Business Land Requirements Review
Western Bay of Plenty

REPORT TO SMART GROWTH

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Summary

Objective

This report has been commissioned to examine the way ahead in the provision of business land for the Western Bay of Plenty in light of discrepancies in analyses of demand. The objective was to resolve or reconcile these conflicts and comment on:

- The appropriate density assumptions for projecting business land needs;
- The key land requirements and staging implications for the region;
- Changes in the nature of business growth and their impact on footprint requirements (site and building densities);
- The types of business that might be expected to favour different localities and sites;
- Possible monitoring provisions.

Projecting Business Land Densities

An analysis of how employment projections are converted into land needs demonstrates variability among sectors, over time, and between places. There are significant issues of interpretation and definition.

The following broad observations can be made:

- Centres-based employment tends to be at a greater density than business land employment;
- Industrial uses tend to have lower densities than office uses;
- Warehouse uses vary from very low density distribution centres with substantial provision for truck movement, through to manufacturing-like densities in general warehouses.
- Retail densities tend to fall between industrial and office uses;
- Retail densities differ substantially between bulk retailing and main street retailing;
- The evidence on density changes is not conclusive: under some circumstances industrial and storage employment densities will diminish. Under others, they will increase;
- Floor Area Ratios are variable, but tend to be lower for industrial uses, moderate for warehousing and retailing, and high for office use.

Drawing on several sources (from Australia, Canada, the United Kingdom, and the United States) and some analysis of evidence from northern North Island regions, the following broad guidelines are proposed:

	Industrial and Warehouse			Office			Retail		
	High	Low	Mid	High	Low	Mid	High	Low	Mid
Employees/Ha (Gross)	40	20	30	210	60	135	180	90	135
Employees/Ha (Useable)	60	30	45	300	100	200	260	150	205

(Rounding has been applied to ensure that the densities are treated as generalised guidelines rather than precise predictors).

Densities may move in different ways in the future. Greater capital intensity (more capital in the form of plant and equipment relative to employment) may reduce densities through its impact on occupancy. Higher environmental and amenity standards may reduce densities through impacts on Floor Area Ratios (FARs) and site coverage. Increasing automation in handling may increase building floor space per employee, while reducing FARs. Land shortages and limits to land use expansion may increase densities. Densities increase as land becomes more valuable, usually by shifting towards higher value uses with greater capacity to absorb higher rents. This implies displacement of lower density activities to fringe localities where reduced accessibility is associated with lower rents.

These examples illustrate the uncertainty of density assumptions for land forecasts. They also indicate how management of densities may be treated as a land use tool. However, even this is contradictory. While planning for increased densities may be one way of modifying trip making to counter the externalities associated with automobile use, lowering them may be associated with reducing the adverse environmental impacts of industry and improving the amenity environment.

The judicious use of standards and design rules is likely to be more effective than attempting to manipulate densities and thereby intervene in the investment processes of individual businesses. This can be done within a general envelope of density provision (given effect through planning rules), which need not be so coercive as to over-ride the range of influences that determine densities.

Reconciling Business Land Projections

Separate analyses of regional business land demand by Market Economics (the Tauriko and the SmartGrowth reports) differ on several grounds:

- The Tauriko report based land demand forecasts on estimates of labour supply, driven by household projections. The SmartGrowth report adapted a forecast of labour demand and (implicitly) a model that dealt with investment by sector.
- Tauriko was not concerned with detailed land allocation among centres and zones, but with the total volume of business land required. It did, however, analyse staging.
- Tauriko suggested that densities would decline due to changes in the nature of business. SmartGrowth suggested that employment densities would increase.

Business Land Supply: According to the Tauriko Report potential useable land for business (industrial) expansion includes Rangiuru (150 usable hectares), Papamoa East (150ha) and Tauriko (180ha), plus smaller blocks at Te Puke and Omokoroa and some vacant land in current zonings. These figures were refined in the SmartGrowth report, and suggest around 568ha currently available, including existing vacant, Omokoroa and Te Puke land. This is probably the best current estimate.

Business Land Demand: The different methodologies and information in the two reports make the resulting figures difficult to reconcile. However, the outcome appears to be a significant difference in projected demand for business land from 2005 to 2021 between them:

- Tauriko Report 324ha, 20ha/year
- SmartGrowth Report High Demand Scenario 250-260ha, 17ha/year
- SmartGrowth Report Medium Demand Scenario 150-160ha, ha/year
- SmartGrowth Report Low Demand Scenario 85-95ha, 6ha/year

An analysis undertaken for the current report based on the share of building consents issued for factories and warehouses in the wider Bay of Plenty Region from 2000 to 2004 suggests that recent demand was comfortably ahead of the highest of these projections, at around 23ha per year for factories and warehouses alone.

Impact of Assumptions

Assumptions are clearly critical to planning the supply of business land, as illustrated through reference to Market Economics' SmartGrowth report.

The underlying employment projections (sourced from NZIER) appear already to be well behind outcomes. The figure projected for 2006 was 51,920 employees, whereas the actual figure in 2005 was already 4% higher, at 53,980. Put another way, the forecast in 2005 was already over two years behind.

If growth rates are also adjusted to reflect recent growth momentum and to allow for a gradual reduction in growth rather than a sharp contraction, forecast demand for land is substantially greater. This has been illustrated by a projecting falling growth that gives rise to a compound rate of 3.4% from 2004 to 2021 (well below the 6.6% of the past five years), compared with 2.1% in the Market Economics report.

Under the higher growth assumptions and at a density of 20 employees/ha, demand could easily meet or exceed the total business land bank identified by 2021, earlier if, as seems likely, densities are lower than 20 employees/hectare. Under the modified growth projections and using the Market Economics moderate demand scenario as a basis for allocation, additional land needs could be as high as 690 ha in 2021.

Implications

This review reveals considerable uncertainty over the employment projections and land use densities used to drive estimates of demand. These uncertainties are endemic in land use planning. The risk is that detailed analysis and precise projection locks policy making into too narrow a band of possibilities, in part by inferring more precision than justified by the data, and in part by inferring greater knowledge of drivers and outcomes than is possible.

Under these circumstances, the analyses to date can be treated as a way of systematically considering and ordering the sorts of events and conditions that might influence outcomes. They can be used to highlight critical issues and interdependencies. They can be used to illustrate the impact of policy decisions.

In this regard, the following general conclusions drawing from the Market Economics SmartGrowth report and the current analysis may be helpful:

1. Strong household growth in the Bay of Plenty will help to sustain an existing hierarchy of centres geared towards final and especially household demand. As a result centres will expand and densities increase. This may in turn force some lower value added activities (including manufacturing and storage) to decentralise, increasing the demand for suburban, peripheral and satellite land.
2. A deepening economy is likely as a result of: growing economies of scale and scope; a focus on the wealth generating capacity of specialist sectors (horticulture and related activities feature strongly in regional thinking), the growing influence of the port; and the growing integration of the Bay of Plenty into a wider northern North Island economy.
3. The nature of activities involved in "deepening" the economy, especially those dependent on comparative advantage and external demand, will have different location requirements from those that prevail at present. Many will require large sites, ready highway access, and even rail access. Technology changes affecting automation, handling, distribution and the blurring of the edges between production and distribution in the logistics sector will influence the nature of demand. These tendencies point to lower rather than higher densities in new business areas.
4. Encouraging the outcomes sought by SmartEconomy will require an adequate release of industrial land to ensure that investors have a good array of options for new sites.

The volume of land required, from both analytical and developmental points of view, may be substantially more than suggested in the reports reviewed. Maintaining growth close to (but below) recent rates and assuming that densities early in the period are modest suggests that planning should be aiming at 600-800ha through to the mid-or late 2020s, or in excess of 30ha per year.

Demand will not be evenly spread over this period, however, nor will staging be predictable. Therefore, a liberal approach may be required, focused on releasing capacity, identifying and enforcing appropriate environmental standards, and defining transparent processes for consenting and bringing land to market.

Such an approach does not depend on picking which parcel should be released first, but focuses on the total range of opportunities and allowing the market to reflect the different site and location preferences of diverse investors, subject to environmental needs and infrastructure provision.

From a developmental point of view, more is better, and early preferable to late release. The cost of holding land that may be prematurely released can be carried by the private sector, as can a large share of the infrastructure costs through development or financial contribution provisions and other methods (including public-private partnerships).

Conclusions

The ideal resource management response may to determine a generous long term target for land supply, identify likely and favoured localities, clarify the environmental and infrastructural expectations associated with development, and establish clear and reasonable criteria to encourage investors to bring the land to the market in an efficient manner.

This approach would not require resolution of the unresolveable (what densities and when?), nor require prediction of the unpredictable (what employment and where?).

Rather, it establishes parameters for development, qualifies them with community-based expectations for environmental and economic performance, and adapts a flexible approach to the release of suitable land. An acknowledgement of demand for business land of perhaps 800ha for the next 25 years, or some similarly general figure, may be the best starting point. Identifying the areas it may come from and the preferred character of development from a resource management point of view and determining guidelines for processing it to market is more constructive than seeking to determine with ever greater refinement what parcel should be released when.

1 The Report

1.1 Purpose

This report has been commissioned to examine the way ahead in the provision of business land for Western Bay of Plenty. It was commissioned in light of apparent discrepancies regarding business land demand among three pieces of relevant work:

- Papamoa East Business Land Analysis (May 2002), Hames Sharley
- Business Land Location and Demand Study, (September 2005 and updated versions), Draft Final Report, prepared for Smart Growth, Market Economics
- Tauriko Plan Change -- Economic Issues Paper (June 2005) Market Economics, prepared for IMF Westland Ltd

These reports give rise to apparently conflicting conclusions about the demand for business land in the Western Bay of Plenty-Tauranga areas that make up the SmartGrowth region. The objective of the current study was to resolve or reconcile these conflicts and identify the most appropriate analysis for the purpose of advancing the SmartGrowth project.

A preliminary review led to additional requirements, including:

- The appropriate density assumptions for projecting business land needs;
- The key business land requirements and staging implications for the region;
- Changes in the nature of business growth and their impact on footprint requirements (site and building densities);
- The types of business that might be expected to favour different localities and sites;
- Possible monitoring provisions.

The current report is based on data sourced from the above reports. Those reports, in turn, are presumed to be based on the best data and methods available to the authors at the time of preparation. Sources and methods have not been discussed with authors, who have not had the opportunity to respond to the interpretations of their work described here.

1.2 Outline

Section 2 sets out an approach to calculating business land requirements. It surveys a number of sources to identify typical employment density, floor space and site requirements, how they interact, and how they vary by locality and by activity.

Section 3 examines the three reports identified above, the methods and assumptions indicated within them, the results derived, and the extent to which results are influenced by the methods used. Section 4 proposes a way forward for SmartGrowth.

2 Estimating Future Business Land Needs

There are two key steps for estimating business land needs, both involving a number of forecasts and assumptions. The first is estimating future labour demand and the second is converting it into a projection of additional land requirements. This section describes these two steps and the respective drivers and assumptions.

2.1 Labour Demand

Employment demand is normally projected as a function of forecast economic activity in an area. The demand for business land can then be projected as a function of future employment numbers and employment densities.

However, the demand for business land is sometimes projected as a function of the labour supply in an area, which is, in turn, associated with population growth. The implicit assumption in the second approach is that labour demand will expand to meet labour supply, without undue impact on unemployment levels.

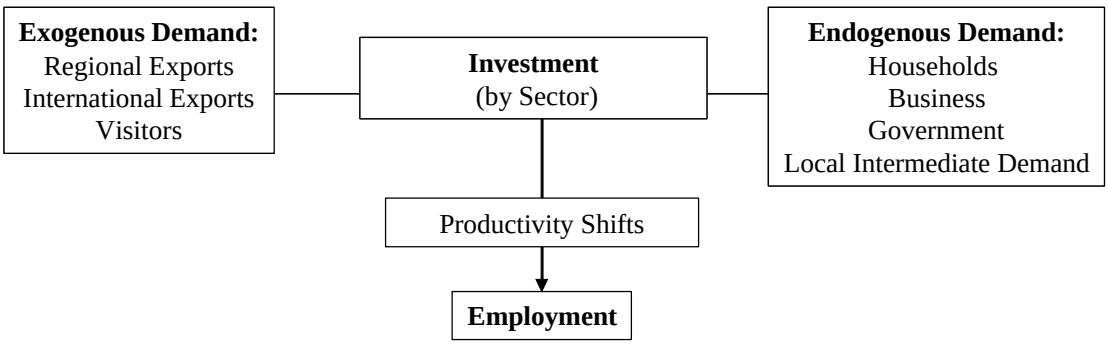
The assumption that there will be no "undue impact" on unemployment (that demand will rise to satisfy supply) is a critical one for planning purposes. If expansion of supply ahead of demand leads to increased unemployment, inward migration might be discouraged or even outward migration encouraged, changing the forecast population outcomes.

Equally, demand expanding ahead of supply, reflecting the investment appeal of a region for example, may boost inward migration and suppress outward migration. Either way, the interaction between labour supply, migration, and labour demand calls for analysis that considers demand and supply, perhaps a range of forecasts and flexibility of policy.

1.1.1 Demand Driven Growth

Demand may be endogenous (locally-driven) or exogenous (dependent on demand external to the region). Exogenous demand reflects the inter-regional and international export of goods and services, and spending by visitors. It depends on the degree of specialisation and comparative advantage through which a region might compete in particular sectors, nationally or internationally.

Figure 1: Determinants of Employment



Endogenous demand reflects population, household, and income growth. These reflect local population composition and demographic ageing. They may also reflect the attractiveness of a region as a residential and working environment. Endogenous demand also results from spending by local government, and from intermediate demand by local businesses (i.e., purchasing inputs from regional suppliers).

The market conditions affecting business location preferences generally differ across this division, so that externally-dependent and internally-dependent organisations may grow at different rates and have different location patterns within a region.

There is a connection between the two sectors, though. Strong export activity will increase the demand for intermediate goods and services from local suppliers, and should increase the income available to be spent (largely by households) on final demand goods and services in the region.

1.2.1 Investment

Increasing demand for goods and services generates investment to achieve the increased output necessary to satisfy it (unless there is substantial unused capacity in an area). The investment influences productivity and employment generation. More capital intensive investment generates less employment per unit of output. Put another way, employment productivity increases as capital substitutes for labour.

Investment eventually creates demand for additional floorspace and business land to accommodate it. Floorspace is generally estimated on a floor area per employee basis. The precise requirement for new capacity and floorspace is influenced by the mix of labour and capital (plant and buildings), which vary across sectors. It also varies over time through productivity shifts. All else being equal, as productivity improves, the ratio of land per employee will increase, as fewer people are required to produce a given quantum of output.

At a regional level, shifts in productivity (labour per unit of output) and floorspace density depend on the shares of investment among different sectors. Space extensive sectors (typically processing and manufacturing, storage and transport) require more land per employee than offices and administration. Some sectors will fall between these two extremes, including retailing and education, for example.

1.3.1 Demand for Land

Expanding floorspace generates a demand for additional land, moderated by subdivision and design standards varying among sectors and areas.

There are thus several variables to project and assumptions to make to estimate the business land required for a given increment in employment.

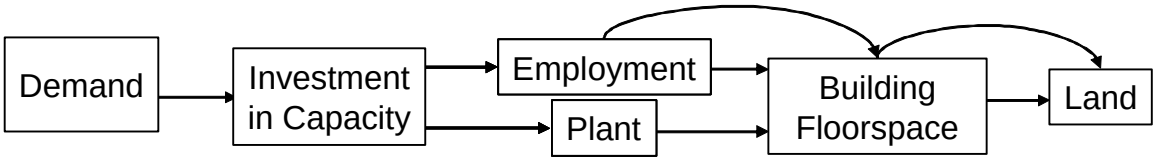
(1) Economic growth and contraction in response to changing demand and competition, usually forecast by business sector;

(2) Productivity shifts, including the adoption of technology within sectors, and its impact on labour and space demand;

(3) Differences in planning and design standards for business land.

Given the uncertainty associated with projecting several variables for different sectors, the analyses used tend to be simplified, moving from employment projections through ratios of employment density and site coverage (curved arrows, Figure 2).

Figure 2: Projecting Business Land Demand

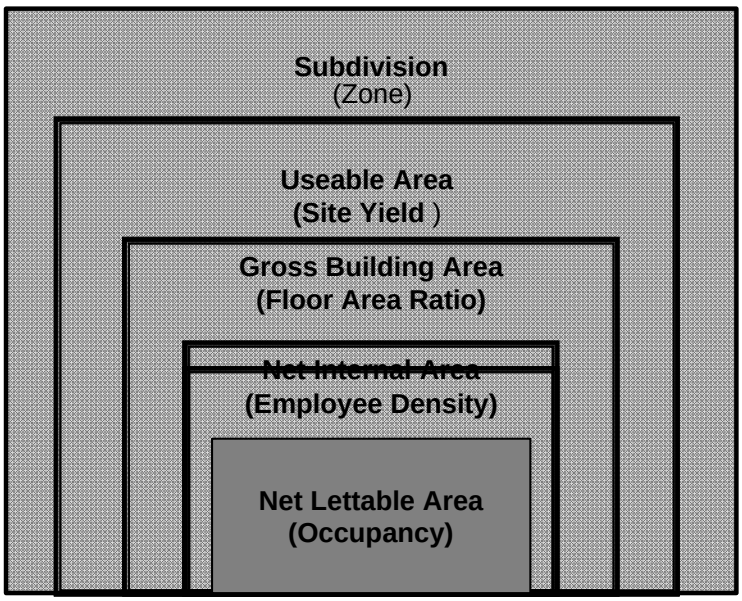


The transition from employment projections to forecasts of land requirements is "unbundled" further using a variety of ratios (Figure 3). The first reflects the technology employed in the particular sector which determines the intensity of employment within buildings – employment density. This equates to the size of building required for a given number of employees, the gross building area.

The area of buildings required gives rise to demand for sites or lots, determined through the Floor Area Ratio: building size to site size.

Finally, to estimate the local, district or regional land requirement associated with a given number of employees, the relationship between lots and zone or subdivision area is calculated, allowing for roads, utilities, and public space needs. For example, sites (or useable area) may be limited to two thirds of the land required to be committed to the use.

Figure 3: Building Blocks of Demand for Business Land



Different parties may be interested in different components of the underlying land demand equation (Figure 3). At the lowest level of resolution, the developer is concerned with the yield that can be extracted from a development in terms of total site area available after allowance for roads, reserves and other infrastructure and amenity requirements.

The yield will reflect local planning and subdivision rules, land suitability, environmental constraints and design choices.

The sum of the lots available once infrastructure and amenities are provided for is equivalent to Market Economics' "useable area" (Business Land Location and Demand Study, page 34, see below)

Within individual lots, planning rules will generally set maximum site coverage to give a maximum gross building area. This is influenced both by the share of the site that may be built upon (the footprint) and the height or number of storeys allowed. With multi-storey buildings the Floor Area Ratio may exceed 1 (i.e., the floorspace exceeds site size). This is most common in commercial areas with multi-story offices and hotels, where the ratio may be 1:4, for example.

Within a particular zone and its bulk and height restrictions, a low FAR will yield less building area than a high FAR. A higher FAR is generally associated with service and office activities; a lower FAR is with industrial and storage activities (which do not lend themselves to multi-storey development).

The FAR is more important to an understanding of the employment capacity of land than the footprint alone. At the same time, variations in the FAR allowed for in different planning zones may reflects expectations of key differences in space utilisation among different sectors as well as differing environmental standards.

The footprint and FAR are generally measured on the basis of gross building floor area for planning purposes. A building's net internal area is smaller, denoting workspace available. Workspace omits outbuildings, parking, plant rooms, and lifts. It does not distinguish between part-time and full-time employees,

The net lettable area is usually lower again, and is of more concern to owners and managers. It deducts from the net internal area common entries, toilets and the like. For offices, gross area may be 15-20% higher than net lettable space. For multi-occupancy buildings, even more space may be allocated to shared or common areas, further reducing the ratio of lettable area to net internal area or to gross building area.

Ideally, employment ratios will be applied to net internal area. In practice, differentiating between gross floorspace and net internal area is difficult. For planning, the ratio of employees to gross building area is sufficient.

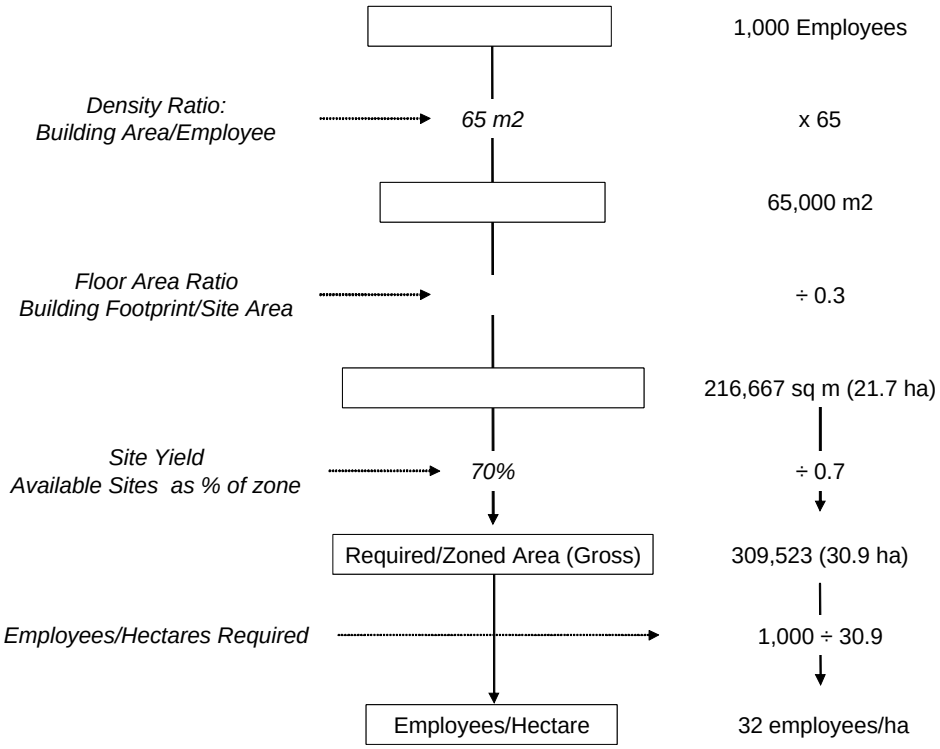
Application of the ratios outlined is illustrated in Figure 4 assuming that 1,000 employees need to be accommodated. Predicting the associated land requirements means identifying and applying ratios appropriate to the employment sector. The ratios used for illustration have been derived as reasonable guidelines for a low density business park from a survey of evidence and examples described below.

At a gross building occupancy or density of 65 m^2/employee, the 1,000 employees proposed for this example require 65,000 m^2 of floorspace. At a FAR of 0.3 (i.e., 30% of the site is committed to buildings), this translates into around 216,670 m^2 of site area (or 21.7 hectares). Given that, say, 30% of the available zone is committed to roads and utilities,

the gross area required to house 1,000 employees is increased by 9.2 ha to a total of 30.9 ha across the whole zone.

Dividing the original 1,000 employees by 30.9 ha indicates a final employment density of 32 employees per hectare. If the underlying assumptions are accepted, this suggests that for Business Parks, a ratio of 32 employees per hectare can be used for estimating land requirements.

Figure 4: Estimating Floorspace and Site Area Requirements



Given this methodology, the challenge is how to determine the most appropriate floorspace and site coverage ratios to apply to forecasts of future employment.

Short of extensive measurement and survey, the best way to do this is to review evidence from similar analyses. Indeed, even if local measurement is undertaken, evidence from elsewhere is useful for verification and for establishing how stable or representative an observed ratio is. The following section reviews analyses across a range of settings to try to identify useful representative ratios.

3 Employment Densities – the Evidence

3.1 United Kingdom

The UK appears to provide the most systematic, readily available sources.

Industrial Employment Densities

In 1999, Thompson reported the results of a long-running survey into industrial and warehouse employment densities (and the results of some other authors' work). [1] He cited McKinnon and Pratt (1984), for example, who suggested representative employment densities of 366 sq ft per worker industrial and 519 sq ft in warehousing. However, these were net building areas and an additional 20% should be allowed to take them to a gross floor area density or occupancy rate. Translated into metric measurement, the resulting ratios are 41 m^2/employee (industrial) and 58 m^2/employee (warehouse).

Thompson also reported 1982 research by London Research Centre which demonstrated a wide range of densities in Greater London manufacturing, from 27 m^2 to 48 m^2, gross, suggesting a mid-point of 45 m^2 net.

Hampshire County Council (1993) recorded average employment density of 43 m^2/employee in manufacturing, and 78 m^2 in warehousing. The latter was much more variable, depending in part on the number presence and number of loading bays.

Thompson himself sampled five property types, deriving manufacturing densities of 43 m^2 and for warehousing around 70 m^2. He suggested average warehouse density was diminishing (i.e., square metres per employee was rising), reflecting changes in how the sector operates, through more national distribution centres, for example.

By contrast, mixed factory and warehouse activities appeared to have increased densities, with floor area ratios falling about 18% through the 1990s. Thompson tried to relate this shift to the economic cycle (suggesting that densities increasing during an upturn as companies lift short-term output by recruitment), but could not demonstrate this effect.

He did note, however, a wide range of densities in manufacturing and the importance structure in determining them – just what sorts of manufacturing activity are present. There is no single "catch-all" ratio to which most manufacturing conforms.

English Partnerships

A report was prepared for English Partnerships, an agency committed to urban regeneration and redevelopment initiatives, by consultants, Arup [2]

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[1] Thompson R (1999) "Industrial Employment Densities", *Journal of Real Estate Research*

[2] *Employment Densities: A Full Guide*, Final Report English Partnership and Regional Development Agencies, July 2001

Average floorspace per person was estimated by surveying a large number of buildings that could be relied on to "provide a reasonable degree of accuracy" in terms of the "best average" density for each use. Nevertheless, the figures were recommended as rules of thumb only.

Density estimates were based on average workspace (net internal area), so have been inflated by 20% to derive a gross floor area equivalent.

The variation in industrial employment densities were between 29 and 34 m^2/employee net and up to 41 m^2/employee, with an average of 38 m^2/employee (Table 1).

There was a significant range in the Warehouse category, however. Again, this reflects the difference between general warehousing and large-scale facilities with significant truck bays, which have less than half the density of manufacturing. Office densities tend around 23 m^2/employee, but are much higher in facilities such as call centres. Another study cited (Gerald Eve/RIC, 2001) indicated that the sales function tended to be the most dense among office activities, at 15.7 m^2/employee.

Finally, in retailing town and city centres and food stores have moderate densities with some consistency. Super stores have far lower densities.

Table 1: Employment Densities Guidelines, English Partnerships

Industry	M^2 / Employee	Plus 20%
General	34	41
Small Business Units	32	38
High Tech	29	35
Science Park	32	38
Average		38
Warehouse & Distribution		
General	50	60
Large Scale & High Bay	80	96
Average		78
Office		
General	19	23
HQ	22	26
Serviced Business Centre	20	24
City of London	20	24
Call Centre	13	16
Average		23
Retail		
Town, city centre	20	24
Food Superstores	19	23
Other Superstores	90	108

Employment Land Reviews: Guidance Note

The Office of the Deputy Prime Minister (Environmental Resource Management) issued a Planning Guide in 2004, covering employment densities and space requirements. It presents research results by Roger Tym & Partners (1997) as one of the most comprehensive data sources for London and the South East (based on a survey of over 1,200 firms).

More recent work (2004) by DTZ Research covered 1,000 firms in the South East, but not London (Table 2).

Table 2: Average Employment Densities in South East England (m^2)

	Tym 97	DTZ 04	Average	+20%
Offices	18	18	18	22
Industrial	32	38	35	42
Manufacturing	30		30	36
Warehousing (General)	40		40	48
Warehousing (with Loading Bays)		78	78	94

The Guide cautions that average densities conceal significant variations. The adoption of new working practices is one source. The Gerald Eve/RICS study identified an increase in net density in office space per worker from 16.6 m^2 in 1997 to 16.3 m^2 in 2001. The survey also indicated that the average densities were higher among offices that had adopted "new" work practices (time flexibility, mobile workforces, laptop connectivity, hot desking, home working, etc), at around 15 m^2/employee, compared with those that have not (17 m^2/employee).

The Guidance Note also considered floor area or plot ratios, although found less evidence for developing robust guidelines. The usual practice is for local authorities to develop their own ratios from design studies or measurement, and to translate these into planning requirements. The following ranges were based on a review by the Office of Environmental Resource Management:

- Business Park 0.25 - 0.40
- Industrial 0.35 - 0.45
- Warehouse 0.40 - 0.60
- Town Centre Office 0.75 - 2.0

3.2 Australia

Sydney

The City of Sydney 2001 survey of floorspace and employment was seen as a benchmark, as the first such survey "of the new century and the first significant survey after the global success of the Sydney Olympic Games" (page 3. The 2001 Floor Space and Employment Survey, Building Service and Planning Policy Unit, City Development and Projects, City of Sydney).

The survey itself has been running since 1976, which gives an opportunity to consider changes. There is a long-term tendency towards falling densities in the CBD, from around 35 m^2/employee in 1976 to 49 m^2/employee in 2001, despite the predominance of office functions.

Short-term changes are volatile, though. A contraction of CBD employment in the late 1980s, for example, was accompanied by a slow down but by no means a reversal in floorspace expansion, resulting in a sharp reduction in densities.

Table 3: Changes in Floorspace and Employment, City of Sydney

	Total			Change		
	m^2	Employment	Ratio	m^2	Employment	Ratio
CBD						
1976	5,645,532	160,864	35			
1986	6,687,461	170,132	39	6,687,461	170,132	39
1991	7,704,372	159,891	48	1,016,911	-10,241	-99
1997	8,673,470	179,133	48	7,656,559	189,374	40
2001	9,781,164	199,702	49	2,124,605	10,328	206
Total Survey Area						
1991	11,842,285	204,742	58			
1997	12,982,809	231,854	56	12,982,809	231,854	56
2001	15,114,765	260,025	58	2,131,956	28,171	76

Note: Based on internal (net) floor area

The nature and changing mix of activities (structural change) account for most obvious variations in ratios. Over the entire City, densities were significantly higher, reflecting changes on the fringe. Finance, insurance, business services and public administration accounted for 36% of floorspace, and 51% of jobs.

Among offices, government departments tend towards lower densities. The transport and storage sector has significantly lower densities than wholesaling. City of Sydney manufacturing densities are relatively low compared with the UK examples (above). This may reflect the higher value of land in the City relative to the rest of Sydney, and the likelihood that industrial premises here are occupied by relatively small, specialised manufacturers.

Table 4: Employment Densities, City of Sydney, 2001

	m^2/Employee	
	Net	Gross
Manufacturing	28	33
Transport & Storage	100	120
Wholesale	34	40
Offices - Commercial	21	26
Offices - Government	34	41
Retail Trade	27	33

Melbourne

A study by Jones Lang Wootton reported in The Melbourne Age (26/11/03) indicated that, on average, Melbourne city office workers now work in the lowest space-to-employee ratio of Australian capital cities at 16 m^2/employee (net lettable area basis – equivalent to around 19 m^2/employee on a gross building area basis). This reflected recent rapid growth in the finance, insurance and property sectors, relatively high intensity uses. The equivalent figures for Adelaide and Canberra were reported to be 19 m^2/employee net, or around 23 m^2/employee gross.

The City of Melbourne undertakes Census of Land Use and Employment (CLUE) surveys, the last reported in 2004, based on gross floor area. The analysis suggests that densities are relatively low in Melbourne (Table 5).[3] The transport and storage sector has much lower employment densities than wholesaling and manufacturing. Densities in public sector offices are higher than in the private sector.

Table 5: Employment Densities, City of Melbourne 2004

Industry	m^2/Employee
Manufacturing	63
Transport & Storage etc	398
Wholesale	125
Offices - Commercial	47
Offices - Government	31
Retail Trade	42

Note: Gross Floor Area

3.3 Oregon

The 1999 Employment Density Study, published by Oregon Metro (the agency of regional government for Portland, Oregon), used case studies for twelve sample areas associated with the 2040 concept map, covering Regional Centre, Town Centre, Employment Areas, Corridors, Main Street and Industrial Area categories.

The study demonstrates a strong relationship between geographic area and sector mix ("industry type") and between geographic area and employment density. A weaker correlation exists between industry type and employment density, suggesting that within SIC sectors densities are moderated by land form and location.

The study indicated a range of densities within manufacturing, as well as among higher order sector (Table 6). Low densities (high ratios) tend to be associated with more capital intensive sectors (pulp and paper, chemicals), or with sectors with substantial demands for storage and processing, such as furniture manufacturing, clay and stone products. More intensive machinery manufacturing has higher densities.

[3] Alternatively, the rule of thumb inflator of 20% from net to gross floor area used in Tables 1 to 4 is low

Table 6: Observed Gross Building Densities, Oregon Metro, 1999

Sector	m^2/Employee
Food & Food Products	59
Textile & Apparel	86
Lumber & Wood	59
Furniture; Clay, Stone & Glass; Misc.	71
Paper & Allied	149
Printing, Publishing & Allied	42
Chemicals, Petroleum, Rubber, Leather	67
Primary & Fabricated Metals	39
Machinery Equipment	28
Electrical Machinery, Equipment	37
Transportation Equipment	65
Transportation and Warehousing	306
Wholesale Trade	129
Communications and Public Utilities	43
Retail Trade	44
Finance, Insurance & Real Estate	34
Non-Health Services	72
Health Services	33
Educational, Social, Membership Services	69

The study also presented floor area ratios on the basis of sample areas. These were described in terms of "design categories". In each case, two sample localities were used. For present purposes, these have been averaged (Table 7).

Table 7: Observed Floor Area Ratios, Oregon Metro Region 1999

	Sample 1	Sample 2	Average
Town Centre	0.63	0.62	0.63
Main Street	0.26	0.63	0.45
Corridor	0.35	0.46	0.41
Regional Centre	0.44	0.36	0.40
Employment Area	0.20	0.33	0.27
Industrial	0.24	0.21	0.23

3.4 Vancouver

A report into real estate trends prepared for the Greater Vancouver Region (Commercial and Industrial Real Estate Development Trends and Forecast for the Greater Vancouver Region, Royal Lepage Advisors, August 2003) compared figures for 1991 and 2001. It identified a contraction in average office space per worker of around 10%, but an increase of over 20% in industry (Table 8). The gain in office densities was attributed to factors including cost cutting, efficiency needs, and especially new business technology, including greater employee mobility.

Table 8: Building Densities, Greater Vancouver, 1991-2001

	m^2/Employee			
	1991	2001	Change	Marginal
Industrial	42	50	21%	118
Office	19	17	-10%	17
Business Park	21	20	-5%	19
Urban Centres	19	18	-4%	16
Retail	35	36	4%	46
Total	33	36	8%	48

Based on surplus floorspace, it was suggested that retail densities could increase slightly, as some growth is absorbed within existing floorspace. However, longer term prospects are for lower densities: "Retail floor space ratios per employee are generally rising due to increased average store size (i.e. big box retailers) and new technology. The trend is expected to continue, with the volume of retail space per worker forecast to rise," from 36 m^2 to 42 m^2/employee by 2021.

Industrial floorspace densities are also projected to decline in response to ongoing pressures for businesses to become more efficient (by 17% by 2021, to around 60 m^2/employee). Firms are increasingly seeking opportunities, like increasing floor space and/or replacing workers with machinery, in order to improve economies of scale in an effort to gain or maintain market share in a highly competitive global economy" (page 32).

3.5 New Zealand

A search of a number of sources (e.g., An ARC Guide to Structure Planning: A Regional Practice and Resource Guide 2005, Urban Design Toolkit, MFE 2005) revealed no obvious sources for "rule of thumb" employment density or floorspace ratio data for New Zealand.

The report UDS Area Industrial Strategy (Property Economics 2006) provides an estimate of footprint and site sizes for Christchurch non-residential uses. This can be used to estimate current floorspace ratios. Several categories have been compiled from the detailed data provided – all industrial uses, retail, miscellaneous commercial uses (ranging from car yards and services stations, through visitor attractions and amenities to multiple use commercial activity), and commercial accommodation, including rest homes (Table 9).

Table 9: Floor Area Ratios, Christchurch 2006

	Footprint	Site Area	FAR
Industrial	2,035,996	7,974,567	0.26
Retail	637,973	2,174,137	0.29
Office	253,222	835,196	0.30
Commercial	820,721	2,966,249	0.28
Accommodation	283,026	1,255,734	0.23

Employment densities can be estimated by comparing employment increases over a period of time with increases in building floorspace by category, although this requires a number of assumptions. For example, employment growth may be absorbed within existing floorspace, so that the estimate of density arising from comparing employment growth to expanded floorspace is likely to be on the high side. In addition, not all building areas consented will be constructed, and there is a lag between consent and completion.

Using available data, the marginal floorspace ratios for Auckland Region have been estimated comparing consents issued by category from 2001 to 2004 with changes in employment by broadly equivalent category from 2002 to 2005 (Table 10). This allows for a one year lag between issuing of consent and employment changes. It is assumed that 90% of floor area for which consents have been issued is taken up.

There is instablity in the ratios derived, sugesting that the lag between consenting, investment and employment may be greater than a year; that the conversion of consents to floorspace may be more variable than assumed, and that more new employment is accommodated in existing floorspace in some years than others.

For these reasons, emphasis is placed on the four year sum of additonal building area consented and employment growth. Even so, the derived ratios will be high because some increase in employment will be absorbed in existing capacity. Conversely, if the conversion rate is lower than 90%, densities will be lower.

Table 10: Incremental Employment Densities (m^2), Auckland Region

	Manufact-uring	Distribution	Retail & Catering	Office	Total
2001-02	242	137	18	48	56
2002-03	23	40	18	11	22
2003-04	72	114	36	14	34
2004-05	125	41	15	11	30
2001-05	71	59	19	14	32

Source: Derived from Statistics New Zealand

In additon, the results demosntrate densities “at the margin”, or incremental densities that may be higher or lower than average densities, depending on the nature of investment undertaken. For example:

- Manufacturing densities appear low, implying a tendency towards more capital intensive or floorspace extensive activity in new investment;
- Densities in the distribution sector apppear high, implying a greater focus on general warehousing (and, perhaps, the more intensive warehousing associated with the expanding freight forwarding in the vicinity of Mangere Airport) than on general storage and truck-based distribution centres;
- Retail and office densities, especially, appear high, suggesting that much of the icnrease in employment could have been absorbed in existing space.

A similar exercise was undertaken for manufacturing (Table 11) and warehouse activity (Table 12) across the northern North Island Regions. In this case, an additional year's information was available, so that the aggregate figures are based on five year's data.

With respect to manufacturing, Auckland density is reduced by the very low density recorded for 2001 employment gains. Bay of Plenty recorded even lower densities. The figures for Northland fluctuate, although smoothed out over the five year period.

Table 11: Marginal Manufacturing Employment Ratios, Northern Regions

	Northland	Auckland	Waikato	Bay of Plenty	Total
2000-01	1,646	173	12	65	46
2001-02	14	242	23	64	45
2002-03	35	23	102	198	36
2003-04	831	72	131	- 88	159
2004-05	48	125	54	80	89
2000-05	49	77	35	107	61
Median	48	125	54	65	46
Average	515	127	64	64	75

Again, gains in warehouse floorspace appear to be at generally higher densities than in manufacturing. This may reflect poor alignment of employment with consents data. It may also reflect the significance of general warehousing rather than large scale distribution centres. Interestingly, Bay of Plenty appears to have the lowest warehouse/distribution density of the regions covered.

Table 12: Marginal Warehouse Employment Ratios, Northern Regions

	Northland	Auckland	Waikato	Bay of Plenty	Total
2000	88	69	21	63	50
2001	12	111	19	47	45
2002	33	26	35	94	30
2003	44	47	52	66	49
2004	34	40	50	42	42
Total	31	44	32	55	42
Median	34	47	35	63	45
Average	42	58	35	62	43

3.6 Indicative Ratios

The preceding analyses provide a range of estimates that can be used to develop rule of thumb ratios for projecting future densities.

They also indicate significant variability within sectors, between locations and over time. On these grounds, selection of an appropriate ratio should also reflect local circumstance. The guideline below should be used as a starting point for forecasting, rather than as a definitive guide. Even within the same region, ratios will vary.

Sources of variation include differences in sector mix (structural differences), which, among other things, will reflect the size and role of the respective region, city, or suburb.

Industry

The industrial floorspace ratios vary significantly from the high densities identified by English Partnerships (with their emphasis on regeneration and brownfield development) through to the low marginal densities recorded in Auckland.

By and large, densities appear to be diminishing, except in more central city locations. On these grounds, and considering the (limited) evidence available for New Zealand, a reasonable, representative occupancy measure for industrial use for present purposes might be 60 m^2/employee (gross floorspace). This is an intermediate figure, with 70 m^2/employee in decentralised localities, and 50 m^2/employee in central areas.

There is even less evidence for floor area ratios (FAR) than employment densities. A policy focus on lifting industrial densities in central areas might see them increase (towards the UK guideline), while decentralisation and a concern for low impact development might see them diminish (towards the Portland figure). For present purposes, the intermediate ratio of 0.30 is recommended. However, this might be expected to diminish rather than increase in greenfield sites (to, say 0.25), both to attract more capital and skill intensive industry and to manage the potential environmental impacts of industrial development.

Warehousing

There are distinct differences between general warehousing (which may be more akin to manufacturing land use) and emerging distribution centres, which are substantially more expansive. The former are more likely to provide for local distribution or freight forwarding, while the latter are more likely to be associated with national centres set up for inter-regional distribution purposes, or to support sea-freight. The former are more likely to be associated with suburban and outer CBD locations and mixed use business parks, the latter with industrial areas, large scale processing, and specialist distribution precincts.

Based on the evidence reviewed, general warehouses may be expected to achieve densities of around 60 m^2/employee. Distribution and transport centres may be expected to require in excess of 90 m^2/employee, with 75 m^2/employee a reasonable intermediate figure, although it may not be representative of any individual operation.

Again, it might be expected that higher densities would be associated with central locations and lower densities with decentralised locations (although the evidence for the cities of Sydney and Melbourne is not consistent with this).

The Floor Area Ratios reported are generally higher than for industrial uses, suggesting that large footprint, single storey warehouse-style buildings are likely to have a lower level of required site amenity given their lower employment densities and more limited range of on-site

activities and processes. On these grounds, a FAR of 0.35 seems reasonable for warehouse, transport and storage uses.

Table 13: Representative Ratios

Source	FAR	Occupancy Ratio	FAR	Occupancy Ratio
	Industrial		Office	
UK - English Partnerships	0.40	38	0.75	23
City of Sydney		33		26
City of Melbourne		63		47
Portland, Oregon	0.23		0.63	35
City of Langley, Washington	0.28	96	0.31	52
City of Newberg, Oregon	0.30		0.40	
Greater Vancouver		50		19
NI Regions Marginal Ratios		61		
Auckland Marginal Ratios		71		14
Christchurch City	0.26		0.30	
Average	0.29	59	0.48	31
	Warehouse		Retail	
UK - English Partnerships		78	0.75	24
City of Sydney		120		33
City of Melbourne	0.40	119		42
Portland, Oregon		62		44
City of Newberg, Oregon	0.31			
Greater Vancouver		50		50
NI Regions Marginal Ratios		42		
Auckland Marginal Ratios		59		19
Christchurch City	0.36		0.29	
Average	0.36	76	0.52	35

Offices

Offices maintain a much higher density of employment, given the difference in processes relative to industry and warehousing. The one or two exceptions in Table 13 are difficult to explain. In the case of Melbourne and perhaps Portland, low densities may reflect a predominance of head office-style activities, rather than the lower order processing and exchange of information associated with many offices. The difference is one of amenity as well as function.

Despite the increasing floorspace ratios of the 1980s, recent evidence suggests that densities are once more increasing. This is in part a structural issue – with a greater share of offices given over to routine tasks such as call centre operation. It may also be a response to calls for efficiency, and to increasing occupancy costs and overheads – an attempt to maximise space utilisation

Based on Table 13, a density of 30 m^2/employee is proposed for office space, with this higher in central areas (say, 25 m^2/employee) and tending to fall as densities increase.

Again, FARs vary. They will vary by location, with higher ratios in inner areas (up to 0.75) and as low as 0.30 in mixed use and business park areas. A ratio of 0.50 appears reasonable for generalising between the two. However, a much higher ratio might be anticipated in city centres with predominance of high rise buildings, so that the guidelines presented here may not be appropriate in these circumstances.

Retail

A density of between 19 and 50 m^2/employee reflects growing variability (Table 3). The averages mask a contrast between the smaller, high value stores of the CBD and the super stores and bulk retailers located in the suburbs and on the urban fringe. Central, suburban and fringe locations will continue to achieve different densities, although a growing movement towards large footprint stores could see average densities diminish.

There is little evidence on retail FARs, and a figure between the high figure for English redevelopment and the current low for Christchurch may be a reasonable generalisation at, say, 0.50

3.7 Land Occupancy

The various ratios derived from the preceding survey have been brought together in Table 14 across four land use sectors. The results have been rounded to the nearest 10 employees to emphasise the indicative nature of the guidelines. High and low figures have been developed, the high density figures more likely to be associated with existing centres and central areas, the low density figures more likely to be associated with decentralised development, business parks, and the like.

Table 14: Site Occupancy Guidelines

	Industrial		Warehouse		Office		Retail	
	High	Low	High	Low	High	Low	High	Low
Building Density (Sq m/Employ)	50	70	60	90	25	30	20	35
Floor Area Ratio	0.30	0.25	0.35	0.35	0.75	0.3	0.50	0.5
Site Yield	0.70	0.60	0.70	0.60	0.70	0.60	0.70	0.60
Land Density (Sq m/Employ.)	278	467	286	429	56	167	67	117
Employees/Ha (Gross Area)	40	20	40	20	210	60	180	90
Mid-Point		30		30		135		135
Employees/Ha (Useable Area)	60	30	60	30	300	100	260	150
		45		45		200		205

While a mid-point is suitable for the illustrative analysis, a more realistic approach would be to vary per hectare figures according to the nature of the land – its physical capacity and locality -- tending towards lower densities on decentralised and greenfield sites, and higher densities on centralised and developed sites.

Gross land area densities of between 60 and 210 employees per hectare (midpoint 135) seem reasonable for commercial and retail activity, and between 20 and 40 employees (mid-point 30) for industrial uses.

The figures may be varied to meet policy objectives – upwards to increase densities and reduce the urban footprint, and downwards to amenity and environmental standards, for example. The analysis summarised here indicates that in projecting land occupancy – or setting density targets -- consideration needs to be given to the elements of density through which they will be achieved,- building employment density, floor area ratio (site coverage), or subdivision yield.

4 Employment Ratios and Future Land Requirements in the Bay of Plenty

This section examines two studies of future employment land needs conducted in the Bay of Plenty. The emphasis is on the assumptions used to move from employment forecasts to land demand projections.

4.1 Tauriko Plan Change

Economic Issues Paper, Market Economics for IMF Westland, June 2005

This, the "Tauriko report", was prepared in support of the proposed private Plan Change to support the development of 195 ha from a holding of 300 ha (a 65% yield) at Tauriko on the edge of Tauranga City for commercial and industrial uses. This was represented as supporting SmartEconomy and its focus on high value, high growth sectors, and on exploiting the region's competitive advantages in, especially, horticulture and related industries.

In developing scenarios, the Tauriko report assumed that:

> *"Current land use intensity is relaxed somewhat into the future because it is believed that the Tauranga business land market is currently under considerable pressure. Increasing the amount of land available would have the effect of loosening the metaphorical belt constraining how much land is available for Tauranga businesses to occupy (and how much businesses can afford to occupy given current high prices resulting from a lack of supply). Failing to recognise this pressure runs the risk of underestimating likely future business land requirements and would not acknowledge the effects of current land constraints.*
>
> *"… Future land densities (as applied in this study) have been adjusted to recognise this decreasing intensity of land use to provide future estimates of land demand per household" (pp2-3)*

The report identifies addresses "a critical shortage of business zoned land and the associated infrastructure…" (page 6). The adjustment to industrial land supply advocated, however, is applied to changes in labour supply rather than labour demand, with the driver of demand seen to be a projected increase in household numbers. This focus on labour supply rather than demand appears inconsistent with the SmartGrowth emphasis on high value, high growth sectors, and the region's comparative production advantage.

Nevertheless, the report acknowledges the potential for Tauriko to cater for variable lot sizes, including large lots, and light and heavy industrial activities (page 7). The implication is that the drivers of demand (investment by sector and changing production functions within sectors) will lead to lower densities.

The report also acknowledges the region-wide role of the CBD, the regional role of large industrial sites, and the propulsive effects of external economies of scope and scale, which contribute to rates of growth higher than might be expected on the basis of local demand alone (page 8).

`The Tauriko report identifies the following land available or potentially available for industrial development:

Currently classified as vacant 104 ha

Plus -

Rangiuru –	150ha
Papamoa East	150 ha (industrial component, including Wairakei and Te Umu)
Tauriko	180 ha
Tauranga Airport	100 ha (after 2021) This has since been dismissed for the foreseeable future.
Te Puke and Omokoroa	"two smaller blocks".

The Tauriko report also suggests that availability is likely to be less than indicated supply for several reasons – the suitability of remaining stocks relative to need, the capacity for a small number of large players to quickly absorb capacity, and classification issues. Land banking by investors also reduces availability at any point in time.

Growth in land demand is forecast to average 20 ha per annum through to 2021, and 17 ha after that (2.6% and 1.4% compound annual growth rates, respectively; Table 15). This suggests 324 ha would be required between 2005 and 2021, and another 518 ha over the following 30 years.

Table 15: Projected Industrial Land Demand, 2005-2051

	Total	Change	Annual	ACGR
2005	696			
2005-06	713	17	17	2.4%
2006-11	812	99	20	2.6%
2011-16	922	110	22	2.6%
2016-21	1020	98	20	2.0%
2006-2021	1,020	324	20	2.6%
2021-51	1,538	518	17	1.4%

Note: Assumes 70% vacant land is occupied;
AGCR – Annual Compound Growth Rate
Source: Market Economics, Tauriko Report, Page 11

Taking 70% absorption as a rule of thumb denoting when availability is effectively exhausted, the 409 ha effective land bank (70% of the total of 584 ha available in the form of currently vacant land and three major areas for expansion - Rangiuru, Papamoa and Tauriko, above) would be absorbed by around 2025.

Market Economics goes into detailed staging scenarios to generate a schedule of supply to match projected growth in demand. The principal conclusions are that:

(1) without more land, the current vacant supply will "dry up between 2006 and 2011, which would have a negative effect on industrial development and employment in the region"; and

(2) with all three proposed developments (Rangiuru, Papamoa East and Tauriko) there should be capacity for 20 to 25 years.

The balance of the report focuses on the advantages of the Tauriko land and the desirability of its early release.

4.2 Business Land and Location Study

Market Economics, Draft (September 2005)

This study – the "SmartGrowth report" – is based on labour demand – an investment perspective (see Figure 2, above), unlike the Tauriko Report labour supply perspective.

Drivers of Investment and Employment

The drivers of investment are household demand and demand from other sectors – business, government and tourism. Market Economics adjusted the source NZIER employment demand projections (2001-base) to take account of the rapid growth in the region through to 2004. However, this faster-than-forecast growth does not appear to be projected forward.

Thus, while the actual compound growth rate from 2000 to 2005 for combined Tauranga and Western Bay of Plenty was 6.6% per annum (based on Statistics New Zealand Business Demographics employment series), the projected rate adopted in the Market Economics report to 2011 is 2.5%, and 2.0% for the following ten years, implying a sharp medium-term reduction in growth. The forecast average growth of 1,150 employees/year from 2004 to 2011 and 1,300 from 2011 to 2021 compares with an actual gain of 2,460/year from 2000 to 2005, and almost 4,200 in the year to February 2005.

2006 Business Demographic figures released in October 2006 point to a correction from the 8.4% gain in 2005, to 2% in 2006 (1,080 new jobs compared with 4,200 in 2005), reducing average growth to 5.8% over the six years to 2006. This reflects a wider downturn in the New Zealand economy, one which is expected to continue through into 2007. Despite this recent performance, projecting a sharp medium-term contraction in employment growth (and by implication, investment) is difficult to justify based on the last seven years' performance.

The percentage change figures used in Market Economics' SmartGrowth report are similar to those associated with household growth rates in the land estimates used for the Tauriko study (see Table 15). This may reflect the centrality of local household demand as an investment driver in the underlying NZIER forecasts.

However, Market Economics reinforces this dependence on local demand by applying up-to-date estimates compared with the source NZIER analysis (based on the 2001 rather than 19906 Input Output table). The results is a shift from 20% to 41% of employment dependent on "Household Consumption". This shift presumably reflects more than short term structural changes (1996 to 2001), and suggests measurement discrepancies or issues of interpretation (page 30, Appendix 2).

The consequent assumption that 41% of (future) employment should be allocated in accord with the current commercial hierarchy and projected residential growth may need to be considered further (Appendix 2). For example, according to the 1996 Inter-Industry Tables less than 14% of

household expenditure accrued to the retail sector. The treatment of household dependent demand in the report implies that retail and all other sectors meeting household demand and their intermediate suppliers are aligned with the existing hierarchy of retail centres. It is not clear why, though, indirect suppliers should be subject to the same location forces as direct suppliers, especially as they are more likely to serve region-wide and inter-regional markets.

Growth in output independent of local households and tourism appears to be treated as dependent on intervention (pages 7 and 8). This downplays growth based on comparative advantage, specialisation, and economies of scale or scope, which are more likely to drive exogenous growth than is "intervention". While external drivers may be covered in the NZIER analysis, the adjustment in market economics' SmartGrowth report may result in under-weighting of exogenous demand. Because exogenous demand is far less likely to be tied to the urban hierarchy than demand aligned with the distribution of household growth, the allocation across the commercial hierarchy may be too heavily skewed to existing centres.

Growth Allocation

Allocation of the employment growth is based on a model which assumes a stable hierarchy of centres. This reinforces location differentials in favour of the existing distribution and the location of activities dependent on local demand (pages 8 and 9) , despite concerns expressed in the Tauriko report about land costs.

The expectation is that the current pattern of centres will be sustained (p. 10), primarily through the expansion of catchment-based, household related demand. Hence, forecasts of household growth by area are the preliminary driver of both growth and growth allocation in this model.

Much of the employment in business zones is considered "location independent", with footloose investment "less constrained by the location or proximity of their customers" (page 9). Growth in these sectors is allocated according to current distribution.

Land Supply and Density

Analysis of business land indicates that the CBD has the highest density, at 199 employees/ha (useable area basis) and the port areas the lowest, at 9 employees/ha (which, while low, is not inconsistent with bulk storage areas). Significant variation is evident within industrial areas, ranging from around 65 employees/ha Judea and Sulphur Point, through 35 Paengaraoa Industrial area, less than 40 at the Port Industrial South Zone, 20 at Port Industrial North and Katikati North, 15 at Rangiuru, down to less than 5 at Te Maunga (page 26).

Similar variation is evident with respect to "Commercial Business Areas". The small Omanu Precinct has 165 employees/ha, and Sulphur Point 110.

Current vacant industrial capacity is revised to around 28 ha (once vacant land that is unlikely to be available has been removed; page 27), substantially less than suggested in the Tauriko study (104 ha gross, 73 ha at 70% utilisation).

Future business land supply comprises (pages 33-35):

- Rangiuru, 243 ha to be rezoned, 152 ha "useable" (63% subdivision yield);
- Papamoa East Te Tumu, 60 ha;
- Papamoa East, Tauranga City Council Plan Change, 89 ha useable;
- Tauriko, Private Plan Change, 182.6 ha;
- Omokoroa, Expected plan Change, 31.5 ha;
- Te Puke, Expected Plan Change , 25.2 ha;

or around 568 ha of useable land, including 28 ha "currently available".

Future commercial land includes (page 35):

- Papamoa East Wairakei (Commercial), 45.3 ha
- Tauriko, 12.4
- Omokoroa, 10.5

Business Land Uptake

Three scenarios were developed to illustrate the possible distribution of employment by category of land (zone). These were based on a single projection of growth, with the need to accommodate a further 20,960 employees by 2021. Assumptions about the capacity of existing land to absorb growth (i.e., the employment densities achieved) were varied across scenarios. The lower the capacity of existing centers and business land, the greater the additional land required.

1. High demand for additional land

This assumed a relatively wide distribution of employment as a result of limited growth in existing centers and significant growth in new business zones. New business zones would account for 25% of new employment and 7% of total employment by 2001 (5,300 employees, Table 15). According to the commentary, this would require around 250-260 ha of additional land 2004 and 2021 (around 15ha/year), suggesting an employment density of 21 employees per hectare. [4]

Scenario 1: Summary of Employment Distribution

Zone	2004	2021	2025
Urban Centres	34%	30%	24%
Business Zones	29%	33%	40%
Includes Proposed Employment Areas	0	7%	19%
Residential	25%	26%	26%
Rural	12%	12%	10%

Under the high land demand scenario, the CBD and large suburban centres account for 5% and 9% of growth, respectively, and urban centres for 19% in total. This means that their share of total employment falls to

[4] This is not consistent with Table 7.1 in the report, in which the densities given appear much lower than reported in the text. There appears to be a similar inconsistency with reference to the other scenarios.

31% from 34%. Existing and new business zones account for 43% of growth, and 33% of total employment in 2021, up from 29% in 2004.

The High Demand Scenario, then, sees decentralisation of employment, an apparent reduction in densities in suburban centres, and gains in most business areas, other than Tauranga City industrial zones. Employment densities (Table 16) appear consistent with the guidelines in Table 14.

Table 16: High Land Demand Scenario

	Employees					Employees/Ha		
	2004	2021	Shift	% Shift	% Share	2004	2021	% Shift
Centres:								
CBD	7,200	8,290	1,090	15%	5%	190	208	9.5%
Large Suburban	6,610	8,460	1,850	28%	9%	104	117	12.5%
Suburban	930	1,400	470	51%	2%	28	13	-53.6%
Local	1,530	1,870	340	22%	2%	67	76	13.4%
Minor	730	1,030	300	41%	1%	63	68	7.9%
Urban Centres	17,000	21,050	4,050	24%	19%	97	82	-15.5%
Rural centres	1,820	2,510	690	38%	3%	50	44	-12.0%
All Centres	18,820	23,560	4,740	25%	23%	89	75	-15.7%
Business Zones:								
Industrial TCC	9,370	11,410	2,040	22%	10%	22	20	-9.1%
Port/Rail	1,550	1,600	50	3%	0%	6	9	50.0%
Industrial WBOP	1,450	2,540	1,090	75%	5%	7	13	85.7%
Commercial Business	2,110	2,650	540	26%	3%	30	38	26.7%
Proposed Employment	-	5,300	5,300	0%	25%	0	12	0.0%
Business Zones	14,480	23,500	9,020	62%	43%	16	16	0.0%
Other:								
Residential	12,460	18,360	5,900	47%	28%			
Rural	4,080	5,380	1,300	32%	6%			
Total	49,840	70,800	20,960	42%	100%			

Source: Market Economics, SmartGrowth Report, Table 7.1

2. Medium Demand for Business Land

This scenario assumes a moderate share of growth in existing business land, and limited redirection of centres-based activity to new business areas, which would account for 20% of growth. 150-160 ha would be required by 2021 (9 ha/year)

Scenario 2: Summary of Employment Distribution

Zone	Share	Share	Share
Urban Centres	34%	30%	27%
Business Zones	29%	33%	37%
Includes Proposed Employment Areas	0	6%	13%
Residential	25%	26%	26%
Rural	12%	12%	10%

3. Low demand for additional land

The Low Demand Scenario allows for greater gains in centres, although their share falls to 31% of total employment by 2021. Again, achieved densities seem reasonable. The biggest difference lies in higher densities in existing industrial and business zones. Again, however, the densities in terms of useable land are well within the indicative range (Table 14). One consequence of achieving these higher densities is a lower level of uptake on proposed business land.

Scenario 3: Summary of Employment Distribution

	2004		2021		2051	
Zone	Share	Density	Share	Density	Share	Density
Urban Centres	34%	97	31%	84	29%	113
Business Zones	29%	16	32%	17	34%	24
Includes Proposed Employment Areas	0	0	4%	6	8%	14
Residential	25%	n.a.	26%	n.a.	26%	n.a.
Rural	12%	n.a.	12%	n.a.	10%	n.a.

Note: Density is Employment Counts/Hectare

This scenario sees new business areas accommodating 2,920 jobs, or 15% of growth by 2021 (Table 17). Only around 85-95 ha (5-6 ha/year) would be required by 2021.

Table 17: Low Land Demand Scenario

	Employees					Employees/Ha		
	2004	2021	Shift	% Shift	Share	2004	2021	% Shift
Centres:								
CBD	7,200	8,410	1,210	17%	6%	190	211	11.1%
Large Suburban	6,610	8,770	2,160	33%	10%	104	120	15.4%
Suburban	930	1,450	520	56%	2%	28	14	-50.0%
Local	1,530	1,910	380	25%	2%	67	79	17.9%
Minor	730	1,080	350	48%	2%	63	71	12.7%
Urban Centres	17,000	21,620	4,620	27%	22%	97	84	-13.4%
Rural centres	1,820	2,590	770	42%	4%	50	44	-12.0%
All Centres	18,820	24,210	5,390	29%	26%	89	77	-13.5%
Zones:								
Industrial TCC	9,370	12,930	3,560	38%	17%	22	30	36.4%
Port/Rail	1,550	1,660	110	7%	1%	6	9	50.0%
Industrial WBOP	1,450	2,660	1,210	83%	6%	7	13	85.7%
Commercial Business	2,110	2,680	570	27%	3%	30	38	26.7%
Proposed Employment	-	2,920	2,920	0%	14%	0	6	0.0%
Business Zones	14,480	22,850	8,370	58%	40%	16	17	6.3%
Other:								
Residential	12,460	18,360	5,900	47%	28%			
Rural	4,080	5,380	1,300	32%	6%			
Total	49,840	70,800	20,960	42%	100%			

Source: Market Economics, SmartGrowth Report, Table 7.1

The report also explored likely as an extreme case, the additional business land area that would be required if all employment growth "seeking to locate on industrial land" was required to be accommodated in new business areas. This involved applying assumed densities to the total increment, suggesting a maximum of 435 ha from 2004 to 2021 if densities remain unchanged on existing land, and are just 20 employees/ha on new land:

	2004-21	2021-51
Employment Counts	9,020	24,810
Total Area Required (ha)		
@ 20 EC/ha	436	693
@ 25 EC/ha	349	554
@ 30 EC/ha	291	462

Market Economics assumes achieved densities of 20 employees/ha when considering the likely demand for new land based on the assumed share of employment growth directed at industrial land. While this is well within the guidelines indicated in Table 14, the tendencies and variability observed in Section 2 suggest that it is unlikely to be achieved evenly or early in the planning period. It is at the top end of current industrial densities (for example, Tauranga City industrial areas). The reality is that densities are low early in development and intensify progressively over a relatively long time period.

If, for example, the achieved density was 15 employees per useable hectare, the land requirements in 2021 would between 195 ha (low demand) and 350 ha (high demand) compared with Market Economics' estimates of between 95 ha and 260 ha.

1.4.1 Commentary

The Market Economics for SmartGrowth report follows a reasonable if arbitrary methodology for allocating land based on employment forecasts. The employment densities assumed are credible in relation to those surveyed in Section 2, although the variability of densities identified in that section suggests that sensitivity testing may have been appropriate. .

There are several other issues that do raise questions, however, about the land demand derived:

1. The underlying (NZIER) employment forecasts appear unreasonably conservative in light of recent performance;
2. While methodology has not been independently reviewed for this analysis, the forecasts appear underweighted for exogenous demand. This reflects an expectation that household demand will dominate growth, which favours incremental employment allocation in existing centres. By downplaying prospects for export driven growth and inward investment, the report is likely to underestimate future growth

of a sort that is likely to favour decentralised rather than centralised investment.[5]

3. Assumed employment densities achieved on new business land early in the period are high.

On these grounds, the results of the study are likely to under-estimate demand for additional business land and lead to a conservative estimate of need, and consequently belated staging requirements. The potential for greater than projected growth increases the total capacity requirement over the planning period, and brings forward the need to have sufficient land available. This is reinforced by the likelihood that a significantly greater share than allowed in the forecasts may be "industrial" in nature, covering processing, manufacturing, transport, storage and logistics.

4.3 Comparison

There are some contrasts in the approaches adopted in the two Market Economics reports:

- Tauriko land demand was based on estimates of labour supply driven by household projections. The SmartGrowth report adapted a forecast of sector-based labour demand and (implicitly) a model that deals with (or assumes) specific investment behaviour.
- Tauriko was not concerned with the detailed description of land allocation, but rather with the total volume of business land required. It did, however, go further than this by projecting land release that favours Tauriko relative to Rangiuru.
- The Tauriko report suggests that employment densities will decline in the future due to changes in the nature of business. The SmartGrowth report suggests that employment densities will increase.

The result of these contrasts is a significant difference in projected demand for business land from 2005 to 2021 between the two reports.

- Tauriko Report 20ha/year
- SmartGrowth Report High Demand Scenario 17ha/year
- SmartGrowth Report Medium Demand Scenario 9ha/year
- SmartGrowth Report Low Demand Scenario 5-6ha/year

These estimates can be best placed in context by considering the likely rate of growth in demand for business land in the recent past. This has been calculated for the entire Bay of Plenty covering the period 2000 to 2004 based only on consented factory and warehouse space (Table 18).

In 2004, the SmartGrowth subregion accounted for 52% of the Bay of Plenty's manufacturing employment and 65% of distribution (warehouses,

[5] The sorts of factors to be considered, over and above the focus of SmartGrowth include: an expanding and potentially diversifying labour force associated with lifestyle opportunities, continuing port development, and growing infrastructural costs and impediments associated with expansion in Auckland,

transport and storage). However, it accounted for 57% and 96%, respectively, of regional growth in those sectors over that period. These figures (reduced to 55% and 80% respectively, to avoid over-estimation) have been used to estimate shares of Region-wide growth that are likely to have taken place in the SmartGrowth area (Table 18).

The results, which exclude office or retail uses in business land, suggest that recent growth has been comfortably in excess of 20ha per year identified at the top end of the Market Economics analyses, and certainly well ahead of the scenario analyses in the SmartGrowth report. This recent evidence suggests, then, that the higher rather than lower projections provide a sounder base for planning future business land.

Table 18: Estimates of Industrial and Warehouse Land Uptake, 2000-2004

	Bay of Plenty Region	SmartGrowth Area
Factory		
Floorspace (m2)	259,690	142,830
Site Area (m2)	865,620	531,090
Zone Area (Ha)	124	68
Uptake/Year (Ha)	25	14
Warehouse		
Floorspace (m2)	137,320	109,860
Site Area (m2)	392,350	313,880
Zone Area (Ha)	56	45
Uptake/Year (Ha)	11	9

Note: Assumes 90% uptake of consents issued
FAR: Factories 0. 30; warehouses 0.35; Site Yield: 70%
Assumed SmartGrowth share: 55% factories; 80% warehouses

Table 18 is based on consented construction of factories and warehouses, and does not rely on assumptions about employment densities. However, the prospect that achieved employment densities will be relatively low in new business zones, and will increase only over a significant period of time, suggests that staging also needs to be more liberal than implied in Market Economics' SmartGrowth report, offering a greater range of choice to potential investors.

1.5.1 Sensitivity Testing

There are two sources of potentially significant variation in the projections. These have been considered with respect to Market Economics' SmartGrowth study.

The effect of underestimating future employment growth is explored in Table 19. In the first instance, the NZIER/Market Economics projection of growth has been converted to compound growth rates and simply projected off the actual February 2005 figure rather than 2004. This is 4,125 ahead of the 2004 base figure used by Market Economics, an upward adjustment compounded through the forecast period.

Applying the same rate of annual change to the adjusted base figure (Alternative 1 projection, Table 19) generates an estimate for 2006 generates an estimate of employment 6% higher in 2006, or 3,186 employees). By 2021 that difference increases to 4,316 employees.

If it is assumed that the rate of decline in projected growth rates will not be as dramatic as in the adopted forecasts, and that moderate growth will be sustained for longer, the demand for additional land will naturally be higher. This is illustrated by the higher, Alternative 2 projection in Table 19, which allows for modest strength in the SmartGrowth economy.

The higher growth rates have not been derived from further analysis, but are simply plausible assumptions in light of the recent strength of the economy, the prospect for stronger than assumed exogenous growth, and increasing gains from "Auckland overspill". The upward adjustment illustrated (based on a compound growth rate of 3.4% per year from 2005 to 2021 compared with 2.1% in the Market Economics/NZIER projection) would see an additional 36,723 employees by 2021.

Table 19: Alternative Employment Projections

	Alternative 1 Actual 2005 Base		Alternative 2 Higher Growth		Comparison		
	Growth Rate	Employed	Growth Rate	Employed	Market Economics	Difference, Alternate 1	Difference, Alternate 1
2000		39,235		39,235			
2001	3.8%	40,730	3.8%	40,730			
2002	7.7%	43,880	7.7%	43,880			
2003	8.3%	47,520	8.3%	47,520			
2004	4.8%	49,780	4.8%	49,780			
2005	8.4%	53,975	8.4%	53,975			
2006	4.2%	55,106	4.5%	56,134	51,920	3,166	4,194
2011	2.2%	61,430	3.5%	66,670	57,880	3,530	8,770
2016	2.0%	67,912	3.0%	77,288	64,020	3,902	13,278
2021	2.0%	75,116	2.5%	87,445	70,800	4,316	16,645
2051	1.1%	106,054	1.5%	136,683	99,960	6,041	36,723

The impact of a higher forecast on the demand for business land can be illustrated. Market Economics' Scenario 3 is the most conservative with respect to the demand for additional land, based on high densities being achieved on existing and new land. Under Scenario 3, 2,920 jobs will be accommodated on new business land by 2021. Using Market Economics' assumption of 35 employees/ha by 2021, this is around 83 ha of additional business land required (Market Economics put it in the range 85-95 ha).

If 35% of the additional employment forecast under Alternative 2 is of a type which needs to would be accommodated in business areas (the industrial, construction and transport sectors share of the NZIER forecast), then an additional 5,825 employees need to be accommodated. At 35 employees/hectare, this is equivalent to an additional 434 hectares is required.

However, assumed employment densities are also important in determination of the final land demand figure.

First, the employment densities assumed for the low land demand scenario are high. For example, CBD densities of 211 area assumed in 2021 (190 in 2004); and large suburban centres are assumed to employ 126 people per hectare (104 in 2004). The capacity of existing areas to absorb new employment may therefore be overstated, especially when compared with the guidelines in Table 14 (above)..

Second, incremental growth is naturally at a lower density than the average. This is simply reflects the nature of uptake of new land, within fill and intensification tending to accompany the "maturing" rather than the development of an area.

Third, the nature of new employment needs to be considered. As a result of structural shifts in the primary and transport sectors, for example, and changes in transport and manufacturing towards logistics, occupation of new industrial land is likely to be at naturally lower densities. In any case, newly developed land tends to be favoured by single story occupation. Both these factors would put densities for much of the projected new land towards the lower rather than upper end of the scale for manufacturing and transport (Table 14).

These influences are considered in Table 20. The allocation of employees between Business Land and other land (centres, rural and residential areas) according to Market Economics' Scenario 3 is presented in Table 20. Scenario 3 is selected as the most intensive development considered, implying a high and unlikely level of intensification of existing land use.

The Alternative Employment projection is based on the high scenario (adjusted base and growth rates, Table 19), with the share of business land based on the original percentage allocation to industrial activities in the NZIER/Market Economics forecasts. The implied additional demand for business land is the difference between this figure and the figure assigned to business land in Scenario 3. This additional employment is then translated into gross land requirement by the application of two density figures, the high (and highly unlikely) 35 employees per hectare, and the moderate, but still difficult to attain, 20 employees per hectare.

Table 20: Alternative Business Land Requirements

	Scenario 3 Employment - High Density, Low Land Demand			Alternative Employment Projection		Land Needs (ha) at Ha/Emp:	
	Elsewhere	Business	Total	Business	Additional	20	35
2004	35,370	14,480	49,850	19,592	5,112	256	146
2006	36,830	15,110	51,940	21,583	6,473	324	185
2011	40,360	17,540	57,900	24,802	7,262	363	207
2016	44,050	19,960	64,010	27,783	7,823	391	224
2021	47,950	22,850	70,800	30,754	7,904	395	226
2051	66,190	33,770	99,960	42,977	9,207	460	263

The result is a requirement for at least 263 ha more than projected in Scenario 3, and more likely 395 ha (20 employees/hectare). This gives a total of 490 ha when added to the increment associated with Scenario 3.

Even this is conservative. Projected additional demand of 395 hectares in 2021 may be better added to the higher Market Scenario 1 projection, of 255-265 ha (for a total of around 655 ha), or Scenario 2 (150-160 ha, for a total of 550 ha). All these outcomes point to a likely shortfall in relation to the land bank of around 568 ha identified by Market Economics.

If, as seems likely, densities on new business land over the first 15 years are lower, the increment would be greater, say 530 ha at 15 employees/ hectare, for a total 690 ha under Scenario 2.

4.4 Commentary

The analysis highlights the uncertainty underlying land forecasts and the arbitrary nature of the many analytical decisions that go into making them. Yet, having at least a feel for possible future demand is important, not because we can predict how much land is required when, but to enable us to ensure appropriate land in terms of volume and quality can be brought to market if required.

There is a circular relationship between provision of business land and investment and employment outcomes. Under-provision will reduce land availability and potentially defer infrastructure development. This can force up prices, discourage investment and constrain growth. On the other hand, over-provision may foster competition in development and support the sort of growth which underpins the Smart Economy strategy.

Policies favouring over- rather than under-provision lower the speculative and windfall components of land banking and deferred development, but raises risks associated with investing too early in infrastructure. The line between these two needs to be carefully managed.

Sensitivity testing demonstrates that forecasting and density assumptions will have significant impacts on projected land requirements. On these grounds, planning within a broad range seems most reasonable and emphasising flexibility in policy, prudent.

The appropriate policy response for SmartGrowth May be to ensure that sufficient land is available to help sustain recent or at least moderate growth rates. The current discussion suggests that the Market Economics' estimates of future requirement are likely to significantly underestimate demand and thereby potentially constrain development. Under-provision, attempts to predict a detailed demand path, and fine-tune supply all risk damaging the prospects for medium-term growth.

A policy that errs in the opposite direction, on the side of ensuring sufficiency, may mean that there will be short periods of apparent "over-supply". This need not be undesirable and, indeed, may be essential in a cyclical economy. Under recessionary conditions the availability of keenly priced land may help stimulate investment. During expansionary periods availability of under-utilised land should enable capacity to recover rapidly without undue inflationary pressure in the property market.

The ideal resource management response may be one which determines a reasonably generous long term supply targets, identifies favoured localities, clarifies environmental and infrastructural expectations, and establishes clear and reasonable criteria and processes to encourage investors to bring land to the market in an efficient manner.

Under current circumstances, an acknowledgement of demand for business land of perhaps 800 ha for the next 20 may be appropriate. Identifying favoured localities, providing guidelines for environmental and subdivision standards, and establishing expectations for financial contributions to support infrastructure will be a more constructive way to provide for business land than trying to decide what parcel should be released when.