Environment Agency - Abu Dhabi (EAD)

TERRESTRIAL HABITAT CLASSIFICATION

هـيـئـة الـبـيـئـة - أبـوظـبـي
Environment Agency - ABU DHABI

Document Status

Version	Date	Pages	Comments

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1 Introduction

1.1 Purpose

The purpose of this document is to provide a detailed description of each terrestrial habitat.

1.2 Structure of the document

The document provides details of the following topics:

- Definitions and explanations of the terms and concepts used.
- Overview of the nomenclature classes to be used.
- Overview of the classification and generalisation processes.
- Specific descriptions of each nomenclature category.

1.3 Acronyms and Terms

Acronym \ Term	Meaning \ Definition
A priori	An *a priori* classification system is based upon the definition of classes before data collection takes place.
CORINE	Coordinated Information on the European Environment
Classification	Classification is an abstract representation of the situation in the field using well-defined diagnostic criteria: the classifiers. A classification describes the systematic framework with the names of the classes and the criteria used to distinguish them, and the relation between classes. Classification thus necessarily involves definition of class boundaries that should be clear, precise, possibly quantitative, and based upon objective criteria. A classification should be scale independent and source independent.
EAD	Environment Agency Abu Dhabi
Habitat	An ecological or environmental area that is inhabited by a particular species of animal, plant, or other type of organism. It is the natural environment in which an organism lives, or the physical environment that surrounds (influences and is utilized by) a species population.
LULC	Land Use Land Cover Land cover is distinct from land use despite the two terms often being used interchangeably. Many land use and/or land cover modelling approaches often treat land use and land cover as if they are interchangeable concepts. The research community requires

Acronym \ Term	Meaning \ Definition
	either land cover for environmental models or land use for policy making.
Land Use	The total of arrangements, activities, and inputs that people undertake in a certain land cover type.
Land Cover	The observed physical and biological cover of the earth's land, as vegetation or man-made features.
Legend	A legend is the application of a classification in a specific area using a defined mapping scale and specific data set. A legend is scale and cartographic representation dependent, and data and mapping methodology dependent.
N/A	Not Applicable
WV-2	Digital Globe WorldView 2 satellite imagery.

2 Background to the Classification Process

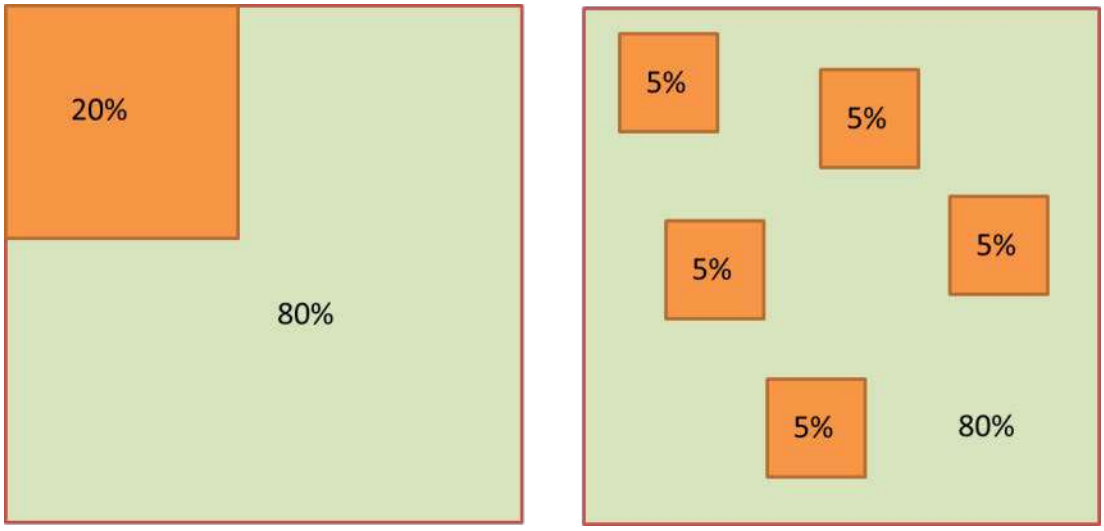
The *a priori* classification schema that will be used within the terrestrial section of the project is based on Brown and Boer's Interpretation manual of the major terrestrial natural and semi-natural habitat types of Abu Dhabi Emirate, v2.0 (2004). However, Brown and Boer's classification categories have been expanded to incorporate elements of land cover and land use in more detail.

As well as a detailed description of the characteristics of each classification category, the rules for delineation will also be presented. Presentation of the rules that will be used will loosely follow the European CORINE Land cover technical guide.

2.1 Principles of Abstracting Reality

Production of a habitat, land use and land cover map requires representation of the real world in an abstract way. Within the abstraction process the general characteristics of a classified feature (map polygon) are as follows:

- The feature should be considered as a homogeneous zone or should comprise a combination of zones with a certain recognizable structure;
- It should present a significant part of the surface in the used scale;
- It should be easily recognisable from its neighbouring zones.
- Inside each class there is a minimal mixture of other classes that are acceptable. In the following example, up to 20% of other classes will not change the principal LULC.



Following these general principles, the minimum mapping units (MMU) of each feature have been defined, as well as the rules for abstracting features.

2.1.1 Spatial Generalisation

Methods of feature extraction and delineation are guided by 'spatial generalisation'. Spatial generalisation basically reduces the complexity of the data structure. It is consistently applied throughout map production each time the general mapping specifications cannot be applied to a specific feature in the ground (i.e. when a feature is not compliant with the minimum mapping unit or with minimum distance between lines, it must be generalised).

Spatial generalisation is also applied in specific form to those classes which include class-particular mapping rules (particular rules for abstracting reality) in their mapping specifications.

The following methods of spatial generalisation apply:

2.1.1.1 Aggregation

This is the merging of a group of individual small features that are in close proximity, and representing this group as one continuous area.

2.1.1.2 Amalgamation

This is the joining of contiguous features, either by merging the area to the closest one, semantically, or by dividing the area between neighbouring features. In the attribute amalgamation, the feature to be generalised is compared to the neighbouring features, and the semantically nearest class is selected to fill the whole feature. In the case that more than the feature to be amalgamated is semantically equal to more than one neighbouring class, it shall be equally divided by these.

2.1.1.3 Exaggeration

This is the slight relocation or shifting of a boundary to exaggerate the true area of a habitat feature so it can comply to the mapping specifications and be mapped

2.1.1.4 Fusion

The small linear spaces between habitat features, which does not meet the mandatory requirements for mapping, must be fused with the other neighboring habitat features to reinforce the landscape structure and continuity.

2.1.1.5 Smoothing

This is the relocation or shifting of a boundary to improve map visualisation and understanding. For instance, it is frequently used to remove the step-effect of the original raster cells and to capture the significant trends of boundaries.

2.1.1.6 Simplification

This is the reduction of boundary line complexity by removing changes of direction smaller than a certain threshold. It also contributes to improving map visualisation and understanding.

3 List of the classification types to be used

Type no.	Sub-type no.	Habitat type	MMUs (ha)
1000		Intertidal habitats	
	1010	Mudflats and sand exposed at low tide	5
	1020	Sheltered tidal flats with cyanobacterial mats	5
	1030	Saltmarsh	5
	1040	Mangroves	5
	1050	Storm beach ridges	5
	1060	Sandy beaches	5
	1070	Beach rock and gravelly beaches	5
2000		Coastal plains, sand sheets and low dunes	
	2011	Coastal plains on well-drained sandy ground	25
	2012	Coastal plains on well-drained rocky or gravelly terrain	25
	2020	Coastal sand sheets and low dunes	5
	2030	Coastal cliffs, headlands, rocky slopes and wadis in coastal situations	5
3000		Coastal sabkha, including Sabkha Matti	
	3100	Coastal sabkha, including Sabkha Matti	25
4000		Sand sheets and dunes	

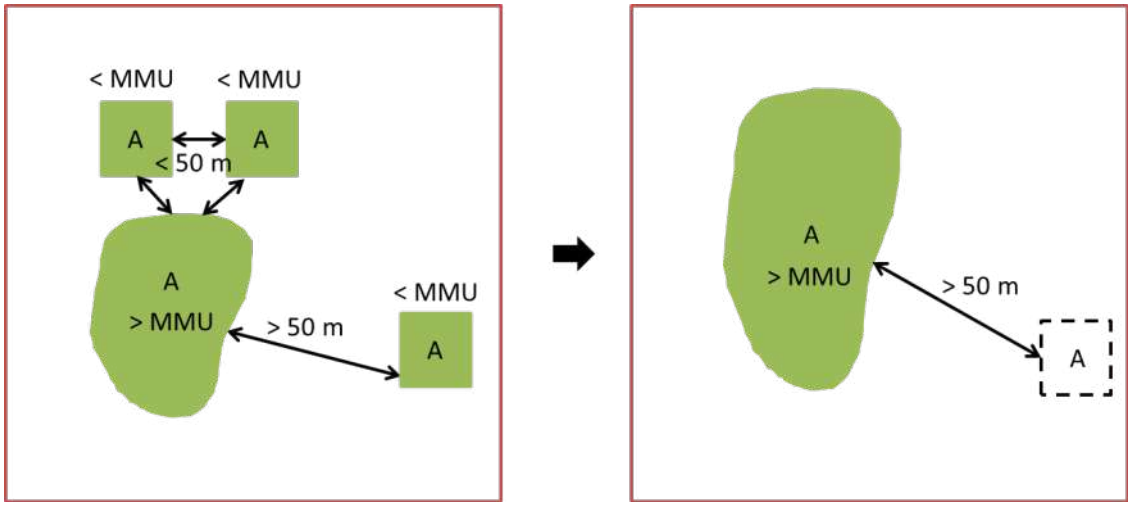
Type no.	Sub-type no.	Habitat type	MMUs (ha)
	4110	Sand sheets and dunes with tree cover	25
	4120	Sand sheets and dunes with shrub cover	25
	4130	Sand sheets and dunes with dwarf shrub cover	25
	4140	Sand sheets and dunes with perennial herbs and graminoids	25
	4200	Mega-dunes	25
5000		Gravel plains (alluvial and interdunal)	
	5110	Gravel plains with distinct tree vegetation	25
	5120	Gravel plains with dwarf shrub vegetation	25
	5130	Gravel plains with sparse vegetation	25
	5200	Inland sabkha	25
6000		Mountains, rocky terrain and wadis	
	6100	Mountain slopes, screes and associated wadis	25
	6210	Jebels (including mesas and burqas)	5
	6220	Escarpments, lithified sand dunes, rocky exposures	5
	6320	Wadis in open terrain, and drainage channels	25
7000		Inland standing water habitats and habitats of moist ground	
	7100	Semi-artificial lakes	1
	7200	Moist ground with *Phragmites*, *Tamarix* and grass mats	5
8000		Oases, Farmland and Forestry	
	8100	Date plantations	1
	8200	Farmland	1
	8300	Livestock areas	1
	8400	Forestry plantations	1
9000		Urban habitat types	
	9110	High density urban	1
	9120	Low density urban	1
	9210	Oil industry	1
	9220	Airports and Aerodromes	1
	9230	Port Areas	1
	9240	Other industry	1
	9300	Leisure areas	1
	9400	Paved roads	1
	9500	Pipelines infrastructure	1
	9600	Disturbed ground	1

4 Project-wide generalisation rules

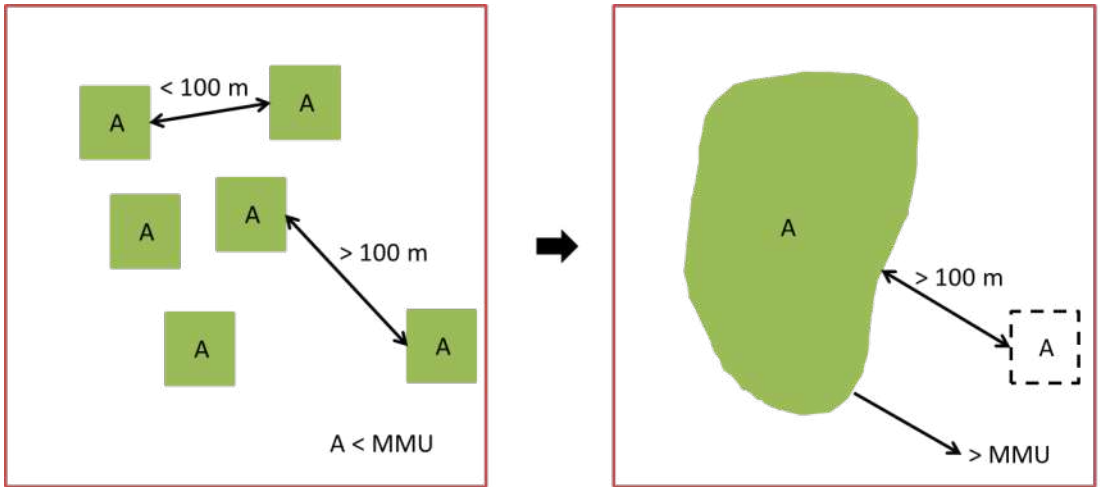
Several generalisation rules will be applied for every terrestrial class within the project, or for groups of classes. These are detailed within this section of the document.

4.1 Aggregation

1st rule: When habitat patches, smaller than the MMU, are less than 50m apart from the same habitat feature larger than the MMU, they will be aggregated to this later feature (fig. below).



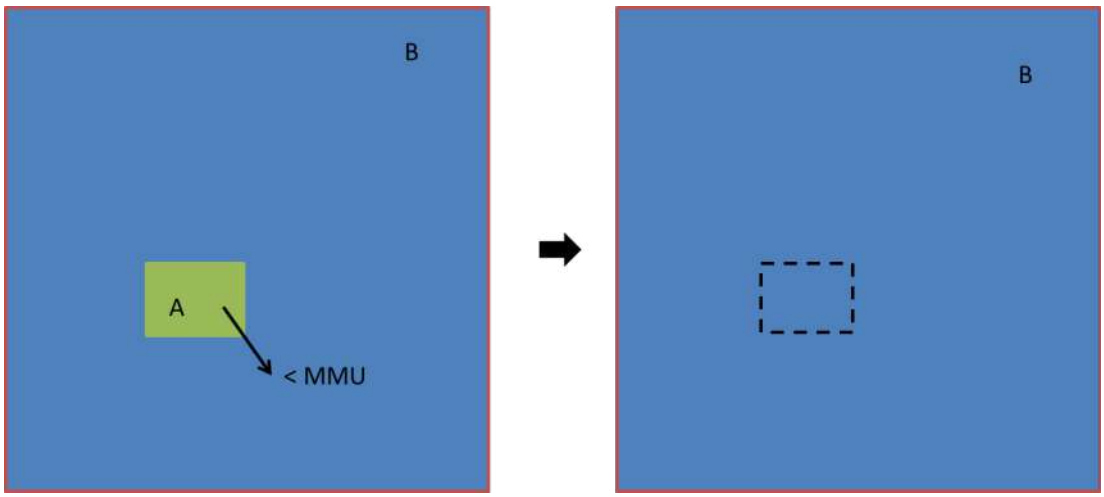
2nd rule: When habitat patches, all smaller than the MMU, are less than 100m apart and together can create a habitat feature larger than the MMU, they will be aggregated (fig. below). The aggregation will be prioritised by joining the closest patches together until reaching the MMU. After, the 1st rule applies (explained above).



4.2 Amalgamation

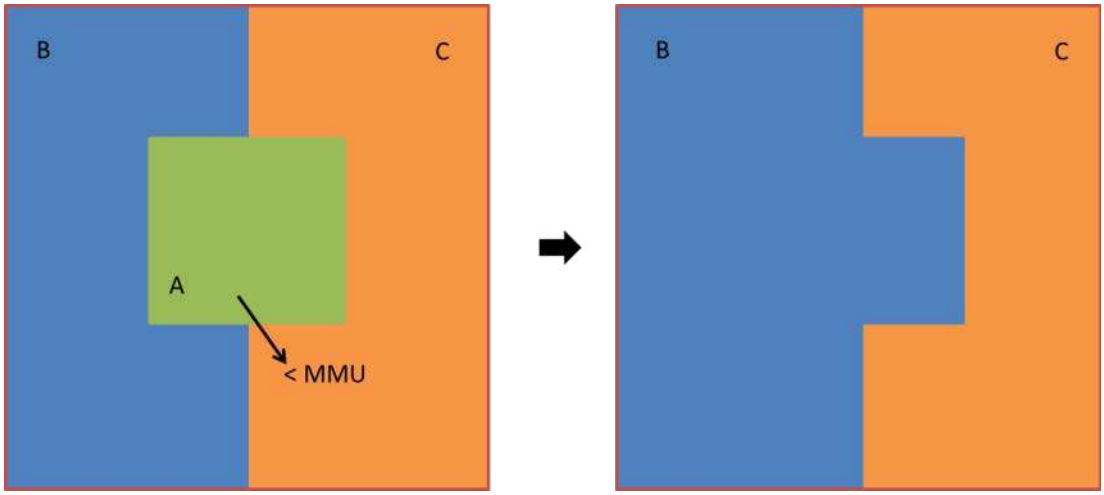
This rule is widely applied to features not compliant with the mapping specifications (i.e. MMU and Minimum distance between lines). Such features, if not in condition of being aggregated, are to be amalgamated according to the following examples:

If within habitats compliant with the mapping specifications, these features will be completely amalgamated by the surrounding habitats (see fig. below)

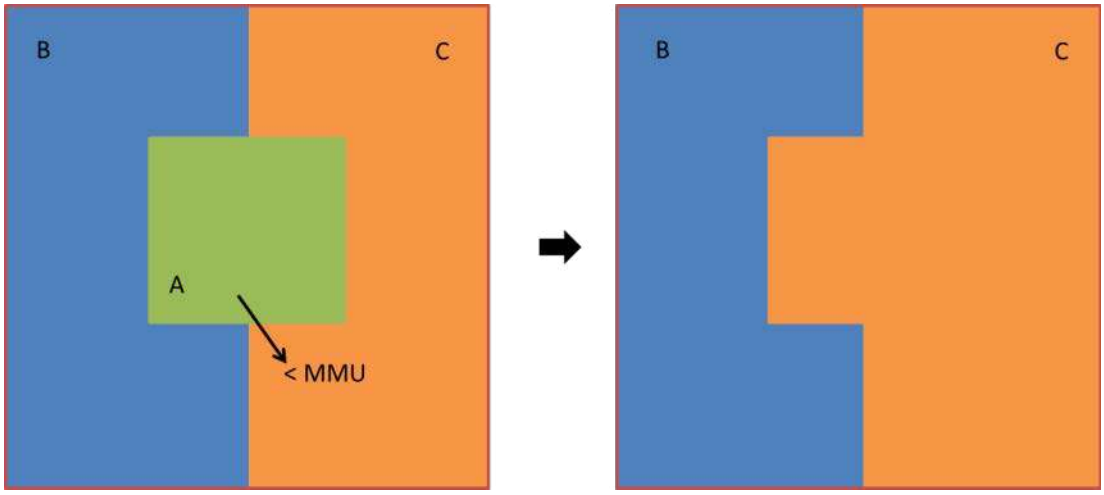


If they are between different habitats, these features shall be amalgamated into either habitat, or to both habitats, according to the priority table available in appendix 2 (see figs. below).

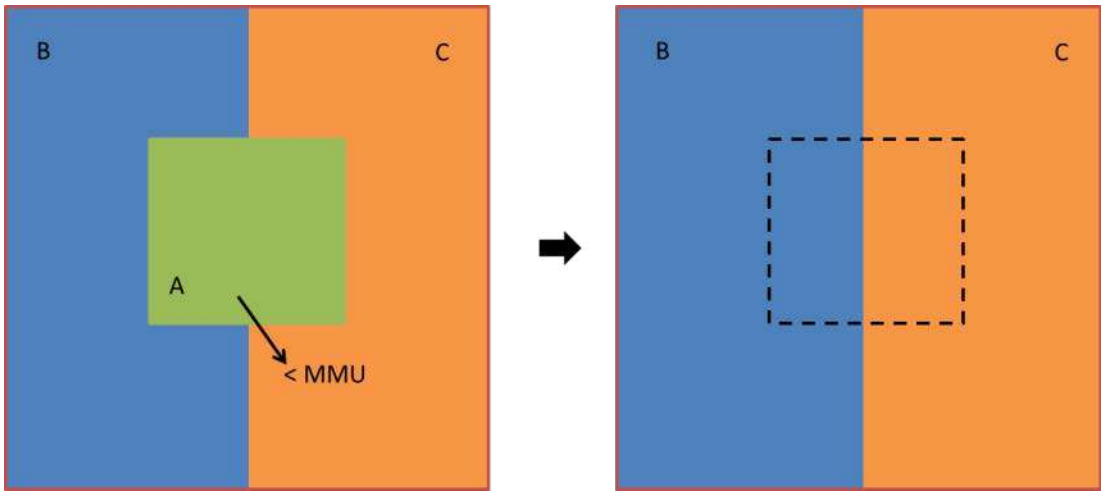
- Higher priority to B



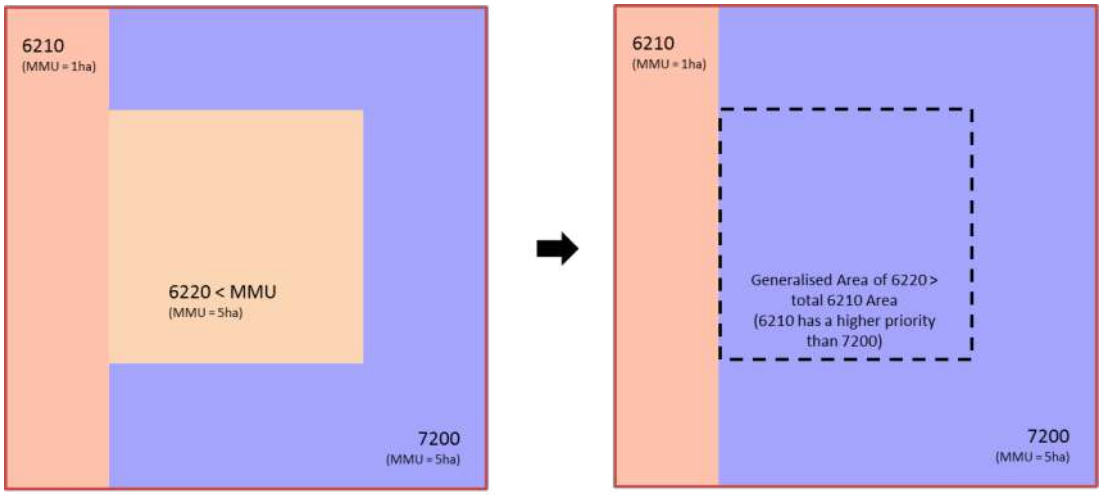
- Higher priority to C



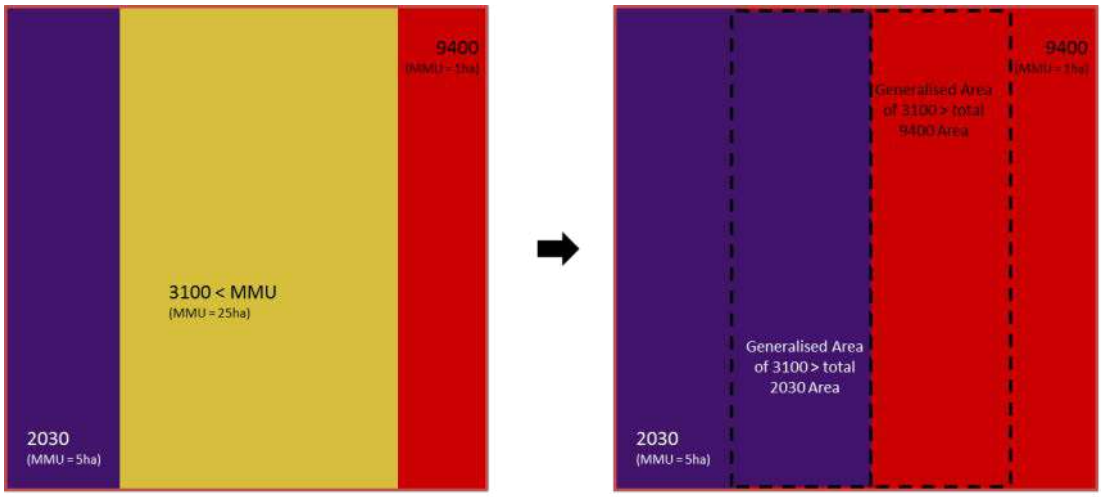
- Equal priority to B and C



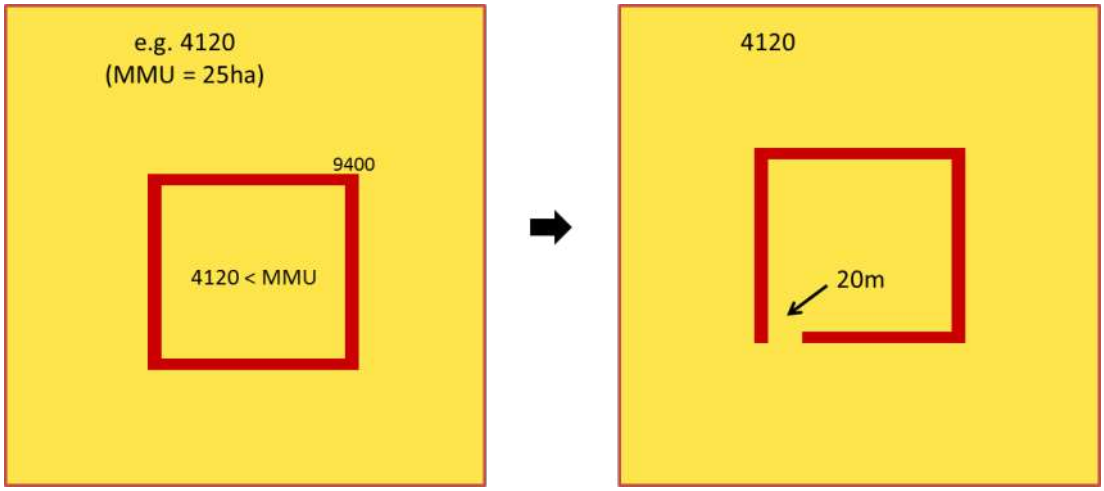
It is mandatory that the habitat feature to be generalized (not compliant with mapping rules) is smaller in area than the features that it will be amalgamated to; a larger area feature shall never be generalized into a smaller area feature, even if it has a higher priority for generalization than the smaller feature habitat. Such situations may occur as we are using a nomenclature with variable MMUs. In such cases the amalgamation shall occur towards the neighbouring habitat feature with the next highest priority and which has a larger area. In the figure below this case is depicted; although there is a higher semantic proximity between 6210 and 6220 (thus higher priority for generalization) the feature is amalgamated with the next highest priority feature with an area larger than itself.

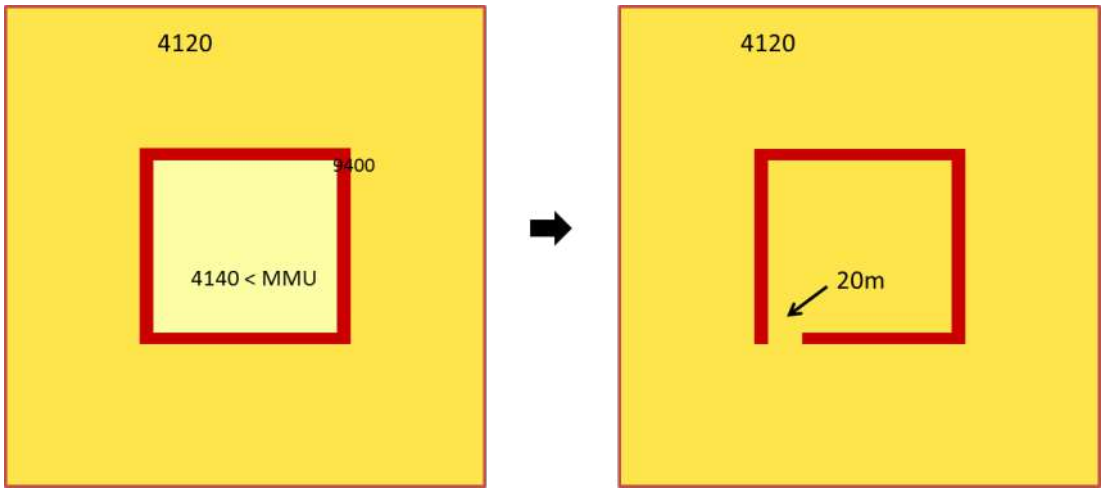


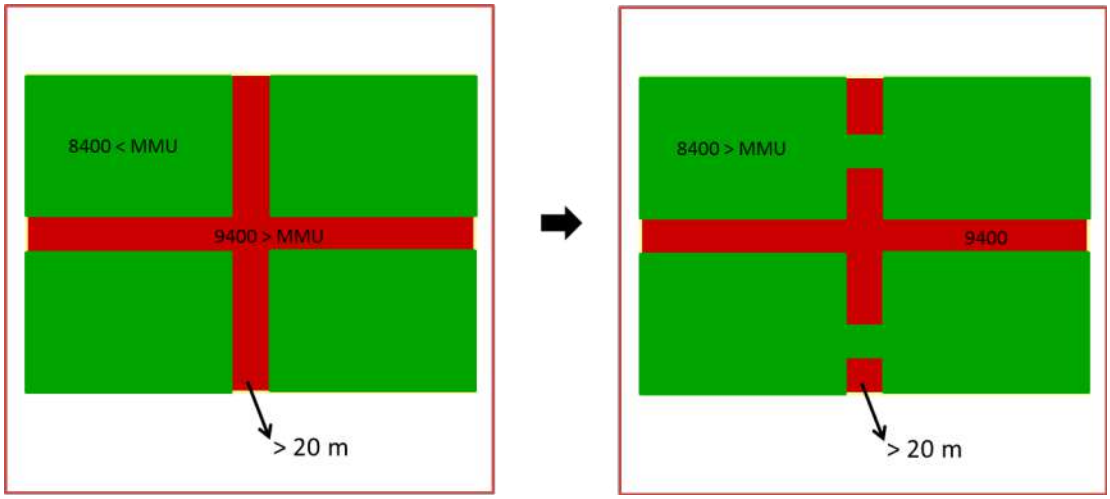
Another complex situation is the case where the feature to be generalised is larger than all neighbouring polygons. In this case (see fig. below), the feature will be equally amalgamated into all surrounding polygons, independently of generalisation priorities.



Other particular amalgamation situation may occur for areas smaller than the MMU and completely contained within linear polygon features (e.g. roads, pipelines). In such situations, to avoid having to amalgamate these areas with the very different linear habitats (which do not share any thematic similarities, and consequently the generalisation of the isolated areas would completely change the landscape information provided by the linear feature) the amalgamation shall occur with the habitats on the outside border of the linear feature and following the generalisation priority table (appendix 2). This is depicted in the three examples below.

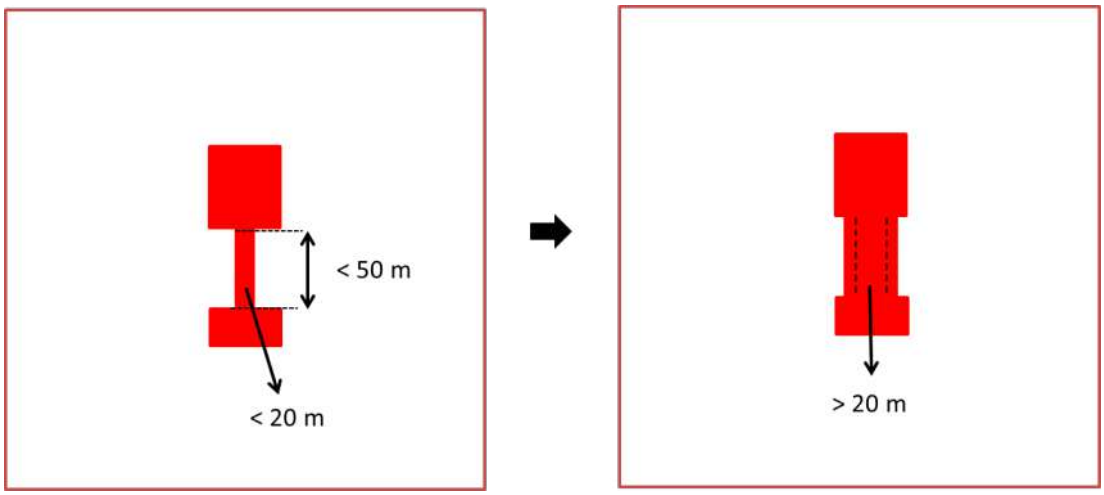

e.g. 4120
(MMU = 25ha)
9400
4120 < MMU
4120
20m


4120
9400
4140 < MMU
4120
20m

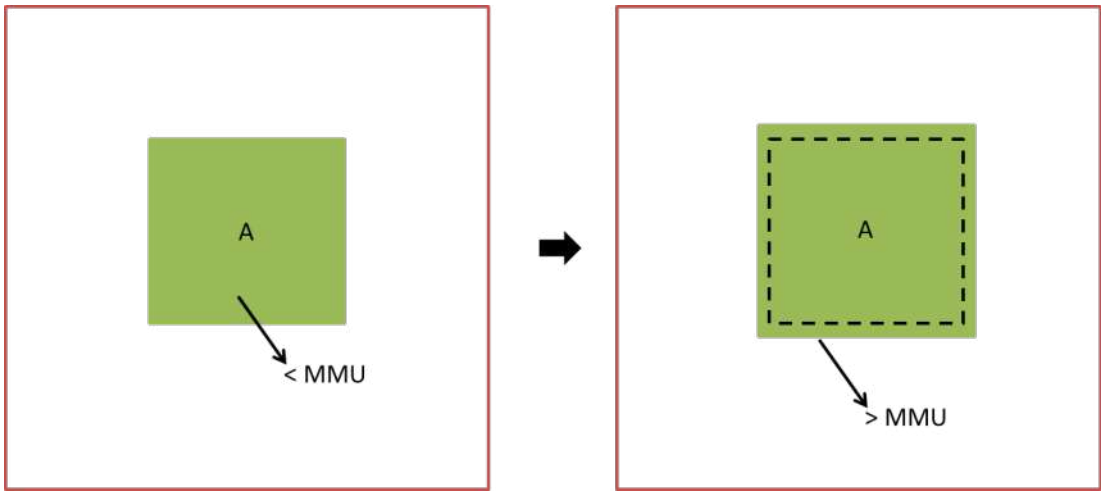

8400 < MMU
9400 > MMU
> 20 m
8400 > MMU
9400
> 20 m

4.3 Exaggeration rules

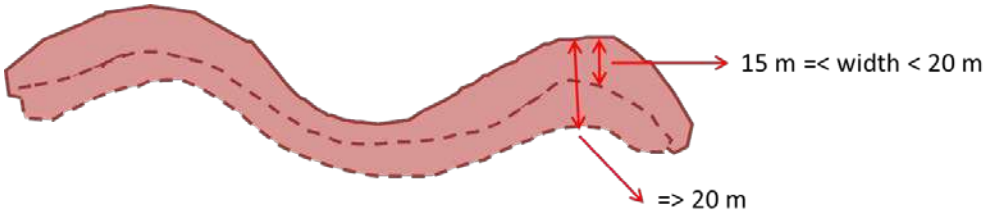
The minimum width of any habitat feature will be 20m. Where a patch of habitat, not larger than 50m long, is less than 20m wide (e.g. >15m), and connected to the same habitat patches, this will be exaggerated to 20m to maintain habitat continuity.



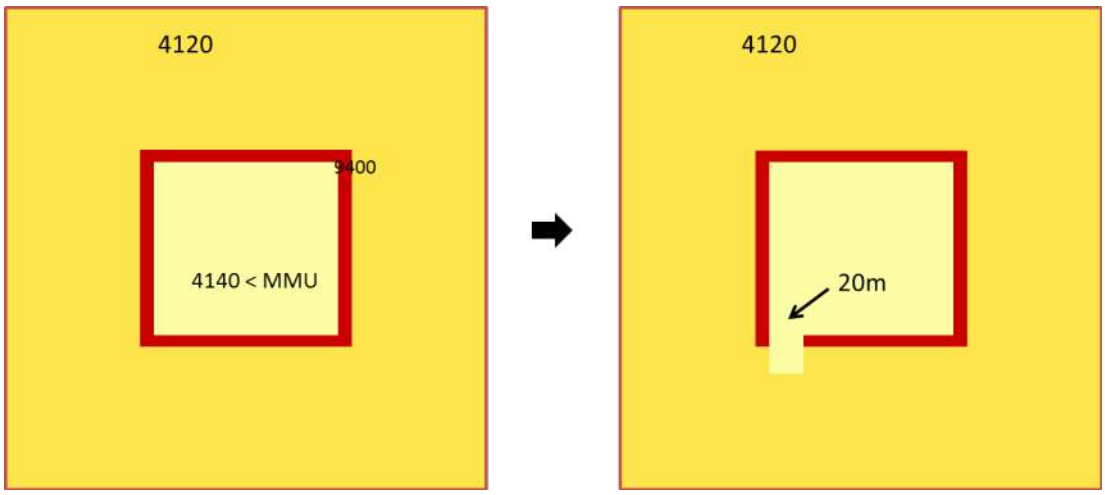
If a polygon is on the verge of reaching the MMU, it should be exaggerated in order to be able to be mapped (see figure below).



In linear structures, such as roads, beaches, and storm beach ridges, the feature should be exaggerated to 20m, if it already measures 15m in width, in order to be able to be mapped (see fig. below).

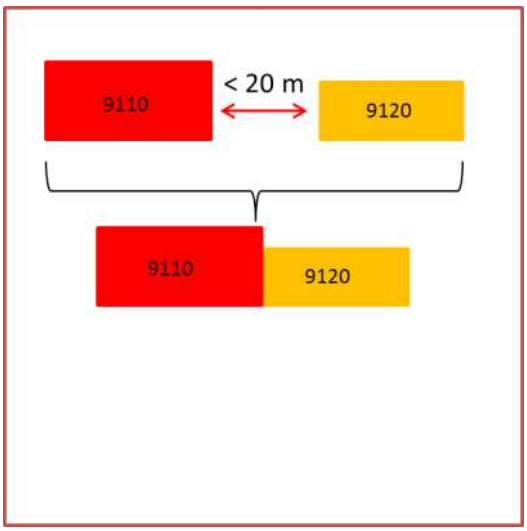


In the particular case of isolated areas almost reaching the MMU and being completely contained within a linear polygon features (e.g. roads, pipelines) the former should be exaggerated as illustrated in the figure below. This is performed to avoid having to amalgamate these areas with the very different linear habitats, which do not share any thematic similarities.



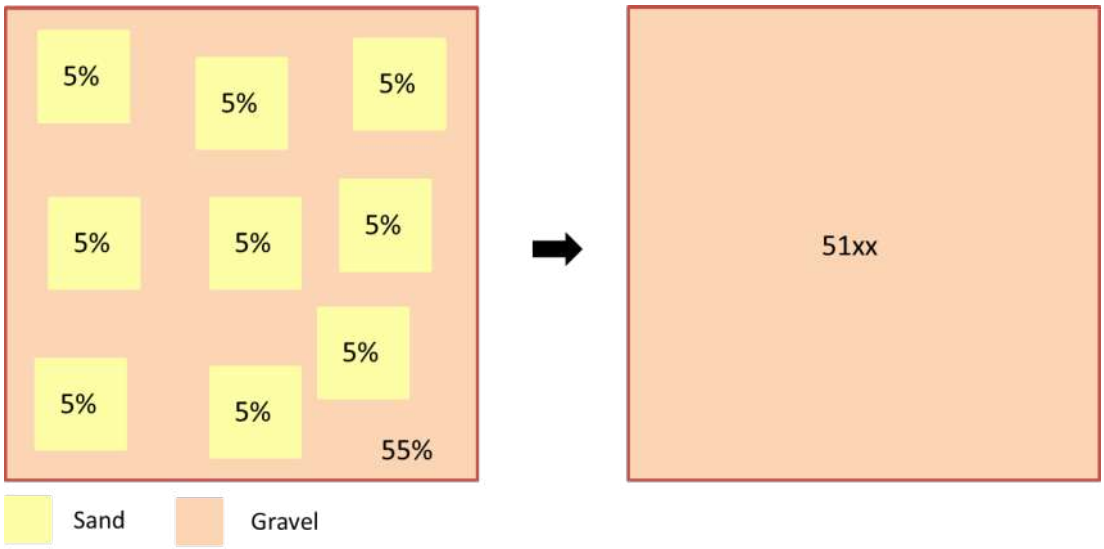
4.4 Fusion Rules

In linear situations where areas do not meet the width specifications (>20m) to be individually mapped, and are between 2 habitats, these latter habitats will be expanded to include the small area. The way these areas will be encompassed, (i.e. by one or the other of the neighbouring habitats), is defined according to the habitat feature areas, where the larger will encompass the unclassified area. If both are similar size areas, the priority table presented in Appendix 2 is used; higher priority indicates which habitat will be used to encompass the missing area and the same priority means that the missing area will be equally divided.



4.5 Sand-sheets and dunes and Gravel plains amalgamation rule

In a mosaic of sand sheets and low dunes with gravel plains, the area shall be classified according to the most common habitat (i.e. sand or gravel). In the following example gravel plains cover 55% of the area; therefore the area will be classified as gravel plains.



If the distances between small areas (<MMU) is less than 100m, they will be amalgamated as one until they are greater in than the MMU (See section 4.1).

4.6 Vegetation priority rule

Higher vegetation will have priority over lower vegetation, i.e. Trees will have priority over any other vegetation; shrubs will have priority over dwarf shrubs;

dwarf shrubs will have priority over herbaceous; and herbaceous will have priority over sparse or bare vegetation areas.

Where the correct density of trees exists, an area will be deemed as a tree habitat rather than a different vegetated habitat, even where other vegetation is evident. The same rationale applies for shrubs, dwarf shrubs and herbaceous.

5 Characteristics of classification categories

The following information will be provided for each nomenclature category. The subsequent sections describe each category in detail.

Title:

Habitat type code and explicit name of the habitat type

i. Definition – general description of the abiotic features and vegetation and/or anthropogenic description.

ii. Characteristic plant and animal species

iii. Geographical distribution

iv. Habitat types generally associated in the field

v. Perceived threats

vi. Bibliographical references

vii. This heading includes

viii. This heading excludes

ix. Representative Image of the class

x. Minimum Mapping Unit

xi. Generalisation rules including representative diagrams

5.1 1000 Intertidal habitats

5.1.1 1010 Mudflats and sand exposed at low tide

i. Definition

Mudflats and sand flats exposed at low tide, devoid of vegetation. Mostly refer to coastal wetlands that form when mud is deposited by tides. These are often devoid of vegetation but can also be found with less than 10% vegetation cover.

ii. Characteristic plant and animal species

No plants, with the exception of one species of seagrass, *Halodule uninervis*, which can be exposed at low tide (usually sparse). No growing macroalgae (broken-off pieces can be present). This is an important habitat for wading birds, especially migratory species in the plover and sandpiper families, which feed on benthic invertebrates. Herons (mainly Striated Heron and Western Reef Heron) feed on tidal flats at low tide.

iii. Geographical distribution

Very widespread along most of the mainland coast and islands of Abu Dhabi.

iv. Habitat types generally associated in the field

Saltmarsh is sometimes present on the upper margin of tidal flats. Mangroves can be present within tidal flats. The flats can be backed by either sandy beaches (1060), storm beach ridge (1050) or coastal cliffs, headlands or rocky slopes (2030).

v. Perceived threats

Dredging, infilling, lowering for mangrove planting.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005), Evans (1994).

vii. This heading includes

- Sparse seagrass exposed at low tide, adjacent to the subtidal.
- Shallow lagoons not fully emptying at low tide.

viii. This heading excludes

- Beach rock (1070).
- Well established cyanobacterial mat (1020).

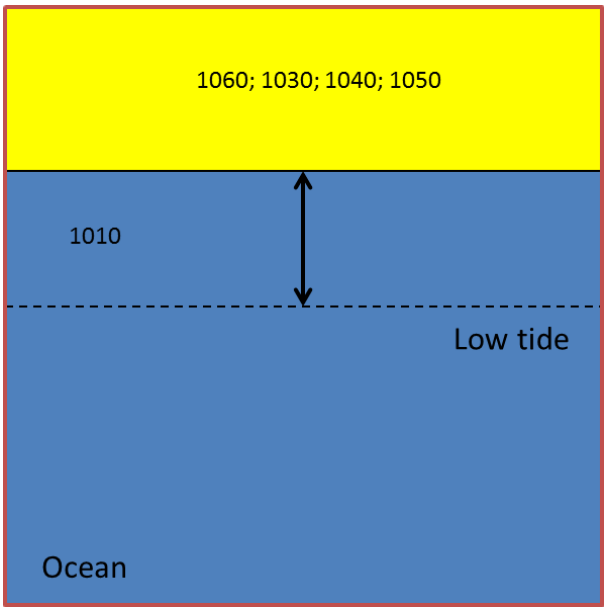
ix. Representative Image of the class

x. Minimum Mapping Unit

5 ha.

xi. Generalisation rules including representative diagrams

Mudflats and sand exposed at low tide shall extend to the low water line.



5.1.2 1020 Sheltered tidal flats with cyanobacterial mats

i. Definition

Thin mats of cyanobacteria overlying saline sand in sheltered coastal locations. These areas are very nearly flat, and are adjacent to and on the upper margin of intertidal flats. Usually devoid of higher plants, although some halophytes may occur where there is a thin covering of sand over the surface. Black in colour and often completely covered by cyanobacterial mats (more than 85% cover).

ii. Characteristic plant and animal species

No higher plants or macroalgae. The gastropod *Nodilittorina arabica* is often present. Small numbers of waders, particularly Kentish Plover.

iii. Geographical distribution

Only present in very sheltered areas, particularly in the lee of islands.

iv. Habitat types generally associated in the field

Intertidal flats (1010).

v. Perceived threats

Dredging, infilling, lowering for mangrove planting

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Only areas with cyanobacterial cover, which is usually very dark or even black.

viii. This heading excludes

- Sabkha, which is not normally covered by high tide.

ix. Representative Image of the class

x. Minimum Mapping Unit

5 ha.

xi. Generalisation rules including representative diagrams

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.1.3 1030 Saltmarsh

i. Definition

Vegetated areas in the upper part of the intertidal zone, i.e. covered by every high tide. Colonized with saltmarsh vegetation in which halophytic chenopods play a predominant role; more than 10% vegetation cover. Open bodies of water may be present.

ii. Characteristic plant and animal species

Saltbushes in the family Chenopodiaceae: *Arthrocnemum macrostachyum, Halocnemum strobilaceum*. The Desert Hyacinth *Cistanche tubulosa* can be parasitic on these chenopods, and the grass *Aeluropus lagopoides* may be present on the landward margin, sometimes with *Cressa cretica.*

iii. Geographical distribution

Mainly in the sheltered khors behind the barrier islands, c. 50 km either side of Abu Dhabi Island.

iv. Habitat types generally associated in the field

Tidal flats (1010) and mangroves (1040).

v. Perceived threats

Infilling, and coastal development in general.

vi. Bibliographical references

Perry, 2008.

vii. This heading includes

- Saltmarsh with a low density of mangrove bushes.

viii. This heading excludes

- Strandline and storm beach ridges where the dominant plants are *Sueda vermiculata* and *Salsola drummondii*.

ix. Representative Image of the class

x. Minimum Mapping Unit

5 ha.

xi. Generalisation rules including representative diagrams

- If the gap between saltbushes is more than 50 metres, they should be treated as separate units.

5.1.4 1040 Mangroves

i. Definition

Coastal woodland formation below the high tide mark. The stands can be natural or planted and range from scattered individual trees to dense, impenetrable woodland occupying extensive areas. Often accompanied by halophytic chenopods towards the margins or in a mosaic. These are areas within the intertidal zone where the cover of mangroves, *Avicennia marina* is more than 10%.

ii. Characteristic plant and animal species

Avicennia marina is obligatory. There can be a proportion of *Arthrocnemum macrostachyum* and *Halocnemum strobilaceum.* Breeding birds are primarily Western Reef Heron, Striated Heron, Laughing Dove, White-eared Bulbul and Graceful Prinia. These are present throughout the year. In winter months there are Grey Heron, Great Egret, Marsh Harrier and various waders, such as Redshank. Benthic invertebrates are present at high density, and the drainage channels are important nursery areas for fish.

iii. Geographical distribution

Present from Shweihat eastwards to the Dubai border, with the greatest concentrations around Abu Dhabi Island.

iv. Habitat types generally associated in the field

Tidal flats (1010) on either side and saltmarsh (1030) on the upper side

v. Perceived threats

Coastal developments where new land is created from intertidal habitats.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005), Hogarth (1999), Loughland ().

vii. This heading includes

- Saltmarshes where the mangrove cover is more than 10 %.

viii. This heading excludes

- Saltmarsh areas where the mangrove cover is less than 10 %.

ix. Representative Image of the class

x. Minimum Mapping Unit

5 ha.

xi. Generalisation rules including representative diagrams

- If the gap between saltbushes trees is more than 50 metres, they should be treated as separate units.
- In the case that patches smaller than 5ha are distanced to 100m , these should be merged together to form a unit larger than 5ha.

5.1.5 1050 Storm beach ridges

i. Definition

A strip of sandy, hummocky, vegetated ground above and parallel with the high water mark, usually less than 1m high, which occasionally gets overtopped by storms, and which traps sand blown inland from the intertidal zone. Several parallel ridges may be developed, the older ones (landward side) frequently with dense cover of halophytic chenopods. These areas have more than 20% vegetation cover and are hummocky.

ii. Characteristic plant and animal species

The most characteristic species is *Sueda vermiculata*. Other common associates are *Salsola drummondii, Salsola imbricata, Halopeplis perfoliata, Zygophyllum qatarense, Anabasis setifera, Cornulaca aucheri, Sesuvium verrucosum.* East of Abu Dhabi Island the dune grass *Halopyrum mucronatum* can be present or locally dominant. Kentish Plover and (locally) Saunders' Tern breed in storm beach ridges, and Hawksbill Turtle use them for egg laying.

iii. Geographical distribution

Formerly present along the majority of the mainland coast west of Abu Dhabi Island and on some of the barrier islands.

iv. Habitat types generally associated in the field

Intertidal flats (1010), sandy beaches (1060) and beach rock (1070) on the seaward side, and coastal plain (2011) on the landward side.

v. Perceived threats

Coastal development.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Lower patches where the dominant plant is *Halopeplis perfoliata*.
- Areas where the height of the ridge has developed and where *Arthrocnemum macrostachyum* (usually associated with saltmarsh) is dominant.

viii. This heading excludes

- Areas further than 100 metres of the high water mark (this is usually coastal plain – 2011).

ix. Representative Image of the class

x. Minimum Mapping Unit

5 ha.

xi. Generalisation rules including representative diagrams

- The ridge needs to be more than 20 metres wide.
- Storm beach ridges between 15 and 20 meters wide will be exaggerated up to 20 metres.
- If the gap between Storm beach ridges is more than 50 metres, they should be treated as separate units.
- In the case that patches smaller than 5ha are distanced to 100m , these should be merged together to form a unit larger than 5ha.

5.1.6 1060 Sandy beaches

i. Definition

Intertidal sandy areas that are maintained in a vegetation-free state by currents and wave energy. Beach invariably extend up to the high water mark, but the lower margin may grade into tidal flats (1010). Devoid of vegetation, although sometimes large amounts of seagrass washed up and deposited.

ii. Characteristic plant and animal species

No plants. Many waders feed along the water's edge, e.g. Lesser Sand Plover, Dunlin, Little Stint, Terek Sandpiper.

iii. Geographical distribution

Much of the mainland coast and the shores of islands mainly facing into the prevailing wind.

iv. Habitat types generally associated in the field

Sandy beaches are prevalent except where intertidal flats directly grade into storm beach ridge or sabkha, where there are coastal cliffs and headlands (2030), or where they have been destroyed by coastal development.

v. Perceived threats

Coastal development

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Man-made and public beaches

viii. This heading excludes

- Beaches less than 15 metres wide.

ix. Representative Image of the class

x. Minimum Mapping Unit

5 ha

xi. Generalisation rules including representative diagrams

- If the gap between sandy beaches is more than 50 metres, they should be treated as separate units.
- In the case that patches smaller than 5ha are distanced to 100m , these should be merged together to form a unit larger than 5ha.

5.1.7 1070 Beach rock and gravelly beaches

i. Definition

Intertidal areas where bedrock is exposed, where sedimentation has consolidated sand into a solid substrate and areas where gravelly material has been deposited onto an intertidal surface. Often devoid of significant vegetation cover. Present below the high water line.

ii. Characteristic plant and animal species

Much of the surface is bare and inhospitable to invertebrate life, but in the low intertidal some algae may be present and the invertebrate community is better

developed. In the upper intertidal the gastropod *Nodilittorina arabica,* which can feed on endo-lithophilic algae, may be present. Where there is some shelter, e.g. in cracks or beneath loose slabs, there can be gastropods such as *Planaxis sulcatus, Lunella coronata, Monodonta nebulosa,* and bivalves such as *Brachidontes variabilis* and *Parviperna nucleus*. Crabs such as *Metapograpsus messor* and snapping shrimps *Alpheus* sp. are present, along with sea anemones such as *Anthopleura* sp.

iii. Geographical distribution

Present in many areas on the mainland shore and on some of the islands.

iv. Habitat types generally associated in the field

Often grading into intertidal flats (1010) downshore. On the landward side, usually storm beach ridge (1050), coastal plains on rocky ground (2012) or coastal cliffs and headlands (2030)

v. Perceived threats

Coastal development.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Intertidal areas where more than 50% of the area is of hard material.
- Intertidal areas where the bedrock, e.g. Miocene deposits, is exposed.
- Intertidal areas where hard material is developing over sand as a result of deposition of carbonate rock (as in the photo below).

viii. This heading excludes

- Man-made rocky intertidal areas such as limestone armouring.

ix. Representative Image of the class

x. Minimum Mapping Unit

5 ha.

xi. Generalisation rules including representative diagrams

- If the gap between patches of Beach rock and gravelly beaches is more than 50 metres, they should be treated as separate units.
- In the case that patches smaller than 5ha are distanced less than 100m these should be merged together to form a unit larger than 5ha.

5.2 2000 Coastal plains, sand sheets and low dunes

5.2.1 2011 Coastal plains on well-drained sandy ground

i. Definition

Low-lying, flat areas on sandy ground adjacent to the coast. Sandy substrate are often somewhat compact and influenced to a certain degree by salinity, with some vegetation (that may be very sparse and distinctly seasonal). Much of the coastal plain habitat has developed on former sabkha.

ii. Characteristic plant and animal species

Typical plants include *Sueda aegyptiaca, Halopeplis perfoliata, Salsola drummondii, S. imbricata,* and *S. cyclophylla, Cornulaca monacantha, Zygophyllum qatarense, Heliotropium digynum, Limonium axillare, Launaea sp., Agriopohyllum minus, Fagonia ovalifolia, Neurada procumbens, Taverniaria spartea, Oligomeris liniifolia, Cyperus arenarius, Panicum turgidum.* To the east of Abu Dhabi Island, *Sphaerocoma aucheri* is a common component. Breeding birds include Crested Lark, Black-crowned Sparrow-lark, Lesser Short-toed Lark, and Chestnut-bellied Sandgrouse.

iii. Geographical distribution

More prevalent in the Western Region of Abu Dhabi.

iv. Habitat types generally associated in the field

Often adjacent to storm beach ridge (1050). The habitat can grade into sabkha (3100) or coastal sand sheets and low dunes (2020).

v. Perceived threats

Coastal development.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- All flat, low-lying areas adjacent to the coast on sandy ground.

viii. This heading excludes

- Sabkha (very saline, with no vegetation).
- Areas more than 3 km from the coast which are not contiguous with 2011 coastal plains on well-drained sandy ground.

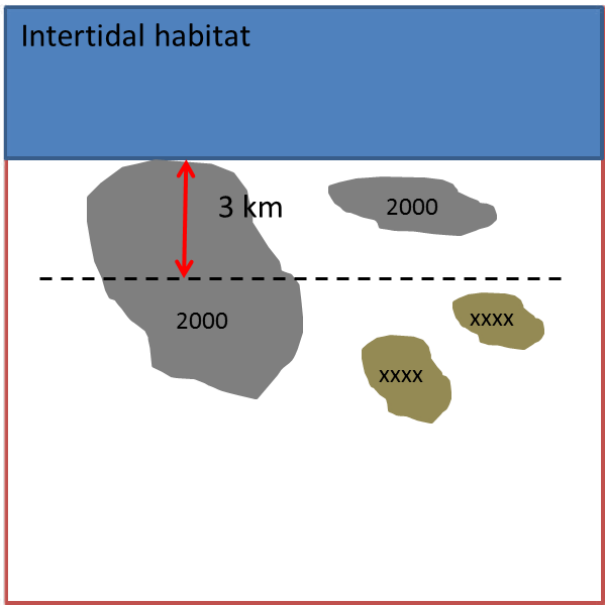
ix. Representative image of the class

x. Minimum Mapping Unit

5 ha.

xi. Generalisation rules including representative diagrams

2000 Habitats can only occur within coastal areas. As a general mapping rule it was considered that the 2000 Coastal plains, sand sheets and low dunes habitats occur within a 3km buffer distance from the intertidal habitats (see fig. below)



5.2.2 2012 Coastal plains on well-drained rocky or gravelly terrain

i. Definition

Areas adjacent to the coast on fairly low-lying but rocky ground (mostly of Miocene age), with a gravelly surface or with exposed aeolianite. Gravelly substrate often somewhat compact and influenced to a certain degree by salinity. Terrain is hard and flat (not hummocky).

ii. Characteristic plant and animal species

Salsola imbricata and S. cyclophylla, Anabasis setifera, Zygophyllum qatarense and Z. simplex, Cornulaca monacantha, Heliotropium kotschyi, Calligonum comosum, Oligomeris liniifolia.

iii. Geographical distribution

More prevalent in the Western Region of Abu Dhabi.

iv. Habitat types generally associated in the field

Similar areas on sandy ground (2011), and coastal cliffs and headlands (2030).

v. Perceived threats

Coastal development

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Areas on firm substrate within 3km of the coastline.

viii. This heading excludes

- Areas near the coast with distinct elevation which are regarded as coastal cliffs, headlands, rocky slopes and wadis in coastal situations (2030).
- Areas more than 3 km from the coast which are not contiguous with 2012 coastal plains on well-drained rocky or gravelly terrain.

ix. Representative image of the class

x. Minimum Mapping Unit

25 ha.

xi. Generalisation rules including representative diagrams

- 2000 Habitats can only occur within coastal areas. As a general mapping rule it was considered that the 2000 Coastal plains, sand sheets and low dunes habitats occur from within a 3km buffer distance from the intertidal habitats (see fig. in section 5.2.1)

5.2.3 2020 Coastal sand sheets and low dunes

i. Definition

Hummocky vegetated terrain on normally pale sand (mostly carbonate), with a coastal influence affecting the vegetation. Perennial grasses and dwarf shrubs are the most prominent elements of the flora. Has more than 3% vegetation cover.

ii. Characteristic plant and animal species

A rich flora including *Cornulaca monacantha, Crotalaria aegyptiaca, Sphaerocoma aucheri, Cyperus conglomeratus and C. arenarius, Zygophyllum*

qatarense and Z. Simplex, Arnebia hispidissima, Moltkiopsis ciliata, Polygala erioptera, Polycarpaea repens, Lotus garcinii, Lotononis platycarpa, Herniaria hemistemon, Neurada procumbens, Panicum turgidum. The habitat supported a rich assemblage of birds, reptiles and insects.

iii. Geographical distribution

Now very rare in Abu Dhabi. Most of the former extent of this habitat (and the most species-rich area) was destroyed by the creation of the Khalifa Port Industrial Zone near Taweelah.

iv. Habitat types generally associated in the field

Coastal plains on sandy ground (2011) and coastal sabkha (3100).

v. Perceived threats

Coastal development.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005), Brown, Aspinall and Sakkir (2007).

vii. This heading includes

- Areas of low sand dunes near the coast, with a coastal influence in the flora.

viii. This heading excludes

- Areas more than 3 km from the coast which are not contiguous with 2020 Coastal sand sheets and low dunes.

ix. Representative Image of the class

x. Minimum Mapping Unit

5 ha.

xi. Generalisation rules including representative diagrams

2000 Habitats can only occur within coastal areas. As a general mapping rule it was considered that the 2000 Coastal plains, sand sheets and low dunes habitats occur from within a 3km buffer distance from the intertidal habitats (see fig. in section 5.2.1).

5.2.4 2030 Coastal cliffs, headlands, rocky slopes and wadis in coastal situations

i. Definition

Areas of elevated firm ground near the coast with halophytic elements within the flora. Low to high cliffs on the immediate coastline. Rocky slopes affected by the maritime influence. Temporary watercourses with coarse, rocky substrate, often deeply incised. Substrate is predominantly hard and with sparse to no vegetation.

ii. Characteristic plant and animal species

Haloxylon salicornicum, Zygophyllum qatarense, Cornulaca monacantha, Calligonum comosum, Salsola imbricata and S. cyclophylla, Helianthemum lippii. On islands, Capparis spinosa and *Mesembryanthemum nodiflorum* may be present.

iii. Geographical distribution

Confined to the western part of the Emirate.

iv. Habitat types generally associated in the field

Coastal plains (2011) and sabkha (3100).

v. Perceived threats

Urban and, particularly, military developments.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Many of these areas are of archaeological and/or paleontological interest.

viii. This heading excludes

- Areas where the majority of the habitat has been altered by development or irrigation.
- Areas more than 3 km from the coast which are not contiguous with 2030 Coastal cliffs, headlands, rocky slopes and wadis in coastal situations.

ix. Representative Image of the class

x. Minimum Mapping Unit

5 ha.

xi. Generalisation rules including representative diagrams

- The habitat boundary should be digitized by the baseline of the slope
- 2000 Habitats can only occur within coastal areas. As a general mapping rule it was considered that the 2000 Coastal plains, sand sheets and low dunes habitats occur from within a 3km buffer distance from the intertidal habitats (see fig. in section 5.2.1)

5.3 3000 Coastal Sabkha, including Sabkha Matti

5.3.1 3100 Coastal Sabkha, including Sabkha Matti

i. Definition

Saline salt flats with a groundwater table close to the surface, and which periodically have salt crystals on the surface, following evaporation. Areas devoid of vegetation due to the salinity of the substrate, although halophytes may occur where there is a thin carpeting of sand on the surface.

ii. Characteristic plant and animal species

No plant species, by definition, but round the edges where sand has built up, there can be *Zygophyllum qatarense*, *Cornulaca monacantha* and *Limonium axillare*. Reptiles can be present in these area, particularly *Phrynocephalus maculatus* and *Stenodactylus khobarensis*.

iii. Geographical distribution

Along the mainland coast from Ras Hasyan (near Taweelah) to Sila'a and southwards from there to the border with KSA.

iv. Habitat types generally associated in the field

Coastal sand sheets (2011),sand sheets and dunes with dwarf shrub cover (4130) and gravel plains (51xx)

v. Perceived threats

Coastal development

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

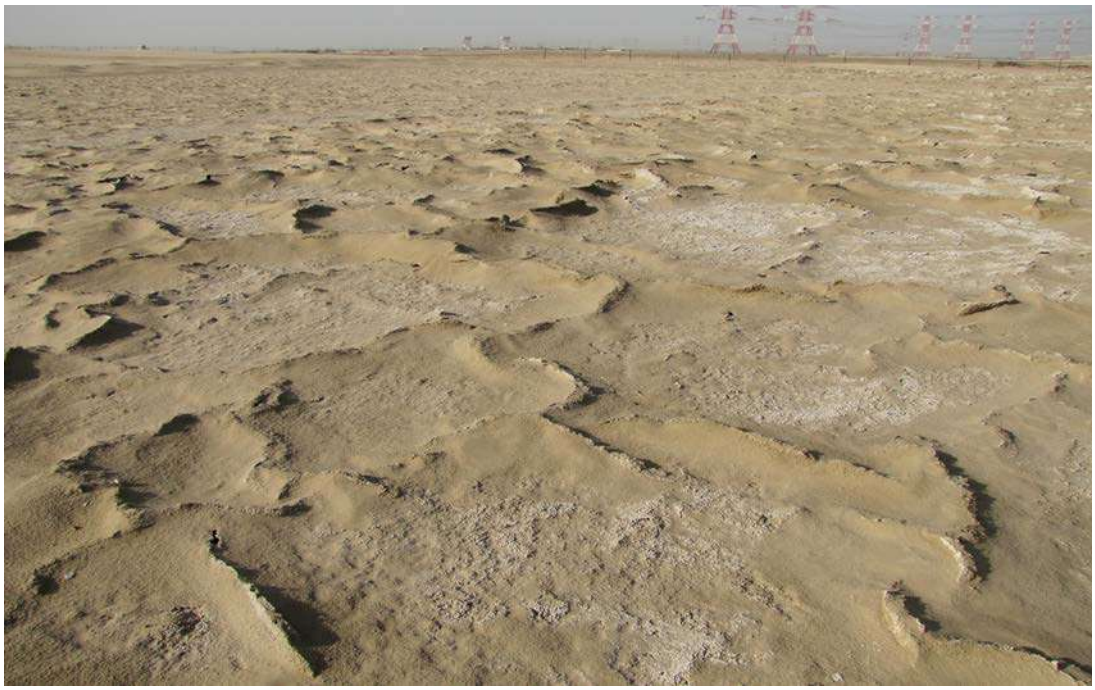
vii. This heading includes

- Sabkha Matti, up to around 100 km from the coast.

viii. This heading excludes

- Areas more than 30 km from the coast which are not contiguous with coastal sabkha.
- Areas where sand has accumulated and vegetation has established (2011, 2020, 41xx).

ix. Representative Image of the class

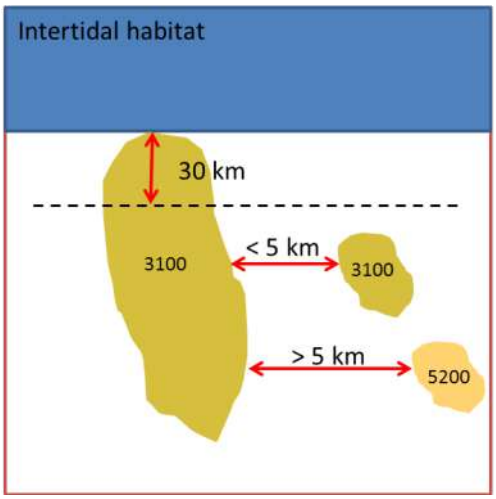


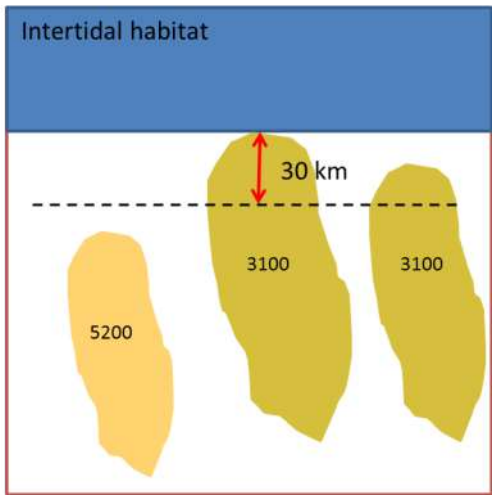
x. Minimum Mapping Unit

25 ha.

xi. Generalisation rules including representative diagrams

- Must be contiguous with sabkha classified in contact with the intertidal habitats and/or at a maximum distance of 30km from coast and/or closer than 5 km from other coastal sabkhas.





5.4 4000 Sand sheets and dunes

5.4.1 4110 Sand sheets and dunes with tree cover

i. Definition

Areas of undulating sandy desert with dunes less than 20 metres in elevation, and with more than 1% tree cover.

ii. Characteristic plant and animal species

The only tree species is *Prosopis cineraria.* Other plant species likely to be present are *Zygophyllum qatarense, Calligonum comosun, Leptadenia pyrotechnica, Cyperus conglomeratus, Dipterygium glaucum, Limeum arabicum. B*reeding bird species include Collared Dove, Greater Hoopoe-lark, Crested Lark and Southern Grey Shrike. The trees are used for roosting, and, probably in a few cases for breeding, by Desert Eagle Owl.

iii. Geographical distribution

Confined to the east of the Emirate, particularly around Al Ain, but extending westwards to within 50 km of Abu Dhabi Island.

iv. Habitat types generally associated in the field

The other sand sheet and dune habitats (4120, 4130, 4140 and 4200).

v. Perceived threats

Overgrazing, particularly by preventing the establishment of new plants of *Prosopis cineraria*.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Areas of low and gently undulating dunes as well as fairly large dunes, provided they contain *Prosopis cineraria*.

viii. This heading excludes

- Megadunes
- Areas of dunes with fewer than three trees per hectare, and areas where the habitat has been altered by irrigation and planting.

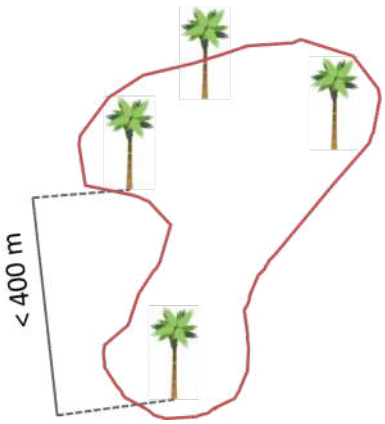
ix. Representative Image of the class

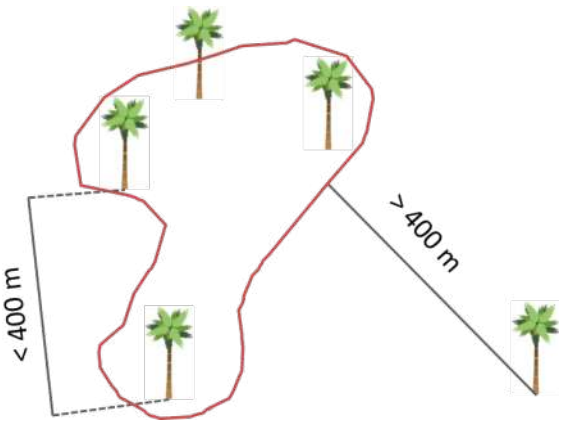
x. Minimum Mapping Unit

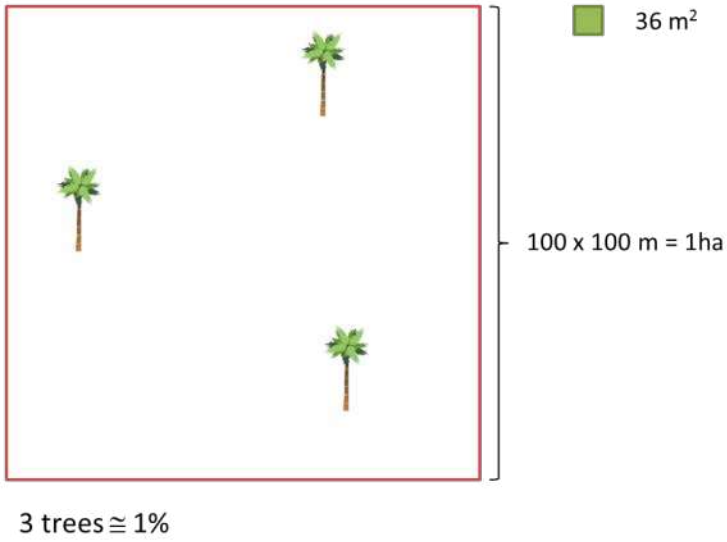
25 ha.

xi. Generalisation rules including representative diagrams

- Every unit (25ha polygon) must have an average of three trees per ha. Three trees per hectare represents approximately 1% of ground cover (one tree can be as large as 3x3 of a 2m pixel (36m2)).
- If the gap between trees is more than 400 metres, they should be treated as separate units.
- Trees will have priority over any other vegetation.







5.4.2 4120 Sand sheets and dunes with shrub cover

i. Definition

Areas of undulating sandy desert with dunes less than 20 metres in elevation, and with significant cover of shrubs (i.e. woody plants taller than ca. 1 m).

ii. Characteristic plant and animal species

The only shrub species are *Leptadenia pyrotechnica, Calotropis procera, Calligonum comosum* and *Haloxylon persicum.* Other species likely to be present are *Zygophyllum qatarense, Cyperus conglomeratus, Dipterygium glaucum, Moltkiosis ciliata, Eremobium aegyptiacum, Silene villosa* and *Limeum arabicum.* Often the only breeding bird species are Greater Hoopoe-lark, Crested Lark and sometimes Southern Grey Shrike.

iii. Geographical distribution

Generally in the northern, eastern, southern and central parts of the Emirate. *Haloxylon persicum* is confined to an area between Medina Zayed and Wathba.

iv. Habitat types generally associated in the field

The other sand sheet and dune habitats (4110, 4130, 4140 and 4200)

v. Perceived threats

Overgrazing, urban expansion, road and railway construction

vi. Bibliographical references

Aspinall and Hellyer (2003), Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

Areas of mixed vegetation where the density of plants comprising the four species, *Leptadenia pyrotechnica, Calotropis procera, Calligonum comosum* and *Haloxylon persicum,* is equal to or greater than 35 per hectare (see xi below).

viii. This heading excludes

- Areas with dunes higher than 20 metres (on average).
- Areas where the habitat has been altered by irrigation and planting.

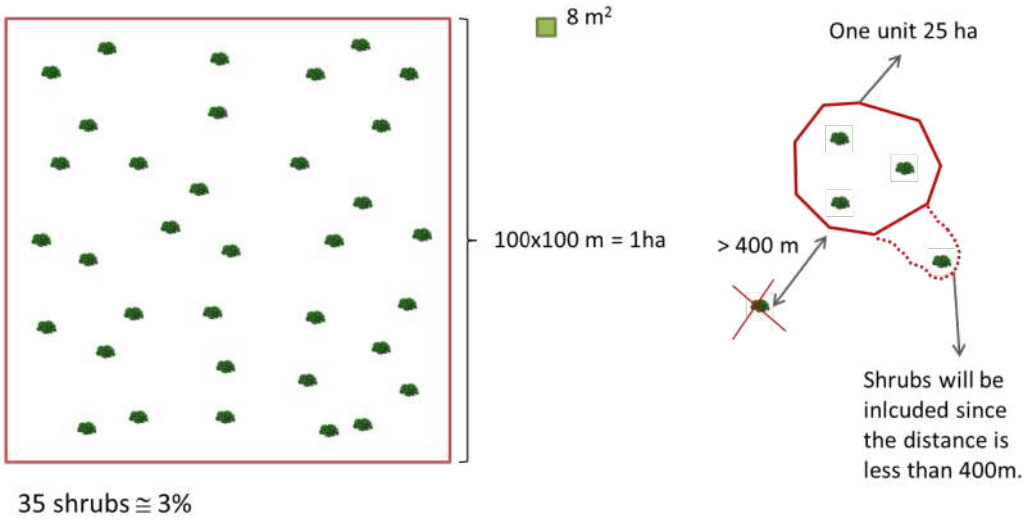
ix. Representative Image of the class

x. Minimum Mapping Unit

25 ha.

xi. Generalisation rules including representative diagrams

- Every unit (25ha polygon) must have an average of 35 shrubs per ha. 35 shrubs per hectare represents approximately 3% of ground cover (one shrub can be as large as 2x1 of a 2m pixel (8m2)).
- If the gap between shrubs is more than 400 metres, they should be treated as separate units.



5.4.3 4130 Sand sheets and dunes with dwarf shrub cover

i. Definition

Areas of undulating sandy desert with dunes less than 20 metres in elevation, and with significant cover of dwarf shrubs (i.e. woody perennials less than 1 m high, usually less than 50 cm).

ii. Characteristic plant and animal species

The only dwarf shrub species are *Zygophyllum qatarense, Haloxylon salicornicum* and *Siedlitzia rosmarinus.* Other species likely to be present are *Cyperus conglomeratus, Dipterygium glaucum, Moltkiosis ciliata, Eremobium aegyptiacum, Silene villosa* and *Limeum arabicum.* Breeding birds include Crested Lark, Greater Hoopoe-lark and Southern Grey Shrike.

iii. Geographical distribution

Widespread throughout most of the Emirate, particularly to the east of the Tarif to Liwa road.

iv. Habitat types generally associated in the field

The other sand sheet and dune habitats (4110, 4120, 4140 and 4200)

v. Perceived threats

Overgrazing, urban expansion, road and railway construction

vi. Bibliographical references

Osborne (1996), Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

Saline areas with a high water table where the dominant species is *Siedlitzia rosmarinus.*

viii. This heading excludes

- Areas with dunes higher than 20 metres (on average) (4200 Mega-dunes).
- Areas where the habitat has been altered by irrigation and planting.

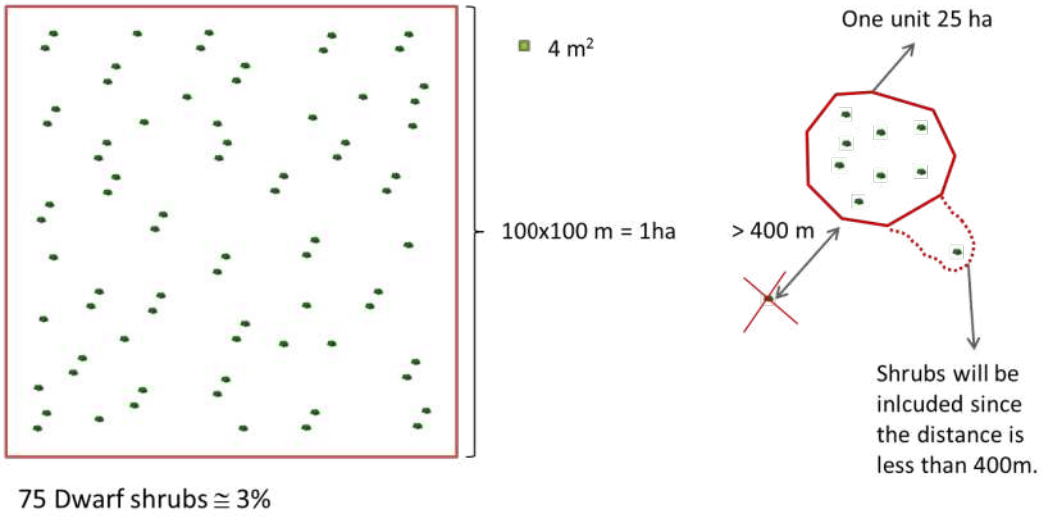
ix. Representative Image of the class

x. Minimum Mapping Unit

25 ha.

xi. Generalisation rules including representative diagrams

- Every unit (25ha polygon) must have an average of 75 dwarf shrubs per ha. 75 dwarf shrubs represents approximately 3% of ground cover per hectare (one dwarf shrub can be as large as 1x1 of a 2m pixel (4m2)).
- If the gap between dwarf shrubs is more than 400 metres, they should be treated as separate units.



5.4.4 4140 Sand sheets and dunes with perennial herbs and graminoids

i. Definition

Areas of undulating sandy desert with dunes less than 20 metres in elevation, and without significant cover of trees, shrubs and dwarf shrubs. Vegetated to non-vegetated sand and dune areas colonized by perennial herbs and/or graminoids.

ii. Characteristic plant and animal species

The most characteristic plant species are *Cyperus conglomeratus, Panicum turgidum, Pennisetum divisum, Stipagrostis plumosa, Tribulus spp., Dipterygium glaucum, Eremobium aegyptiacum.* Often the only breeding bird species is Greater Hoopoe-lark. Crested Lark can be resident, mostly in the vicinity of human settlement.

iii. Geographical distribution

Widespread throughout most of the Emirate, particularly to the east of the Tarif to Liwa road.

iv. Habitat types generally associated in the field

The other sand sheet and dune habitats (4110, 4120, 4140 and 4200)

v. Perceived threats

Overgrazing, urban expansion, road and railway construction

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Sand sheets and dune areas which are not 4110, 4120 or 4130.

viii. This heading excludes

- Areas with dunes higher than 20 metres (on average), and areas where the habitat has been altered by irrigation and planting.

ix. Representative Image of the class

x. Minimum Mapping Unit

25 ha.

xi. Generalisation rules including representative diagrams

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.4.5 4200 Mega-dunes

i. Definition

Areas of undulating sandy desert with dunes on average more than 20 metres high in elevation with none to sparse vegetation cover.

ii. Characteristic plant and animal species

The most characteristic species are *Calligonum comosum*, *Zygophyllum qatarens, Heliotropium digynum, Dipterygium glaucum, Tribulus sp., Cyperus conglomeratus and Stipagrostsis sp.* Often the only breeding bird species is Greater Hoopoe-lark.

iii. Geographical distribution

Generally in the southern part of the Emirate, but extending eastwards to Al Ain.

iv. Habitat types generally associated in the field

The other sand sheet and dune habitats (4110, 4120, 4130 and 4140)

v. Perceived threats

Overgrazing, road and railway construction

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Large dunes with and without any vegetation.

viii. This heading excludes

- Areas with dunes lower than 20 metres (on average).
- Areas where the habitat has been altered by irrigation and planting.

ix. Representative Image of the class

x. Minimum Mapping Unit

25 ha.

xi. Generalisation rules including representative diagrams

- If trees, shrubs or dwarf shrubs are present within an area higher or equal than 25 ha, that area should be considered 4110, 4120 or 4130 respectively.

5.5 5000 Gravel plains (alluvial and interdunal)

5.5.1 5110 Gravel plains with distinct tree vegetation

i. Definition

Areas of substrate consisting of gravel, pebbles or rocky material covered with distinct tree vegetation.

ii. Characteristic plant and animal species

Plants: The tree species are *Acacia tortilis and Prosopis cineraria. Other woody plants are Haloxylon salicornicum, Lycium shawii, Calotropis procera.* Any of the plant species listed under 5120 and 5130 may also be present.

Animals: Dhub (*Uromastyx aegyptius and U. leptieni*). Breeding birds can include Arabian Babbler.

iii. Geographical distribution

Eastern part of the Emirate.

iv. Habitat types generally associated in the field

Gravel plains with dwarf shrubs (5120) and wadis in open terrain (6320).

v. Perceived threats

Widespread destruction due to construction, recreational activities and overgrazing.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Areas with trees on gravelly ground growing outside of plantations.

viii. This heading excludes

- Trees growing inside plantations.

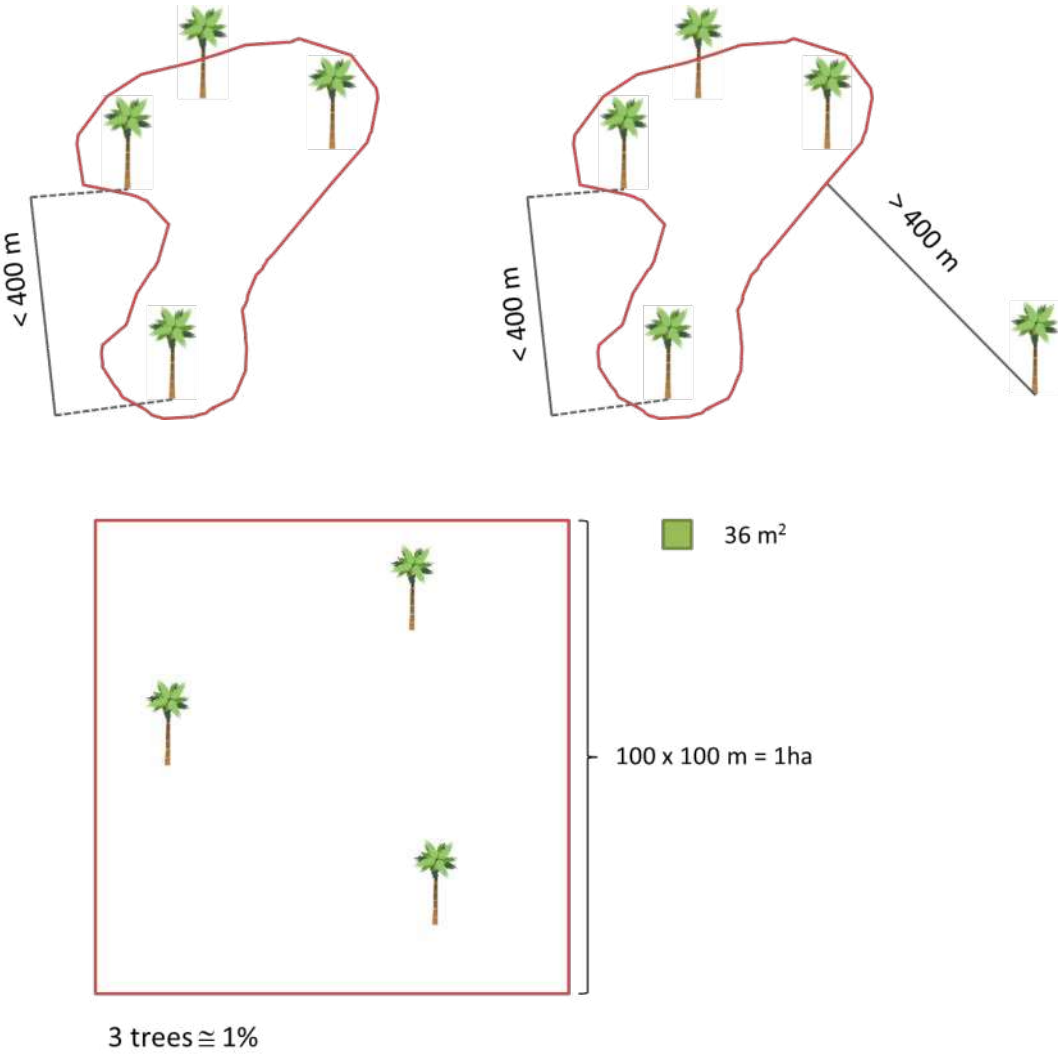
ix. Representative Image of the class

x. Minimum Mapping Unit

25ha

xi. Generalisation rules

- Every unit (25ha polygon) must have a minimum of three trees per ha (average). Three trees represents approximately 1% of ground cover per hectare (One tree can be as large as 3x3 of a 2m pixel (36m2)).
- If the gap between trees is more than 400 metres, they should be treated as separate units.
- Trees will have priority over any other vegetation.



5.5.2 5120 Gravel plains with dwarf shrub vegetation

i. Definition

Areas of substrate consisting of gravel, pebbles or rocky material supporting dwarf shrub (i.e. woody perennials less than 1 m high, and usually less than 50 cm) and sometimes shrub vegetation but few trees.

ii. Characteristic plant and animal species

Plants: *Haloxylon salicornicum, Zygophyllum qatarense, Acacia ehrenbergiana, Lycium shawii, Arnebia hispidissima, Stipagrostis plumosa.*

Animals: Breeding birds include Cream-coloured courser, Chestnut-bellied Sandgrouse, Crested Lark.

iii. Geographical distribution

Eastern part of the Emirate.

iv. Habitat types generally associated in the field

Gravel plains with dwarf shrubs (5120) and wadis in open terrain (6320).

v. Perceived threats

Widespread destruction due to construction, recreational activities, overgrazing, and construction of roads and railways.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Shrub and dwarf shrub areas growing outside of irrigated plantations.

viii. This heading excludes

- Shrubs and dwarf shrub areas growing inside plantations.

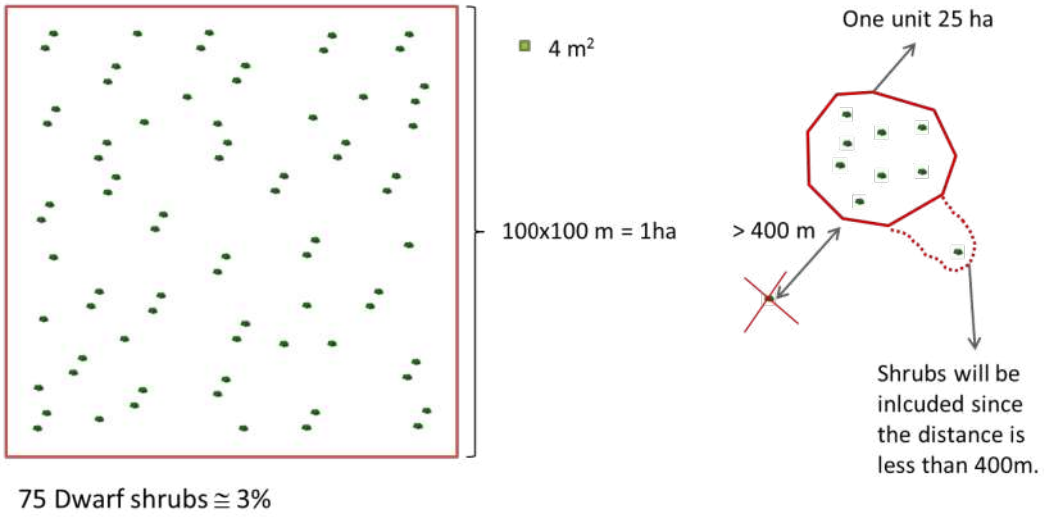
ix. Representative Image of the class

x. Minimum Mapping Unit

25ha

xi. Generalisation rules

- Every unit (25ha polygon) must have an average of 75 dwarf shrubs per ha. 75 dwarf shrubs represents approximately 3% of ground cover per hectare (one dwarf shrub can be as large as 1x1 of a 2m pixel (4m2)).
- If the gap between dwarf shrubs is more than 400 metres, they should be treated as separate units.



5.5.3 5130 Gravel plains with sparse vegetation

i. Definition

Areas of substrate consisting of gravel, pebbles or rocky material supporting very little vegetation.

ii. Characteristic plant and animal species

Plants: *Haloxylon salicornicum, Zygophyllum qatarense, Arnebia hispidissima*

Animals: In the east of the Emirate the breeding birds include Cream-coloured courser, Chestnut-bellied Sandgrouse, Crested Lark and (very rarely) Bar-tailed Lark. Elsewhere Greater Hoopoe-Lark can occur where there is both gravel plains and sand dunes.

iii. Geographical distribution

More common in the eastern part of the Emirate.

iv. Habitat types generally associated in the field

Gravel plains with dwarf shrubs (5120) and sand sheets and dunes (4000 series).

v. Perceived threats

Widespread destruction due to construction, recreational activities, overgrazing, and construction of roads and railways.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Vegetated to non-vegetated gravel plains areas which are not 5110 or 5120.
- Heavily grazed areas where Haloxylon salicornicum is present at a low density but which is likely to become significant when grazing pressure is released.

viii. This heading excludes

- Area where the ground surface has been mainly disturbed (9600).

ix. Representative Image of the class

x. Minimum Mapping Unit

25ha

xi. Generalisation rules

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.5.4 5200 Inland sabkha

i. Definition

Flat areas of saline ground with no vegetation (due to the high salinity of the substrate), although halophytes may occur where there is a thin carpeting of sand on the surface. More than 30 km from the coast, and distanced more than 5km from any coastal sabkha.

ii. Characteristic plant and animal species

None

iii. Geographical distribution

Within the megadunes south of the Liwa Crescent and in the south-east of the Emirate.

iv. Habitat types generally associated in the field

Sand sheets and unes with perennial herbs and graminoids (4140) and Megadunes (4200).

v. Perceived threats

Very few.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Low-lying, flat inland areas that are more than 5 km from any area of coastal sabkha.

viii. This heading excludes

- Bare saline inland areas that are not flat.

ix. Representative Image of the class

x. Minimum Mapping Unit

25ha

xi. Generalisation rules

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.6 6000 Mountains, rocky terrain and wadis

5.6.1 6100 Mountain slopes, screes and associated wadis

i. Definition

Mountain terrain including rocky foothills, associated wadis and temporary water courses. Wadis refer to the upper and middle reaches of the wadi system, before it merges into the flood plain and open terrain.

ii. Characteristic plant and animal species

Trees and shrubs at lower levels are *Ziziphus spina-christi, Prosopis juliflora, Acacia tortilis and Lycium shawii,* with several other woody species at higher altitudes, such as *Moringa peregrina, Peripolca aphylla and Ephedra foliata.* Shrubs and dwarf shrubs include *Acridocarpus orientalis, Capparis cartilaginea,*

Euphorbia larica, Pergularia tomentosa, Gaillonia aucheri and *Ochradenus arabicus.* Breeding birds include Barbary Falcon, Liechtenstein's Sandgrouse, Sand Partridge, Little Owl, Pale Crag Martin, Hume's Wheatear, Hooded Wheatear, Desert Lark, and White-spectacled Bulbul. Mammals include Arabian Tahr, Blanford's Fox and Egyptian Spiny Mouse.

iii. Geographical distribution

Confined to Jebel Hafeet and adjacent foothills.

iv. Habitat types generally associated in the field

Gravel plains (5000 series).

v. Perceived threats

Recreational developments, e.g. a cable car, further recreational ventures, and more irrigation.

vi. Bibliographical references

Aspinall and Hellyer (2004).

vii. This heading includes

- Jebel Hafeet and adjacent foothills, excluding built and irrigated areas.

viii. This heading excludes

- Jebel Dhanna, which is regarded as habitat 2030.

ix. Representative Image of the class

x. Minimum Mapping Unit

25ha

xi. Generalisation rules including representative diagrams

- The habitat boundary will be digitized by the baseline of the slope.

5.6.2 6210 Jebels (mesas and burqas)

i. Definition

Flat-topped hills, generally 5 to 15 metres high, that are protected from erosion by a hard layer of Miocene age, overlying softer sediments beneath. Island-like rocky exposures particularly occurring in coastal areas. Can also be occasionally found further inland. These exposures can be nearly barren to well-vegetated, with halophytic and non-halophytic vegetation.

ii. Characteristic plant and animal species

Haloxylon salicornicum, Salsola cyclophylla, Cornulaca monacantha, Calligonum comosum, Helianthemum lippii. Birds, mammals and reptiles use the holes that develop beneath the outer edge of the protective layer. Birds include Desert Eagle Owl, Barn Owl and Lilith Owlet. Mammals include Red Fox.

iii. Geographical distribution

Confined to the outcrop of Miocene aged rocks, which extends from Abu Dhabi Island westwards to Sila'a, and generally within 50 km of the coastline, but extending further south in the west.

iv. Habitat types generally associated in the field

Coastal plains (2011) and sabkha (3100).

v. Perceived threats

Quarrying and development for military and irrigation purposes. Recreational driving.

vi. Bibliographical references

Perry (2008), Hellyer and Aspinall (2005).

vii. This heading includes

- Some of the jebels are of paleontological interest.

viii. This heading excludes

- Zeugen (small features, 2-3 metres high) within the sabkha or intertidal habitats.

ix. Representative Image of the class

x. Minimum Mapping Unit

1 ha.

xi. Generalisation rules including representative diagrams

- The habitat boundary will be digitized by the baseline of the slope

5.6.3 6220 Escarpments, lithified sand dunes, rocky exposures

i. Definition

Outcrops of rocky material, mostly either exposures of Miocene material or aeolianite. Areas covered by escarpments, lithified sand dunes (paleodunes) and rocky exposures. Rocky exposures are characterized by small areas that are neither jebels nor cemented sand dunes. Vegetation is sparse, absent and distinctly seasonal.

ii. Characteristic plant and animal species

Plants: *Heliotropim kotschyi, Helianthemum lippii, Arnebia hispidissima, Salsola cyclophylla*. Holes are often present and can support breeding birds such as Little owl (Lilith Owlet) and Green Bee-eater. Reptiles include *Uromastyx aegyptius, U. leptieni, Acanthodactylus opheodurus, Meselina adramitana* and *Cerastes gasperetti.*

iii. Geographical distribution

Likely to occur in all areas except coastal, megadunes (4200) and the Liwa Crescent.

iv. Habitat types generally associated in the field

Sand sheets (4130 and 4140).

v. Perceived threats

Infrastructure development, recreational driving.

vi. Bibliographical references

Osborne (1996), Perry (2008), Hellyer and Aspinall (2005).

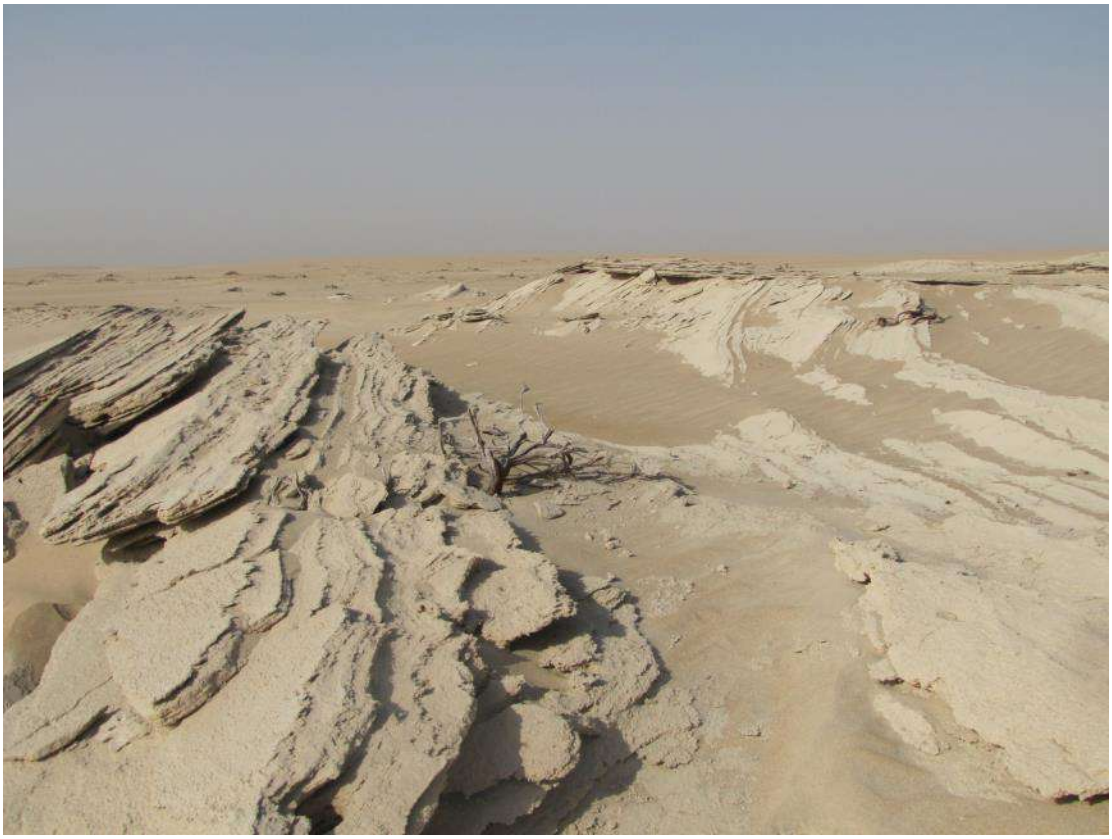
vii. This heading includes

- Mosaics of hard material and sand sheet.

viii. This heading excludes

- Flat-topped jebels (mesas) and zeugen.

ix. Representative Image of the class



x. Minimum Mapping Unit

5 ha.

xi. Generalisation rules including representative diagrams

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.6.4 6320 Wadis in open terrain, and drainage channels

i. Definition

Drainage channels that can hold flowing water after rain, together with associated terrain that is mostly gravelly. The vegetation tends to be more lush than in the hinterland, because of a seasonally higher water table. Areas with shallow drainage channels and dry riverbeds. They only have surface water when there is heavy rainfall.

ii. Characteristic plant and animal species

Trees and shrubs are often present, such as *Acacia tortilis, A. ehrenbergiana, Prosopis juliflora, Lycium shawii.* Many herbaceous species may be present. Birds can include Southern Grey Shrike, Arabian Babbler, Purple Sunbird.

iii. Geographical distribution

Exclusively around Jebel Hafeet and the western fringe of the Hajar Mountains.

iv. Habitat types generally associated in the field

Mountain slopes (6100), and gravel plains (5000 series).

v. Perceived threats

Infrastructure and recreational developments.

vi. Bibliographical references

Aspinall and Hellyer (2004).

vii. This heading includes

- Drainage channels that have been improved by human activity or which have engineered margins but an undisturbed stream bed.

viii. This heading excludes

- Drainage channels near the coast.

ix. Representative Image of the class

x. Minimum Mapping Unit

25 ha

xi. Generalisation rules including representative diagrams

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.7 7000 Inland standing water habitats and habitats of moist ground

5.7.1 7100 Semi-artificial water bodies

i. Definition

These areas have all arisen as a result of some kind of human activity, creating areas of standing water like lakes or water channels. Some are the result of groundwater levels being raised by waste irrigation water, and others have arisen from discharge from sewage treatment plants. Must have surface water present throughout most of the year. The water body limit will be drawn from the visible high water mark.

ii. Characteristic plant and animal species

Marginal plants include *Phragmites australis, Tamarix* spp. and *Pluchea dioscoridis.* Aquatic macrophytes may be present, particularly *Chara sp., Potamogeton pectinatus* and *Najas marina.* Birds include Greater Flamingo, Little and Black-necked Grebe, Teal, Mallard, Shoveler, Grey Heron, etc.

iii. Geographical distribution

Near Abu Dhabi there are two examples: Wathba Wetland Reserve, and Shahama Lake. Near Al Ain there is Zakher Pools, and some small lakes near Al ain Airport. Lakes have also been created by the outfall from the sewage works at ADNOC's Residential Complex at Ruwais.

iv. Habitat types generally associated in the field

Reed fringes (7200).

v. Perceived threats

- Improvement of sewage treatment so that semi-treated sewage is no longer discharged but is used for irrigation.
- Infilling

vi. Bibliographical references

vii. This heading includes

- Seasonally flooded areas, generally in sandy terrain, of 1 ha or more, that hold water for most months every year.
- Lakes that have arisen as a result of quarrying of material (normally gatch for road construction).
- Water channels adjacent to the sea (should be delineated only from the high tide mark towards inland)

viii. This heading excludes

- Man-made lakes in golf courses near Abu Dhabi and Al Ain.
- Lakes within working quarries.

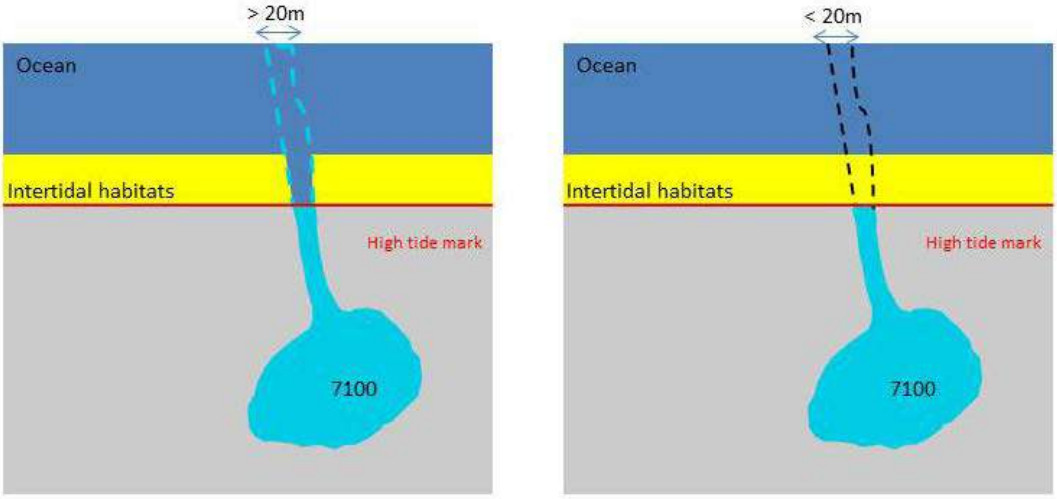
ix. Representative images of the class

x. Minimum Mapping Unit

1 ha.

xi. Generalisation rules including representative diagrams

- The habitat boundary should be digitized by the visible high water mark.



5.7.2 7200 Moist ground with *Phragmites*, *Tamarix* and grass mats

i. Definition

These areas have all arisen as a result of human activity, often resulting in groundwater appearing on the surface or being very close to the surface. Waste irrigation water is the main source. Moist sandy ground normally covered by trees or grass mats.

ii. Characteristic plant and animal species

Plants include *Phragmites australis, Tamarix* spp. and *Pluchea dioscoridis, Aeluropus lagopoides, Cressa cretica, Taverniaria spartea, Polygala erioptera.* Reedbeds are important as feeding areas for migratory birds such as Bluethroat and Marsh Warbler, and also as roost sites for various species, especially hirundines. The most typical breeding bird is Clamorous Reed Warbler.

iii. Geographical distribution

The main areas are around Greater Abu Dhabi, Ruwais and Al Ain.

iv. Habitat types generally associated in the field

Sand sheets with dwarf shrubs (4130) and gravel plains (5000 series).

v. Perceived threats

Reduction of irrigation, urbanisation, “tidying up”.

vi. Bibliographical references

vii. This heading includes

- Mixtures of *Phragmites australis* and *Prosopis juliflora*.

viii. This heading excludes

- Wet areas without *Phragmites australis*.

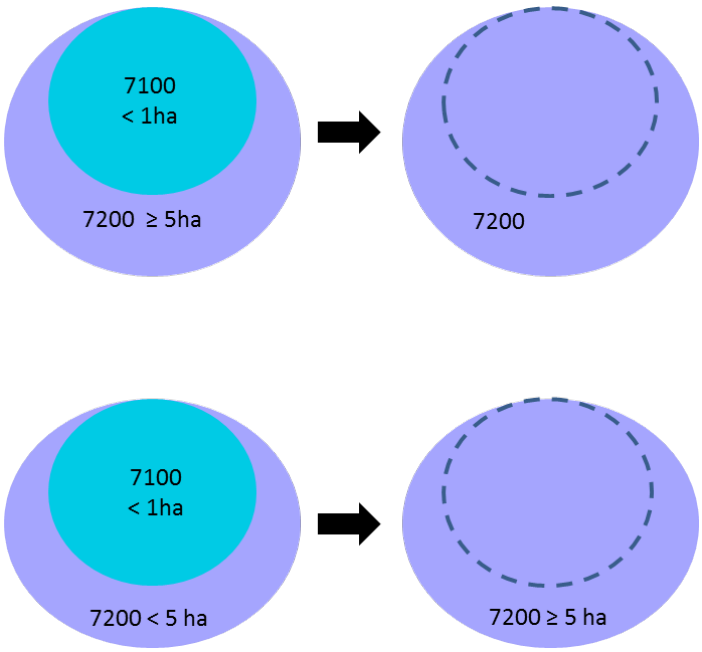
ix. Representative Image of the class

x. Minimum Mapping Unit

5 ha

xi. Generalisation rules including representative diagrams

- In case of 7200 Moist ground with Phragmites, Tamarix and grass mats and surrounding 7100 semi-artificial lakes that are less than 5 ha, the water surface and Moist ground with *Phragmites*, *Tamarix* and grass mats areas should be grouped together to reach a 7200 polygon ≥ 5 ha.



5.8 8000 Oases, Farmland and Forestry

5.8.1 8100 Date plantations

i. Definition

Planted and irrigated stands of *Phoenix dactylifera*, often with fodder or other crops beneath. Areas presenting a regular structure where date trees are usually planted in a line formation and are artificially irrigated.

ii. Characteristic plant and animal species

N/A

iii. Geographical distribution

The largest concentrations are around the Liwa Crescent, but also plentiful around Al Ain, Al Hayer and Shwaib. Occasional occurrence elsewhere.

iv. Habitat types generally associated in the field

Most commonly beside sand sheets (4000 series), but can be any habitat that is not too saline.

v. Perceived threats

No significant threats. Interest in dates is still strong.

vi. Bibliographical references

None

vii. This heading includes

- Formalised date plantations, like Al Ain Oasis.

viii. This heading excludes

- Plantations in which date palms constitute <50% of the planted trees.

ix. Representative Image of the class

x. Minimum Mapping Unit

1 ha.

xi. Generalisation rules including representative diagrams

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.8.2 8200 Farmland

i. Definition

Mosaics of arable land with crops, small date plantations, fodder plantations and farm infrastructures. Also includes date palm plantations smaller than 1 ha when in mosaic with the remaining farmland.

ii. Characteristic plant and animal species

Farmland areas around the Liwa Crescent have been colonised by Rufous-tailed Bush Robin in addition to common species like Graceful Prinia and Purple Sunbird. Around Al Ain the ditches are known to support a range of wetland invertebrates and, occasionally, Arabian Toad.

iii. Geographical distribution

The largest concentrations of farmland are around the Liwa Crescent, but also present around Sila'a, Madinat Zayed, from Remah to Al Ain, around Al Hayer, Sweihan and Ajman. Occasional occurrence elsewhere.

iv. Habitat types generally associated in the field

Date plantations.

v. Perceived threats

None

vi. Bibliographical references

vii. This heading includes

- Vegetable growing areas.
- Date plantations or forest plantations with less than the MMU or with less than 20 m width.

viii. This heading excludes

- Abandoned fodder fields
- Date plantation > 1ha
- Forestry plantation >1ha
- Low/High urban areas > 1ha

ix. Representative Image of the class

x. Minimum Mapping Unit

1 ha

xi. Generalisation rules including representative diagrams

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.8.3 8300 Livestock areas

i. Definition

Areas used for intensive production of livestock and areas used for fodder storage. Areas presenting a regular structure and usually surrounded by a fence.

ii. Characteristic plant and animal species

Laughing Dove, Crested Lark, House Sparrow,

iii. Geographical distribution

Very widespread, except near the coast.

iv. Habitat types generally associated in the field

Gently undulating sand sheets (4130, 4140) and gravel plains (5130).

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

- Areas used for storage and handling of fodder bales.

viii. This heading excludes

- Isolated individual camel holding areas
- Non-permanent livestock areas

ix. Representative Image of the class

x. Minimum Mapping Unit

1 ha.

xi. Generalisation rules including representative diagrams

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.8.4 8400 Forestry plantations

i. Definition

Man-made planted forests with various native and non-native tree species. Areas presenting a regular structure where forest trees are usually planted in a line formation and are artificial irrigated. Also includes plantations of *leptadenia pyrotechnica.* Usually surrounded by a fence.

ii. Characteristic plant and animal species

Many species, particularly the more adaptable ones.

iii. Geographical distribution

Widespread except in the far west of the Emirate, and near the coast.

iv. Habitat types generally associated in the field

Sand sheets (4130 and 4140).

v. Perceived threats

Cessation of irrigation

vi. Bibliographical references

vii. This heading includes

- Roadside plantings more than 20 metres wide.

viii. This heading excludes

- Planting as part of formal landscaping.

ix. Representative Image of the class

x. Minimum Mapping Unit

1 ha.

xi. Generalisation rules including representative diagrams

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.9 9000 Urban habitat types

5.9.1 9110 High density urban

i. Definition

Urban areas where more than 80% of the ground surface is impervious. Mainly occupied by artificial structures such as buildings and other man-made urban infrastructures.

ii. Characteristic plant and animal species

White-eared Bulbul, Common Mynah, House Sparrow.

iii. Geographical distribution

The major cities are Abu Dhabi and Al Ain

iv. Habitat types generally associated in the field

N/A

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

- Disturbed ground areas smaller than 1ha as long as the degree of imperviousness remains >80%. On the contrary the class changes to 9120 Low density urban.
- Paved roads inside urban areas.

viii. This heading excludes

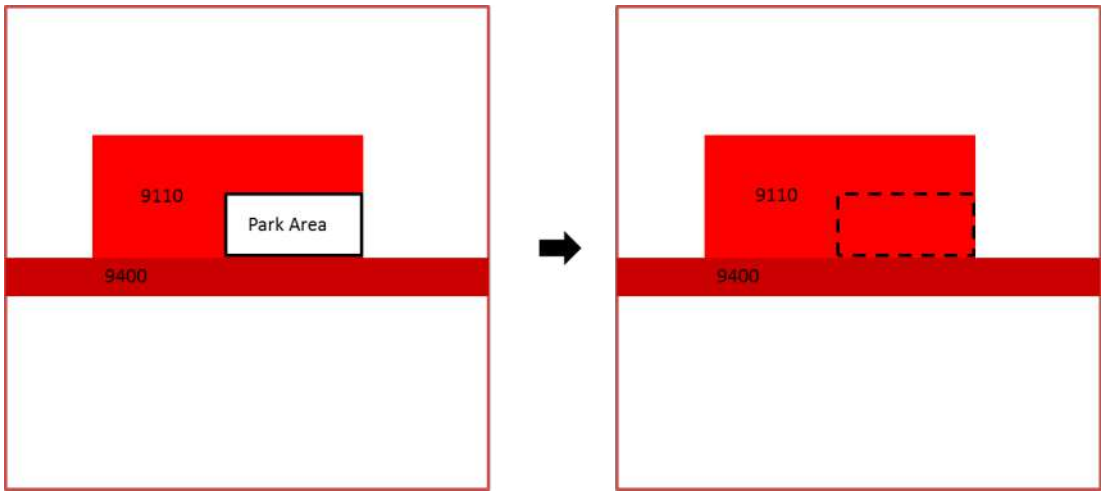
- Industrial areas

ix. Representative image of the class

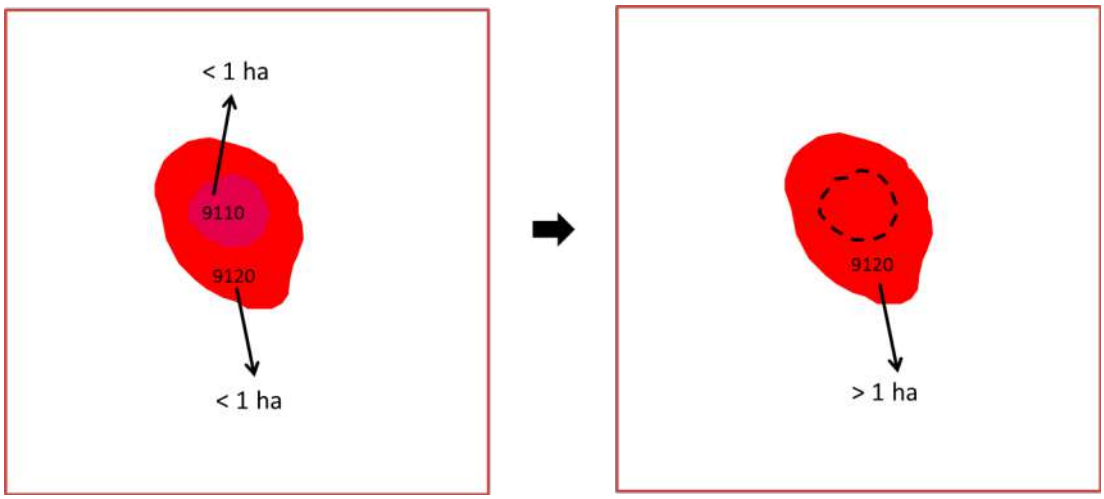
x. Minimum Mapping Unit

1 ha

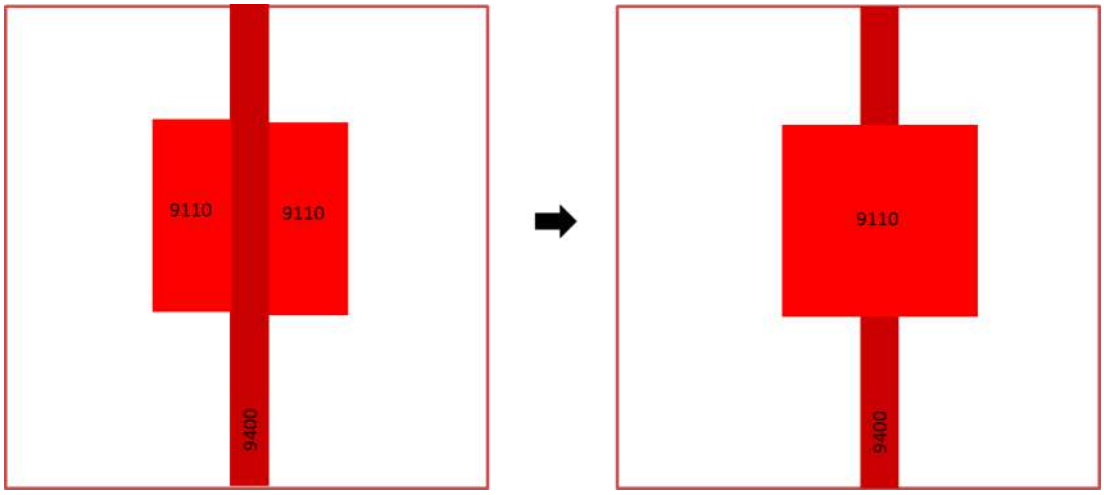
xi. Generalisation rules including representative diagrams



When generalizing areas of different habitats, smaller than the MMU, within 9110 High density urban areas it is necessary to take into consideration the resulting degree of imperviousness of the final total area: if > 80% it will be classified as 9110; if < 80% it will be classified as 9120 (see fig. below).



Paved roads inside urban areas are always considered part of the 9110 or 9120 habitats.



5.9.2 9120 Low density urban

i. Definition

Urban areas in which less than 80% of the ground surface is impervious. Areas usually occupied by artificial structures such as buildings and other man-made urban infrastructures, and also by patches of vegetation or soil.

ii. Characteristic plant and animal species

N/A

iii. Geographical distribution

iv. Habitat types generally associated in the field

N/A

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

- Disturbed ground areas smaller than 1ha.
- Paved roads inside urban areas.

viii. This heading excludes

- Green areas larger than 1ha (9300).

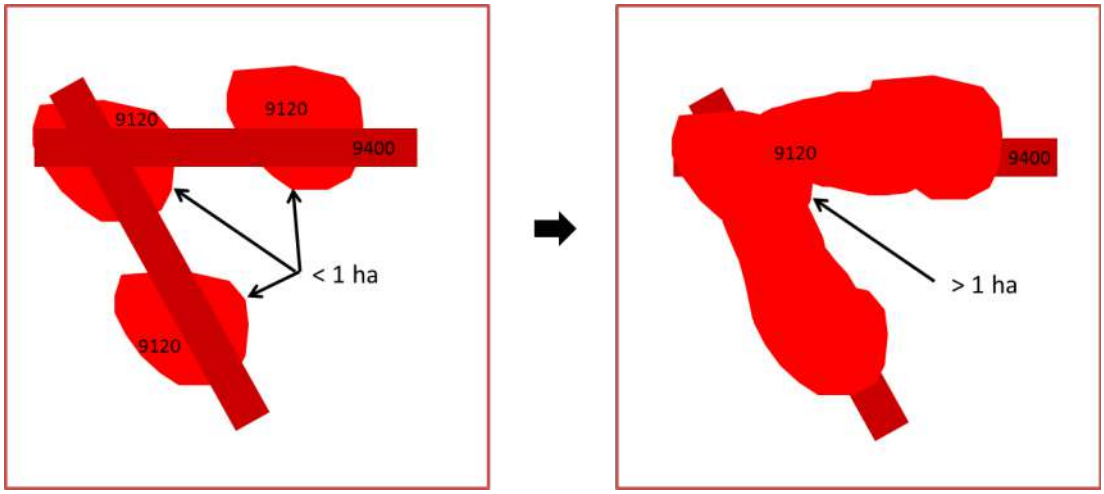
ix. Representative image of the class

x. Minimum Mapping Unit

1 ha

xi. Generalisation rules including representative diagrams

Different patches of 9110 or 9120 habitats smaller than the MMU and traversed by a paved road (9400 habitat), if in within the generalisation conditions, will be aggregated together using the shape of the polygon of the 9400 class, which is transformed to the 91xx class.



5.9.3 9210 Oil industry

i. Definition

Infrastructures designed to extract and process (transform, storage, etc) petroleum oil hydrocarbon.

ii. Characteristic plant and animal species

N/A

iii. Geographical distribution

iv. Habitat types generally associated in the field

N/A

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

N/A

viii. This heading excludes

N/A

ix. Representative Image of the class

x. Minimum Mapping Unit

1ha

xi. Generalisation rules including representative diagrams

- Generalisation rules for this class are depicted within the Project-wide Generalisation Rules (section 4).

5.9.4 9220 Airports and Aerodromes

i. Definition

Airports and aerodromes installations including runways and associated man-made grounds and buildings.

ii. Characteristic plant and animal species

N/A

iii. Geographical distribution

iv. Habitat types generally associated in the field

N/A

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

- Heliports
- Man-made grounds such as buildings and green areas

viii. This heading excludes

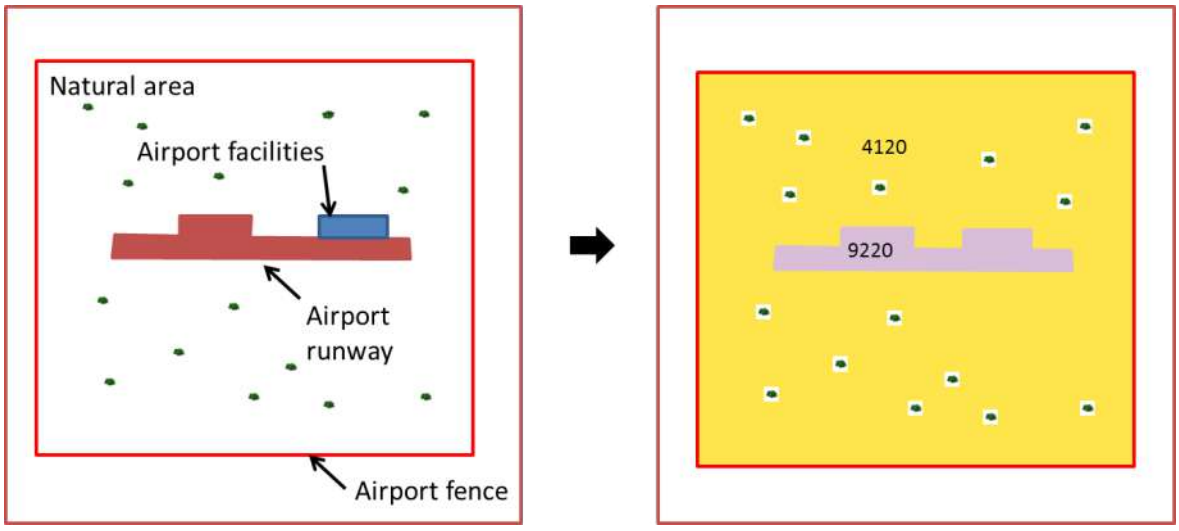
- Natural areas inside airport limits as defined by the existing fences

ix. Representative Image of the class

x. Minimum Mapping Unit

1ha

xi. Generalisation rules including representative diagrams



5.9.5 9230 Port areas

i. Definition

Infrastructures of port areas near the sea or a waterway including quays, dockyards and marinas. Waterways and associated spaces are to be considered only if they measure 20m or more in width.

ii. Characteristic plant and animal species

N/A

iii. Geographical distribution

Mostly within or near urban areas.

iv. Habitat types generally associated in the field

N/A

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

viii. This heading excludes

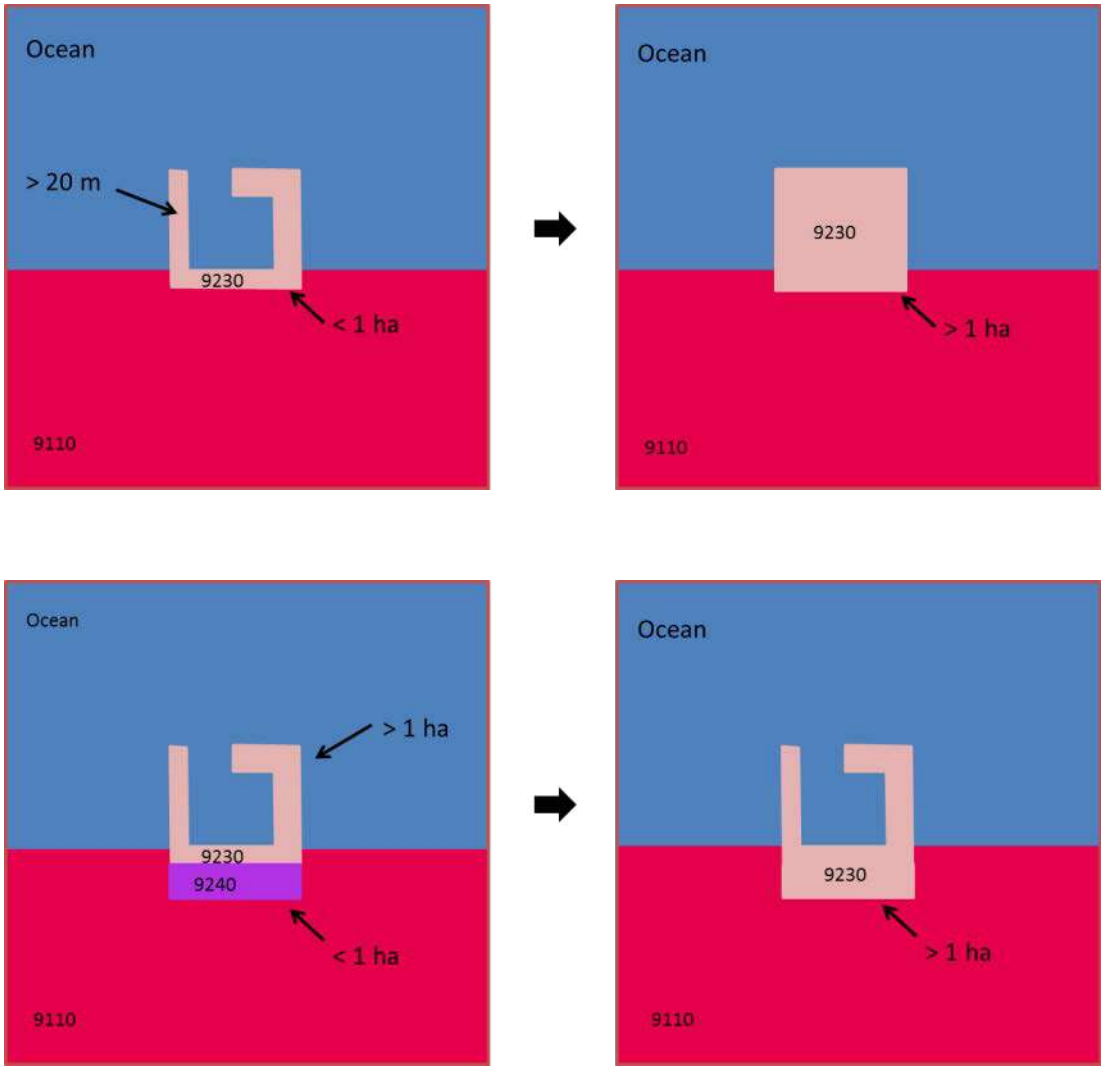
ix. Representative Image of the class

x. Minimum Mapping Unit

1ha

xi. Generalisation rules including representative diagrams

- Port areas occupying less than 1ha will be mapped together with the water surface area delineated by the port basins, if all will sum to more than 1ha.



5.9.6 9240 Other industry

i. Definition

Artificial surfaced areas (cement, tarmacadam or beaten earth) for industrial purposes, with little or no vegetation and containing industrial facilities.

ii. Characteristic plant and animal species

N/A

iii. Geographical distribution

Mostly within or near urban areas.

iv. Habitat types generally associated in the field

N/A

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

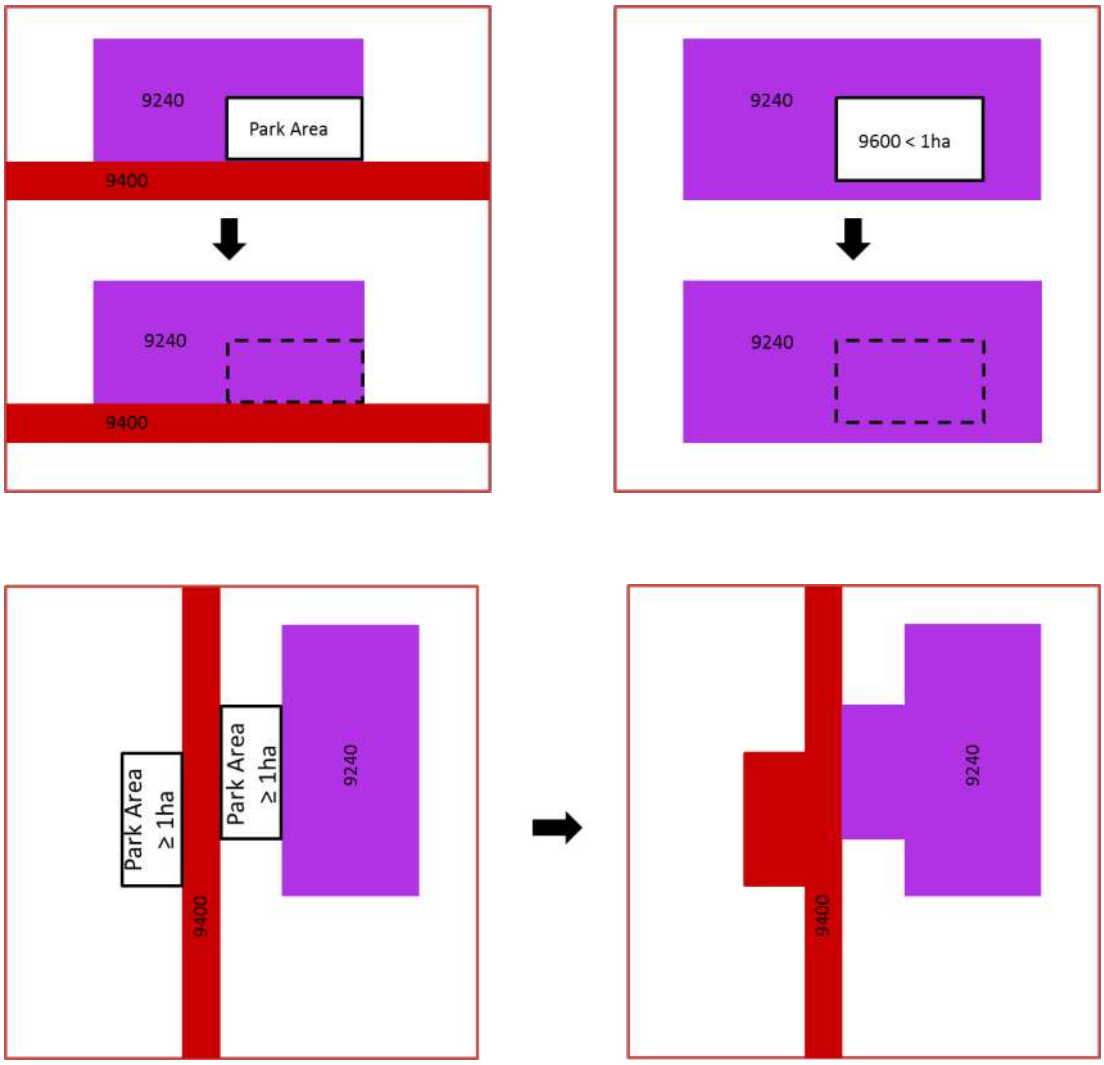
viii. This heading excludes

ix. Representative Image of the class

x. Minimum Mapping Unit

1ha

xi. Generalisation rules including representative diagrams



5.9.7 9300 Leisure and landscaped areas

i. Definition

Areas where the main land use is for human recreation containing different facilities for sport and leisure activities, such as sports hall, golf courses, race tracks and camel race tracks. Also includes green areas, such as parks and large gardens, and areas for ornamental purposes.

ii. Characteristic plant and animal species

N/A

iii. Geographical distribution

Mostly within or near urban areas

iv. Habitat types generally associated in the field

N/A

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

- Formal parks
- Sports fields
- Golf courses
- Camel race tracks and associated grounds

viii. Areas for ornamental purposes.*This heading excludes*

- Hotel and Resorts main buildings

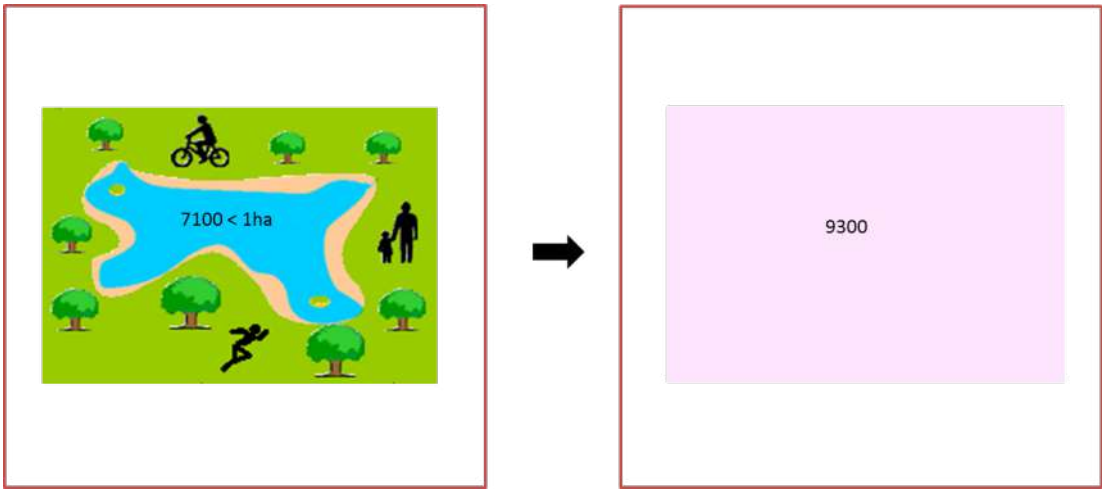
ix. Representative image of the class

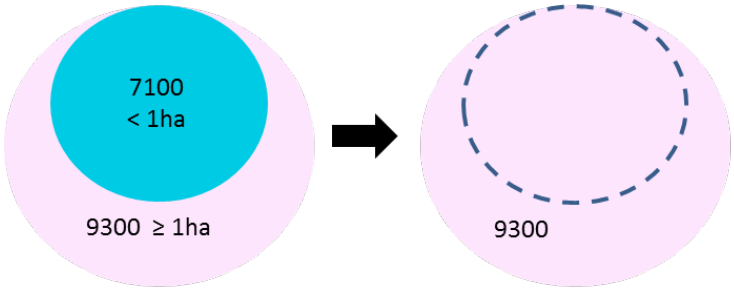
x. Minimum Mapping Unit

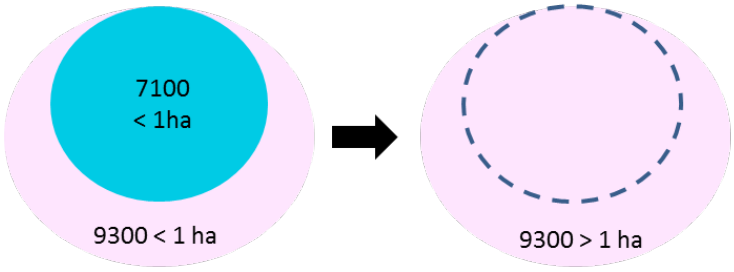
1 ha

xi. Generalisation rules including representative diagrams

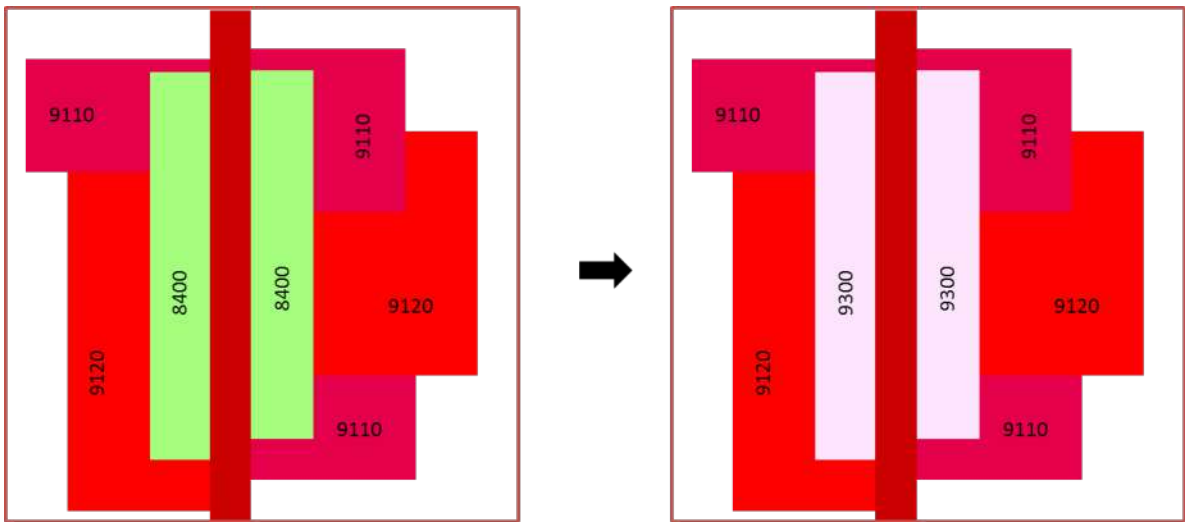
- In case of leisure areas surrounding semi-artificial lakes which are less than 1 ha, the water surface and leisure facility areas should be grouped together to reach a polygon greater than 1 ha.







- Vegetated areas, such as forestry plantations, within urban areas which are used for recreational or ornamental purpose should be classified as leisure areas.



5.9.8 9400 Paved roads

i. Definition

Roads are linear infrastructures made with tarmac (or occasionally concrete).

ii. Characteristic plant and animal species

N/A

iii. Geographical distribution

N/A

iv. Habitat types generally associated in the field

N/A

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

- Margins of roads which are fenced.

viii. This heading excludes

- All roads which are not tarmac paved.
- Roadside plantations more than 20 metres wide (8400).
- Roads inside and around urban areas (9110 or 9120)

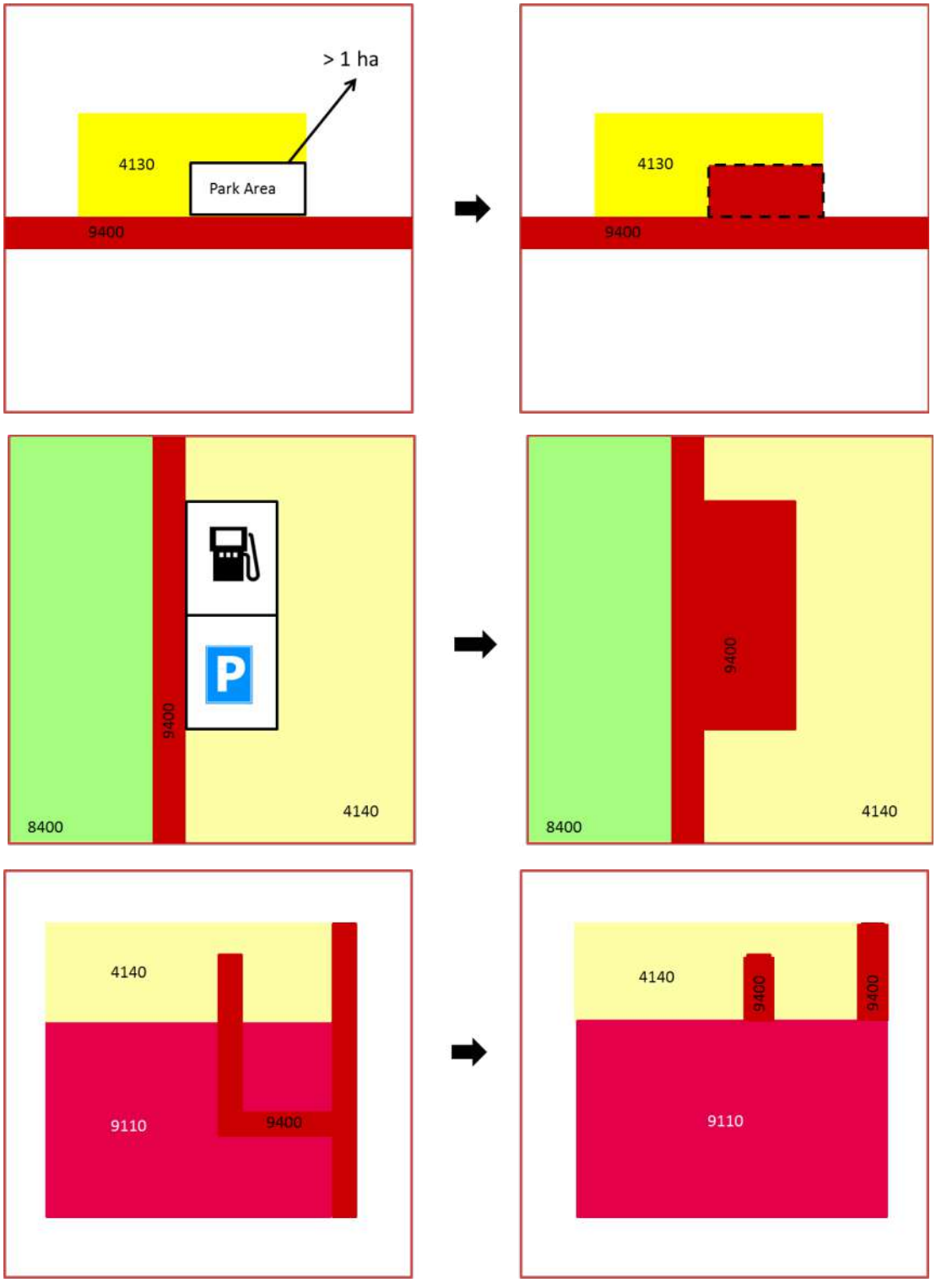
ix. Representative image of the class

x. Minimum Mapping Unit

1ha

xi. Generalisation rules including representative diagrams

- Roads between 15 and 20 meters wide will be exaggerated up to 20 meters.


> 1 ha
4130
Park Area
9400
4130
9400
9400
8400
4140
9400
8400
4140
4140
9110
9400
4140
9400
9400
9110

5.9.9 9500 Pipelines infrastructure

i. Definition

Linear infrastructures used for oil or water transportation. The visible group of pipelines altogether must reach a width of 20m.

ii. Characteristic plant and animal species

N/A

iii. Geographical distribution

Most pipelines run to Ruwais, Habshan or Taweelah

iv. Habitat types generally associated in the field

N/A

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

viii. This heading excludes

Pipelines inside and around oil industry (9210)

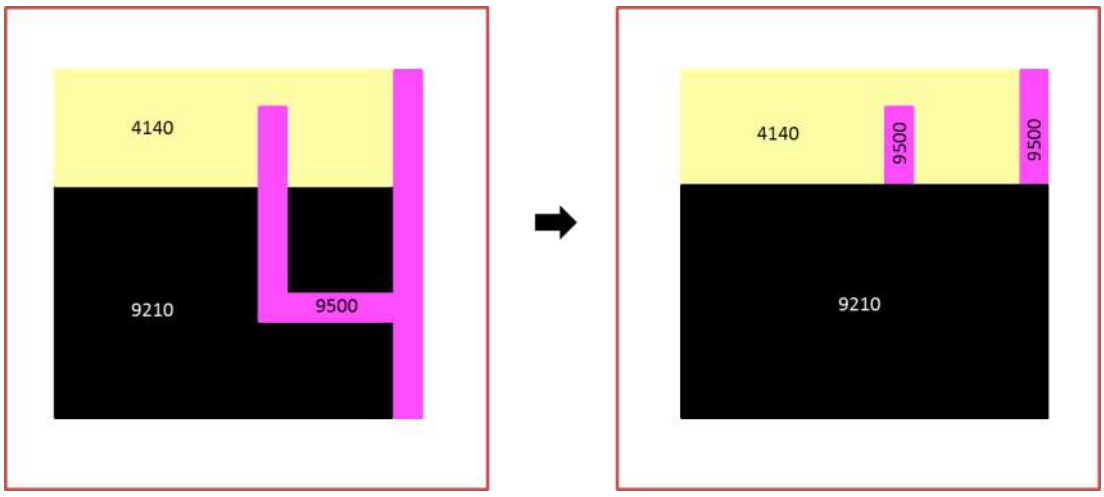
ix. Representative image of the class

x. Minimum Mapping Unit

1ha

xi. Generalisation rules including representative diagrams

- Pipelines infrastructures between 15 and 20 meters wide will be exaggerated up to 20 meters.
- Linear pipeline units that are coincident with each other and thinner than 20m width will be mapped as a single unit.



5.9.10 9600 Disturbed ground

i. Definition

Areas grossly disturbed by anthropogenic processes that cannot be considered as natural habitats, including construction sites, soil mobilization, sand drag and other areas under earthworks development.

ii. Characteristic plant and animal species

N/A

iii. Geographical distribution

Mostly around urban areas.

iv. Habitat types generally associated in the field

N/A

v. Perceived threats

None

vi. Bibliographical references

None

vii. This heading includes

viii. This heading excludes

- Construction sites where the "habitat" being constructed can be discriminated from the image.

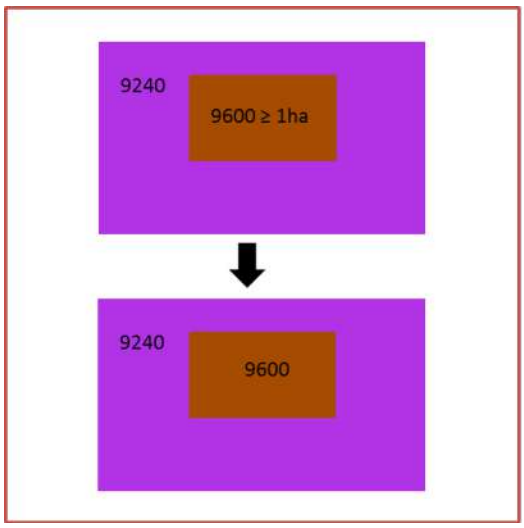
- Non-paved roads

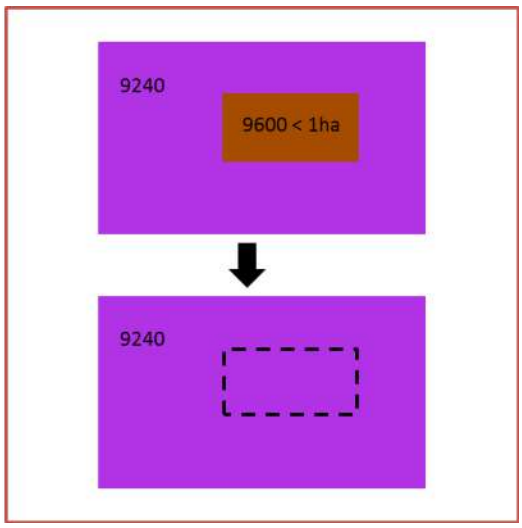
ix. Representative image of the class

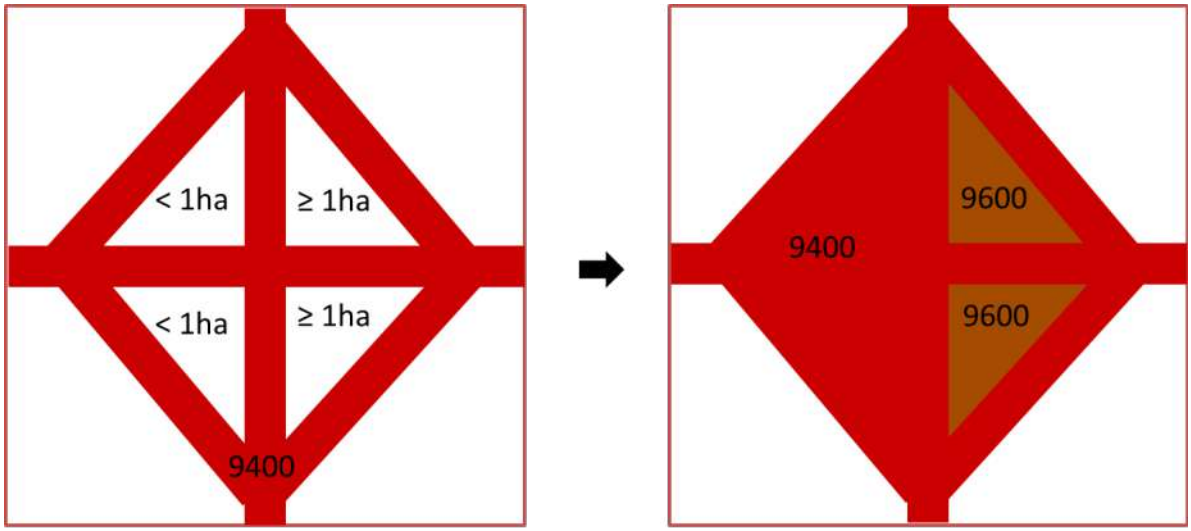
x. Minimum Mapping Unit

1 ha

xi. Generalisation rules including representative diagrams






< 1ha
≥ 1ha
< 1ha
≥ 1ha
9400
9400
9600
9600

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Appendix 1 – Cross-referencing of Habitat Types to Land Use Land Cover Scheme for Abu Dhabi Emirate

Type no.	Sub-type no.	Habitat type	MMUs (ha)	Land Cover (Land form) No.	Landcover type	Land Use No.	LandUse Type
1000		Intertidal habitats					
	1010	Mudflats and sand exposed at low tide	5	22211	Bottom	4000	Vacant
	1020	Sheltered tidal flats with cyanobacterial mats	5	12220	Algae	4000	Vacant
	1030	Saltmarsh	5	12240	Salt Marsh	4000	Vacant
	1040	Mangroves	5	12230	Mangrove	4000	Vacant
	1050	Storm beach ridges	5	21311	Beach	4000	Vacant
	1060	Sandy beaches	5	21311	Beach	4000	Vacant
	1070	Beach rock and gravelly beaches	5	21324	Beach	4000	Vacant
2000		Coastal plains, sand sheets and low dunes					
	2011	Coastal plains on well-drained sandy ground	25	21312	Sand Dune/Sheet	4000	Vacant
	2012	Coastal plains on well-drained rocky or gravelly terrain	25	21331	Gravel Plain	4000	Vacant
	2020	Coastal sand sheets and low dunes	5	21312	Sand Dune/Sheet	4000	Vacant
	2030	Coastal cliffs, headlands, rocky slopes and wadis in coastal situations	5	21322	Hills	4000	Vacant
3000		Coastal sabkha, including Sabkha Matti	25				
3100		Coastal sabkha, including Sabkha Matti	25	21342	Coastal Sabkha	4000	Vacant
4000		Sand sheets and dunes					
	4110	Sand sheets and dunes with tree cover	25	11210	Trees	4000	Vacant
	4120	Sand sheets and dunes with shrub cover	25	11220	Shrubs	4000	Vacant
	4130	Sand sheets and dunes with dwarf shrub cover	25	11220	Shrubs	4000	Vacant
	4140	Sand sheets and dunes with perennial herbs and graminoids	25	11230	Herbaceous	4000	Vacant
	4200	Mega-dunes	25	21312	Sand Dune/Sheet	4000	Vacant
5000		Gravel plains (alluvial and interdunal)					
	5110	Gravel plains with distinct tree vegetation	25	11210	Trees	4000	Vacant
	5120	Gravel plains with dwarf shrub vegetation	25	11220	Shrubs	4000	Vacant
	5130	Gravel plains with sparse vegetation	25	21331	Gravel Plain	4000	Vacant
	5200	Inland sabkha	25	21341	Inland Sabkha	4000	Vacant

Type no.	Sub-type no.	Habitat type	MMUs (ha)	Land Cover (Land form) No.	Landcover type	Land Use No.	LandUse Type
6000		Mountains, rocky terrain and wadis					
	6100	Mountain slopes, screes and associated wadis	25	21321	Mountain	4000	Vacant
	6210	Jebels (including mesas and burqas)	1	21322	Hills	4000	Vacant
	6220	Escarpments, lithified sand dunes, rocky exposures	5	21323	Consolidated Plain	4000	Vacant
	6320	Wadis in open terrain, and drainage channels	25	21351	Alluvial Plain	4000	Vacant
7000		Inland standing water habitats and habitats of moist ground					
	7100	Semi-artificial lakes	1	22100	Inland Water Undifferentiated	3000	Water Undifferentiated
	7200	Moist ground with *Phragmites*, *Tamarix* and grass mats	5	22100	Inland Water Undifferentiated	3000	Water Undifferentiated
8000		Oases, Farmland and Forestry					
	8100	Date plantations	1	11110	Farms	2400	Date Plantations
	8200	Farmland	1	11110	Farms	2100	Farm
	8300	Livestock areas	1	21210	Livestock	2200	Livestock
	8400	Forestry plantations	1	11120	Forestry	2400	Forestry
9000		Urban, industrial and commercial habitat types					
	9110	High density urban	1	21110-21120-21130-21170	Urban Areas	1100-1200-1300-1700	Urban Areas
	9120	Low density urban	1	21110-21120-21130-21170	Urban Areas	1100-1200-1300-1700	Urban Areas
	9210	Oil Industry	1	21140	Industrial	1400	Industrial/Commercial
	9220	Airports and Aerodromes	1	21161	Transportation	1400	Industrial/Commercial
	9230	Port areas	1	21140	Industrial	1400	Industrial/Commercial
	9240	Other industry	1	21140	Industrial	1400	Industrial/Commercial
	9300	Leisure areas	1	21150	Open Space/Recreation-Developed	1500	Open Space/Recreation - Developed
	9400	Paved roads	1	21161	Transportation	1610	Transportation
	9500	Pipelines infrastructure	1	21162	Utilities	1620	Utilities
	9600	Disturbed ground	1	21180	Vacant with Improvments	1800	Vacant with improvements

Appendix 2 – Generalisation priority table

	1010	1020	1030	1040	1050	1060	1070	2011	2012	2020	2030	3100	4110	4120	4130	4140	4200	5110	5120	5130	5200	6100	6210	6220	6320	7100	7200	8100	8200	8300	8400	9110	9120	9210	9220	9230	9240	9300	9400	9500	9600	
1010	0	1	1	1	2	2	2	4	4	4	4	2	5	5	5	5	6	5	5	5	6	6	5	6	6	10	7	8	8	8	8	9	9	9	9	9	9	9	9	9	9	1010
1020	1	0	1	1	2	2	2	4	4	4	4	2	5	5	5	5	6	5	5	5	6	6	5	6	6	10	7	8	8	8	8	9	9	9	9	9	9	9	9	9	9	1020
1030	1	1	0	1	2	2	2	4	4	4	4	2	5	5	5	5	6	5	5	5	6	6	5	6	6	10	7	8	8	8	8	9	9	9	9	9	9	9	9	9	9	1030
1040	1	1	1	0	2	2	2	4	4	4	4	2	5	5	5	5	6	5	5	5	6	6	5	6	6	10	7	8	8	8	8	9	9	9	9	9	9	9	9	9	9	1040
1050	2	2	2	2	0	1	1	3	3	3	3	2	5	5	5	5	6	5	5	5	6	6	5	6	6	10	7	8	8	8	8	9	9	9	9	9	9	9	9	9	9	1050
1060	2	2	2	2	1	0	1	3	3	3	3	2	5	5	5	5	6	5	5	5	6	6	5	6	6	10	7	8	8	8	8	9	9	9	9	9	9	9	9	9	9	1060
1070	2	2	2	2	1	1	0	3	3	3	3	2	5	5	5	5	6	5	5	5	6	5	5	6	6	10	7	8	8	8	8	9	9	9	9	9	9	9	9	9	9	1070
2011	4	4	4	4	3	3	3	0	1	1	2	2	3	3	3	3	5	4	4	4	5	6	6	6	6	10	7	7	7	7	7	9	9	9	9	9	9	9	9	9	9	2011
2012	4	4	4	4	3	3	3	1	0	1	2	2	4	4	4	4	5	3	3	3	5	5	5	5	5	10	7	7	7	7	7	9	9	9	9	9	9	9	9	9	9	2012
2020	4	4	4	4	3	3	3	1	1	0	2	2	3	3	3	3	5	4	4	4	5	6	6	6	6	10	7	7	7	7	7	9	9	9	9	9	9	9	9	9	9	2020
2030	4	4	4	4	3	3	3	2	2	2	0	3	4	4	4	4	5	3	3	3	5	5	5	5	5	10	7	7	7	7	7	9	9	9	9	9	9	9	9	9	9	2030
3100	2	2	2	2	2	2	2	2	2	2	3	0	3	3	3	3	6	2	2	2	1	4	4	4	4	10	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	3100
4110	5	5	5	5	5	5	5	3	4	3	4	3	0	1	1	1	2	3	3	3	3	5	5	5	5	10	7	7	7	7	7	9	9	9	9	9	9	9	9	9	9	4110
4120	5	5	5	5	5	5	5	3	4	3	4	3	1	0	1	1	2	3	3	3	3	5	5	5	5	10	7	7	7	7	7	9	9	9	9	9	9	9	9	9	9	4120
4130	5	5	5	5	5	5	5	3	4	3	4	3	1	1	0	1	2	3	3	3	3	5	5	5	5	10	7	7	7	7	7	9	9	9	9	9	9	9	9	9	9	4130
4140	5	5	5	5	5	5	5	3	4	3	4	3	1	1	1	0	2	3	3	3	3	5	5	5	5	10	7	7	7	7	7	9	9	9	9	9	9	9	9	9	9	4140
4200	6	6	6	6	6	6	6	5	5	5	5	6	2	2	2	2	0	4	4	4	5	6	6	6	6	10	7	7	7	7	7	9	9	9	9	9	9	9	9	9	9	4200
5110	5	5	5	5	5	5	5	4	3	4	3	2	3	3	3	3	4	0	1	1	2	3	3	3	3	10	6	7	7	7	7	8	8	8	8	8	8	8	8	8	8	5110
5120	5	5	5	5	5	5	5	4	3	4	3	2	3	3	3	3	4	1	0	1	2	3	3	3	3	10	6	7	7	7	7	8	8	8	8	8	8	8	8	8	8	5120
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5200	6	6	6	6	6	6	6	5	5	5	5	1	3	3	3	3	5	2	2	2	0	4	4	4	4	10	6	7	7	7	7	8	8	8	8	8	8	8	8	8	8	5200
6100	6	6	6	6	6	6	5	6	5	6	5	4	5	5	5	5	6	3	3	3	4	0	2	2	2	10	6	7	7	7	7	8	8	8	8	8	8	8	8	8	8	6100
6210	5	5	5	5	5	5	5	6	5	6	5	4	5	5	5	5	6	3	3	3	4	2	0	1	2	10	6	7	7	7	7	8	8	8	8	8	8	8	8	8	8	6210
6220	6	6	6	6	6	6	6	6	5	6	5	4	5	5	5	5	6	3	3	3	4	2	1	0	2	10	6	7	7	7	7	8	8	8	8	8	8	8	8	8	8	6220
6320	6	6	6	6	6	6	6	6	5	6	5	4	5	5	5	5	6	3	3	3	4	2	2	2	0	10	6	7	7	7	7	8	8	8	8	8	8	8	8	8	8	6320
7100	6	6	6	6	6	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	7	7	7	7	0	2	4	4	4	4	4	4	4	4	4	4	3	8	8	5	7100
7200	7	7	7	7	7	7	7	7	7	7	7	5	7	7	7	7	7	6	6	6	6	6	6	6	6	10	0	3	3	7	3	7	7	7	7	7	7	7	7	7	7	7200
8100	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	10	3	0	1	2	1	5	4	5	5	5	5	4	6	6	6	8100
8200	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	10	3	1	0	1	1	5	4	5	5	5	5	4	6	6	6	8200
8300	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	10	7	2	1	0	2	5	4	5	5	5	5	4	6	6	6	8300
8400	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	10	3	1	1	2	0	5	4	5	5	5	5	4	6	6	6	8400
9110	9	9	9	9	9	9	9	9	9	9	9	7	9	9	9	9	9	8	8	8	8	8	8	8	8	10	7	5	5	5	5	0	1	2	2	2	2	1	4	4	3	9110
9120	9	9	9	9	9	9	9	9	9	9	9	7	9	9	9	9	9	8	8	8	8	8	8	8	8	10	7	4	4	4	4	1	0	2	2	2	2	1	4	4	3	9120
9210	9	9	9	9	9	9	9	9	9	9	9	7	9	9	9	9	9	8	8	8	8	8	8	8	8	10	7	5	5	5	5	2	2	0	1	1	1	2	4	1	3	9210
9220	9	9	9	9	9	9	9	9	9	9	9	7	9	9	9	9	9	8	8	8	8	8	8	8	8	10	7	5	5	5	5	2	2	1	0	1	1	2	4	2	3	9220
9230	9	9	9	9	9	9	9	9	9	9	9	7	9	9	9	9	9	8	8	8	8	8	8	8	8	10	7	5	5	5	5	2	2	1	1	0	1	2	4	2	3	9230
9240	9	9	9	9	9	9	9	9	9	9	9	7	9	9	9	9	9	8	8	8	8	8	8	8	8	10	7	5	5	5	5	2	2	1	1	1	0	2	4	2	3	9240
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9600	9	9	9	9	9	9	9	9	9	9	9	7	9	9	9	9	9	8	8	8	8	8	8	8	8	10	7	6	6	6	6	3	3	3	3	3	3	3	5	3	0	9600
	1010	1020	1030	1040	1050	1060	1070	2011	2012	2020	2030	3100	4110	4120	4130	4140	4200	5110	5120	5130	5200	6100	6210	6220	6320	7100	7200	8100	8200	8300	8400	9110	9120	9210	9220	9230	9240	9300	9400	9500	9600	

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