Scenarios assessed for coastal vulnerability

(Note: Below is an extract from the Theme 2 Full report (INGC, 2012) Section 6, pages 102 -104. The full report is available in the Repository section of the portal)

Detail vulnerability assessments for 12 coastal towns were conducted for 16 different hazard scenarios. Based on the SLR projections (Section 5.3 of the Full Report) and hazard assessment and analyses, four levels of SLR were considered, namely 0 m, 0.5 m, 1 m and 2 m. As cyclones are such a major hazard along the Mozambique coast, the assessments were conducted both with and without taking cyclones into account. Other than SLR, the effects of climate change were also assessed by both including and excluding increases in "storminess" (i.e. wave height increase leading to increased wave attack). The total number of scenario combinations thus assessed comes to 16, as summarised in Table 6.3 (copy below).

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Summary of scenarios assessed for coastal vulnerability

			Excluding cyclones			Including cyclones	
			Present wave climate	**Increased storminess**		**Present wave climate**	**Increased storminess**
			1	**2**		**3**	**4**
No Climate Change:		**A**	Present wave climate	Present wave climate		Present wave climate	Present wave climate
Climate change included	SLR = 0.5 m	**B**	Present wave climate	Increased storminess		Present wave climate	**Increased storminess**
	SLR = 1.0 m	**C**	Present wave climate	Increased storminess		Present wave climate	**Increased storminess**
	SLR = 2.0 m	**D**	Present wave climate	Increased storminess		Present wave climate	**Increased storminess**
Note:			*1 Scenario A1 is the same as A2, therefore no A2 Scenario is included in the scoring* *2 Scenario A3 is the same as A4, therefore no A4 Scenario is included in the scoring*				

The potential effect of each scenario combination (e.g. D4: SLR = 2 m; increased storminess; including cyclone hazard) was assessed on each of the 14 vulnerability indicators (see Section ^, Table 6.1) at each shoreline location (assessment) point. To account for each different scenario, the scoring for each vulnerability indicator was changed (e.g. vulnerability score increases by 1 for a particular scenario) or the weighting for that indicator changed (increased). Thus, appropriate weightings were also applied to the scoring to account for those parameters which have a (progressively) greater influence on the vulnerability as the scenarios change. The scores or weightings for specifically Vulnerability Indicators # 1, 2, 4, 5, 10 and 13 (Table 6.1) were therefore consistently adapted to properly account for each different scenario.

For example, as the sea level rises, both elevation and distance from the sea (Indicators #1 and #2 in Table 6.1) decrease relatively. Thus, the vulnerability in terms of these 2 indicators increases with each higher SLR scenario. (Specifically, for all C Scenarios, i.e. SLR = 1 m, the scores for Indicators #1 and #2 are double weighted; while for all D Scenarios, i.e. SLR = 2 m, the scores for Indicators #1 and #2 are triple weighted.) Increased storminess has a direct effect on vulnerability to waves (Indicator #4 in Table 6.1). (Therefore, specifically, for Scenarios B2, C2, D2, B4, C4 and D4, i.e. increased storminess, the individual location scores for Indicator #4 are increased by one vulnerability class (= 1 point)).

Cyclones mostly approach from some easterly direction, within a very wide range of approach directions. In addition, due to their "circular" wind fields, the largest incident waves can approach the shoreline from a very wide range of directions. Thus, while a specific location may be relatively sheltered from say long period ocean swells approaching from the south-east, waves generated by a cyclone could approach from, e.g. the north-east, to which this particular location might have much less shelter due to the specific shoreline configuration in this area. The occurrence of cyclones therefore reduces the degree of protection (Indicator #10 in Table 6.1) of many particular coastal locations. (For example, under all Scenarios 1 and 2, a particular coastal location may be partially sheltered from the usual deep sea swell approaching from the south-east and according to the evaluation criteria awarded a vulnerability score of 3 for Indicator #10. Under all Scenarios 3 and 4, i.e. including cyclones, this particular coastal location may be fully exposed to cyclone generated waves approaching from the north-east and now awarded a vulnerability score of 5 for Indicator #10.)

These examples are given to illustrate how each of the 14 vulnerability indicators was assessed in terms of potential effects of the 16 different scenario combinations. In general, the vulnerability of coastal locations increase as the scenarios "increase" from A to D and # 1 to # 4 in Table 6.3, resulting in Scenario D4 being the "worst case" scenario. The effects of the different scenarios on the vulnerability ratings at each location can be seen in the vulnerability maps discussed in the following section.

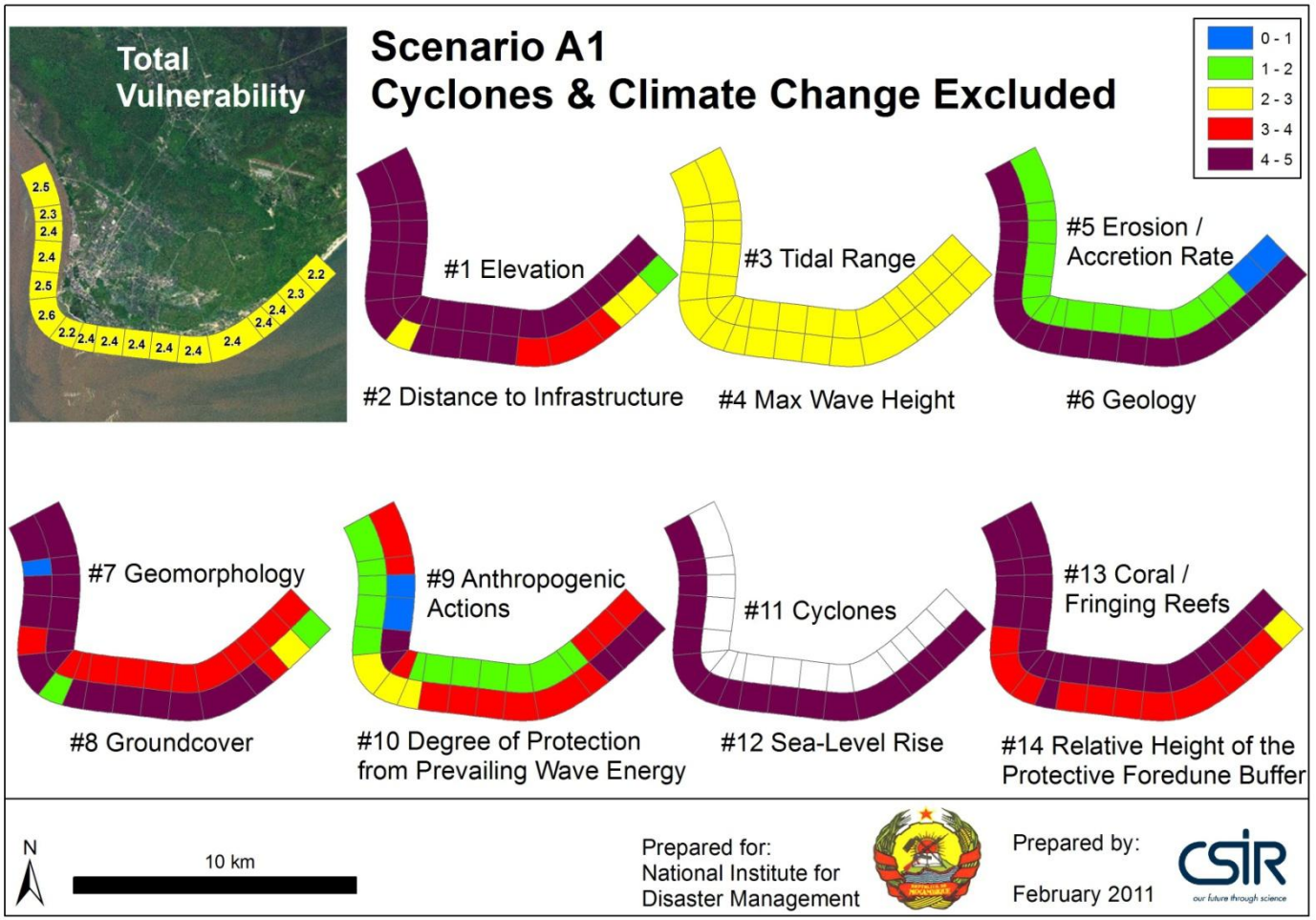
Reference: National Institute for Disaster Management (INGC) Phase II: Theme 2: Coastal Planning and Adaptation to Mitigate Climate Change Impacts. INGC, 2012

Mapping of detail vulnerability assessment outputs

(Note: Below is an extract from the Theme 2 Full report (INGC, 2012) Section 6, pages 104 -122. The full report is available in the Repository section of the portal)

The vulnerability scores for each parameter at each coastal point (representative of a 1 km section) along the Beira study area, for example, is summarised in the map depicted in Figure 6.23. The vulnerability at each point is indicated by the colour code, ranging from blue "very low" (score in 0 to 1 band), to purple "very high" (score in 4 to 5 band), as indicated by the legend. The examples are shown for 3 of the 16 scenarios assessed.

The total or overall vulnerability scores (all parameters combined) at each point (representative of a 1 km coastal section) along the study area, for each of the 16 scenarios, is summarised in the maps depicted in Figure 6.24. The vulnerability at each point is again indicated by the colour code, ranging from blue "very low" (score in 0 to 1 band), to purple "very high" (score in 4 to 5 band), as indicated by the legend. Besides the differences in vulnerability due to the different scenarios, it is concerning to note that almost all of the points are rated as having between medium (for Scenarios A1 to B4) to some very high vulnerability (for Scenarios D3 and D4).


Total Vulnerability
2.5
2.3
2.4
2.4
2.5
2.6
2.2
2.4
2.4
2.4
2.4
2.4
2.4
2.4
2.4
2.3
2.2
Scenario A1
Cyclones & Climate Change Excluded
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
#1 Elevation
#2 Distance to Infrastructure
#3 Tidal Range
#4 Max Wave Height
#5 Erosion / Accretion Rate
#6 Geology
#7 Geomorphology
#8 Groundcover
#9 Anthropogenic Actions
#10 Degree of Protection from Prevailing Wave Energy
#11 Cyclones
#12 Sea-Level Rise
#13 Coral / Fringing Reefs
#14 Relative Height of the Protective Foredune Buffer
N
10 km
Prepared for:
National Institute for Disaster Management
Prepared by:
February 2011
CSIR
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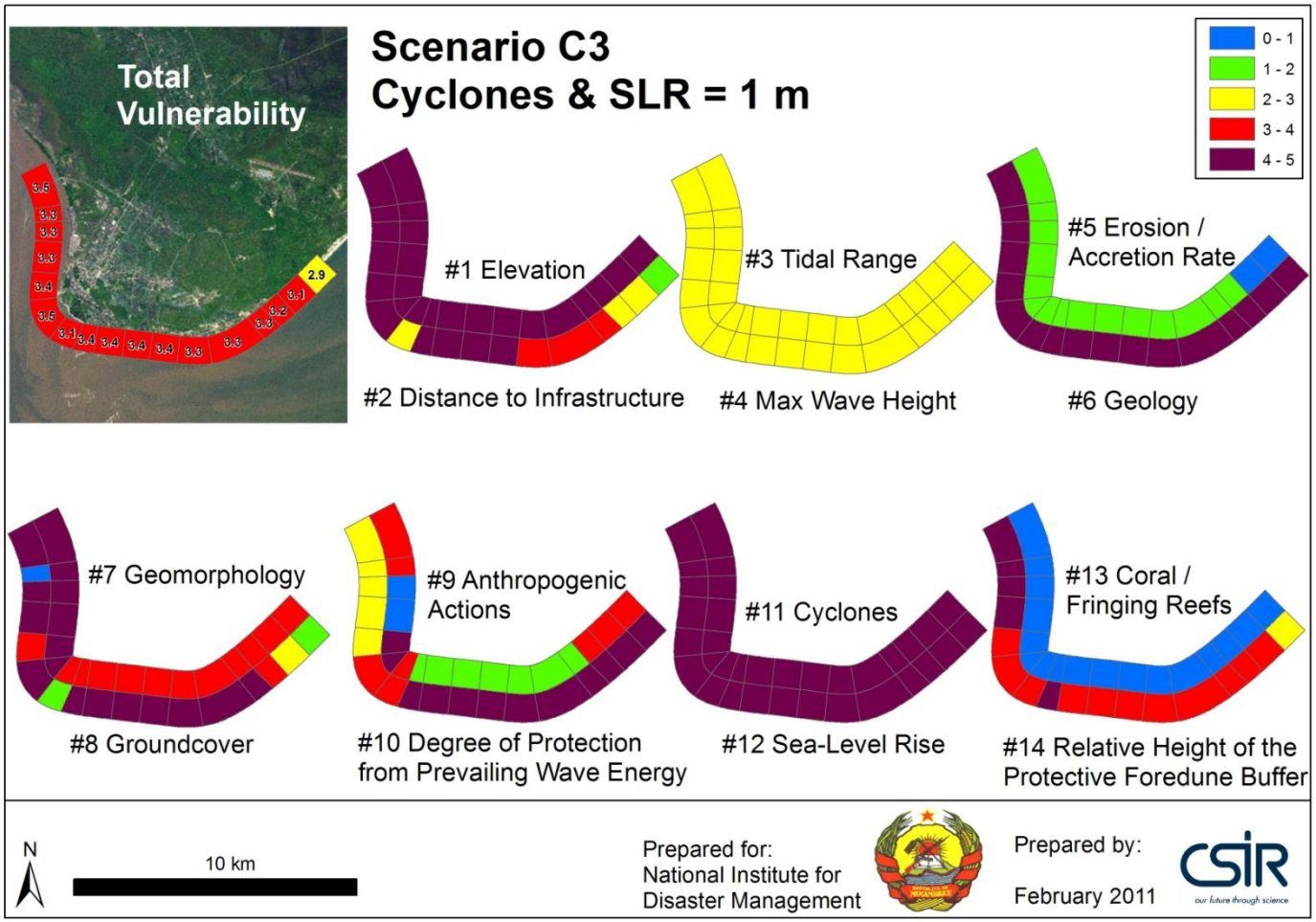
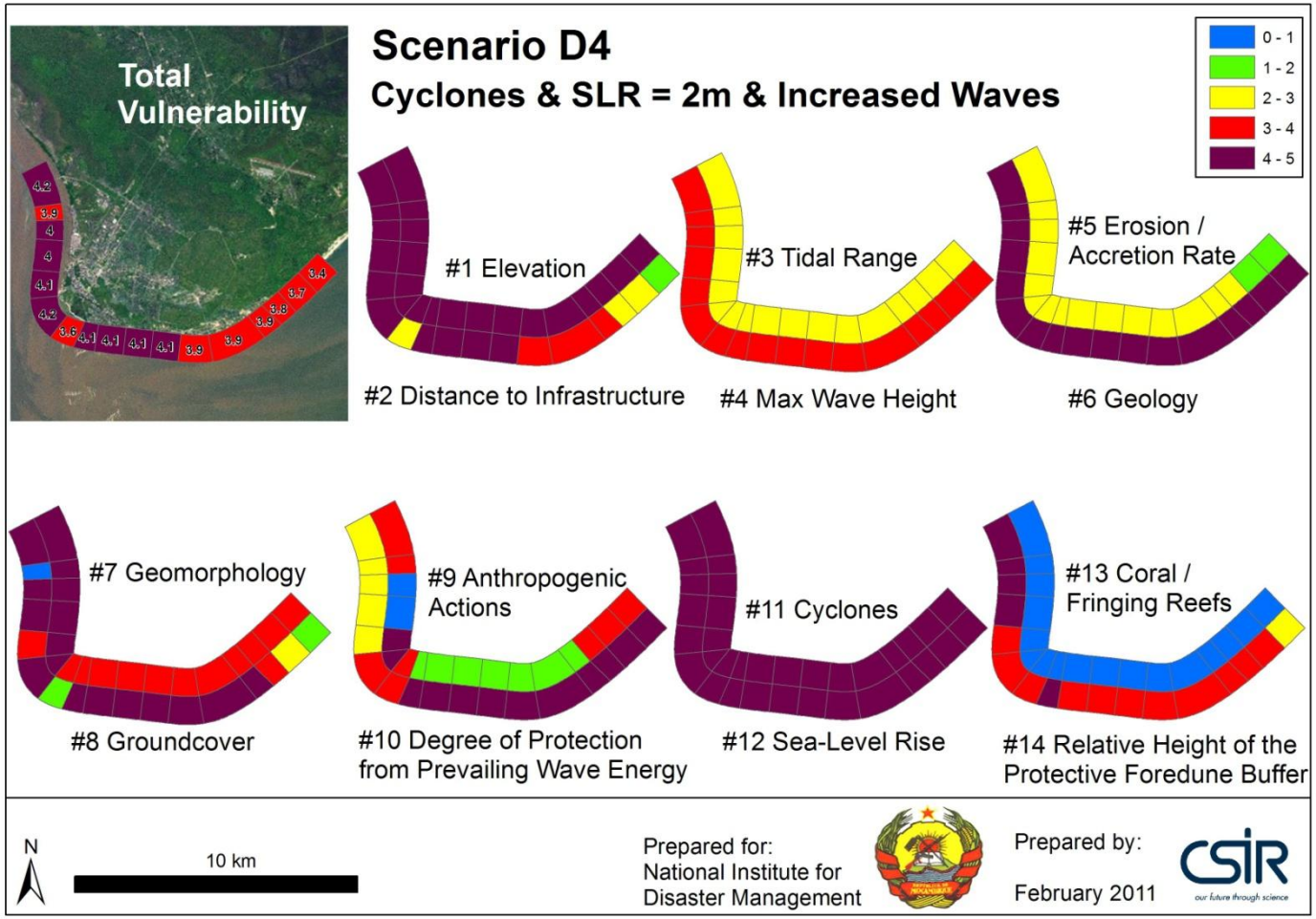
(a)


Total Vulnerability
Scenario C3
Cyclones & SLR = 1 m
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
#1 Elevation
#2 Distance to Infrastructure
#3 Tidal Range
#4 Max Wave Height
#5 Erosion / Accretion Rate
#6 Geology
#7 Geomorphology
#8 Groundcover
#9 Anthropogenic Actions
#10 Degree of Protection from Prevailing Wave Energy
#11 Cyclones
#12 Sea-Level Rise
#13 Coral / Fringing Reefs
#14 Relative Height of the Protective Foredune Buffer
N
10 km
Prepared for:
National Institute for Disaster Management
Prepared by:
February 2011
CSIR
our future through science

(b)



(c)

Figure 6.23 a to c: Beira vulnerability mapping showing all 14 parameters for 3 of the 16 scenarios.

(Vulnerability is measured on a scale of 1- 5 with 1= lowest vulnerability and 5 = highest vulnerability as depicted in Table 6.1))

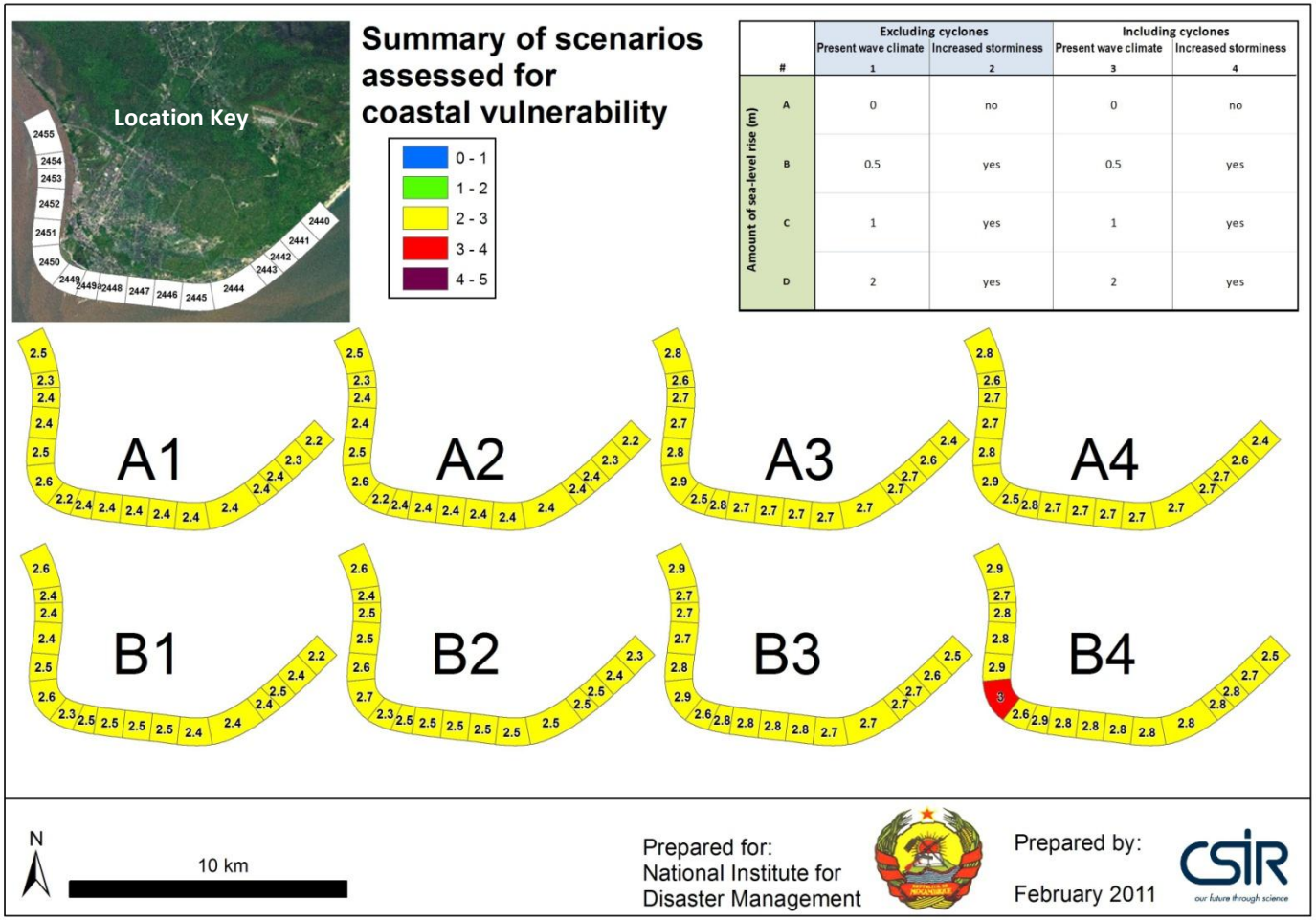


Figure 6.24a: Beira detail vulnerability mapping: Scenarios A & B

(showing overall vulnerability rating when the 14 parameters in Table 6.1 are combined).

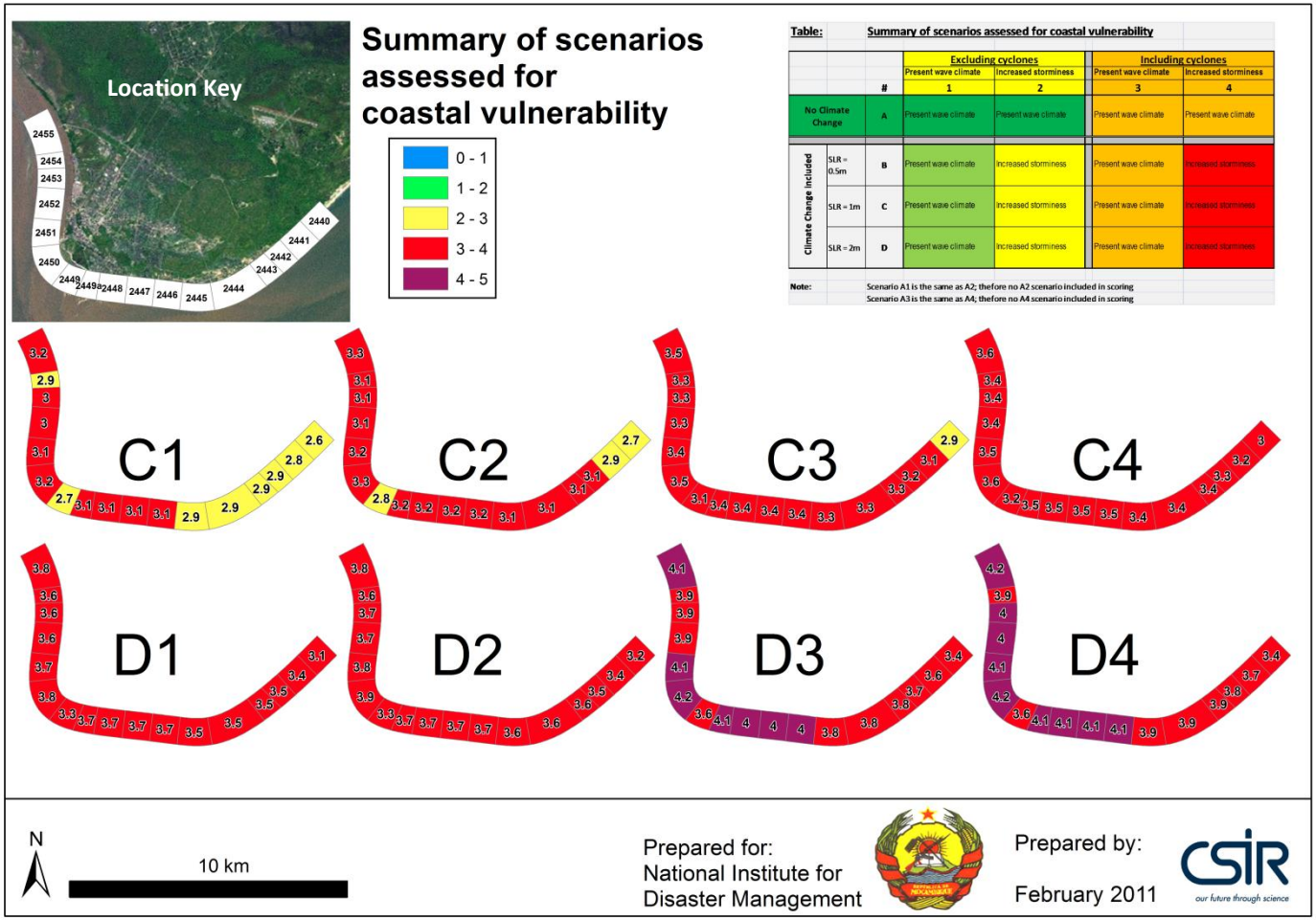


Figure 6.24b: Beira detail vulnerability mapping: Scenarios C & D