B1, C1, D1	16.9	14.3	3.7	3.7	26.5
B2, C2, D2	16.9	13.5	4.8	4.2	42.1

BakerAECOM Transect 1016

TABLE 10
TRANSECT B47 WAVE MODELING AND RUNUP RESULTS

Scenario	Description	Still Water Level	Wave height	Wave crest elevation	Wave Runup	Max Runup	Total Water Level	Max TWL	SWL	WCE	Max TWL	Design TWL
		(SWL)	(H _s)	(WCE)	(R _{2%})	(R _{max})	(TWL)	(TWL _{max})	+ 2 ft FB	+ 1 ft FB	+ 1 ft FB	
		ft	ft	ft NAVD	ft	ft	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD
Existing Conditions												
A1	Existing, 1% SWL	10.8	0.9	11.9	1.1	1.4	11.9	12.2	12.8	12.9	13.2	13.2
A2	Existing, 1% wave	9.7	0.9	10.7	1.3	1.7	11.0	11.4	11.7	11.7	12.4	
2050 Conditions												
A2050_1	2050, 1% SWL	11.8	0.5	12.4	0.8	1.0	12.6	12.8	13.8	13.4	13.8	13.8
A2050_2	2050, 1% wave	10.8	0.6	11.4	1.0	1.4	11.8	12.2	12.8	12.4	13.2	
+3.5 SLR Conditions												
B1	+3.5 ft SLR, w/marsh rise & vegetation, 1% SWL	14.3	0.6	15.0	1.0	1.4	15.3	15.7	16.3	16.0	16.7	16.7
B2	+3.5 ft SLR, w/marsh rise & vegetation, 1% wave	13.5	0.7	14.3	1.3	1.7	14.8	15.2	15.5	15.3	16.2	
C1	+3.5 ft SLR, w/o marsh rise & no vegetation, 1% SWL	14.3	2.1	16.7	2.0	2.6	16.3	16.9	16.3	17.7	17.9	17.9
C2	+3.5 ft SLR, w/o marsh rise& no vegetation, 1% wave	13.5	2.1	15.9	2.3	3.0	15.8	16.5	15.5	16.9	17.5	
D1	+3.5 ft SLR, eroded to mudflat, 1% SWL	14.3	2.4	17.0	2.1	2.8	16.4	17.1	16.3	18.0	18.1	18.2
D2	+3.5 ft SLR, eroded mudflat, 1% wave	13.5	3.3	17.2	2.8	3.7	16.3	17.2	15.5	18.2	18.2	

6.5 Transect B48

TABLE 11
TRANSECT B48 INPUT PARAMETERS

Scenario ID	1% Offshore Wave Crest Elevation (ft NAVD)	SWL (ft NAVD)	Wave Height (ft)	Wave period (seconds)	Wind speed (mph)
Existing Conditions					
A1	12.2	10.9	1.9	2.6	18.5
A2	12.2	9.7	3.6	3.6	37.3
+3.5 SLR Conditions					
B1, C1, D1	16.8	14.4	3.4	3.5	18.5
B2, C2, D2	16.8	13.5	4.7	4.2	37.3

BakerAECOM Transect 1017

TABLE 12
TRANSECT B48 WAVE MODELING AND RUNUP RESULTS

Scenario	Description	Still Water Level	Wave height	Wave crest elevation	Wave Runup	Max Runup	Total Water Level	Max TWL	SWL	WCE	Max TWL	Design TWL
		(SWL)	(H _s)	(WCE)	(R _{2%})	(R _{max})	(TWL)	(TWL _{max})	+ 2 ft FB	+ 1 ft FB	+ 1 ft FB	
		ft	ft	ft NAVD	ft	ft	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD
Existing Conditions												
A1	Existing, 1% SWL	10.9	0.6	11.6	1.9	2.5	12.8	13.4	12.9	12.6	14.4	14.4
A2	Existing, 1% wave	9.7	0.6	10.4	2.1	2.7	11.8	12.4	11.7	11.4	13.4	
+3.5 SLR Conditions												
B1	+3.5 ft SLR, w/marsh rise & vegetation, 1% SWL	14.4	0.7	15.2	2.3	3.0	16.7	17.4	16.4	16.2	18.4	18.4
B2	+3.5 ft SLR, w/marsh rise & vegetation, 1% wave	13.5	0.7	14.3	2.3	3.1	15.8	16.6	15.5	15.3	17.6	
C1	+3.5 ft SLR, w/o marsh rise & no vegetation, 1% SWL	14.4	1.9	16.5	5.2	6.8	19.6	21.2	16.4	17.5	22.2	23.5
C2	+3.5 ft SLR, w/o marsh rise& no vegetation, 1% wave	13.5	2.2	16.0	6.8	9.0	20.3	22.5	15.5	17.0	23.5	
D1	+3.5 ft SLR, eroded to mudflat, 1% SWL	14.4	1.9	16.5	5.2	6.9	19.6	21.3	16.4	17.5	22.3	24.7
D2	+3.5 ft SLR, eroded mudflat, 1% wave	13.5	2.8	16.6	7.7	10.2	21.2	23.7	15.5	17.6	24.7	

6.6 Transect B49

TABLE 13
TRANSECT B49 INPUT PARAMETERS

Scenario ID	1% Offshore Wave Crest Elevation (ft NAVD)	SWL (ft NAVD)	Wave Height (ft)	Wave period (seconds)	Wind speed (mph)
Existing Conditions					
A1	12.1	10.9	1.7	2.5	22.4
A2	12.1	9.9	3.1	3.4	32.5
+3.5 SLR Conditions					
B1, C1, D1	16.4	14.4	2.8	3.2	22.4
B2, C2, D2	16.4	13.7	3.9	3.8	32.5

BakerAECOM Transect 1018

TABLE 14
TRANSECT B49 WAVE MODELING AND RUNUP RESULTS

Scenario	Description	Still Water Level	Wave height	Wave crest elevation	Wave Runup	Max Runup	Total Water Level	Max TWL	SWL	WCE	Max TWL	Design TWL
		(SWL)	(H _s)	(WCE)	(R _{2%})	(R _{max})	(TWL)	(TWL _{max})	+ 2 ft FB	+ 1 ft FB	+ 1 ft FB	
		ft	ft	ft NAVD	ft	ft	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD
Existing Conditions												
A1	Existing, 1% SWL	10.9	0.4	11.3	0.8	1.1	11.7	12.0	12.9	12.3	13.0	13.0
A2	Existing, 1% wave	9.9	0.6	10.6	1.1	1.5	11.0	11.4	11.9	11.6	12.4	
+3.5 SLR Conditions												
B1	+3.5 ft SLR, w/marsh rise & vegetation, 1% SWL	14.4	0.4	14.8	0.8	1.1	15.2	15.5	16.4	15.8	16.5	16.5
B2	+3.5 ft SLR, w/marsh rise & vegetation, 1% wave	13.7	0.6	14.4	1.2	1.5	14.9	15.2	15.7	15.4	16.2	
C1	+3.5 ft SLR, w/o marsh rise & no vegetation, 1% SWL	14.4	0.4	14.8	0.8	1.1	15.2	15.5	16.4	15.8	16.5	16.5
C2	+3.5 ft SLR, w/o marsh rise& no vegetation, 1% wave	13.5	0.6	14.2	1.2	1.5	14.7	15.0	15.5	15.2	16.0	
D1	+3.5 ft SLR, eroded to mudflat, 1% SWL	14.4	1.8	16.4	5.3	6.9	19.7	21.3	16.4	17.4	22.3	24.3
D2	+3.5 ft SLR, eroded mudflat, 1% wave	13.5	2.5	16.4	7.5	9.8	21.0	23.3	15.5	17.4	24.3	

6.7 Transect B50

TABLE 15
TRANSECT B50 INPUT PARAMETERS

Scenario ID	1% Offshore Wave Crest Elevation (ft NAVD)	SWL (ft NAVD)	Wave Height (ft)	Wave period (seconds)	Wind speed (mph)
Existing Conditions					
A1	11.2	11.0	0.3	1.0	19.2
A2	11.2	9.1	3.0	3.3	29.5
+3.5 SLR Conditions					
B1, C1, D1	15.3	14.5	1.1	2.0	19.2
B2, C2, D2	15.3	12.8	3.6	3.6	29.5

BakerAECOM Transect 1019

TABLE 16
TRANSECT B50 WAVE MODELING AND RUNUP RESULTS

Scenario	Description	Still Water Level	Wave height	Wave crest elevation	Wave Runup	Max Runup	Total Water Level	Max TWL	SWL	WCE	Max TWL	Design TWL
		(SWL)	(H _s)	(WCE)	(R _{2%})	(R _{max})	(TWL)	(TWL _{max})	+ 2 ft FB	+ 1 ft FB	+ 1 ft FB	
		ft	ft	ft NAVD	ft	ft	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD
Existing Conditions												
A1	Existing, 1% SWL	11.0	0.1	11.1	0.2	0.2	11.2	11.2	13.0	12.1	12.2	13.0
A2	Existing, 1% wave	9.1	0.1	9.2	0.2	0.3	9.3	9.4	11.1	10.2	10.4	
+3.5 SLR Conditions												
B1	+3.5 ft SLR, w/marsh rise & vegetation, 1% SWL	14.5	0.1	14.6	0.2	0.2	14.7	14.7	16.5	15.6	15.7	16.5
B2	+3.5 ft SLR, w/marsh rise & vegetation, 1% wave	12.8	0.2	13.0	0.2	0.3	13.0	13.1	14.8	14.0	14.1	
C1	+3.5 ft SLR, w/o marsh rise & no vegetation, 1% SWL	14.5	0.1	14.6	0.2	0.2	14.7	14.7	16.5	15.6	15.7	16.5
C2	+3.5 ft SLR, w/o marsh rise& no vegetation, 1% wave	12.8	0.2	13.0	0.2	0.3	13.0	13.1	14.8	14.0	14.1	
D1	+3.5 ft SLR, eroded to mudflat, 1% SWL	14.5	0.7	15.3	1.7	2.3	16.2	16.8	16.5	16.3	17.8	20.2
D2	+3.5 ft SLR, eroded mudflat, 1% wave	12.8	1.9	14.9	4.8	6.4	17.6	19.2	14.8	15.9	20.2	

6.8 Transect B51

TABLE 17
TRANSECT B51 INPUT PARAMETERS

Scenario ID	1% Offshore Wave Crest Elevation (ft NAVD)	SWL (ft NAVD)	Wave Height (ft)	Wave period (seconds)	Wind speed (mph)
Existing Conditions					
A1	11.2	11.0	0.3	1.0	18.5
A2	11.2	9.1	3.0	3.3	28.5
+3.5 SLR Conditions					
B1, C1, D1	15.2	14.5	1.0	1.0	18.5
B2, C2, D2	15.2	12.8	3.5	3.3	28.5

BakerAECOM Transect 1020

TABLE 18
TRANSECT B51 WAVE MODELING AND RUNUP RESULTS

Scenario	Description	Still Water Level	Wave height	Wave crest elevation	Wave Runup	Max Runup	Total Water Level	Max TWL	SWL	WCE	Max TWL	Design TWL
		(SWL)	(H _s)	(WCE)	(R _{2%})	(R _{max})	(TWL)	(TWL _{max})	+ 2 ft FB	+ 1 ft FB	+ 1 ft FB	
		ft	ft	ft NAVD	ft	ft	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD
Existing Conditions												
A1	Existing, 1% SWL	11.0	0.4	11.5	0.8	1.0	11.8	12.0	13.0	12.5	13.0	13.0
A2	Existing, 1% wave	9.1	0.1	10.0	0.2	0.3	9.3	9.4	11.1	11.0	10.4	
+3.5 SLR Conditions												
B1	+3.5 ft SLR, w/marsh rise & vegetation, 1% SWL	14.5	0.5	15.2	1.2	1.6	15.7	16.1	16.5	16.2	17.1	17.1
B2	+3.5 ft SLR, w/marsh rise & vegetation, 1% wave	12.8	0.5	14.0	1.6	2.2	14.4	15.0	14.8	15.0	16.0	
C1	+3.5 ft SLR, w/o marsh rise & no vegetation, 1% SWL	14.5	0.5	15.3	1.3	1.7	15.8	16.2	16.5	16.3	17.2	18.2
C2	+3.5 ft SLR, w/o marsh rise& no vegetation, 1% wave	12.8	1.2	14.8	3.3	4.4	16.1	17.2	14.8	15.8	18.2	
D1	+3.5 ft SLR, eroded to mudflat, 1% SWL	14.5	0.6	15.3	1.3	1.7	15.8	16.2	16.5	16.3	17.2	19.0
D2	+3.5 ft SLR, eroded mudflat, 1% wave	12.8	1.6	15.3	3.9	5.2	16.7	18.0	14.8	16.3	19.0	

6.9 Transect B52

TABLE 19
TRANSECT B52 INPUT PARAMETERS

Scenario ID	1% Offshore Wave Crest Elevation (ft NAVD)	SWL (ft NAVD)	Wave Height (ft)	Wave period (seconds)	Wind speed (mph)
Existing Conditions					
A1	11.2	11.0	0.3	1.0	19.0
A2	11.2	9.2	2.8	3.2	29.2
+3.5 SLR Conditions					
B1, C1, D1	15.0	14.5	0.7	1.6	19.0
B2, C2, D2	15.0	12.8	3.1	3.4	29.2

BakerAECOM Transect 1021

TABLE 20
TRANSECT B52 WAVE MODELING AND RUNUP RESULTS

Scenario	Description	Still Water Level	Wave height	Wave crest elevation	Wave Runup	Max Runup	Total Water Level	Max TWL	SWL	WCE	Max TWL	Design TWL
		(SWL)	(H _s)	(WCE)	(R _{2%})	(R _{max})	(TWL)	(TWL _{max})	+ 2 ft FB	+ 1 ft FB	+ 1 ft FB	
		ft	ft	ft NAVD	ft	ft	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD
Existing Conditions												
A1	Existing, 1% SWL	11.0	0.3	11.5	0.8	1.0	11.8	12.0	13.0	12.5	13.0	13.0
A2	Existing, 1% wave	9.2	0.2	10.1	0.8	1.0	10.0	10.2	11.2	11.1	11.2	
+3.5 SLR Conditions												
B1	+3.5 ft SLR, w/marsh rise & vegetation, 1% SWL	14.5	0.4	15.1	1.0	1.4	15.5	15.9	16.5	16.1	16.9	16.9
B2	+3.5 ft SLR, w/marsh rise & vegetation, 1% wave	12.8	0.4	13.9	1.3	1.8	14.1	14.6	14.8	14.9	15.6	
C1	+3.5 ft SLR, w/o marsh rise & no vegetation, 1% SWL	14.5	0.5	15.2	1.1	1.5	15.6	16.0	16.5	16.2	17.0	18.4
C2	+3.5 ft SLR, w/o marsh rise& no vegetation, 1% wave	12.8	1.4	15.0	3.5	4.6	16.3	17.4	14.8	16.0	18.4	
D1	+3.5 ft SLR, eroded to mudflat, 1% SWL	14.5	0.5	15.2	1.1	1.5	15.6	16.0	16.5	16.2	17.0	18.5
D2	+3.5 ft SLR, eroded mudflat, 1% wave	12.8	1.5	15.1	3.5	4.7	16.3	17.5	14.8	16.1	18.5	

6.10 Transect B53

TABLE 21
TRANSECT B53 INPUT PARAMETERS

Scenario ID	1% Offshore Wave Crest Elevation (ft NAVD)	SWL (ft NAVD)	Wave Height (ft)	Wave period (seconds)	Wind speed (mph)
Existing Conditions					
A1	11.2	11.0	0.3	1.0	18.9
A2	11.2	9.2	2.8	3.2	29.1
+3.5 SLR Conditions					
B1, C1, D1	15.0	14.5	0.7	1.6	18.9
B2, C2, D2	15.0	12.8	3.1	3.4	29.1

BakerAECOM Transect 1022

TABLE 22
TRANSECT B53 WAVE MODELING AND RUNUP RESULTS

Scenario	Description	Still Water Level	Wave height	Wave crest elevation	Wave Runup	Max Runup	Total Water Level	Max TWL	SWL	WCE	Max TWL	Design TWL
		(SWL)	(H _s)	(WCE)	(R _{2%})	(R _{max})	(TWL)	(TWL _{max})	+ 2 ft FB	+ 1 ft FB	+ 1 ft FB	
		ft	ft	ft NAVD	ft	ft	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD	ft NAVD
Existing Conditions												
A1	Existing, 1% SWL	11.0	0.3	11.5	0.5	0.6	11.5	11.6	13.0	12.5	12.6	13.0
A2	Existing, 1% wave	9.2	0.2	10.1	0.5	0.6	9.7	9.8	11.2	11.1	10.8	
+3.5 SLR Conditions												
B1	+3.5 ft SLR, w/marsh rise & vegetation, 1% SWL	14.5	0.4	15.1	1.1	1.4	15.6	15.9	16.5	16.1	16.9	16.9
B2	+3.5 ft SLR, w/marsh rise & vegetation, 1% wave	12.8	0.4	13.9	1.2	1.5	14.0	14.3	14.8	14.9	15.3	
C1	+3.5 ft SLR, w/o marsh rise & no vegetation, 1% SWL	14.5	0.5	15.3	1.2	1.6	15.7	16.1	16.5	16.3	17.1	17.5
C2	+3.5 ft SLR, w/o marsh rise& no vegetation, 1% wave	12.8	0.9	14.5	2.8	3.7	15.6	16.5	14.8	15.5	17.5	
D1	+3.5 ft SLR, eroded to mudflat, 1% SWL	14.5	0.6	15.3	1.2	1.6	15.7	16.1	16.5	16.3	17.1	18.6
D2	+3.5 ft SLR, eroded mudflat, 1% wave	12.8	1.5	15.1	3.6	4.8	16.4	17.6	14.8	16.1	18.6	