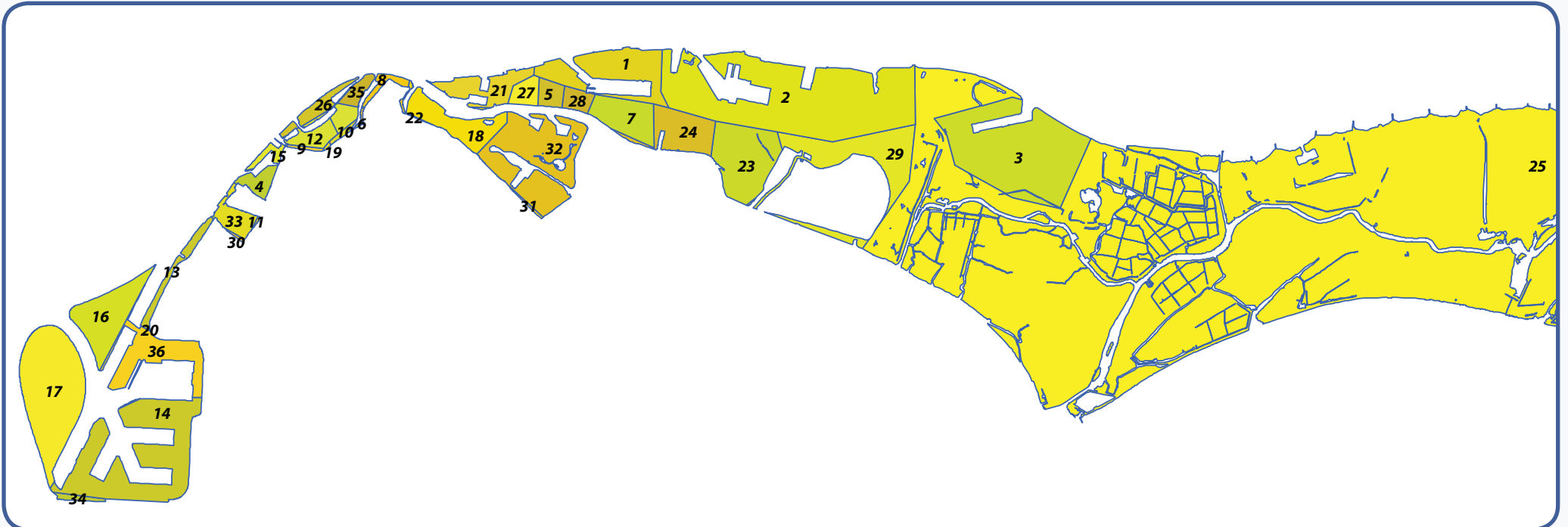


# 1. Existing Location

Fig 1: Neighborhoods in the outer Marches of Dordrecht

## 1.1 Neighborhoods



- |                               |                                       |   |
|-------------------------------|---------------------------------------|---|
| 1 1e Merwedehaven en omgeving | 13 Handelskade en 's-Gravendeelsedijk | 25 Merwelanden                              |
| 2 2e Merwedehaven en omgeving | 14 Julianahaven                       | 26 Nieuwe Haven en omgeving                 |
| 3 3e Merwedehaven             | 15 Kalkhaven                          | 27 Noorderkwartier                          |
| 4 Achterhakkers en omgeving   | 16 Krabbegors                         | 28 Plein 1940-1945 en omgeving              |
| 5 Amerstraat en omgeving      | 17 Krabbepolder                       | 29 Spaarbekken                              |
| 6 Augustijnenkamp en omgeving | 18 Lijnbaan                           | 30 Viottakade en omgeving                   |
| 7 Beekmanstraat en omgeving   | 19 Lombard en omgeving                | 31 Vogelplein-Aalscholverstraat en omgeving |
| 8 Bleijenhoek                 | 20 Louterbloemen                      | 32 Wantijpark en omgeving                   |
| 9 Boogjes en omgeving         | 21 Maasstraat en omgeving             | 33 Weeskinderendijk en Dokweg               |
| 10 Centrum                    | 22 Matena's Pad en omgeving           | 34 Wieldrecht                               |
| 11 Erasmuslaan en omgeving    | 23 Merwedepolder-Oost                 | 35 Wijnstraat en omgeving                   |
| 12 Groenmarkt en omgeving     | 24 Merwedepolder-West                 | 36 Wilhelminahaven                          |

Fig 2: Neighborhoods in the outer Marches of Dordrecht

## 1.2 Aerial picture

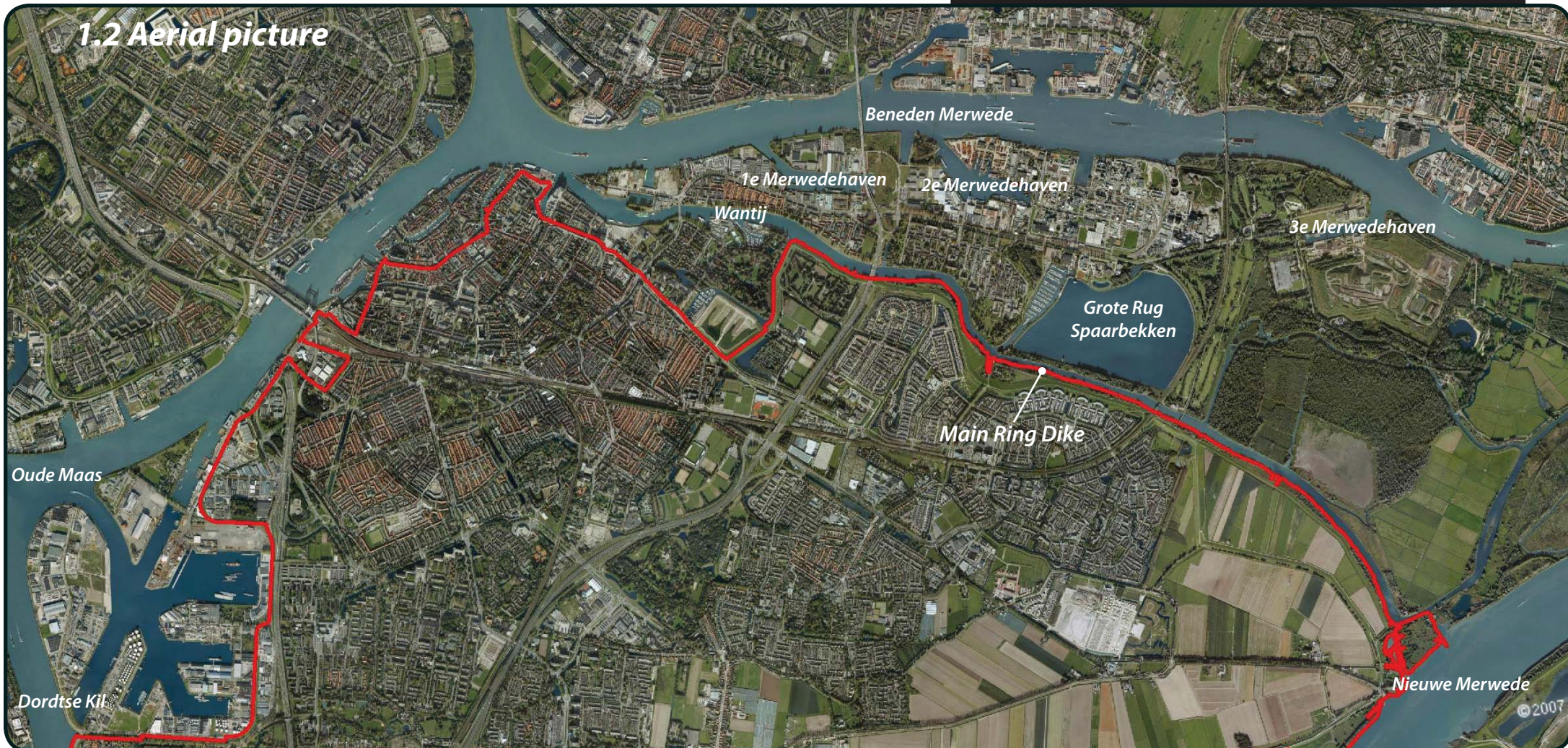
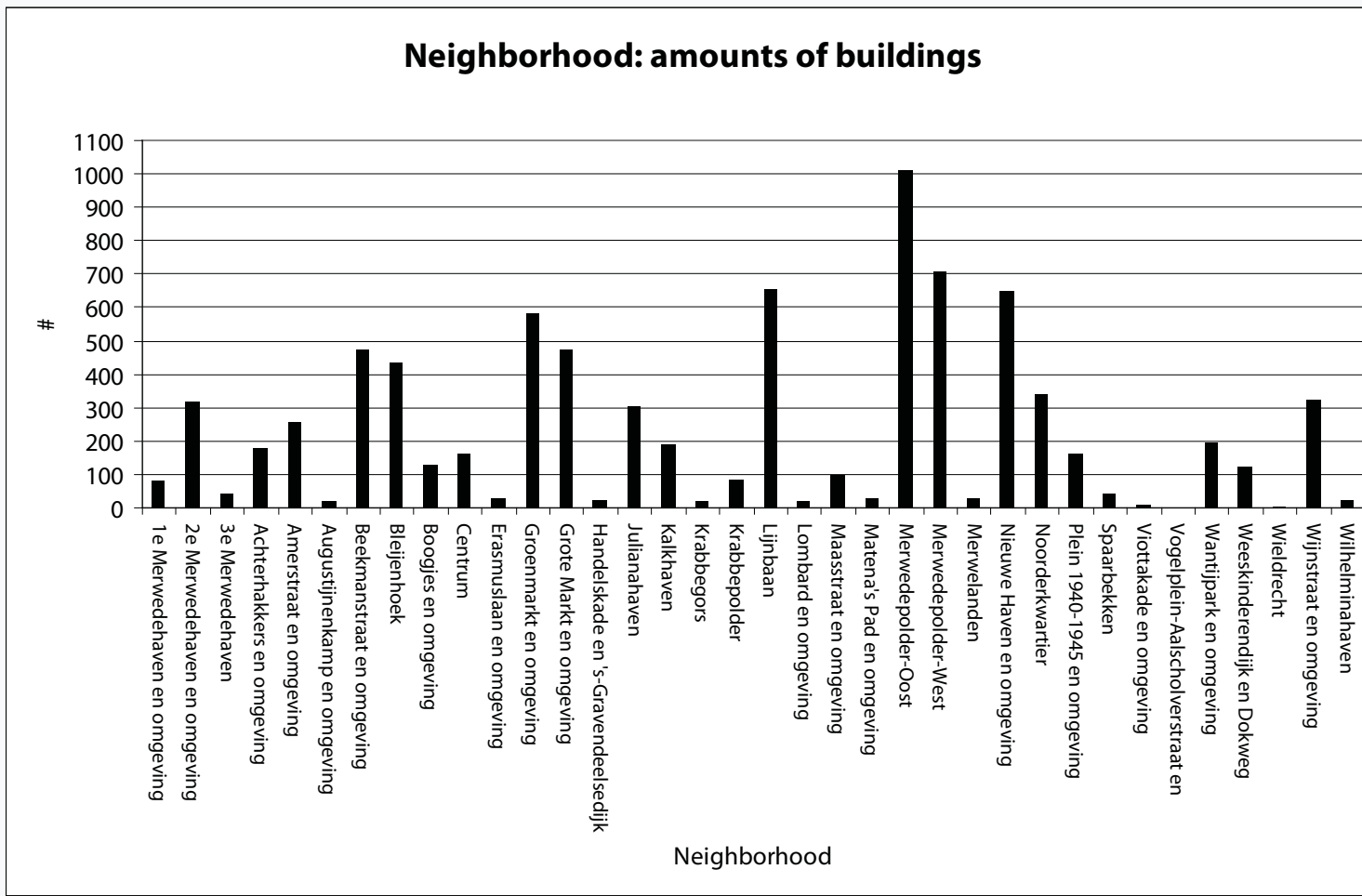


Fig 2: Building Stock

Table 1: Housing Distribution over Neighborhoods

### 1.2 Building Stock: Distribution over Neighborhoods

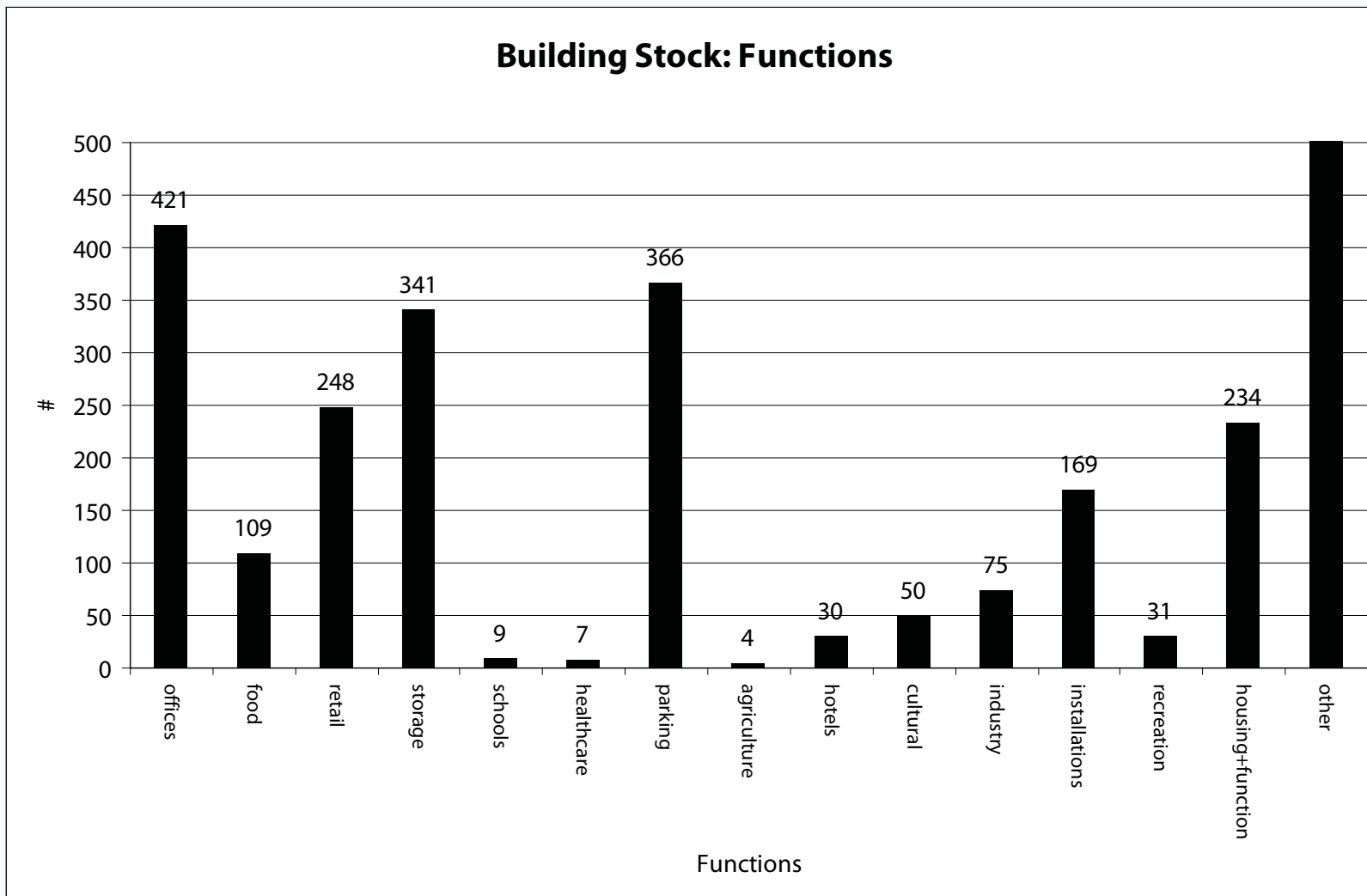


Neighborhood	Amount
1e Merwedehaven en omgeving	81
2e Merwedehaven en omgeving	317
3e Merwedehaven	42
Achterhakkers en omgeving	182
Amerstraat en omgeving	254
Augustijnenkamp en omgeving	18
Beekmanstraat en omgeving	476
Bleijenhoek	435
Boogjes en omgeving	127
Centrum	163
Erasmuslaan en omgeving	29
Groenmarkt en omgeving	585
Grote Markt en omgeving	476
Handelskade en 's-Gravendeelsedijk	25
Julianahaven	303
Kalkhaven	188
Krabbegors	21
Krabbepolder	83
Lijnbaan	653
Lombard en omgeving	19
Maasstraat en omgeving	101
Matena's Pad en omgeving	30
Merwedepolder-Oost	1011
Merwedepolder-West	708
Merwelanden	29
Nieuwe Haven en omgeving	650
Noorderkwartier	341
Plein 1940-1945 en omgeving	162
Spaarbekken	43
Viottakade en omgeving	11
Vogelplein-Aalscholverstraat en omgeving	1
Wantijpark en omgeving	193
Weeskinderdijk en Dokweg	124
Wieldrecht	4
Wijnstraat en omgeving	322
Wilhelminahaven	23

Fig 3: Functions

Table 2: Inventory of Functions within the area

### 1.3 Building Stock: Functions

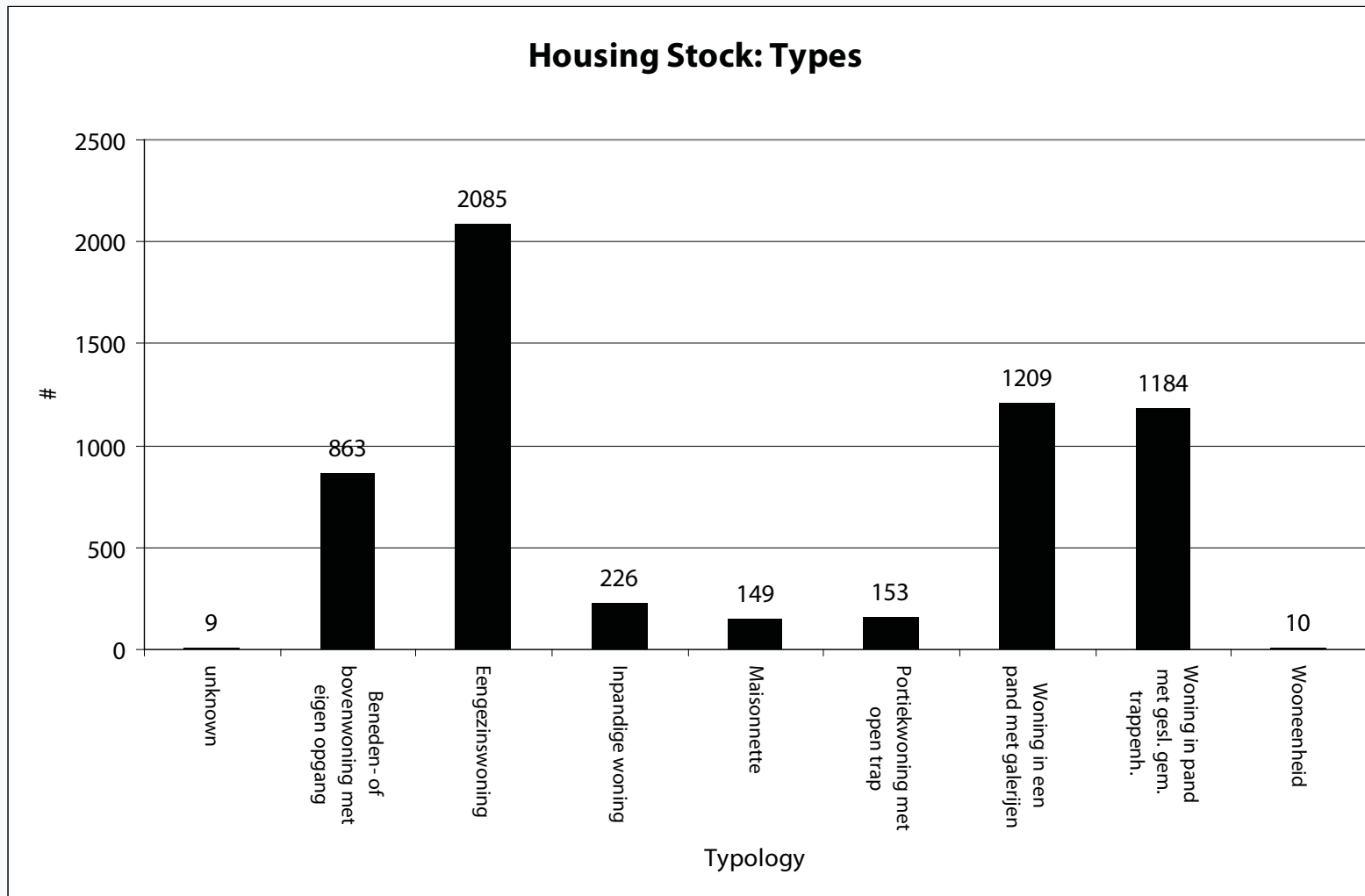


Function	Amount
houses	5634
offices	421
food	109
retail	248
storage	341
schools	9
healthcare	7
parking	366
agriculture	4
hotels	30
cultural	50
industry	75
installations	169
recreating	31
housing+function	234
other	502

Fig 4: Typologies

Table 3: Inventory of Housing Typologies

### 1.4 Housing Stock: Housing Types

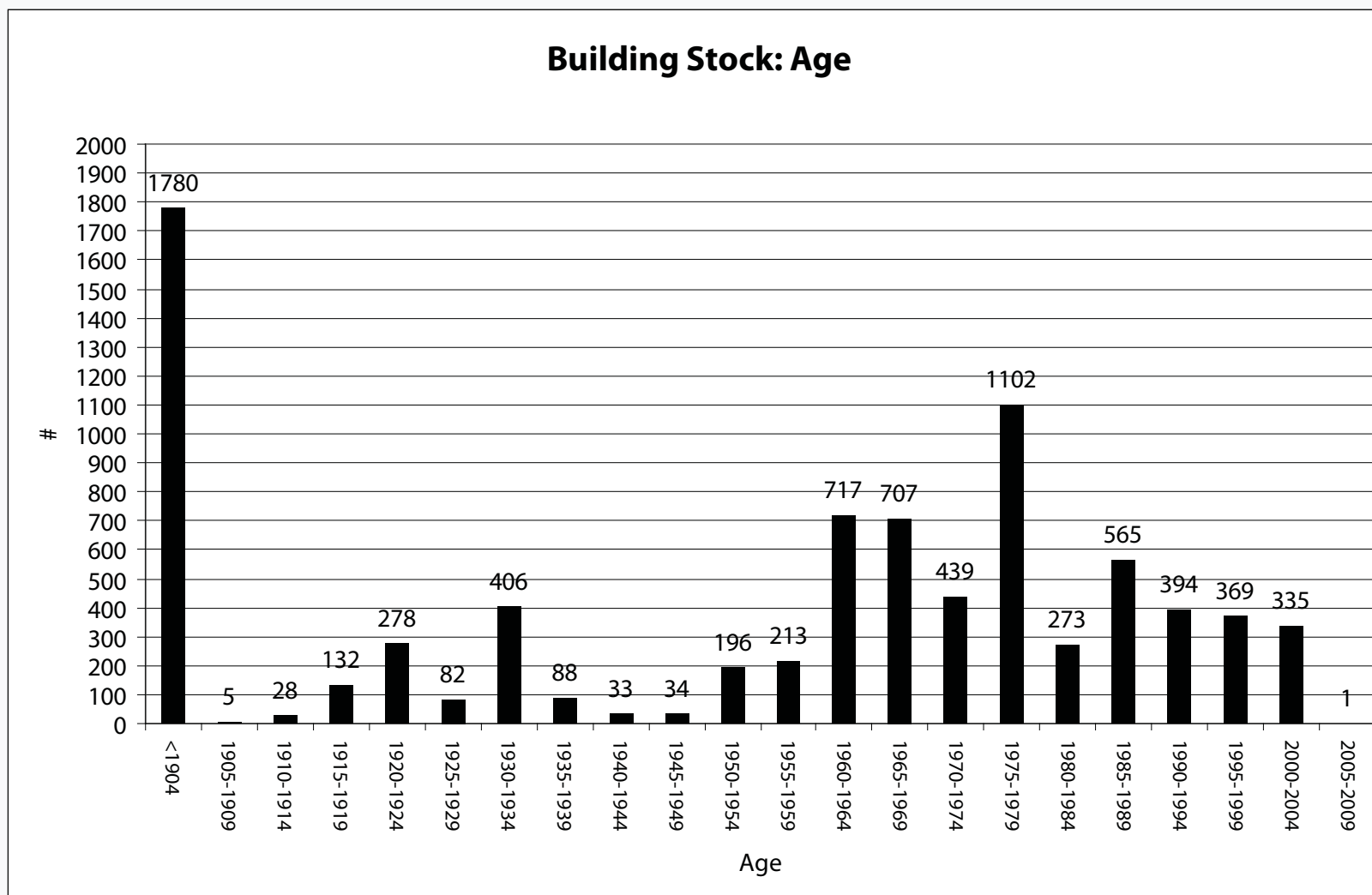


Type	Amount
unknown	9
beneden- of bovenwoning	863
eengezinswoning	2085
inpandige woning	226
maisonette	149
portiekwoning	153
gallerijwoning	1209
appartement	1184
wooneenheid	10

Fig 5: Age

Table 4: Age Distribution of Buildings in the Area

### 1.5 Building Stock: Age



Year	Amount
<1904	1780
1905-1909	5
1910-1914	28
1915-1919	132
1920-1924	278
1925-1929	82
1930-1934	406
1935-1939	88
1940-1944	33
1945-1949	34
1950-1954	196
1955-1959	213
1960-1964	717
1965-1969	707
1970-1974	439
1975-1979	1102
1980-1984	273
1985-1989	565
1990-1994	394
1995-1999	369
2000-2004	335
>2005	1

Total amount of buildings 8177  
 Built before WW2 2832(0.346)  
 Built after WW2 5345(0.654)

mean 355.5217  
 std. dev. 417.8185  
 skewness 2.1253  
 minimum 1  
 maximum 1780

## 2. Existing Location: Flood Impact

Fig 6: Flood Extent

### 2.1 Flood extent for a range of return periods

## Flood Extent

0 125 250 500 750 1,000 Meter

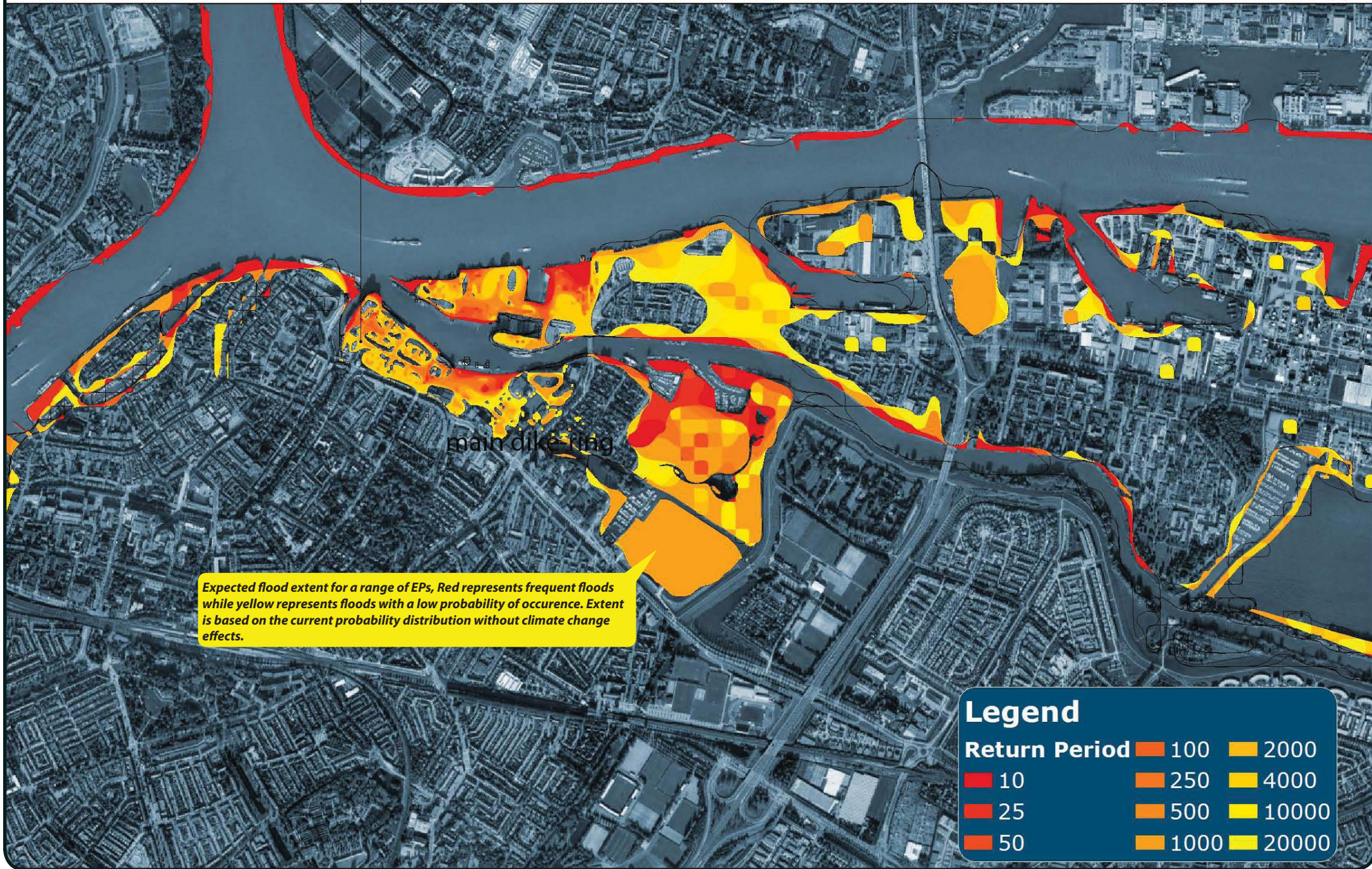


Fig 7: Inundation depths Extreme Event

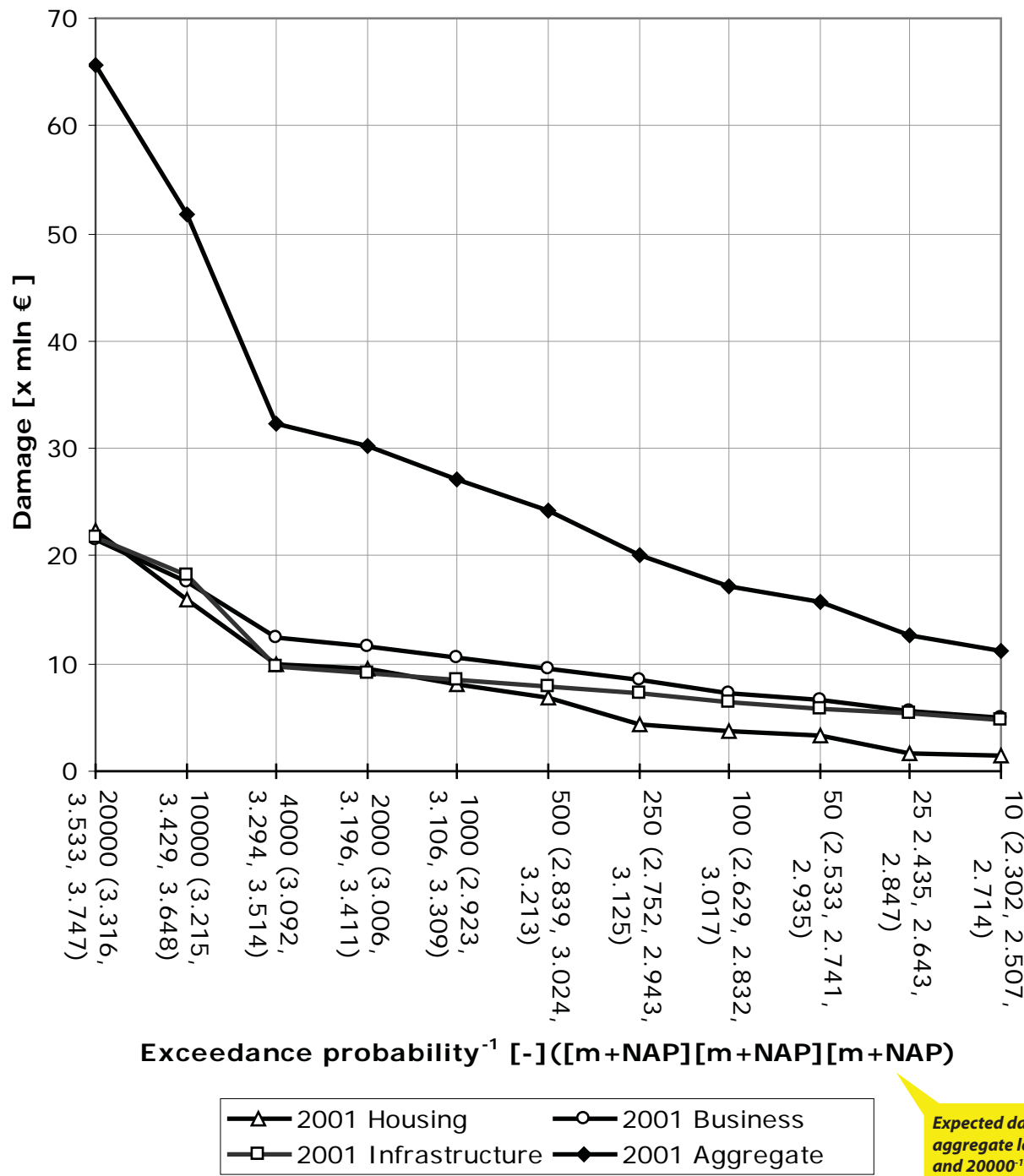
### 2.2 Inundation Depths 4000 year flood



Fig 8: Direct Damage for Different Return Periods

Table 5&6: Aggregate Damage and Damage Distribution

### 2.3 Aggregate Damage Levels for Housing, Businesses and Infrastructure



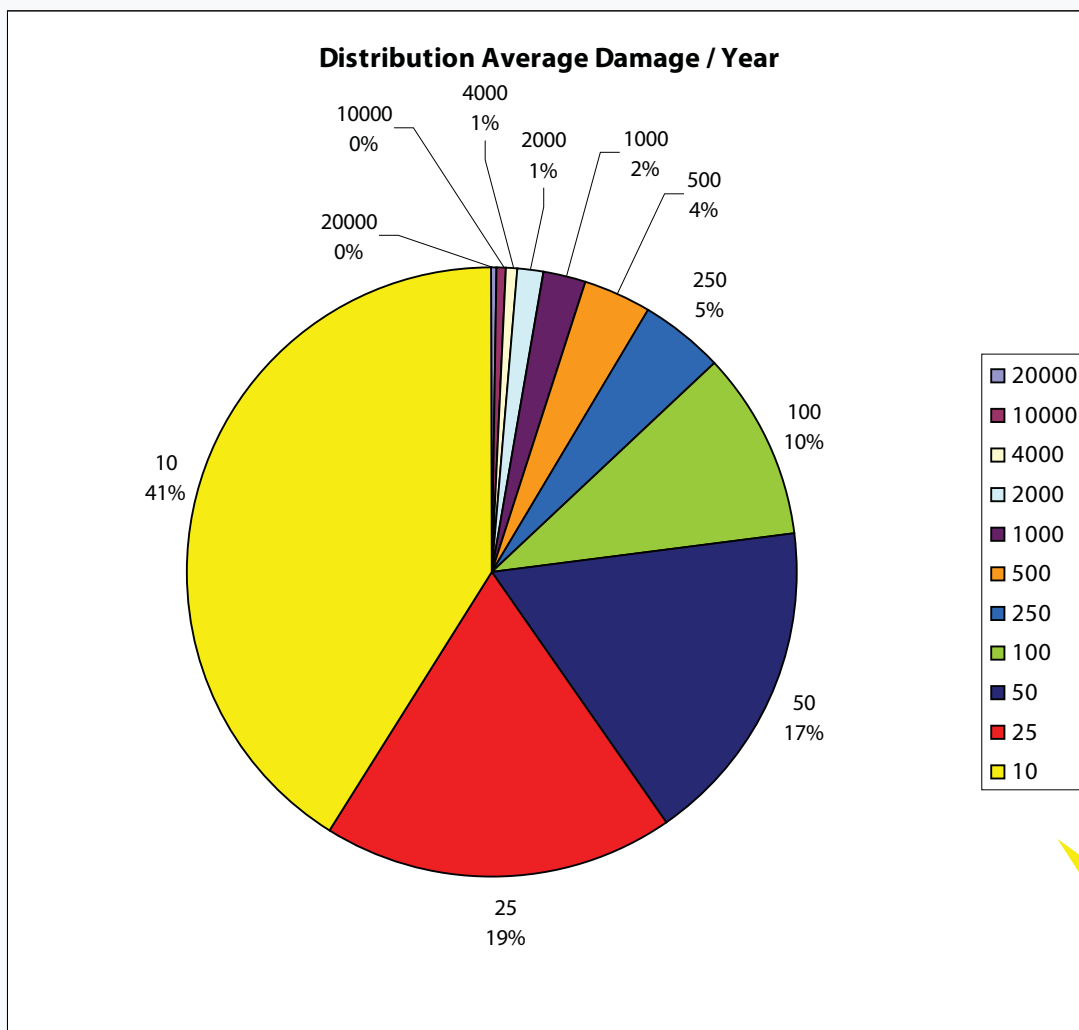
Stage	Current Return Period	Damage	AVG. Damage/Year
3.316	1:20000	€65.667.520	€3.283
3.215	1:10000	€51.864.249	€5.186
3.092	1:4000	€32.265.708	€806
3.006	1:2000	€30.171.445	€1.5085
2.923	1:1000	€27.076.638	€2.7076
2.839	1:500	€24.202.271	€48.404
2.752	1:250	€19.985.488	€79.942
2.629	1:100	€17.230.485	€172.305
2.533	1:50	€15.712.088	€314.241
2.435	1:25	€12.720.763	€508.830
2.302	1:10	€11.236.085	€1.123.608

Current Return Period	Housing	Businesses	Infrastructure
1:20000	€22.431.034	€21.450.085	€21.786.401
1:10000	€16.013.106	€17.580.560	€18.270.583
1:4000	€9.953.347	€12.480.587	€9.831.774
1:2000	€9.509.575	€11.549.485	€9.112.385
1:1000	€8.117.342	€10.502.920	€8.456.376
1:500	€6.825.082	€9.558.067	€7.819.122
1:250	€4.264.157	€8.482.038	€7.239.293
1:100	€3.660.850	€7.223.867	€6.345.768
1:50	€3.251.498	€6.598.797	€5.861.793
1:25	€1.752.045	€5.680.785	€5.287.933
1:10	€1.461.310	€4.992.027	€4.782.748

Expected damage curves for housing, businesses and infrastructure and aggregate levels within the case study area for annual EPs between 10<sup>-1</sup> and 20000<sup>-1</sup>.

Fig 9: Distribution of Average Damage per Year

### 2.4 Mean Annual Damage for Return Periods



Contribution of flood events with different return periods to the expected Mean Annual Damage.

**Table 7: Damage per Neighborhood**

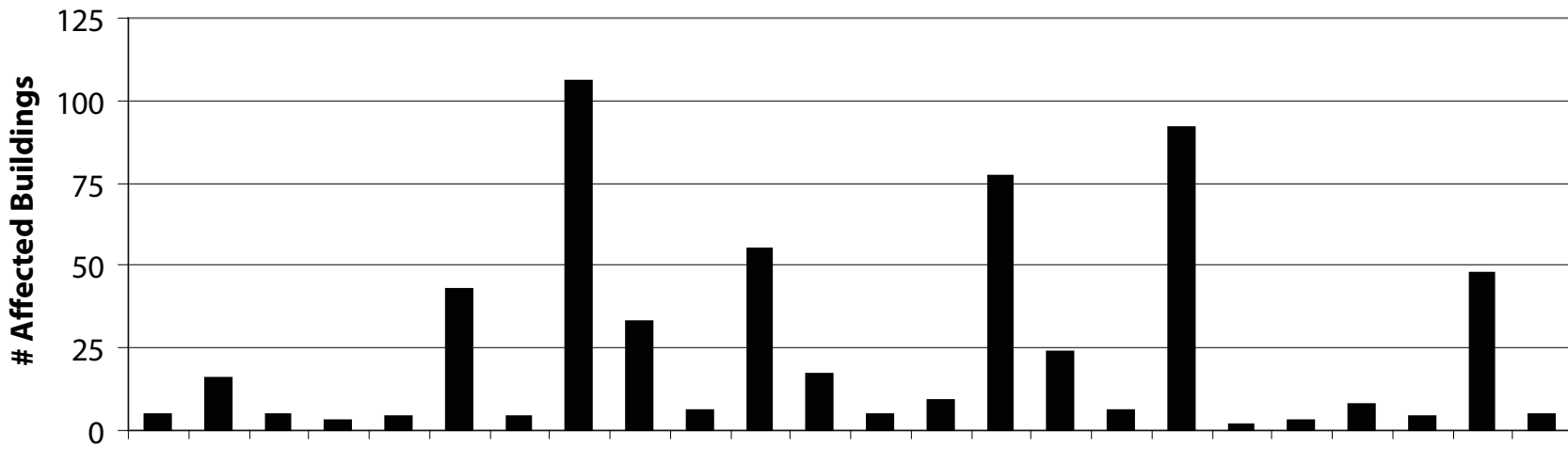
**2.5 Damage Curve per Neighborhood (continued)**

Neighborhood	1:4000	1:2000	1:1000	1:500	1:250	1:100	1:50	1:25	1:10
	DAMAGE	DAMAGE	DAMAGE	DAMAGE	DAMAGE	DAMAGE	DAMAGE	DAMAGE	DAMAGE
1e Merwedehaven en omgeving	629728	579276	564900	545668	479953	468329	454080	443703	423814
2e Merwedehaven en omgeving	2376599	2211852	2038200	1973041	1837864	1816769	1732201	1537255	1459485
3e Merwedehaven	1217616	935062	792664	783115	757119	746617	685150	631615	549413
Achterhakkers en omgeving	108467	110567	106367	102692	93767	100592	0	0	0
Amerstraat en omgeving	17372	17372	16799	16399	16012	15622	15217	14644	14198
Beekmanstraat en omgeving	165353	136642	127012	153594	137549	147226	143766	134531	12966
Bleijenhoek	2156201	2096737	2059646	2054006	2039908	2008805	1766811	1762104	1689322
Boogjes en omgeving	151122	158997	157947	156372	156897	154797	156372	156897	149022
Groenmarkt en omgeving	7307196	7168658	6971826	6740644	6507740	6096671	5443391	5316397	3377891
Grote Markt en omgeving	1862988	1860090	1772158	1807638	1744843	1689427	1451671	1379112	815881
Handelskade en 's-Gravendeelsedijk	348888	352038	368490	368490	265459	249184	257059	274909	267034
Julianahaven	4110165	3914078	3807903	3659806	3233049	2872091	2702498	2605498	2498775
Kalkhaven	1091057	1028106	165295	165295	144630	156154	37183	45058	45058
Krabbegors	910423	893057	904815	820639	692563	770379	766999	599745	533240
Krabbepolder	1093448	1073346	1050907	980429	854475	932591	886631	556883	541001
Lijnbaan	3849357	3336750	1820928	854538	674444	456208	409218	345536	246138
Maasstraat en omgeving	2828521	2247839	1769675	1355758	1123204	1010159	816407	688440	559329
Merwelanden	1166319	1056779	1056369	1013345	1039562	1032684	962990	763338	558327
Merwedepolder-Oost	63225	62332	61738	60776	59716	47671	46954	28808	26761
Merwedepolder-West	24013	17659	17659	17659	14201	14201	14201	14201	9341
Nieuwe Haven en omgeving	6595405	6513403	6317041	5164486	4597209	3188046	2802524	1674529	1179272
Noorderkwartier	80308	84504	84499	2814	2767	2721	2671	194	897
Plein 1940-1945 en omgeving	192727	183020	137141	128954	136003	193551	212587	11889	11546
Spaarbekken	18006	13444	13147	12620	12494	12322	9444	8842	8805
Wantijpark en omgeving	930918	943125	838945	807627	714992	719586	639971	545384	381073
Weeskinderendijk en Dokweg	175320	167105	129326	123551	118301	97887	64908	70683	35547
Wijnstraat en omgeving	3339311	3228684	3053031	3046391	3015565	3018705	2528051	2393208	2231675
Wilhelminahaven	1535311	1441361	1247304	1231319	1213702	1195430	1106701	1091433	1031039

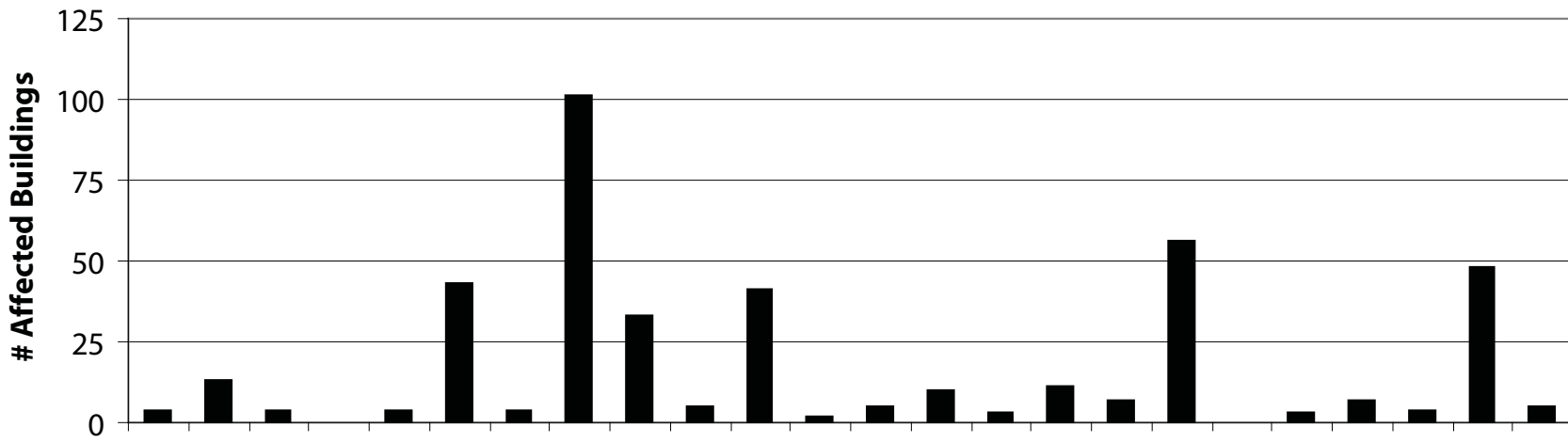
Fig 10: Affected Buildings for Different Return Periods

## 2.6 Affected Buildings per Neighborhood

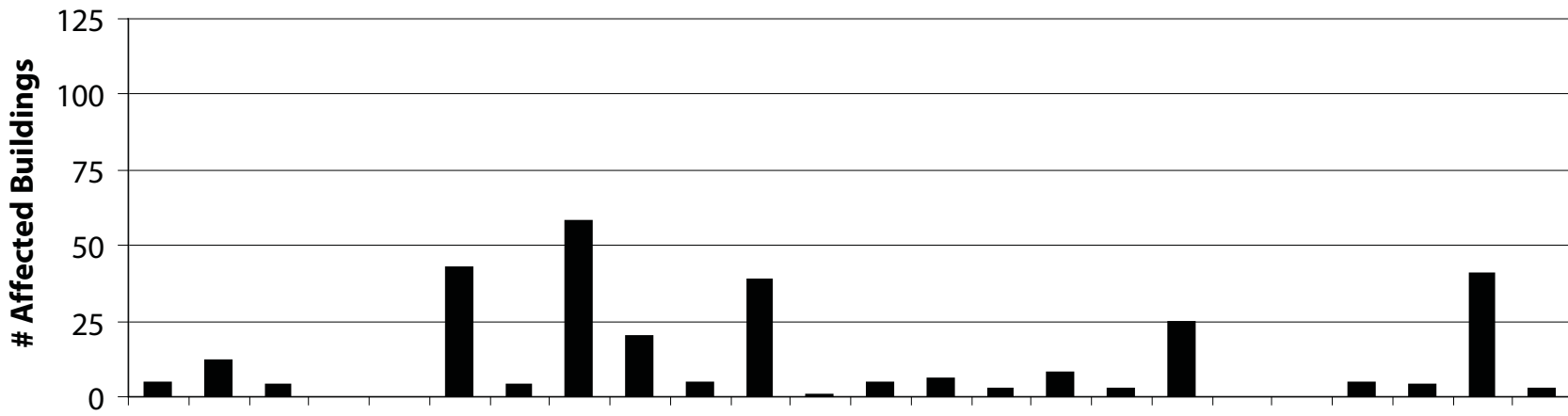
### 1:2000 (1:100) Affected Buildings per Neighborhood



### 1:100 (1:1) Affected Buildings per Neighborhood



### 1:10 Affected Houses per Neighborhood



### 1:1 Affected Buildings per Neighborhood

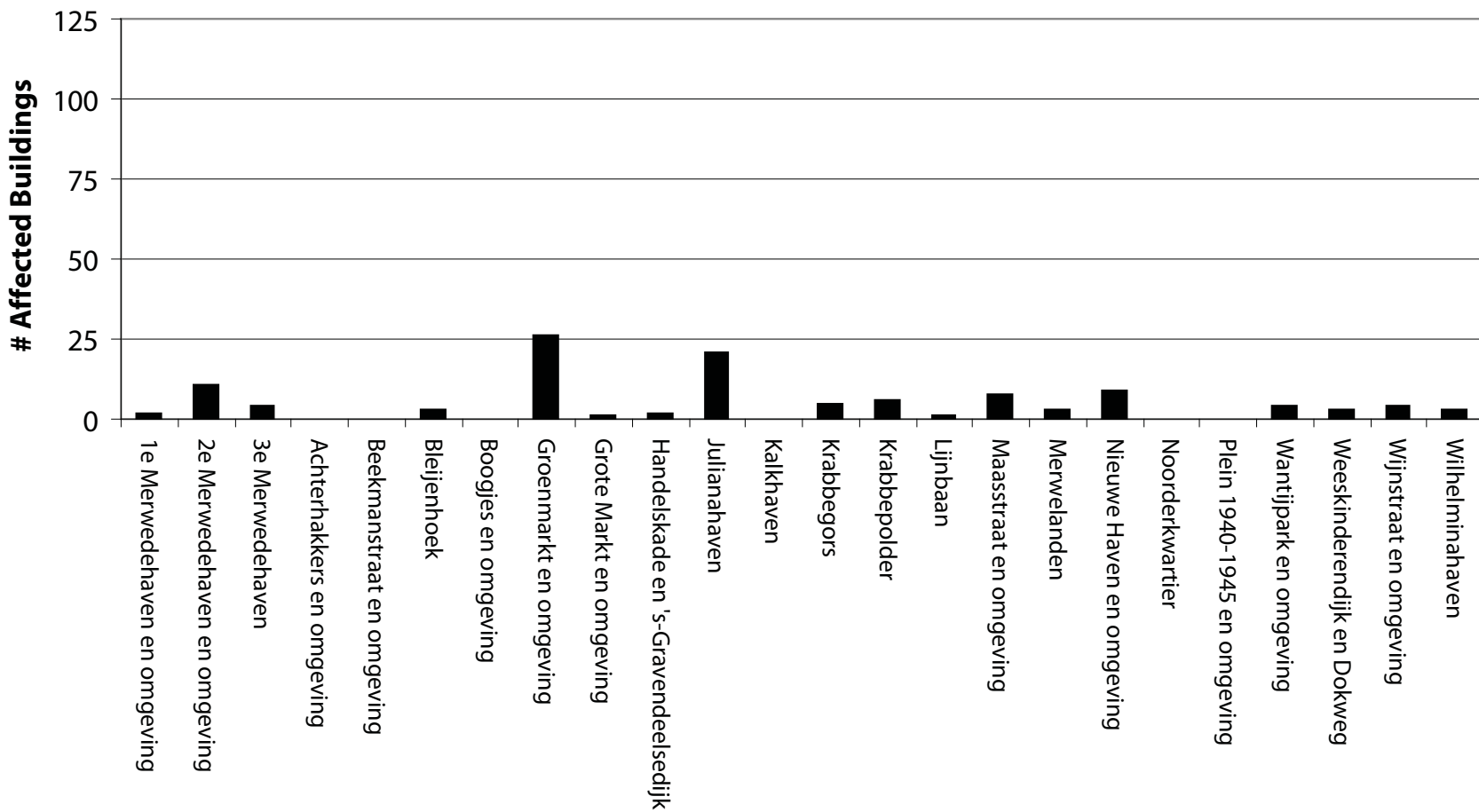


Fig 11: Direct Damage for Different Damage Components

### 2.7 Damage Curve for components

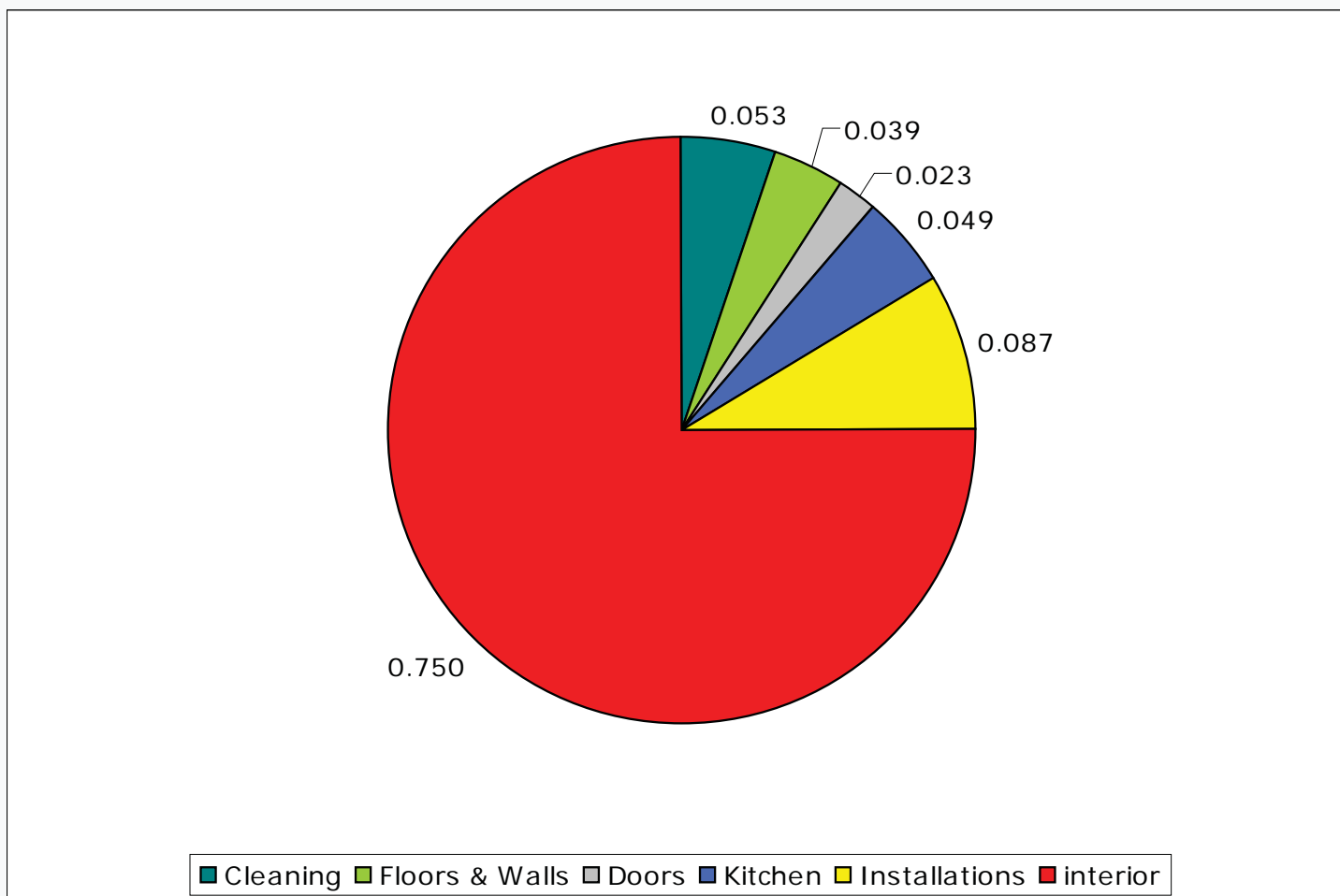
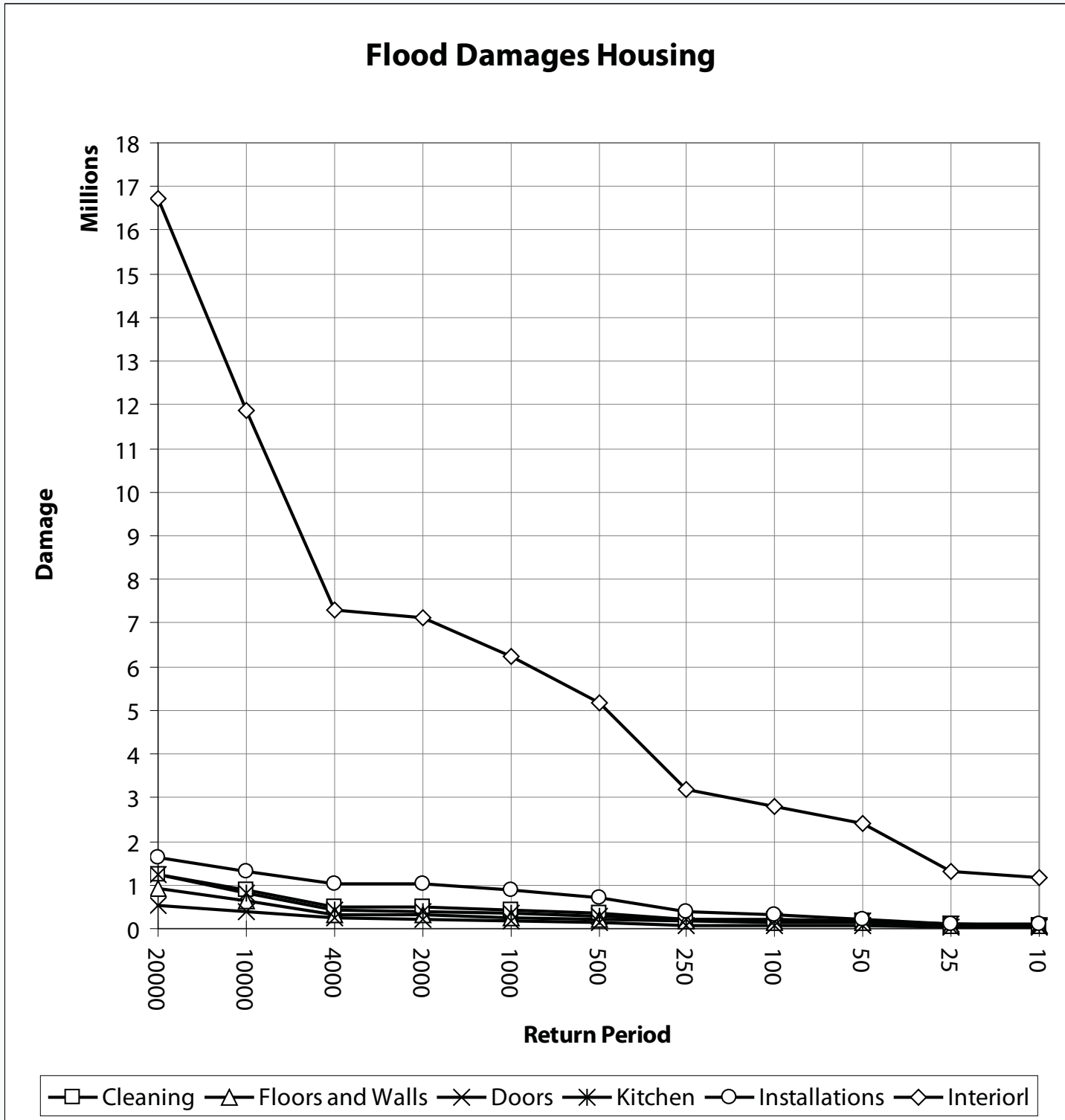
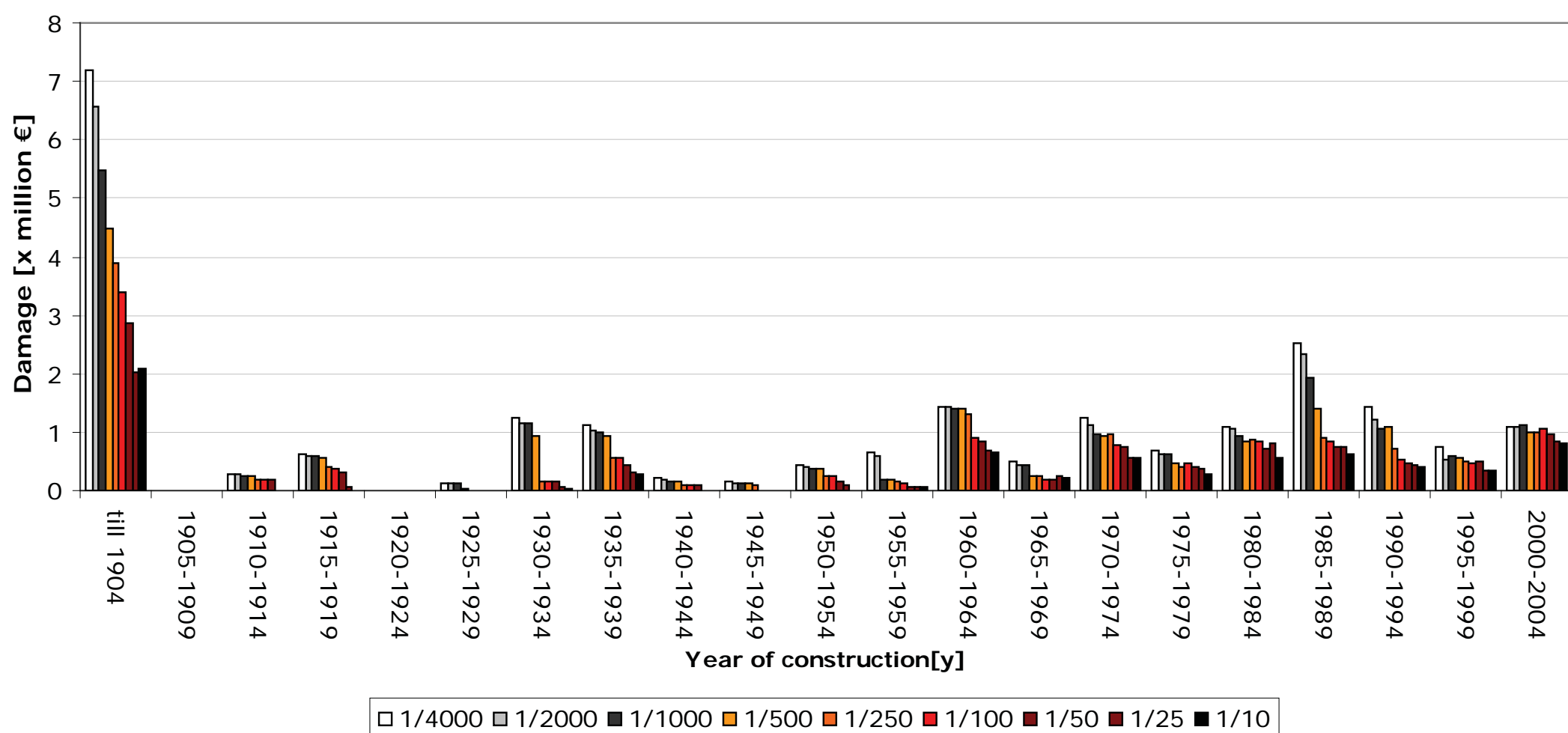


Fig 12: Damage Ratios for components

Fig 13: Damage Distribution over Age Building Stock

## 2.8 Damage Distribution over Age



period of construction	1:4000	1:2000	1:1000	1:500	1:250	1:100	1:50	1:25	1:10
-1904	€7.184.927	€6.557.971	€5.484.818	€4.471.223	€3.883.462	€3.400.334	€2.849.347	€2.037.414	€2.088.747
1905-1909	€0	€0	€0	€0	€0	€0	€0	€0	€0
1910-1914	€281.001	€276.051	€263.729	€239.486	€185.540	€182.069	€174.515	€0	€0
1915-1919	€636.667	€599.224	€580.801	€545.409	€404.652	€367.487	€298.123	€51.857	€0
1920-1924	€0	€0	€0	€0	€0	€0	€0	€0	€0
1925-1929	€135.000	€132.000	€132.000	€34.125	€0	€0	€0	€0	€0
1930-1934	€1.232.535	€1.152.920	€1.152.935	€937.524	€153.226	€146.776	€159.582	€5.5497	€45.522
1935-1939	€1.108.601	€1.024.323	€1.007.050	€925.240	€550.630	€546.618	€448.177	€299.284	€280.684
1940-1944	€223.439	€201.203	€156.634	€152.584	€80.133	€80.658	€90.108	€0	€0
1945-1949	€149.810	€116.025	€116.025	€118.725	€97.760	€0	€0	€0	€0
1950-1954	€433.876	€417.430	€373.622	€361.239	€244.013	€263.253	€142.530	€85.458	€0
1955-1959	€651.879	€578.845	€196.657	€190.563	€141.103	€115.000	€63.668	€73.462	€60.302
1960-1964	€1.425.312	€1.430.154	€1.393.224	€1.393.026	€1.308.341	€898.711	€838.218	€672.358	€663.295
1965-1969	€494.615	€428.751	€437.971	€246.691	€244.141	€189.897	€188.847	€235.015	€221.013
1970-1974	€1.252.989	€1.132.209	€962.081	€933.361	€969.653	€786.076	€747.820	€570.911	€545.346
1975-1979	€675.387	€637.072	€625.801	€453.721	€418.258	€453.218	€420.143	€376.272	€293.582
1980-1984	€1.081.058	€1.065.988	€938.196	€855.059	€882.600	€836.081	€715.821	€804.384	€565.004
1985-1989	€2.523.428	€2.333.792	€1.929.571	€140.1455	€889.214	€853.904	€752.877	€737.974	€608.810
1990-1994	€1.444.861	€1.202.895	€1.055.941	€109.2544	€701.268	€519.404	€461.041	€424.211	€396.760
1995-1999	€755.083	€543.115	€593.604	€551.574	€513.262	€475.352	€504.353	€331.673	€341.908
2000-2004	€1.100.384	€1.093.709	€1.121.377	€1.003.442	€988.347	€1.050.432	€976.217	€843.435	€801.462

Table 8: Damage Distribution over Age Building Stock





Fig 16: Damage Clusters for EP=25<sup>-1</sup>

### 2.11 Damage Clusters for a 25 year flood

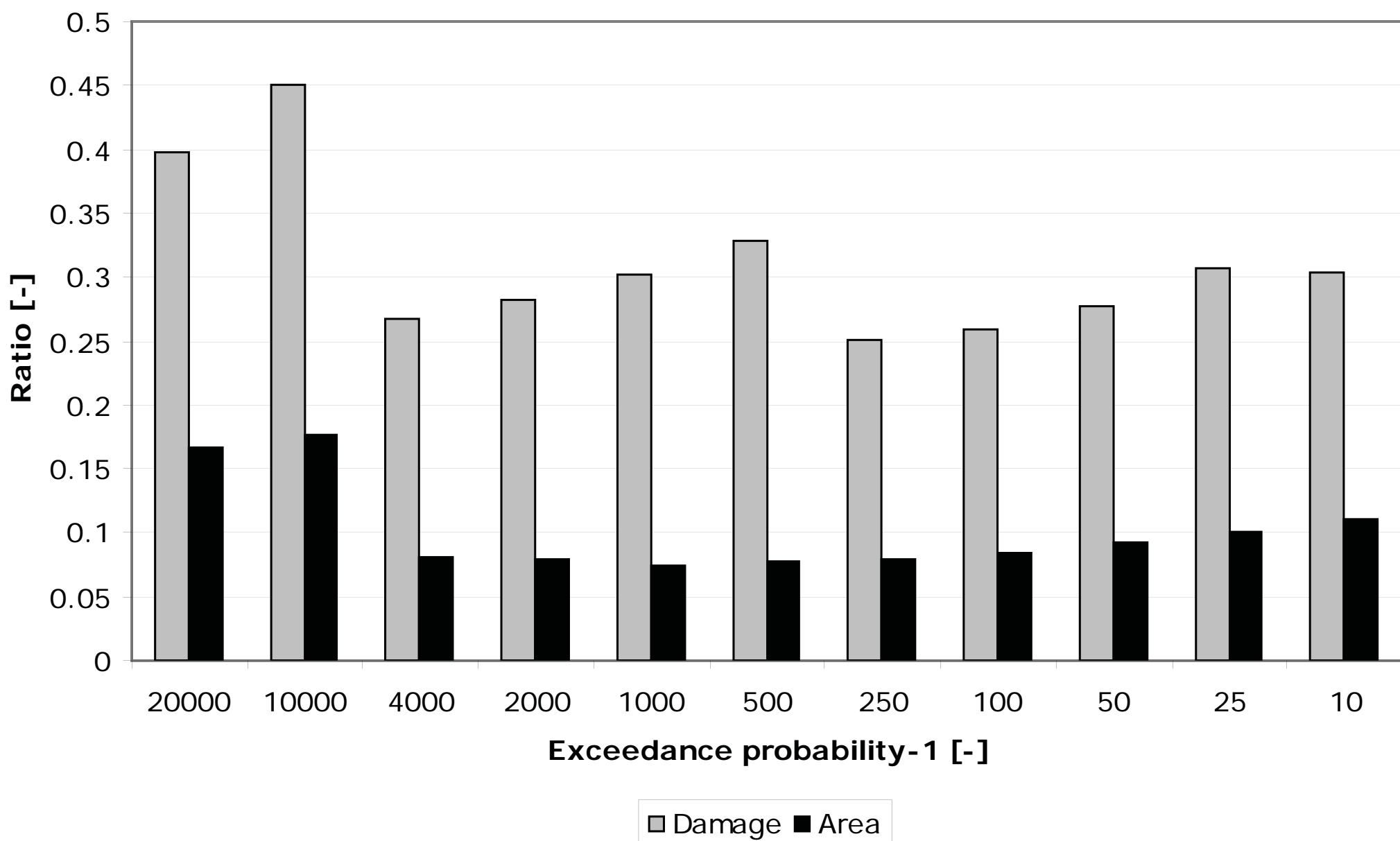
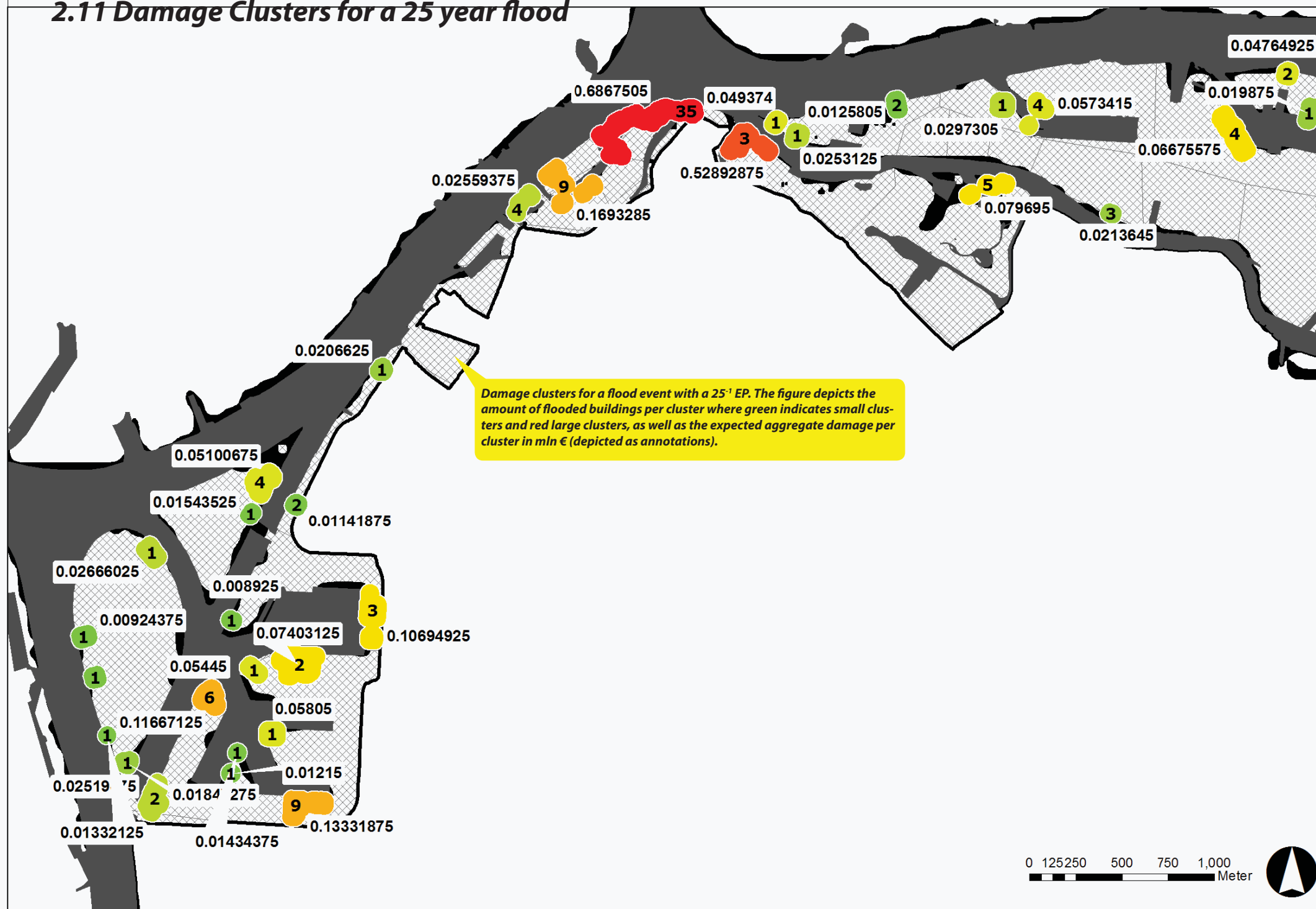


Fig 17: Largest cluster ratio

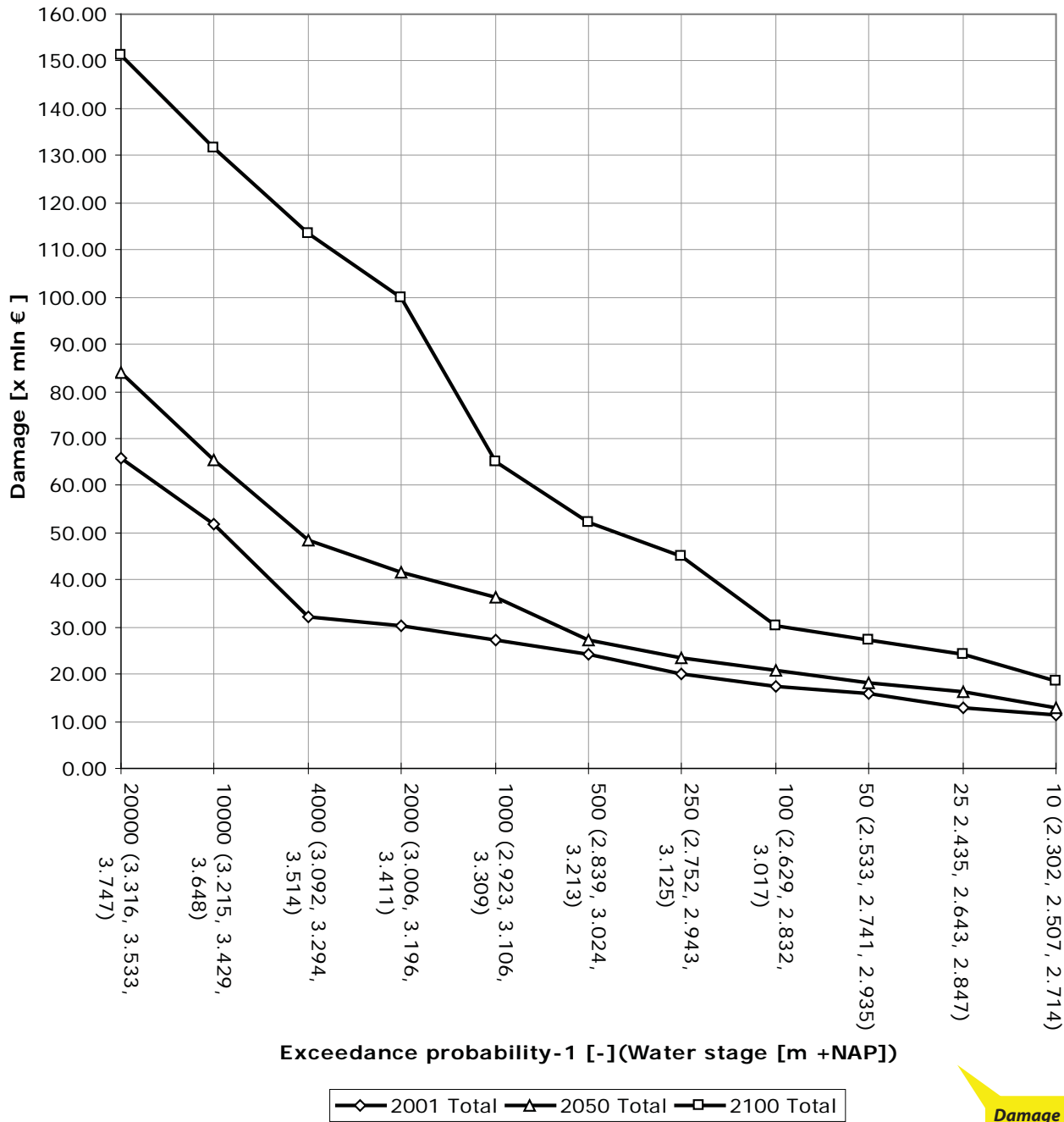
Expected damage and covered area (size) for the largest cluster as a ratio of the aggregate expected damage for a range of flood events for annual EPs between 10<sup>-1</sup> and 20000<sup>-1</sup>.

# 3. Climate Change

Fig 18: Direct Damage for Different Return Periods and 2 climate change scenarios

Table 9: Aggregate Damages for 2 climate change scenarios

## 2.3 Aggregate Damage Levels for Housing, Businesses and Infrastructure



Return Period	2001	WB21 2050	WB21 2100
1:20000	€65.667.520	€83.932.037	€151.361.596
1:10000	€51.864.249	€65.387.116	€131.702.974
1:4000	€32.265.708	€48.515.483	€113.390.317
1:2000	€30.171.445	€41.440.131	€99.789.719
1:1000	€27.076.638	€36.457.377	€65.177.257
1:500	€24.202.271	€27.407.406	€52.045.338
1:250	€19.985.488	€23.542.811	€44.825.479
1:100	€17.230.485	€20.769.341	€30.289.548
1:50	€15.712.088	€18.329.595	€27.225.424
1:25	€12.720.763	€16.214.018	€24.063.600
1:10	€11.236.085	€12.844.928	€18.388.853

Damage curves (aggregate levels) for annual EPs between 10<sup>-1</sup> and 20000<sup>-1</sup> using the current probability distribution (2001) and distributions for the climate change middle scenario WB21 for 2050 and 2100. Note that the water stages belonging to the EPs are noted at the x-axis. These are for the current probability distribution (2001), and those for the WB21 2050 and 2100 distribution.