

BEFORE THE BOARD OF INQUIRY

IN THE MATTER of the Resource Management Act
1991

AND

IN THE MATTER of applications for resource consent
and notices of requirement by
Transpower New Zealand Limited for
the North Island Grid Upgrade Project

**STATEMENT OF EVIDENCE OF GAVIN CRAIG LISTER FOR TRANSPOWER NEW
ZEALAND LIMITED
(Landscape / visual)**

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INTRODUCTION

Qualifications and experience

1. **MY** name is Gavin Craig Lister. I am a director of the Isthmus Group, a nationwide firm specialising in landscape architecture and urban design.
2. **MY** qualifications include a Post-Graduate Diploma in Landscape Architecture from Lincoln College, a Master of Urban Design degree from Sydney University, and a Bachelor of Arts degree from Auckland University. I am a Fellow of the New Zealand Institute of Landscape Architects.
3. I have been in practice for twenty years, during which time I have carried out a wide range of projects throughout New Zealand. My experience includes background landscape assessments for District Plan provisions and structure plans; large scale parks, city and town centre urban development projects; land development projects; and infrastructure projects. My experience regarding infrastructure projects includes highways and urban motorway projects; sewerage and stormwater reticulation; wind, hydro, thermal and geothermal generation projects; telecommunication projects; and low voltage overhead utilities. I have carried out landscape and visual assessments for a large number of projects, provided expert evidence to Council hearings and the Environment Court, and have acted as an Independent Hearings Commissioner. I have been a member or leader of teams receiving New Zealand Institute of Landscape Architects national awards on ten occasions.

Code of Conduct

4. I confirm that I have read and am familiar with the Code of Conduct for Expert Witnesses in the Environment Court Consolidated Practice Note (2006). I have approached the preparation of this evidence in the same way that I would for the Environment Court.
5. The evidence in my statement is within my area of expertise, except where I state that I am relying on the evidence of others. I have not omitted any matters that I am aware of that might change my evidence.

My involvement with the Upgrade Project

6. I was commissioned by Transpower New Zealand Limited (**Transpower**) in August 2004 as part of the MWH consultant team to provide landscape and visual input to the North Island Grid Upgrade Project (**Upgrade Project**). Initially the scope of work comprised the landscape and visual analysis leading to route identification for the proposed 400kV capable line. Subsequent work entailed input to detailed alignment of the line, recommended mitigation measures, and preparation of the assessment of landscape and visual effects as part of the documentation accompanying the Notices of Requirement (**NORs**).

Scope of evidence

7. **MY** evidence is structured as follows:
- (a) Upgrade Project description;
 - (b) Route identification:
 - (i) Methodology:
 - Baseline Assessment;
 - Landscape attributes;
 - Baseline visual factors;
 - ACRE route selection process;
 - (ii) Area phase;
 - (iii) Corridor phase;
 - (iv) Route 1 phase;
 - (v) Route 2 phase;
 - (vi) Easement phase;

(c) Landscape and visual effects:

(i) Methodology;

(ii) Landscape and visual effects by section:

- Pakuranga Substation;
- Otahuhu Substation;
- Proposed Brownhill Substation site;
- Whakamaru and proposed Whakamaru North Substations;

(iii) Overhead transmission line:

- Section 1: Whitford Valley;
- Section 2: Brookby Area;
- Section 3: Ardmore Basin;
- Section 4: Hunua Basin;
- Section 5: South of Hunua Township to South of Lyons Road;
- Section 6: South of Lyons Road to Kopuku;
- Section 7: Kopuku to Te Hoe;
- Section 8: Te Hoe to Flaxmill Road;
- Section 9: Flaxmill Road to Tauhei Road;
- Section 10: Tauhei Road to South of Wairama Rd;
- Section 11: South of Wairama Road to North of State Highway 1;
- Section 12: North of State Highway 1 to South of Waikato River;
- Section 13: South of Waikato River to Arapuni;
- Section 14: Arapuni to Wiltsdown Road;
- Section 15: Wiltsdown Road to Whakamaru North;

(d) Mitigation:

(i) Tower design;

(ii) Landscaping; and

- (e) Submissions.

UPGRADE PROJECT DESCRIPTION

8. **THE** Upgrade Project is described in the evidence of Mr Coad, Mr Noble, Mr Wildash and Mr Deller. By way of summary, the proposed 400kV capable line (**proposed line**) will comprise 429 towers over a distance of approximately 185km between Whakamaru North and a transition station/sub-station at Brownhill Road, on the outskirts of the Auckland urban area from where the line will go underground to Pakuranga and Otahuhu Substations. The concept design includes towers ranging between approximately 25m¹ and 70m in height with an average height of 60m and an average span between towers of approximately 437m. It will comprise a "double circuit" line - that is, each tower will have three cross-arms carrying a three phase circuit on each side. The conductors will be in a 'triplex' arrangement comprising 3 x 33.8mm diameter conductors bundled in a triangular section with spacers. Each triplex set will be connected to the tower arms by up to two insulator strings on suspension towers and three insulator strings on strain towers. Thinner earth-wires with diameter between approximately 14mm-20mm will be carried on smaller arms at the top of the towers.
9. **THE** towers will be taller, heavier in appearance, and more visually dominant than towers on existing lines in New Zealand. Perhaps the New Zealand example nearest in appearance to the proposed line is a section of the 220kV Huntly-Otahuhu (**HLY-OTA A**) line north of Runciman², which has relatively heavy towers averaging 45m high with a maximum height tower of approximately 58.3m at Morewa Place adjacent to the Southern Motorway at Takanini.³ The proposed line will be on average 15m higher than these towers, have wider arms, and a greater distance separating each arm.⁴
10. **THE** proposed line will be considerably larger than the existing ARI-PAK A line, the alignment of which is generally followed by the new alignment. The ARI-PAK A line will be removed prior to or at the time that the proposed line is

¹ Flat top tower on Brookby ridge.

² The line crosses Auckland's Southern Motorway at the Drury Interchange and roughly parallels the motorway north and south for some distance.

³ In other words the highest tower on this line is similar in height to the average tower on the proposed line

⁴ I am informed that as a result of design carried out as part of the alliance-tender process, the towers are likely to be more slender than illustrated in the NOR. In particular, I am informed the base of the towers are likely to be reduced by a factor of approximately 1/3.

constructed. The ARI-PAK A line is a 110kV line and comprises lattice towers typically 25m tall with an average span of approximately 320m.

11. **THE** northern terminus of the proposed line will comprise initially a Gas Insulated Switchgear (**GIS**) transition station and later GIS switching station on a site near the end of Brownhill Road, Manukau City, from where the line will transfer to 220kV underground cable to the Pakuranga and Otahuhu Substations. Provision has been made at the Brownhill Road site for a 400kV-220kV GIS substation in anticipation of the eventual increase in voltage of the line to 400kV.
12. **A** 220kV Air Insulated Switchgear (**AIS**) substation is proposed at Pakuranga Substation, in place of the existing 110kV substation. Modifications are also proposed within the existing Otahuhu Substation.
13. **THE** southern terminus of the proposed line will comprise a new AIS substation, "Whakamaru North", 700m north of the existing Whakamaru Substation with which it will be connected. Initially Whakamaru North will provide 220kV switching facilities only, and will be extended when the line is required to be operated at 400kV.
14. **FURTHER** details of the line, transition station and substations are provided in the relevant sections of my evidence dealing with landscape and visual effects.

ROUTE SELECTION

Methodology

15. **THE** route selection methodology was set out in my Methodology Report, September 2004.⁵ It was peer reviewed prior to finalisation by an experienced landscape practitioner and leading academic respectively as follows:

- (a) Mary Buckland, FNZILA, Director (at that time) LA4 Landscape Architects; and

⁵ Appendix 2 in the MWH Route Report (**Common Exhibits**)

(b) Professor Simon Swaffield, FNZILA, Group Leader, Landscape Architecture Group, Lincoln University.

16. **THE** methodology was tailored to the purpose of the project, to progressively determine a route best able to accommodate the proposed transmission line and satisfy the requirements of the RMA. In essence, the landscape was mapped into landscape units, each of which was assessed and ranked in terms of three attributes: "Natural Character", "Landscape Quality", and "Landscape Absorption Capability". (I describe these attributes further below at paragraph 33). This enabled landscape factors to be assessed as part of a multi-disciplinary assessment. The methodology also followed the ACRE model (Area, Corridor, Route, Easement) whereby the landscape was assessed at more detailed levels as alignments were narrowed down.

Baseline assessment

17. **AT** the start of the project, I carried out a preliminary inspection of existing transmission lines to analyse factors (such as distance, backdrop and intervening landscape) that influence their landscape and visual effects. I also assessed alignment characteristics that appeared to influence the degree to which transmission lines fitted in with their landscape settings.
18. **THIS** assessment informed the route selection process and subsequent assessment of Landscape and Visual Effects, although my understanding of the different factors was naturally refined during the course of the Upgrade Project. This was backed up by information gathered from literature on transmission lines, and later study trips to Portugal, Spain, Scotland and Australia, to inspect existing 400kV and 330kV lines.
19. **FACTORS** influencing the visual prominence of transmission lines include the following:

Factors Relating to the Transmission Line Itself

20. **TOWER Height:** Higher towers mean greater scale impacts and visibility. However, the visual effect is not a linear function of height. An increase in height does not necessarily increase the apparent scale of the tower by the same proportion. Towers have generic forms and proportions that remain

similar at different sizes. Towers are also often a different order of scale compared to other landscape elements such as trees or buildings. Scale becomes most apparent where there is an obvious reference such as an adjacent line of a different size. Where such references are not present, it is more difficult to perceive changes in scale. This was apparent, for instance, when I observed new 400kV lines in Portugal and Spain of similar scale to the towers proposed for the Upgrade Project.

21. **THERE** is also a visual trade-off between tower height and spacing. Lower tower heights can be achieved by closer spacing but at the cost (in visual terms) of greater numbers of towers.⁶
22. **TOWER Weight:** The weight or "solidness" of a tower has a significant influence on visual prominence. Strain towers, most commonly used where there is a change in direction of the line, are more substantial in construction and therefore more prominent. Lighter weight towers (for instance suspension towers) tend to be less prominent and to fade more quickly with distance.
23. **TOWER Form:** Generally speaking, slender and well proportioned forms have less visual impact than squat and poorly proportioned towers. Appearance is influenced by the manner in which cross-arms and earth-peaks are designed and integrated into the tower body, and the extent to which the detailed lattice work is symmetrical and uncluttered. Flat-top towers are shorter, but multiply the number of lines and towers required because they carry only a single-phase compared to double-phase towers. Monopoles are more elegant and less visually cluttered than lattice towers. However, they tend to be more prominent over greater distances because of their larger solid dimension compared with lattice towers which tend to fade more quickly with distance to a faint grey colour, and can be more easily lost against a landscape backdrop. I discuss monopoles later in my evidence at paragraph 453.
24. **LINE Alignment:** Factors that tend to reduce visual prominence include straight alignments, and evenly spaced towers of similar height where the line is over

⁶ The ratio of Height to Span of Towers is discussed in George A Goultly (1990), 'Visual Amenity Aspects of High Voltage Transmission', ISBN 0 86380 093 9, pp 137-140. It outlines research based on surveys to identify the preferred trade-off between height and span, the options ranging between 8 x 110ft towers per mile, to 4 x 182ft towers per mile. (i.e 5 x 33.5m towers per km (200m spans) to 2.4 x 55.5m towers per km (420m spans)). The survey was carried out amongst public and professional groups including engineers, accountants and landscape architects. 83% of respondents favoured fewer numbers of taller towers (the 4 x 182ft tower option). However there was support for the other extreme amongst 27% of Landscape Architects, 20% of Civil Engineers and 45% of Accountants. It is noted that the survey was based on a simple elevation comparison rather than photomontages.

even terrain. Abrupt angles require more substantial towers, and zig-zags in a line create a more cluttered appearance that tends to draw the eye.

25. **NUMBER and Size of Conductors and Insulator Strings:** Visual prominence of conductors is a product of both thickness and number of conductors. Conductors are arranged in bundles of either one (simplex), two (duplex), three (triplex) or four (quad) conductors. My observation is that there is a significant increase in complexity of wirescape between triplex and quad arrangements, with less of a difference between duplex and triplex. The effect of increasing the number of conductors can be offset where thinner diameter conductors are used. The Upgrade Project will entail 33.8mm conductors in a triplex arrangement. The length and diameter of insulator strings also varies, for instance between 3m length for 220kV and 5m for 400kV. The number and colour of insulator strings needed on each cross-arm is also a significant element. Glass and grey or light coloured ceramic insulators tend to be less prominent than conventional brown ceramic insulators.

Factors Relating to Views of Transmission Lines

26. **THE** height of the towers and the length of the line mean its potential visibility necessarily extends over a wide area. However, the visual prominence of the lines will be mostly determined by distance from the line, the extent of trees in the intervening landscape, and a range of other contributing factors.
27. **DISTANCE:** The prominence of transmission lines decreases with increasing distance. Visual effects diminish in an exponential manner rather than a linear manner. They diminish due to several factors including decreasing scale, increasing relative field of view, and atmospheric perspective (the tendency for objects to fade in the distance, which is more pronounced with a lattice-type structure). The following table (**Table 1. Rule of Thumb Relationship of Prominence to Distance**) attempts to quantify this by "rule of thumb" although it is noted that other factors influence the prominence of transmission lines in different contexts.⁷

⁷ The distance rule of thumb appeared to be confirmed by a research paper that I became aware of recently. **R. Bruce Hull IV and Ian D. Bishop**, 'Scenic Impacts of Electricity Transmission Towers: The Influence of Landscape Type and Observer Distance', *Journal of Environmental Management* (1988) 27, 99-108. This paper was based on survey responses to photos of 500kV towers at various distances –although the height of the towers is not noted. The paper concludes: "The relationship between distance and scenic impact of transmission towers is concave up. Close to the tower, impact decreases rapidly as distance increases. Most of the scenic impact occurs in the 100m-1km range. The scenic impact observed at a distance of 500m is c.25% of the observed maximum impact. By 1000m, the level of impact is reduced to 10% of the maximum".

Table 1. Relationship of Prominence to Distance from Line – Rule of Thumb

Distance	Comments
0 – 150m	Towers are typically the most dominant element in views within this distance.
150m – 500m	The transmission line can appear large and dominant.
500m – 1km	The transmission line is likely to still be prominent, but tends to be in the middle-distance and part of a broader landscape.
1km – 3 km	Effects are noticeably diminished after about 1km unless the towers are in a prominent skyline location.
>3 km	The transmission line tends to appear in the background as a distant feature, becoming faint grey in most light conditions, or difficult to make out if seen against a landscape backdrop.

28. **SCREENING** and *Foreground Complexity*: Vegetation and local topographic features can screen the transmission line. This effect generally increases in conjunction with increasing distance. In other words, the greater the distance the greater the chance there will be intervening screening objects. Even where a transmission line is not screened, a more complex foreground landscape (with trees and buildings for instance) tends to increase the sense of depth and separation, and create a more complex figure-ground relationship.
29. **BACKDROP**: Transmission lines are more prominent when silhouetted against the sky ("sky-lined") and less prominent when seen against a landscape backdrop ("back-clothed"), especially where the backdrop is textured, such as a tree covered hillside .
30. **LIGHT Conditions**: The prominence of transmission lines varies considerably depending on transient qualities of light and changing angle of view relative to light. Towers appear more prominent when backlit and seen against a light sky (for instance in views from the south in sunlight). On the other hand, towers can appear relatively light coloured and less prominent when looking in the

same direction as the sun, and similarly in the diffuse light of overcast conditions.

31. **ANGLE of View Relative to Alignment:** Transmission lines generally appear more prominent where the view is parallel to their alignment, and less prominent where the view is perpendicular to the alignment. For instance, a line will appear more solid and foreshortened if one is looking along a row of towers, rather than looking at right angles across the alignment with just one or two towers within a field of view. In particular, a line crossing a road at right angles is less obtrusive than a line paralleling a road (in which case, the view is parallel and the duration of the view also extended).

32. **ALIGNMENT Relative to Landscape Patterns:** As discussed above in paragraph 24, straight lines and small angles are generally preferable visually. In my view it is also preferable for transmission lines to be aligned with broad scale landscape patterns, such as along large valleys or connecting spur ends along the foothills of a range of hills. However, aligning transmission lines along prominent landscape edges or lines can accentuate their prominence. Such edges that are likely to draw the eye include ridgelines, rivers or lake edges, and roads.

LANDSCAPE ATTRIBUTES

33. **DURING** the route selection process, the landscape was assessed in terms of three attributes:
 - (a) "Natural Character";
 - (b) "Landscape Quality"; and
 - (c) "Landscape Absorption Capability".

34. **EACH** attribute was assessed in terms of factors relating to physical, perceptual and associational⁸ dimensions of the landscape. I developed criteria to help assess each group of factors. The following table (**Table 2**.

⁸ By 'associational' is meant those aspects, values or meanings associated with a landscape such as historical associations, or value to tangata whenua. 'Perceptual' refers to those aspects related more particularly to sight and perception such as vividness, memorability, distinctiveness.

Landscape Attributes and Factors) illustrates how each of the three landscape attributes was considered in terms of the three groups of factors, with an outline of the criteria used. A fuller list of criteria is contained in the Methodology Report, September 2004.

Table 2. Landscape Attributes and Factors

		LANDSCAPE FACTORS ('DIMENSIONS')		
		<i>Physical</i>	<i>Perceptual</i>	<i>Associational</i>
ATTRIBUTES	Natural character	Intactness of natural topography Intactness of natural vegetation Absence of structures and infrastructure	Expressiveness of natural processes Visual dominance of natural features and patterns	'Naturalness meanings' (eg recognised by community through special status, community history and identity etc)
	Landscape quality	Intactness of natural features, patterns and processes	Coherence Vividness and memorability	Shared or recognised value Historical value Value to tangata whenua
	Absorption capability	Visibility	Nature of backdrop and foreground objects Relative scale Landscape complexity and geometry patterns	Sensitivity of viewing audience and anticipated responses in relation to context

35. **"NATURAL Character"** refers to the relative dominance of those things that are products of nature (natural landform, vegetation, wildlife) as opposed to human structures and infrastructure; and it refers to the extent to which natural

elements, patterns and processes are present. Natural character includes biophysical naturalness (eg the extent to which a natural ecosystem has been modified), and perceived naturalness (eg the extent to which natural components dominate the landscape's appearance). Both aspects are relevant, given that 'landscape' comprises both physical and perceptual dimensions.

36. **"LANDSCAPE Quality"** was assessed in terms of the range of factors listed in the "Pigeon Bay Criteria".⁹ The "corrected Pigeon Bay criteria" are listed in the first *Queenstown-Lakes* decision. The Court noted that the list is not frozen and may be improved with further use and understanding. It also noted that the "criteria" fall into those relating to the physical landscape and those relating to perceptual landscape, although some of them, such as historical associations and value to tangata whenua, might more precisely be regarded as meanings (or values) associated with the landscape. For those reasons, I grouped factors into three groups covering physical factors, perceptual factors, and associational factors. I considered this grouping organised the factors into a more open ended framework. I developed criteria to help assess these factors.
37. **"LANDSCAPE Absorption Capability"** as used for the Upgrade Project refers to the landscape's ability to absorb a transmission line of the type proposed. I organised factors relating to "*Landscape Absorption Capability*" into three groups (physical, perceptual and associational), as with natural character and landscape quality. Physical factors were measured against criteria such as visibility and the number of people affected¹⁰. Perceptual factors were measured against criteria such as figure-ground relationships (nature of backdrop, scale, complexity of landuse)¹¹. The third group of factors was measured against criteria such as the anticipated sensitivity of people to

⁹ The first *Queenstown-Lakes* Landscape decision (*Wakatipu Environmental Society v Queenstown-Lakes District Council* (C180/99)) discusses the definition of the term 'landscape' which is described as more than merely visual; that it is a broad subset of the environment; and that it is a concept that integrates a range of factors. It included a list of factors referred to as the '*corrected Pigeon Bay Criteria*' to be considered when assessing landscapes.

¹⁰ Visibility will be mostly controlled by the combination of distance and vegetation in the intervening landscape, rather than by theoretical line of sight (or inter-visibility).

¹¹ For instance, foreground objects increase the sense of depth in a landscape and can reduce the apparent prominence of a more distant object (as well as increasing the degree of screening). A transmission line will also be less prominent when seen against a landscape backdrop rather than the sky. Complex landscapes in which there is no readily-apprehensible structure or pattern, may absorb lines relatively easily without resulting in visual conflict.

transmission lines in different landscape settings¹². In this case, the following assumptions were made in relation to transmission lines:

- (a) Transmission lines are almost universally regarded as unattractive features that intrude on the character of natural, rural and urban landscapes.
- (b) Transmission lines will generally be regarded as more obtrusive in natural areas and those areas valued for scenic qualities, and less obtrusive in 'working landscapes' such as ordinary rural farmland, plantation forests, and industrial areas.
- (c) Residents are a more sensitive audience than people who see transmission lines in passing.
- (d) At the same time, transmission lines will generally be regarded as more obtrusive by the wider community when they impact on public viewpoints, such as main roads, important intersections, and settlements.

38. **"LANDSCAPE Absorption Capability"** is not to be equated with "Visual Absorption Capacity" (**VAC**) an attribute sometimes used to indicate the capacity of a landscape to visually absorb unspecified activities and usually a measure of such things as complexity and existing range of activities. "*Landscape Absorption Capability*" as used for the Upgrade Project is more focused. It relates specifically to the ability of the landscape to accommodate a transmission line of the type proposed.

39. **AS** discussed, criteria were selected to help assess factors for each of "Natural Character", "Landscape Quality", and "Landscape Absorption Capability". Criteria were used in the manner of a tool to assist analysis of each of these "attributes" but they were not used in a formulaic or mathematical manner. "Scores" were given only at "attribute" level. I acknowledge that it is problematic to reduce a multi-dimensional concept, such as landscapes to numerical "scores" and that it is necessary to maintain a critical view toward such exercises. However, landscapes did need to be

¹² This mirrors visual assessment practice in which the nature of the audience ('visual receptors') is identified and a judgement made about its 'sensitivity'.

compared against each other for the purpose of selecting an alignment, and such "scoring" assisted that process.

ROUTE IDENTIFICATION: ACRE PROCESS

40. **THE** route selection followed the ACRE process, which in summary involved the sifting of alignments at progressively finer scales – namely Area, Corridor, Route and Easement stages. Ms Allan describes this process in her evidence. In summary, during the first three phases the landscape and visual input comprised assessment of landscape attributes "*Natural Character*", "*Landscape Quality*", and "*Landscape Absorption Capability*" in conjunction with other factors in a multi-criteria analysis described in Ms Allan's evidence. Landscape and visual analysis was recorded in the following reports:

Table 3, Landscape and Visual Reports¹³

Landscape and Visual	Methodology	September 2004
Landscape and Visual	Area Report	September 2004
Landscape and Visual	Corridor Report	September 2004
Landscape and Visual	Route 1 Report	October 2004
Landscape and Visual	Route 2 Report	April 2005

Area Phase¹⁴

41. **THE** "Area" phase comprised an overview of the land between Whakamaru and Auckland. Its purpose was to identify both regional features to be avoided, and broad potential corridors, for further investigation.

Description of regional landscape features

42. **IN** simplest terms, the study "Area" has a pattern consisting of parallel bands of hill country and valleys as follows: West Waikato Hills; Waikato Valley; Central Waikato Hills; Waihou Valley; and Kaimai Ranges.

¹³ These reports became appendices to the MWH reports, provided as **Common Exhibits**.

¹⁴ Outlined in Landscape and Visual Report, Area Phase, September 2004, **Common Exhibits**.

Waihou Valley

43. **THE** Waihou Valley is strongly defined on its eastern side by the Kaimai escarpment, which forms a striking skyline of which the focal point is Mount Te Aroha, on its eastern edge. The Waihou River follows the base of the escarpment, and the towns of Te Aroha, Paeroa and Thames are nestled at the toe of the escarpment. The western edge of the valley is formed by the Harawera Hills, Hapuakohe Hills, and Maungakawa-Te Tapui-Ruru Hills. State highway 27 (**SH27**) follows the western edge of the valley. The upper valley near Matamata and Tirau has a closely settled and well-treed character. The lower valley is more open and characterised by grids of drainage channels, but also contains the Kopuatai peat dome, which is regarded as the only significant unaltered peat dome of its type in New Zealand.¹⁵

Waikato Valley

44. **THE** Waikato Valley has upper and lower basins separated by the Hakikarimata – Taupiri Range, which forms a sharp escarpment and backdrop. The Waikato River, State highway 1 (**SH1**), and the North Island Main Trunk (**NIMT**) railway, are all channelled through the Taupiri Gorge. Taupiri Mountain at the entrance to the gorge is a distinctive landmark of particular significance to Tainui.
45. **THE** upper Waikato Basin has an established and manicured character, with a picturesque quality of pasture, hedgerows and large trees, a close pattern of settlement, and country towns. The lower Waikato Basin is low lying, contains shallow lakes and peat swamps, is relatively sparsely settled apart from the industrial township of Huntly, and includes prominent industrial features such as coal mines and the Huntly Power Station.
46. **NATURAL** and cultural features are organised in a more central pattern compared with the Waihou Valley. The Waikato River, SH1, and the NIMT railway, run across the middle of the basins, with Hamilton providing a central focus for the Upper Waikato Basin.

¹⁵ Identified as a wetland of international significance under the 'RAMSAR' convention.

Central Hills

47. A band of hills approximately 15km wide separates the Waihou and Waikato Valleys. They are more pronounced in the north where they rise to around 500m above sea level (**ASL**) in the Hapuakohe Range, the upper slopes of which are steep and bush-clad. South of Morrinsville, the hills are more subdued, although still reasonably steep, with pastoral character. There are two gaps, at Piarere and near Morrinsville, connecting the Waihou Valley with the Waikato Valley – both of which are former courses of the Waikato River.

Western Hills

48. A band of hill country 20km–25km wide separates the Waikato Valley from the Tasman coast. This area is formed from a mix of largely sedimentary rock types, with a complex drainage pattern. The area is mostly pastoral farming, with areas of pine plantation, and is relatively sparsely settled.

Mangatawhiri Escarpment

49. **THE** Mangatawhiri Escarpment is a prominent east-west feature that cuts across the pattern of north-south valleys and hills. The escarpment follows a fault-line between Port Waikato and Kaiua and is traced by the lower reaches of the Waikato River, the Maramarua Valley and State highway 2 (**SH2**). It forms a boundary between Waikato and Auckland.
50. **THERE** are a number of landmark features in the Waikato, in addition to those mentioned above. Maungatautari and Pirongia are prominent bush clad volcanic cones south of Cambridge, and there are several smaller volcanic cones south of Te Awamutu. Karioi provides a landmark at the entrance to Raglan Harbour on the west coast.
51. **NORTH** of the Mangatawhiri Escarpment, the most prominent regional features are the Manukau Harbour and the Hunua Ranges, which is an extensive area of bush-clad steep hill country.

Landscape units

52. **LANDMARK** features that I identified at the "Area" Phase as features to avoid included Mount Te Aroha, Taupiri Mountain and Gorge, Mount Pirongia, and Maungatautari.
53. **LINEAR** features at an "Area" scale that the line should avoid paralleling included the Waikato, Waihou, and Waipa Rivers, SH1 and SH27, regional ridgelines such as the Hapuakohe Range, the Hakarimata Range ridgeline on the western side of the upper Waikato Basin, the Maungakawa-Te Tapui-Ruru ridgeline, the Kaimai Escarpment, and the Maungatawhiri Escarpment.
54. **THE** study "Area" was divided into 36 broad landscape units and 125 sub-units which were assessed in terms of the attributes "*Natural Character*", "*Landscape Quality*" and "*Landscape Absorption Capability*". It was acknowledged that at such a scale there is variability within landscape units.
55. **EXTENSIVE** areas of high natural character and high landscape quality identified as areas to avoid included the Kaimai Range, upper eastern slopes of Hapuakohe Range, Hakarimata Range, Mount Pirongia, Maungatautari and the Hunua Ranges.
56. **THE** study also identified areas better able to accommodate a line (higher Landscape Absorption Capability) including areas in the West Waikato Hills, Central Waikato Hills, a 3km-5km band in the central part of the Waihou Valley, and the plantation landscape west of Tokoroa.
57. **WHEN** viewed in terms of the need to achieve a continuous north-south alignment, the eastern Waihou Valley/Kaimai Ranges and the Waikato Valley were discarded and three preliminary corridors selected for closer assessment: West Waikato Hills, Central Waikato Hills and part of the Waihou Valley. These broad alternative corridors were identified, each of which comprised a braided pattern (**Common Exhibits**).

Corridor Phase¹⁶

58. **THE** "Corridor" phase consisted of refining the preliminary corridors and then comparing them in order to identify a preferred corridor for further investigation.
59. **LANDSCAPE** units were assessed using the same factors used at the "Area" phase: Natural Character, Landscape Quality, and Landscape Absorption Capability. In essence, the objective was to identify connected corridors with lower natural character/landscape quality and higher landscape absorption capability.
60. I considered the eastern corridor following the Waihou Valley less preferable in landscape and visual terms, because of reasonably high landscape quality and low landscape absorption capability.
61. **BRANCHES** within the western corridor through the West Waikato Hills (west of Huntly), were considered more favourable because of modest natural character and landscape quality and relatively high landscape absorption capability. However branches crossing Pureora Forest and the lowland basin between Hamilton and Mount Pirongia were considered less favourable: the former area has high natural character and high landscape quality. The latter area has moderate landscape quality but low landscape absorption capability.
62. **IN** the southern part of the central corridor, branches in the vicinity of Maungatautari, the Waikato River and the volcanic hills east of Cambridge (Ruru, Te Tapui, Maungakawa) were considered less favourable while the branch on the east side of the Waikato River was considered more favourable. Between Morrinsville and the Maramarua valley, it was considered two branches were more favourable, one on the eastern foothills of the Hapuakohe Range and one in the Waiterimu-Taniwha-Kopuku valley on the west side of the range, while a branch through the lower Waikato Basin parallel to SH1 was considered less favourable. North of the Maramarua valley a branch around the eastern perimeter of the Hunua Ranges was considered less favourable for landscape quality and landscape absorption capability reasons, including the fact it crossed sections of Regional Park connecting the Hunua Ranges with the coast, while the western branch following the valley on the

¹⁶ Outlined in Landscape and Visual Report, Corridor Phase, September 2004.

