

WILDERNESS AND EXTENSIVE NATURAL VALUES

SOUTH-EAST QUEENSLAND COMPREHENSIVE REGIONAL ASSESSMENT (PROJECT 3.1)

**QUEENSLAND CRA/RFA STEERING
COMMITTEE**

DRAFT

WILDERNESS AND EXTENSIVE NATURAL VALUES

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Note: This draft report has been prepared as part of the comprehensive, regional assessment for South east Queensland on the identification of wilderness quality, wilderness boundaries and remote and natural area boundaries in South East Queensland.

The draft report has been prepared using the general layout and approach used for similar reports for the Victorian and New South Wales RFAs.

1. INTRODUCTION

This report provides information on the assessment and identification of wilderness, remote and natural areas, natural landscapes and undisturbed catchments (Project EH3.1) for the Queensland Regional Forest Agreement.

The projects objectives are to identify, in the South-East Queensland RFA region, the extent of land having the following natural values that are extensive in nature and operate at the landscape scale:

- . Wilderness
- . Remote and Natural areas
- . Natural Landscapes
- . Undisturbed Catchments

The Commonwealth and Queensland Governments signed a Scoping Agreement for all Queensland RFAs in January 1997. The agreement included a commitment to utilise the JANIS criteria in developing a CAR reserve system. The agreement also outlines the individual assessments required for the CRA component of each RFA. In relation to wilderness, it states:

This assessment will include wilderness areas identified under the National Wilderness Inventory (NWI) analysis of wilderness in the region. The NWI analysis will be refined by the application of disturbance information from old-growth forest surveys, improved information on the nature of road access and additional information of relevance.

The Agreement lists the wilderness-related map outputs required for the region. These are:

- a map showing all wilderness areas identified under the provisions of the *Wilderness Act 1987* and of NWI wilderness quality and size above agreed thresholds (note: reference to the *Wilderness Act 1987* appears to be an error due possibly to the use of the NSW Scoping agreement text as a basis for the Queensland agreement. The legislation referred to is NSW legislation which is not applicable in Queensland);

- a map identifying rational boundaries for protection of wilderness values; and
- a map of rational boundary options for wilderness areas.

The identification of wilderness, as well as being required under JANIS, is part of the assessment of national estate values agreed for the South-East Queensland CRA/RFA. The extensive natural values that form part of this project also form part of the agreed assessment of national estate values.

There are currently no formally gazetted wilderness areas in South East Queensland, although there are provisions in the *Nature Conservation Act 1992* for the declaration and management of wilderness areas.

2. BACKGROUND

2.1. National Forest Policy Statement

Wilderness - land that, together with its plant and animal communities, is in a state that has not been substantially modified by, and is remote from, the influences of European settlement or is capable of being restored to such a state; is of sufficient size to make its maintenance in such a state feasible; and is capable of providing opportunities for solitude and self-reliant recreation (National Forest Policy Statement, 1992).

The National Forest Policy Statement (NFPS) (Commonwealth of Australia, 1992) is an agreement between the Commonwealth and State governments on broad goals for the management of Australia's forests. These goals are based on the concept of ecologically sustainable development, with the dual aims of conserving the natural and cultural values of forested areas and developing a dynamic and internationally competitive forest products industry. A major conservation aim is the creation of a comprehensive, adequate and representative (CAR) forest reserve system to protect biodiversity, old-growth forests and wilderness values.

The goals of the NFPS are to be attained through a series of comprehensive regional assessments (CRAs) and regional forest agreements (RFAs) which are guided by nationally-agreed criteria.

2.2. JANIS Criteria

Implementation of the conservation initiatives of the NFPS, in particular the creation of a CAR forest reserve system, is governed by the *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia* (Commonwealth of Australia, 1997), commonly referred to as the JANIS criteria or the JANIS

report. These criteria were developed by the Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee and apply to all forested regions of Australia.

The JANIS criteria which deal specifically with wilderness identification and assessment in the CRA/RFA process are:

- Potential areas (of high quality wilderness) will have a minimum National Wilderness Inventory (NWI) rating of 12. In addition, minimum thresholds for each of the wilderness quality indicators will be set within the regional context. These thresholds will take into account the importance of the indicators, and in particular the biophysical naturalness component as a primary indicator;
- The guideline for size which is considered generally appropriate for areas encompassing forested wilderness is 8,000 ha. However, thresholds of less than 8,000 ha may apply to areas contiguous with the sea or which adjoin wilderness areas in adjacent regions;
- The presence of "nodal" areas with higher wilderness quality may provide an indication of their significance and may guide the future management of identified wilderness areas;
- Other factors which are not considered in determining the NWI rating may need to be considered, in determining wilderness quality. These factors may include the impacts of exotic plants and feral animals on biophysical naturalness; and
- As forest and non-forest vegetation types form a mosaic, non-forest vegetation types may be included within largely-forested wilderness areas.

The JANIS report includes the following guidelines for determining appropriate boundaries for areas of high quality wilderness:

- Potential areas identified using the NWI database will be considered in a regional context to ensure their viability as wilderness, including considerations of shape;
- Both ecological and management features such as topography, water catchment boundaries, roads and other transport routes, may be useful when delineating boundaries; and
- Wilderness values also will need to be maintained by appropriate management and design of wilderness areas.

The criterion which applies to wilderness protection is:

- Ninety per cent, or more if practicable, of the area of high quality wilderness that meets minimum area requirements should be protected in reserves.

2.3. Wilderness Restoration

The project specification identified several key issues including the capacity and timeframe for restoration. Conservation stakeholder groups expressed strong interest in identifying areas that have National Wilderness Inventory wilderness quality of less than 12, but which could be readily restored to wilderness. Queensland representatives on the Queensland RFA steering committee have indicated interest in examining areas with wilderness quality of 10 and 11 with a view to their possible restoration as wilderness. Consultation between governments and with stakeholders on possible criteria that could be used to identify areas that might be suitable for restoration are currently in progress.

The identification of restoration involves investigation of the four wilderness quality indicators of remoteness and disturbance that combine to comprise wilderness quality in the National Wilderness Inventory (NWI).

2.4. National Estate Values

The agreed framework for carrying out comprehensive assessments of the economic, social, environmental and heritage values of forest regions agreed under the National Forest Policy Statement (NFPS) includes the assessment of the national estate values of forest regions.

The National Estate is defined in the *Australian Heritage Commission Act 1975* as:

those places, being components of the natural environment of Australia, or the cultural environment of Australia, that have aesthetic, historic, scientific or social significance or other special value for future generations as well as for the present community.

The Australian Heritage Commission's responsibility is to identify the national estate and, under section 30 of the Act, to advise the Commonwealth Government on the protection of national estate places and the potential impact on national estate values of Commonwealth decisions relating to those places. The Act also requires the establishment of the Register of the National Estate. The Register includes places of importance at a local, regional or national level. The identification and assessment of places for listing in the Register is guided by the national estate criteria.

Wilderness and extensive natural values are assessed under national estate sub-criterion B.1: Importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as a wilderness.

Areas of wilderness and extensive natural values identified in this project as having potential national estate value are indicative only. The project documents the values that need to be taken into account in determining national estate places. The data layers and indicative areas will remain indicative until they have been considered by the Australian Heritage Commission (AHC). Areas endorsed by the Australian Heritage Commission will be entered in the interim list of the Register of the National Estate. The AHC will delineate national estate places based on the value assessments and protection afforded in the formal and informal reserve system. Those places will then be advertised and subject to the statutory period of three months allowed for public comment. Interim listing of areas identified through this process occur sometime after the South-East Queensland RFA is signed.

3. NATIONAL WILDERNESS INVENTORY AND WILDERNESS DELINEATION

3.1. Introduction

Wilderness identification is conducted in two general stages:

1. the updating and analysis of data using the National Wilderness Inventory to produce maps of wilderness quality, and
2. the delineation (boundary identification) of wilderness areas, using the National Wilderness Inventory database and other relevant information.

3.2. National Wilderness Inventory

The National Wilderness Inventory (NWI) is a computer-based mapping system which presents wilderness as being part of a continuum of remote and natural conditions that vary from essentially undisturbed at one end of the continuum to urban at the other end (Lesslie and Taylor, 1985). This is prepared using GIS techniques in the collation and analysis of data, using consistent and objectively measurable criteria, to produce a database of wilderness quality.

NWI assessments seek to identify and assess the common environmental attributes upon which a multiplicity of wilderness-related benefits are based and do not include anthropocentric characteristics such as aesthetic,

landscape or recreational values. Some physical characteristics of the land that are relevant to the identification of wilderness, such as topography, are also not included in NWI assessments but are taken into account at the delineation stage.

3.2.1. Wilderness Quality Indicators

The NWI measures wilderness quality across the landscape by using four wilderness quality 'indicators' that represent the two essential attributes of wilderness: remoteness and naturalness. The indicators are derived from the definition of wilderness quality as the extent to which a location is remote from, and undisturbed by, the influence of modern technological society. These indicators are:

Remoteness from Settlement

- . remoteness from places of permanent occupation;

Remoteness from Access

- . remoteness from established access routes;

Apparent Naturalness

- . the degree to which the landscape is free from the presence of permanent structures associated with modern technological society;

Biophysical Naturalness

- . the degree to which the natural environment is free from biophysical disturbance caused by the influence of modern technological society.

Fundamental to the NWI is the creation of two databases: a primary database and a wilderness quality database.

3.2.2. Primary Database

The primary database consists of a wide range of geographical data, including detailed infrastructure and land use information as outlined in Table 1. The storage of this data within the NWI Geographic Information System (GIS) is described in the NWI Handbook (Lesslie and Maslen, 1995).

Table 1: NWI Primary Data Layers

Primary Data Layer	Description	Usage
Land cover	All polygonal land cover information; including natural cover, cultural cover, built up areas, reservoirs etc.	Establishes areas for wilderness quality survey (natural areas), and in calculating, Remoteness from Settlement, Apparent Naturalness and Biophysical Naturalness.
Lines	All linear information required for wilderness analysis; including roads and tracks, railways, and other linear infrastructure.	For use in calculating Remoteness from Access and Apparent Naturalness.
Points	All point features required for wilderness analysis, including settlements, buildings, other point infrastructure.	For use in calculating, Remoteness from Settlement and Apparent Naturalness.

3.2.3. Wilderness Quality Database

The information contained in the primary database is utilised to create the wilderness quality database. For each of the three distance-based wilderness indicators, primary data is graded according to its associated impact. The Remoteness from Access and Remoteness from Settlement indicators utilise four categories or grades of impact, whilst three grades are used in determining Apparent Naturalness.

The analysis process for deriving the three distance-based indicators (Figure 1) is outlined below, as a sequence of four steps. (For a detailed description of this process refer to the *National Wilderness Inventory - Handbook of Procedures, Content and Usage*, (Lesslie and Maslen, 1995.)

i) Grading feature impacts:

For each indicator, point, line and polygon features are grouped into the appropriate impact grade (eg, Remoteness from Access grades 1 to 4).

ii) Distance Calculation:

Distance (in meters) is calculated between each sample point and the nearest feature in each grouped coverage generated in (i) above.

iii) Minimum Weighted Distance Calculation:

For each indicator, the distance measures are standardised using a weighting factor that reflects the grade of impact. This, in effect, converts all distances to be equivalent to those of high impacting features. The minimum, effectively the closest, of the standardised distances is recorded.

iv) Indicator Classification:

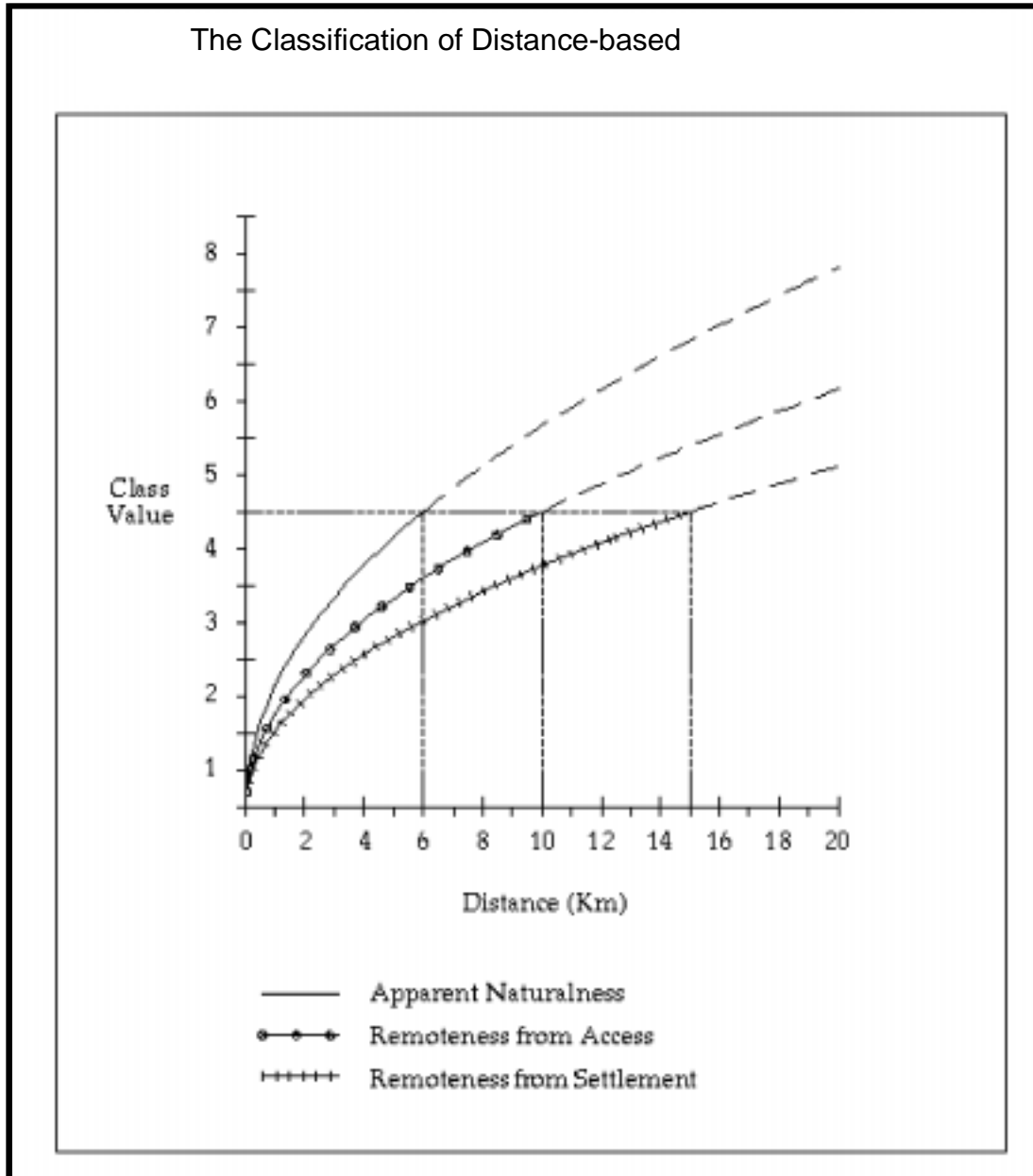
Minimum standardised distances are classified to produce consistent Remoteness from Settlement, Remoteness from Access, and Apparent Naturalness classes, with values of 0 to at least 5.

The fourth indicator, Biophysical Naturalness (BN), is based upon the assumption that the degree of change sustained by an ecosystem is directly related to the intensity and duration of interference. For the NWI, land use considerations are generally restricted to the grazing of stock and the harvesting of timber. However, where other reliable data is available, information on a range of other disturbances is also included.

The datasets typically used to derive the BN layer includes:

- timber harvesting;
- air photo interpretation (API) (used to determine disturbance levels)
- land tenure;
- grazing leases;
- vegetation communities (eg old growth); and
- mining sites.

Figure 1: Classification of distance-based indicator values

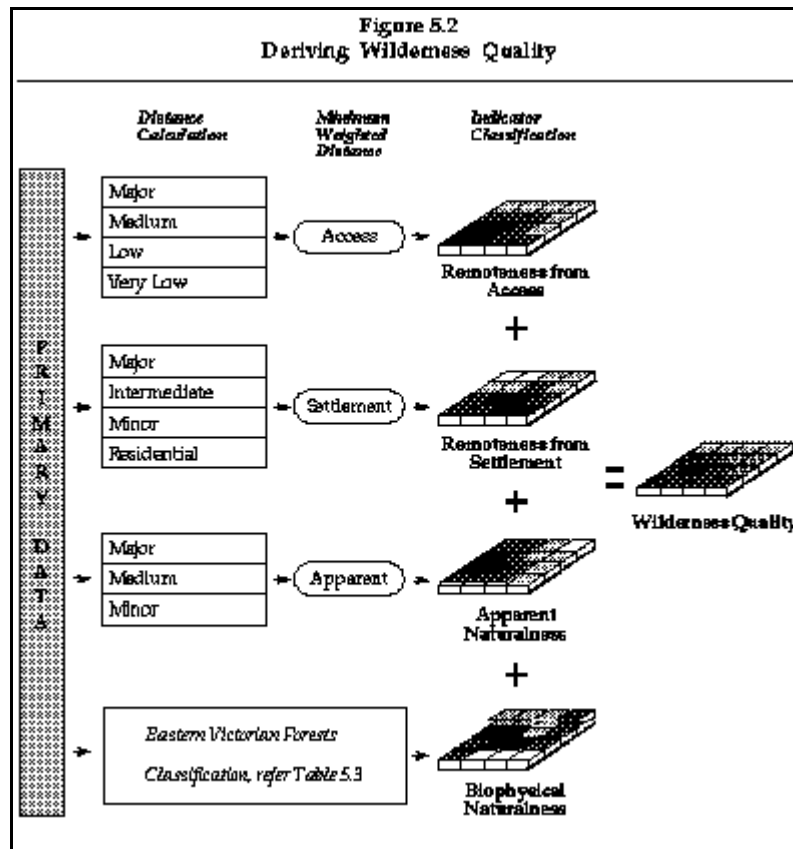


3.2.4. Deriving Wilderness Quality

Each grid cell across a project area is assigned a value for each of the NWI indicators. A total wilderness quality (WQ) index is produced by summing the values of the four indicators. The process is additive, resulting in a total wilderness quality scale ranging from 0 to a maximum value of 20. This procedure rests on the assumption that each indicator contributes independently and equally to total wilderness quality. The process of deriving a total wilderness quality index is illustrated in Figure 2.

Areas with WQ index equal to or above 12 are considered significant. The presence of areas of very high NWI value, termed 'nodal areas' (ie. NWI > WQ 14), can help in assessing the significance of potential areas.

Figure 2: Deriving wilderness quality



4. APPLICATION OF THE NWI METHODOLOGY AND WILDERNESS DELINEATION IN QUEENSLAND

As previously described, the first step in developing a wilderness quality layer is the updating of the primary data in the National Wilderness Inventory. In Queensland the major information for updating the National Wilderness Inventory came from disturbance information derived by the South-East Queensland Old Growth project (EH2.1). This included the datasets listed in Table 2. The CRA Old Growth project report describes the extent of disturbance information incorporated in its analyses.

Table 2: Primary data sources for updating the NWI

Primary Data Layer	Data Provider	Scale
Stock Grazing Permits/grazing related treatments	QDNR	1:25,000 - 1:50,000
API for South-East Queensland	QDNR	1:25,000
Pre 1950 logging and virgin suids	QDNR	1:50,000

The API layer was the primary layer used to determine disturbance when it was available. Note: The currency of the datasets is taken to be the date that they were constructed (derived) for the purposes of the old growth project (1996-1998). The original datasets's currency varies (1987-1996 for the API) and older for the logging and grazing history.

In areas not covered by information collected as part of the Old Growth assessment, Biophysical Naturalness is based on the existing NWI database which was derived using the best available data in 1994. This comprised:

- . 1992 DPI digital landcover (1:250 000)
- . AUSLIG 1:250 000 and 1:100 000 topographic maps
- . Landsat TM image interpretation
- . AUSLIG Australian Public Lands Database

A rating scheme for Biophysical Naturalness was then developed for use in determining the NWI value for South East Queensland. The scale is outlined in Table 3.

Table 3: Biophysical naturalness rating scheme

Indicator Value	NWI Descriptor for baseline NWI
5, High	No evidence of logging or grazing. Natural vegetation cover, free from disturbance.
4	Pre 1950s logging, regrowth or evidence of slight small scale disturbance to canopy with no associated records of logging in areas of rainforest or natural canopy cover.
3	Evidence of disturbance by light grazing or evidence of grazing in unlogged forests or pre 1950s logged areas under an altered canopy.
2	Grazed lands under altered canopy or evidence of grazing in pre 1950s logged forests.
1, Low	This class is reserved for recent clearfelled logging operations. This class does not apply in South-East Queensland.
0	Agricultural, urban and developed land, pine and other exotic plantations, reservoirs.

The NWI database for the remaining three indicators (remoteness from settlement, remoteness from access and apparent naturalness) has been built up from data on settlements, structures and roads derived from:

- AUSLIG 1:250 000 and 1:100 000 digital coverages and topographic maps.
- All available current digital road coverages for South east Queensland were incorporated into the database (Forestry 1:50 000 mapping).

Each grid cell across the project area was assigned a value of between 0 and 5 for each of the NWI indicators. A total wilderness quality (WQ) index is produced by summing the values of the four indicators, resulting in a total wilderness quality scale ranging from 0 to a maximum value of 20.

The output of this step has been the production of a map of wilderness quality across SEQ bioregion.

4.1. Setting indicator thresholds

The JANIS criteria provide for the setting of minimum thresholds for each of the four wilderness quality indicators according to the regional context,

The setting of minimum indicator thresholds was investigated in the RFA process for other regions, and was found to have little influence on outcomes. No individual thresholds have been applied in Queensland.

4.2. Wilderness Delineation

Step two of defining wilderness in South east Queensland involved defining indicative areas of NWI 12 and above that are of at least 8,000 ha (consistent with JANIS).

Commonwealth and State officials (including regional officers with on ground knowledge) considered the draft wilderness quality map and indicative areas. The following areas were accepted on the information presented and no further issues were identified:

1. Fraser Island National Park (northern section)
2. Cooloola National Park (eastern section)
3. Lamington National Park (adjoins NSW wilderness areas).

The following places supporting high wilderness quality were identified as containing some disturbed areas and additional information was requested from State officials to improve wilderness quality and boundary delineation.

Place	Approx. Area of WQ 12+ (ha)
Kroombit Tops	55 000
Blackdown Tableland	47 000
Bania (Upper Burnett River)	20 000
Many Peaks Range	18 000
Bobby Range	15 000
Wide Bay Military Reserve	10 000
Pine Creek	8 000
Mt Barney	8 000
Maaroom	7 000
Table Range	7 000
Cooloola West	5 000

As additional information became available for the draft proposed areas, (usually roading/track information or local knowledge about logging or other disturbances) this was incorporated into the NWI layer and adjustments were made to the draft list.

4.3. Wilderness Identification Outcomes Under JANIS

The wilderness areas that meet the JANIS criteria are in Table 4.

Table 4: Areas of potential wilderness

Place	Approx. Area of WQ 12+ (ha)	Comments
Fraser Island North	50 000	Boundary follows shoreline three sides and four wheel drive track across southern boundary
Kroombit Tops	55 000	Boundary follows power line in the north, otherwise topographic features/break of slope. South eastern boundary follows 2WD road. Track through northern section is a locked 4wd track.
Cooloola East	27 000	Boundary follows coastline and NP boundary with road the western boundary. Option is: inclusion of the road between the eastern and western portions of the National Park.
Blackdown Tableland	47 000	Boundary mostly follows State forest boundary. Excludes 2WD road to the north and national park infrastructure but includes 4WD track. Option is the exclusion of the 4WD

		track if it has been upgraded.
Bania (Upper Burnett River)	10 000	Boundary is road on eastern side and topographic features on western side. Option is inclusion of adjacent area to road if road is in poor condition. Additional information indicates recent logging in, southern section. Boundary incorporates only northern section.
Mt Huntley - Mt Roberts	14 400	Boundary is cleared land to the east and topographic features on western side. Options are exclusion of non NWI12 land on north and removal of point to point boundary using RFA boundary instead.
Place	Approx. Area of WQ 12+ (ha)	Comments
Pine Creek	8,600	Boundary mostly follows break of slope. Road status to north will define boundary on that side.
Mt Molangul (Many Peaks Range)	8 000	Boundary follows State forest boundary on western side, 4WD tracks and break of slope remainder. Area includes narrow tail of NWI 12+ steep topography, joined to remainder by neck approx 3km wide. Options are exclusion of tail (which would reduce area below 8000 ha or addition of non NWI12 land on north eastern side to remove neck.
Lamington National Park	7000	Boundary is national park. Contiguous with NSW wilderness (total >8 000).
Mt Barney	8 000	Boundary is break of slope and up to cleared land. Contiguous with 875 ha of WQ12+ NSW wilderness (road from NSW is closed and deteriorating)

5. REMOTE AND NATURAL AREAS

5.1. Introduction

The project proposal has also identified the possibility of identifying remote and natural areas in Queensland.

Remote and natural areas are considered to be areas that have significant value for their relative lack of disturbance, remoteness, and relatively natural condition, but that are too small to qualify as wilderness. They are not a substitute for wilderness areas.

The concept of remote and natural areas originated in Victoria during the conduct of the Land Conservation Council investigation of wilderness in Victoria (LCC, 1991). Some remote and natural areas identified in Victoria by the LCC in 1991 were identified as wilderness areas by the Victorian RFA wilderness investigation in 1996 (VicRFASC, 1996). A remote and natural area was identified in the Victorian Central Highlands RFA wilderness investigation in 1996. There were no areas of high wilderness quality big enough to meet the criteria for wilderness areas in the Central Highlands.

The National Wilderness Inventory data base has been used in the same way as for the identification of wilderness.

5.2. Methods

Generally, the same principles apply to delineating remote and natural areas as apply to delineating wilderness areas.

The criteria for delineation of Remote and Natural areas in South-East Queensland are proposed as follows:

- Areas with a node of high wilderness quality (12+) but less than 8000ha
- Topographic integrity,
- Recreational considerations, such as an ability for the area to offer an experience of remoteness.

5.3. Outcomes

Areas that could qualify as remote and natural areas using the proposed criteria include: North Many Peaks Range (5389 ha); South Many Peaks Range (6500 ha); Cooloola West (5,000 ha) and Maaroom (7,000 ha).

These areas have not been reviewed and their sizes are approximate.

The output will be a map showing remote and natural areas.

6. . NATURAL LANDSCAPES

6.1. Introduction

Natural landscapes are large, relatively undisturbed areas with topographic and catchment integrity, where natural processes continue largely unmodified by the impacts of European settlement. Natural processes include the following:

- energy flows

- nutrient cycling
- hydrological processes
- ecological and evolutionary processes

Within the context of forested regions of Australia, natural landscapes are uncommon and in some regions rare occurrences. The essential difference between natural landscapes and wilderness is that remoteness indicators do not form part of the analysis of natural landscapes.

6.2. Method

The assessment of natural landscapes is based on the biophysical naturalness indicator of the National Wilderness Inventory, which indicates the degree to which the natural environment is free from biophysical disturbance caused by the influence of modern technological society. The indicator provides a six class rating, from a value of 0, representing cleared land, to a value of 5, representing areas free of significant unnatural disturbance.

Areas with potential value as natural landscapes are contiguous areas of high biophysical naturalness that have a size and integrity in the landscape, that allow natural processes to continue largely unmodified.

6.3. Outcomes

Areas with most potential value as natural landscapes in the South-East Queensland RFA region have been identified in the Blackdown Tableland, Fraser Island, Cooloola, Bunya Mountains, Main Range, Mt Barney. The Conondale and D'Aguilar Ranges are also notable for potential natural landscapes.

7. UNDISTURBED CATCHMENTS

7.1. Introduction

Catchments or sub-catchments that are essentially undisturbed are an uncommon if not rare component of the Australian landscape. Undisturbed catchments are identified through interrogation of the datasets maintained by the World Heritage and Wilderness Branch of Environment Australia. The analytical tools used to identify undisturbed catchments are closely linked with the data sets and methods used to determine wilderness.

7.2. Method

Undisturbed catchments are identified by analysing impediments to river flow and the naturalness of catchments.

The assessment of undisturbed catchments is based on the wild rivers database (Stein 1995) held by the Wilderness and Wild Rivers section, Environment Australia. The database is made up of geographical data derived from topographical map series and the NWI database. The NWI sources provide information about settlement infrastructure features, the extent of non-natural landcover and an index of biophysical naturalness.

Topographic map series provide data on watercourses, built up areas, infrastructure, reservoirs and canals.

The wild rivers database delineates a modelled sub-catchment for each stream segment, as defined on the AUSLIG 1:250,000 scale hydrography theme database. The database allows an assessment of river/stream quality across the sub-catchment areas based on an index of the naturalness of the river flow regime and an index of the naturalness of the sub-catchment.

The wild rivers database contains seven factors and five indices. The factors identify specific types and levels of disturbance while the indices calculate an overall impact on the natural ecological processes.

Factors:

- settlement factor
- infrastructure factor
- points source pollution factor
- landaus factor
- levee bank factor
- impoundment factor
- flow diversions factor

Indices:

- sub-catchment disturbance index
- catchment disturbance index
- section flow regime disturbance index
- flow regime disturbance index
- river disturbance index

The first four factors contribute to the sub-catchment disturbance index, which in turn determines the catchment disturbance index. The last three factors contribute to the section flow regime disturbance index which is used to derive the flow regime disturbance index.

The river disturbance index is derived from evenly weighting the final catchment disturbance index and flow regime disturbance index values.

7.3. Outcomes

An undisturbed catchment coverage was generated from information held in the wild rivers database. The coverage indicated undisturbed catchments in the Blackdown Tableland, Kroombit Tops and the north of Fraser Island. However a threshold to capture undisturbed catchments is yet to be determined for South-East Queensland. In the process of identifying potential wilderness areas in South-East Queensland, significant new infrastructure

and disturbance information was identified. Work to incorporate this updated information has commenced and the Wild Rivers database will be interrogated again to generate a new coverage. Undisturbed catchments will then be re-assessed in the context of the most recent disturbance information.

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GUIDELINES USED IN THE DELINEATION OF WILDERNESS AREAS

The delineation of wilderness areas is guided by the JANIS report and general principles of conservation reserve boundary identification. The process concentrates on identifying rational and manageable boundaries for wilderness areas that wherever possible are clearly identifiable on the ground.

The following guidelines are referred to in delineating wilderness boundaries:

- . wilderness areas should preferably have a low perimeter-to-area ratio, but not to the extent of the exclusion of significant features or significant areas of high wilderness quality (narrow linear patches less than two kilometers across however are not considered as wilderness).
- . some areas smaller than the minimum size threshold may be considered as wilderness where additional remoting factors apply such as particularly steep or well defined topography, or location on the coast.
- . boundaries should follow easily definable natural features such as ridges, spurs, catchments, creeks, rivers or breaks of slope, and should include complete catchments and the entirety of distinctive topographic features such as massifs, plateaux, gorges and escarpments, where possible.
- . where the edge of a wilderness is in the vicinity of a significant defining landscape feature such as an escarpment, cliff or gorge, the boundary should be set if possible to include that feature.
- . where the use of natural features is inappropriate, boundaries should follow features or infrastructure which are clearly identifiable on the ground, such as roads, 4WD tracks, transmission lines, fence lines, or native vegetation/cleared land interfaces.
- . boundaries should be set at a minimal distance from bordering 2WD roads (eg, 15 meters for gravel roads) and other disturbed sites. In such cases the setback is to be measured from the centreline of the road. Setbacks are not required where a boundary follows a 4WD track.
- . land tenure boundaries may be used if no other more appropriate defining features are present, and the tenure of land is not to be used as a reason to exclude land of high wilderness quality from inclusion in a wilderness area.
- . boundaries associated with impoundments should follow the high water mark.
- . coastal boundaries are taken to be the low tide mark and, in cases where there are mangroves, the outermost extent of the mangroves, whichever is further to seaward.

- . the use of point-to-point straight lines, contour lines or other such lines which are not apparent on the ground should be avoided wherever possible.
- . relatively small disturbed areas which are capable of being restored may be included within a delineated wilderness if to do so would enhance the wilderness quality of the surrounding or adjacent wilderness, or result in the amalgamation of otherwise separate areas of high quality wilderness, or where their exclusion is not practical.
- . wilderness areas may include 4WD tracks, but not 2WD roads.
- . visibility of cleared land or infrastructure from within an area of high wilderness quality is not a reason to exclude that land of high wilderness quality from inclusion within wilderness.