Appendix G. Surface and area calculation for the 100-year and 500-year floods

The results of the probabilistic tsunami hazard analysis (PTHA) are grids of probability values for a series of tsunami wave heights in 0.5-m increments from 0.5 m to 10.5 m. The cell size is defined by the near-field tsunami source models and is 0.000558 degree in geographic coordinates or approximately 60 m in projected coordinates. The cell values were exported from PTHA as xyz (longitude, latitude, probability) values and reformatted as ArcGIS grids. The grid for each wave height was contoured with an interval of 0.2% or 0.002 probability (Figs. G1a–c). The 1.0% contours for each wave height were merged into one file representing an annual probability of exceedance of 1.0% or the 100-year tsunami (Fig. G1d). The 0.2% contours were similarly merged to represent the annual probability of exceedance of 0.2% or the 500-year tsunami (Fig. G1e).

The wave height contours overlap or are closely spaced (sub-pixel separation) in coastal and inshore areas (Fig. G2d). The overlaps of the 100-year contours were clarified in the plate that accompanies this report by selective labeling, but overlaps for the 500-year contours are more complex and were processed to smooth the surface, taking into account the maximum wave height values at grid cell resolution (Fig. G2d–f).

Several ArcGIS surface interpolation methods were tested (with the overlapping and nonoverlapping contours separated or combined) to isolate one that most closely reproduced the maximum grid values. Combining contour data from the non-overlapping area and the extracted maximum points from the overlapping area in the TOPOGRID tool provided final wave heights with a standard deviation 0.25 m around the maximum PTHA wave heights. The TOPOGRID command is an interpolation method designed for the creation of digital elevation models (DEMs) (Hutchinson, 1993) from both line and point input.

Each of the 500-year wave height contours was converted to a grid, the grids were merged by descending wave height to capture the maximum value in each grid cell. The maximum grid values were converted to points and clipped to the overlap area for input to TOPOGRID (Fig. G2b). Contours that do not overlap are clipped and input to TOPOGRID as line features without modification. Contours of the resulting grid are used in the final representation of these flood surfaces (Fig. G2c, Plate 1).

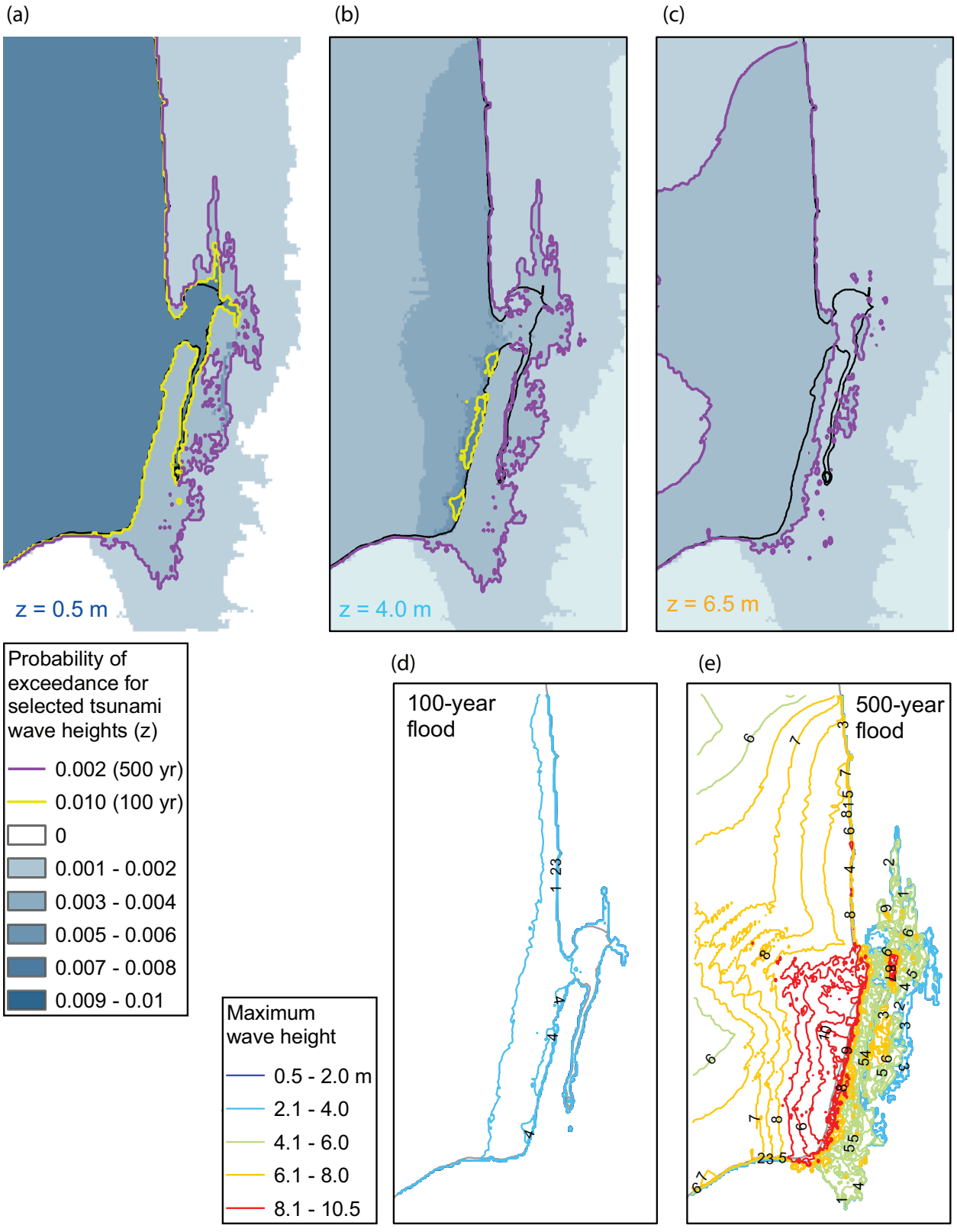

Figure G1: Probability grids from probabilistic tsunami hazard analysis (PTHA) for selected wave heights (a) 0.5 m, (b) 4.0 m, and (c) 6.5 m with the 0.002 and 0.010 contours where they exist. 100-year (d) and 500-year (e) flood maps of wave heights compiled from 0.010 and 0.002 probability contours, respectively.

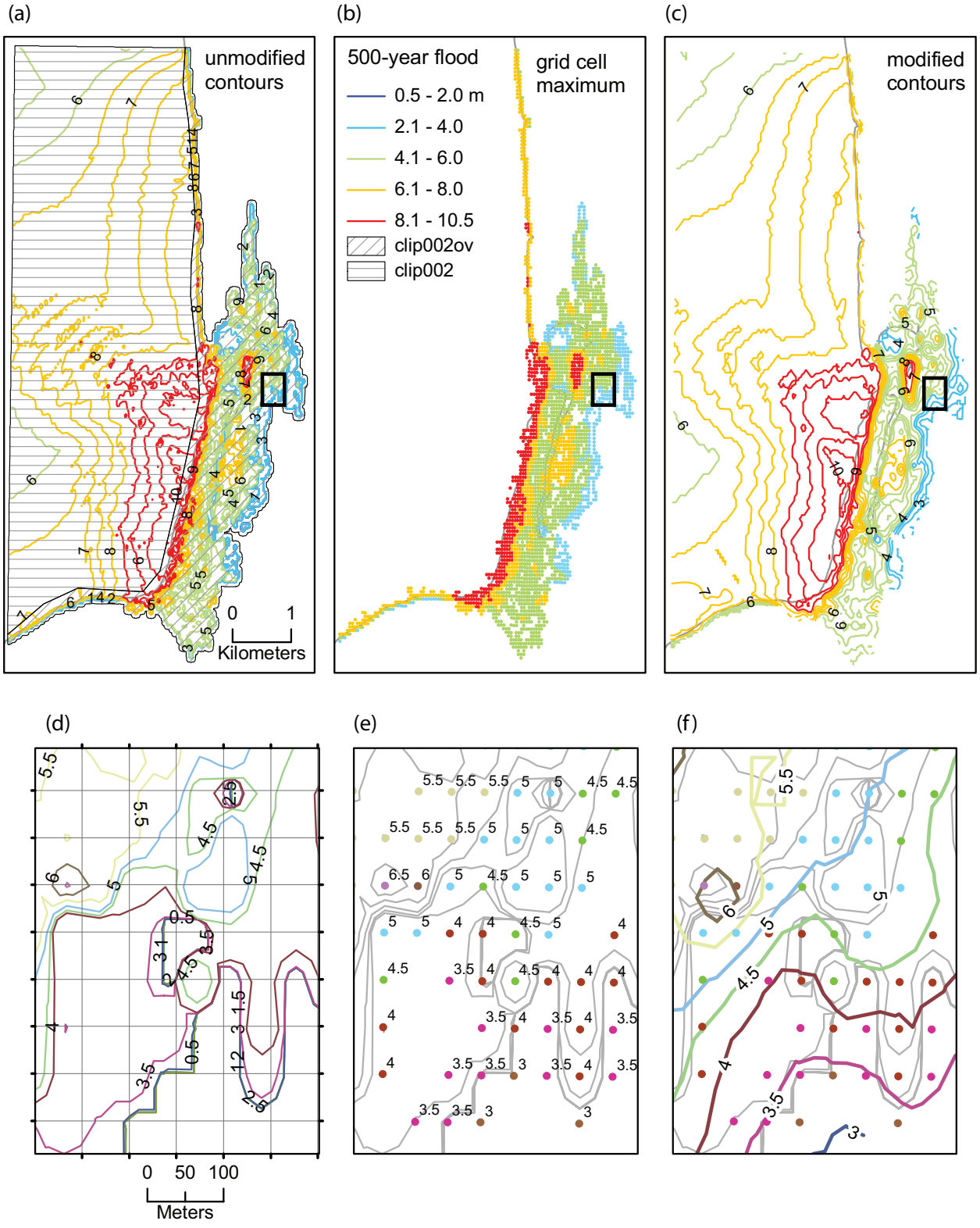

Figure G2: Maps of 500-year flood data for entire study area with accompanying enlargements of a selected area. (a) 500-year flood contours as extracted from PTHA model. Enlargement (b) shows that contours lie close together at the grid-cell level. (c) Maximum wave height values extracted for each grid cell in the inshore area. (d) Enlargement shows values for each grid cell in relation to original contours. (e) Contours recalculated by Arc TOPOGRID are generalized, but generally honor the original data (f).

The eastern edge of the data portrays a maximum wave height of no less than 2.5 m. This artificial thickness of water may be addressed by going to a smaller grid spacing and/or modeling finer increments of wave height exceedance from PTHA.

The extents of the 100- and 500-year maps are combined with the mean lower low water line (or_seaside1_3navd) (Venturato, 2005) to produce the tsunami-based flood zone map (Fig. G3).

References

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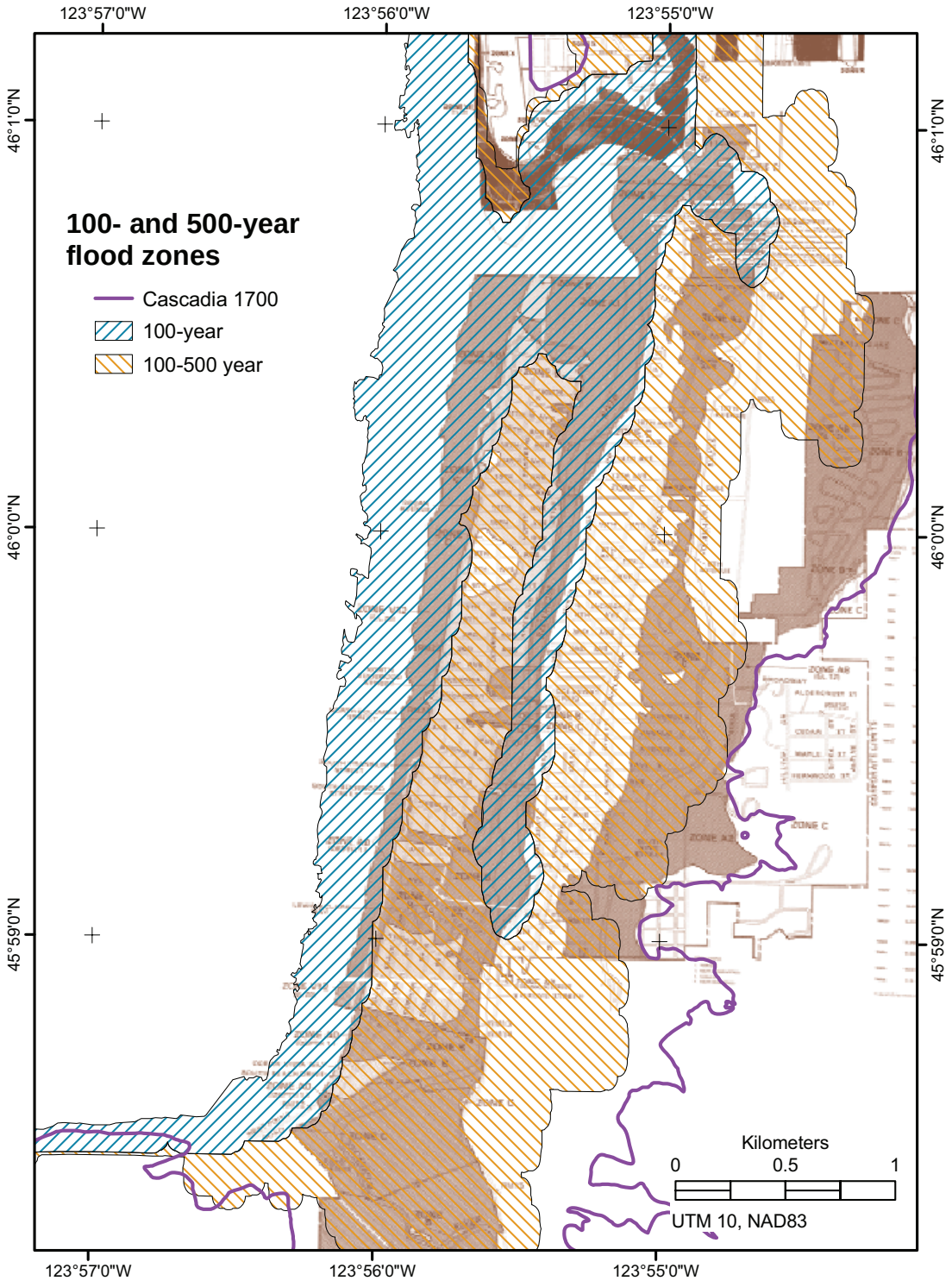

Figure G3: Map of 100- and 500-year flood zones based on PTHA overlaid on FEMA Flood Insurance Rate Maps for Seaside-Gearhart area. Seaward limit is mean lower low water (NAVD88). Landward boundary of 500-year flood zone may extend eastward because maximum wave height is 2.5 m at eastern edge. Line showing extent of deposits from tsunami generated by 1700 Cascadia earthquake (Priest *et al.*, 1997) is included for comparison.