

10 CONSTRAINT GRID CREATION

Each of the constraints outlined in Section 9 forms part of the overall constraint value of the study area. However, as the constraints are not uniform in nature, impact or extent it is difficult to sum them in a meaningful way to provide a holistic value that represents the actual constraint. In order to overcome this difficulty a two stage process was established:

- Stage 1: Establish a study area grid.
- Stage 2: Assign ranking values for each grid point for each constraint.

The formation of a grid across the study area allows for each constraint to be ‘draped’ across this grid. Using this approach, each point within the study area grid can be assigned a value for each constraint. Using the defined geographic extent of the study area (-33.313091°, 149.975887 ° to -33.634643 °, 150.355592 ° (approximately 1,258 square kilometres)), the study area was divided into grid points at 25m intervals. This represents a total of 2,174,025 grid points.

Each constraint mapped was then draped on top of this grid and values assigned to each point on the grid. The value assigned was based on a simple ranking from one to five in terms of the perceived ‘cost’ (dollar or otherwise, eg cost of environmental loss) of constructing a road through the specific grid point. A value of one was taken to indicate a minimal cost value incurred (or maximal benefit for positive constraints) and a value of five taken to indicate a maximal costs value incurred for passing a road through that grid point. This scale was applied uniformly across the identified constraints:

- To allow comparison between constraints.
- To assist in determining accurate weightings (eg a value of five in one constraint would not necessarily be equal in magnitude to a value of five in another).
- To ensure ease of incorporation into the subsequent multi-criteria assessment undertaken as part of the economic analysis.

To ensure weightings were not biased by individuals all weightings were agreed upon by Cardno team members from the various disciplines relevant to the corridor selection (engineering, transport planning and environment).

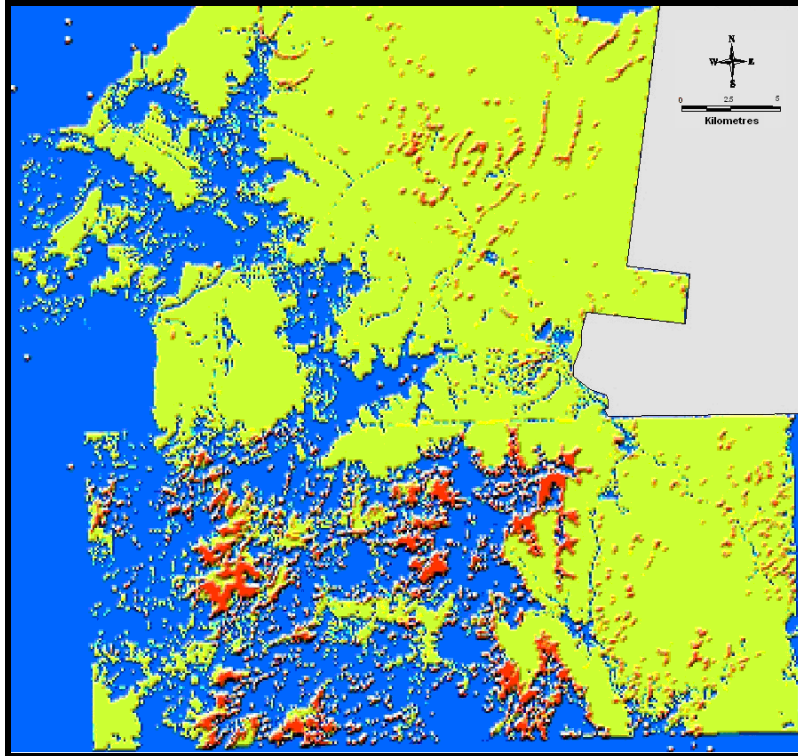
The majority of the constraints were observed to be generally polar in nature having an either a minimal or maximal effect. For example the cost involved in passing through land owned by the ADF would be minimal (ie a value of one) for all grid points located outside ADF land and maximal for all grid points within ADF land (ie a value of five). In contrast, some constraints had a greater scale of impacts. For example, the impacts of road noise on a residence may be minimal at a distance of 10 kilometres (ie a value of one), intermediate at 500m (ie a value of three) and maximal within 100m (ie a value of five).

Thus a spatial map of the study area showing subjective ‘cost’ relief was able to be created for each environmental constraint derived from the grids and their assigned ranked values (eg Figure 10.1, Figure 10.2).

Not all constraints identified in Section 9 were incorporated into the gridding and ranking process as they were seen to be either incorporated into the grid value of another constraint (eg Water quality and catchments were seen to be incorporated within Watercourses and dams), or were considered to be factors that do not significantly directly constrain the

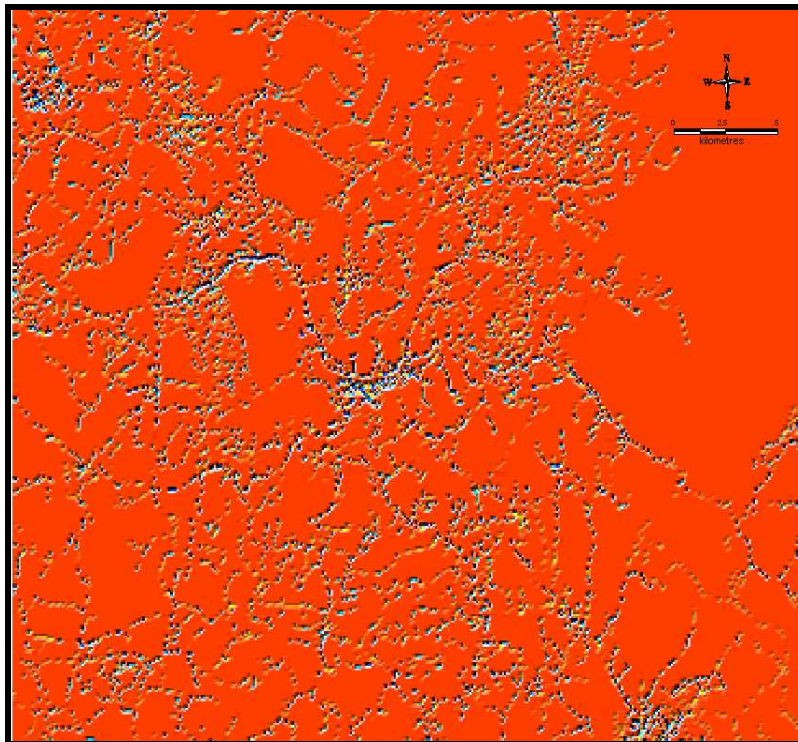
construction and operation of a major road (eg Geology and soils) and more related to engineering design and construction issues. Table 10.1 lists the final 19 constraints incorporated and the rankings adopted.

Figure 10.1 Spatial ecology constraints



(blue = lower 'cost', red = higher 'cost')

Figure 10.2 Topographic existing road constraints



(blue = lower 'cost', red = higher 'cost')

Table 10.1 Environmental constraints and ranking system

Category	Constraint	Ranking System
Financial impacts	Slope (topography)	1 = 0–4 per cent slope 2 = 4–8 per cent slope 3 = 8–12 per cent slope 4 = 12–16 per cent slope 5 = 16–20 per cent slope *10 = > 20 per cent slope
	Watercourses and dams	1 = Crossing of a watercourse not required 5 = Crossing of a watercourse required
	Existing roads	1 = Major road 2 = Sealed road 3 = Path or fire trail 5 = Non-road surfaces
Social impacts	Aboriginal heritage	1 = Not within Aboriginal likelihood area 3 = Within Aboriginal likelihood area 5 = < 100 m of known heritage object
	Non-Aboriginal heritage	1 = > 100 m of known heritage object 5 = < 100 m of known heritage object
	Residence location	1 = > 500 m from residence 3 = > 100 m for residence and < 500 m from residence 5 = < 100 m from residence
	Commercial value	1 = City 2 = Major town 3 = Small town 5 = Rural
	Education facilities	1 = > 500 m from a school 5 = < 500 m from a school
	Social services	1 = < 100 m from a social service 5 = > 100 m from a social service
	Railways	1 = Rail crossing not required 5 = Rail crossing required
	Electrical transmission lines	1 = Power supply crossing not required 3 = Low voltage power supply (< 135 KV) crossing required 5 = High voltage (> 135 KV) power supply crossing required
	Native title claims	1 = Outside Native Title claim boundaries 5 = Within Native Title claim boundaries
	Major projects	1 = Outside major project boundaries 5 = Within major project boundaries
Natural resources	1 = Outside natural resource extraction areas 5 = Within natural resource extraction areas	

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Category	Constraint	Ranking System
	Defence land	1 = Outside ADF boundaries 5 = Within ADF boundaries
Environmental impacts	Parks and reserves	1 = Private land and other 2 = State Forest 5 = National Park
	Ecology	1 = Cleared and developed land 3 = Remnant vegetation 5 = within 100 m of known threatened species and endangered ecological communities
	Riparian corridors	1 = > 75 m from a watercourse 5 = < 75 m from a watercourse
	Mine subsidence	1 = Outside known mine subsidence compensation areas 5 = Within known mine subsidence compensation areas

**Due to the need to incorporate physical impossibilities within the program a value of 10 was ascribed to slope of greater than 20 per cent. In effect this increases the constraint weightings for slope as discussed in Section 12.*

As seen in Table 10.1 a total of 19 constraints were mapped, gridded and assigned values. Table 10.1 also demonstrates the grouping of these constraints into broader categories of financial impacts (direct financial costs/benefits calculable on a cost per square metre basis), social impacts (costs/benefits, either monetary or cultural, borne by specific parts of society), and environmental impacts (detrimental or positive impacts upon the natural environment). The categories were constructed so as to align with the process utilised in the triple bottom line multi-criteria economic assessment (Part 5).